

Could carbon financing appreciably accelerate the diffusion of Solar Home Systems?

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ANNEXES

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Washington DC, June 2001

The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the view of the World Bank, its Executive Directors, or the countries they represent.

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Annex I: Current Market and Predicted Price for Carbon Credits

Recent Carbon Trades and Prices of Transactions

A number of publicized carbon transactions have taken place in the past few years. The projects that will yield carbon credits utilize a number of energy related emission reduction techniques including energy efficiency activities, fuel switching, and alternative and renewable energy utilization technologies. The transactions also include carbon sequestration projects in the forest and agriculture sectors. Table A2 provides a list of the recent carbon transactions and the volume and price of each deal. The price of carbon credits for executed deals ranged from $\$0.6/tC$ to $\$23.4/tC$.

Additional Price Indications from Active Carbon Investment Funds and National Legislations

The Prototype Carbon Fund

The Prototype Carbon Fund (PCF) aims to procure high quality project-based emissions reductions (ERs) with a preference to transfer the ERs to PCF investors prior to the end of 2012. As a portfolio of carbon purchase agreements that the PCF plans to enter into, the PCF targets the price outcome of carbon purchases at $\$10-20/tC$ averaged across the portfolio.

The first carbon purchase agreement that the PCF has entered into is the Liepaja Solid Waste Management project with the Government of Latvia. The agreed price to purchase 105,800 tonnes of carbon equivalent emissions reduction generated from 2002 to 2012 is approximately $\$23$ per tonne of carbon.

The Netherlands Emission Reduction Unit Procurement Tender (Eru-PT)

In the first call for the Netherlands Emission Reduction Unit Procurement Tender (Eru-PT) issued in May 2000, nine projects with the potential to generate 9.1 million tonnes of CO₂ emission reduction during the Kyoto Protocol first commitment period of 2008-2012 for a potential carbon payment of EUR 72 million on a total investment of EUR 495 million were invited to submit detailed proposals. On a per tonne of CO₂ and carbon equivalent basis, this is approximately $EUR 7.9/tCO_2$ and $\$26/tC$ ¹.

In issuing the tender, Senter International, the representative organization of the Dutch Ministry of Economic Affairs, estimated that the market price for a tonne of CO₂ will be between EUR 4.54 and EUR 9.08 ($\$15/tC$ to $\$30/tC$). Also, the emissions reduction generated for sale to the Eru-PT program must be generated during the Kyoto Protocol commitment period 2008-2012 from Joint Implementation projects in Central and Eastern Europe.

¹ $\$1 = EUR 1.11$, February, 2001.

Denmark CO₂ Cap and Trade Scheme

Denmark CO₂ cap and trade scheme, introduced in Bill 235, was adopted for the electricity sector in May 1999. Emission allowances were grandfathered for existing power generating companies based on 1994-1998 emissions. Under the cap and trade scheme, penalty for non-compliance is set at approximately \$22 per tonne of carbon.

Price Predictions for Carbon Credits

A number of individuals and research institutions have carried out analyses and modeling work to predict the future price of carbon credits within the Kyoto Protocol commitments. A compilation of some of the published analytical work on predicting the price of carbon credits is presented in Table A1. The predicted price ranged from \$3.5/tC to \$50/tC depending on the assumptions that each model and analysis made on the degree of limit on the use of the flexibility mechanisms of the Kyoto Protocol.

Table A1 Price Predictions for Carbon Credits

Models	Predicted Price (US\$/tC)
MIT (No limits on global carbon trading)	24
PNNL (No limits on global carbon trading)	26
US Council of Economic Advisors (No limits on global carbon trading)	14-23
Charles River Associates (No limits on global carbon trading)	50
Zhang, Z.X., Nov. 1999	
No limits on global carbon trading	9.6
Limited demand –50% from Annex I	4.7
Limited demand –EU proposed ceilings	3.5
Limited supply– no hot air traded	12.6
Byron Swift and Aldyen Donnelly, <i>Environmental Finance</i> , April 2000	<20

Table A2 Carbon Trades: Volume and Price

Carbon Trades	Volume (million tonnes CO₂)	Price (US\$/tC)
Project: Energy efficiency, fuel switching, and renewable energy Buyer: Suncor Energy Inc., a Canadian integrated energy company Seller: Niagara Mohawk Power Corp. of Syracuse, NY. Environmental Resources Trust, Inc. will track the actual emissions reduction.	0.1 (Initial transaction) 10 (options to buy during 2001 and 2010)	0.59
Project: Coal mine methane to electricity project Buyer: PacificCorp Power Marketing, Inc. and City of Klamath Falls, Oregon Seller: Northwest Fuel Development, Inc.	4.5 (over 50-year period)	0.81
Project: Methane to energy Buyer: Ontario Hydro Seller: Regional municipality of Waterloo and Toromont Energy		2.05
Project: Costa Rica forest carbon sequestration Buyer: Norwegian Gov't and Norwegian companies (ABB Kraft, Cvaerner Energy, and EEG-Henriksen) Seller: Government of Costa Rica	0.73	10.0
Project: Forest plantation project Buyer: Tokyo Electric Power Co. Seller: State Forests of New South Wales, Australia		1.1
Project: Changes in agricultural techniques and activities Buyer: Greenhouse Emissions Management Consortium (GEMCO) representing 10 Canadian energy firms. Seller: IGF Insurance Company. CQuest, Ltd will verify and oversee the credit transfers.	2.8	1.8 – 7.3 (indicative price from broker)
Project: A swap between CO ₂ reduction and SO ₂ allowance Buyer: Arizona Public Service (APS), an electric utility Seller: Niagara Mohawk Power Corp. of Syracuse, NY. Carbon price based on market value of SO ₂ allowance.	2.5	2.6
Project: Wind Power Generation Buyer: TransAlta, Canada Seller: Hamburgische ElectricitatsWerke (HEW), Germany	0.024 (over 8 years)	2.75 – 7.3
Project: Liepaja Solid Waste Management Project Buyer: The Prototype Carbon Fund Seller: Republic of Latvia	0.388	23.4

Annex II: Data for Installed Price of Solar Home Systems and Price Projections

A Brief Survey of Installed Price of SHS

The Netherlands Energy Research Foundation Study²

The Netherlands Energy Research Foundation (ECN) and independent experts undertook an analysis of 104 projects in the RSVP³-ECN database as well as a literature survey to compile an inventory of experiences with solar photovoltaic applications for households in developing countries. The review estimates that approximately 1.3 million solar home systems have been distributed in developing countries with a total capacity of about 40 MWp.

Table A3 shows the price for SHS in several countries. The retail price ranged from US\$ 10 to 22 per Wp for a 'standard' SHS. A 'standard' system includes a 45-55 Wp panel, a 70-110 Ah battery, a battery regulator, 3-4 lights, and cabling and mounting material. For some systems, the price includes the cost of installation while for others only the cost of the hardware is included.

Table A3 Prices of SHS in Several Countries

Country	Year	Indicative System Price (US\$ / Wp)	Note
Dominican Republic	'89-'91	15	
Brazil	'94-'95	11-15	
Bolivia	'95?	12	
Peru	'95	11-15	
Bangladesh	'93-'97	16	
Philippines	'93-'94	15	
Ghana	'98	14	
Namibia	'97 - '99	22	incl. installation
Swaziland	'97 - '99	17	incl. installation
Botswana	'97 - '99	16	
South Africa	'95- '96	10	hardware price
Zimbabwe	'97	17	incl. Installation

Source: F.D.J. Nieuwenhout, et. al., September 2000.

² F.D.J. Nieuwenhout, et. al., Monitoring and Evaluation of Solar Home Systems: Experiences with applications of solar PV for households in developing countries, The Netherlands Energy Research Foundation, September 2000.

³ The National Renewable Energy Laboratory (United States) Renewables for Sustainable Village Power.

Solar Photovoltaic Market Assessment Survey in Bangladesh⁴

A market assessment survey of four Thanas (administrative areas) was undertaken in Bangladesh to determine the potential for SHS to serve rural households. The survey reported that the installed cost of small SHS with 35 Wp module, 70 Ah battery, and 3 10W lights is estimated at \$485 (**\$13.8/Wp**) and a large SHS with 75 Wp module, 100 AH battery, and five 10W lights or three 10W lights and 1 television set is expected to cost \$875 (**\$11.7/Wp**).

Solar Photovoltaic Electricity in China⁵

A survey of a PV retail shop in Qinghai Province in China found that one brand (Nima) of a 20 Wp system sold for 1500 to 1560 Yuan (~\$9/Wp) depending on metal or wood case for the system and it includes a voltage meter. A 10 Wp system of the same brand with a light bulb sold for 800 Yuan (\$9.6/Wp). Another brand (Yulong) sold for 1300 Yuan (\$8/Wp) with wet battery and 1460 Yuan (\$8.8/Wp) with dry battery for a 20 Wp system and 730 Yuan for a 10 Wp system (\$8.8/Wp).

SHS for Lighting (+TV and Radio) in Sukatani, Indonesia⁶

The SHS system includes a 40Wp module, a charge controller, a 12V battery of 100Ah, one 10W and two 6W lamps and other small accessories (wires and cables). The typical system cost \$400 (\$10/Wp).

⁴ Khan, H.J. and A.J. Huque, Solar Photovoltaic in Rural Electrification: Market Assessment Survey in Bangladesh, Prokaushali Sangsad Ltd., Dhaka, Bangladesh, presented at Village Power '98, Washington DC.

⁵ Sonja Ling, Solar Photovoltaic Electricity in China: Local Commerce in Xining, Qinghai Province, University of Oxford, Dissertation, September 2000.

⁶ Gregory, J., et. al., Financing Renewable Energy Projects, Intermediate Technology Publications, 1997.

Projection of PV Price

*The Brightness Program of China*⁷

In the first phase of the Brightness Program, the Chinese government plans to install 1.78 million solar home systems during 2000-2004. The systems will include large home systems with over 500 Wp, 'standard' household systems of 60 Wp, and small systems with 25 Wp. See Table A4 for a breakdown of the number of systems that will be installed for each system size.

Table A4 System Installation Goals of the Brightness Program

System	Approximate Peak Power per System (W)	Number of Systems to be Installed	Installed Capacity (MW)
Home Systems			
- High consumer	526	356,000 (20%)	187
- Mid consumer	62	801,000 (45%)	50
- Small consumer	25	623,000 (35%)	15
Total		1,780,000	286

In 1999, the price for PV systems in China ranged from \$9.7 to 13.3 per Wp depending on system size. The Brightness Program expects to reduce the price by 20-30 percent during its implementation over 5 years. This level of price reduction is possible from a large volume project that intends to install close to 300 MW of PV capacity.

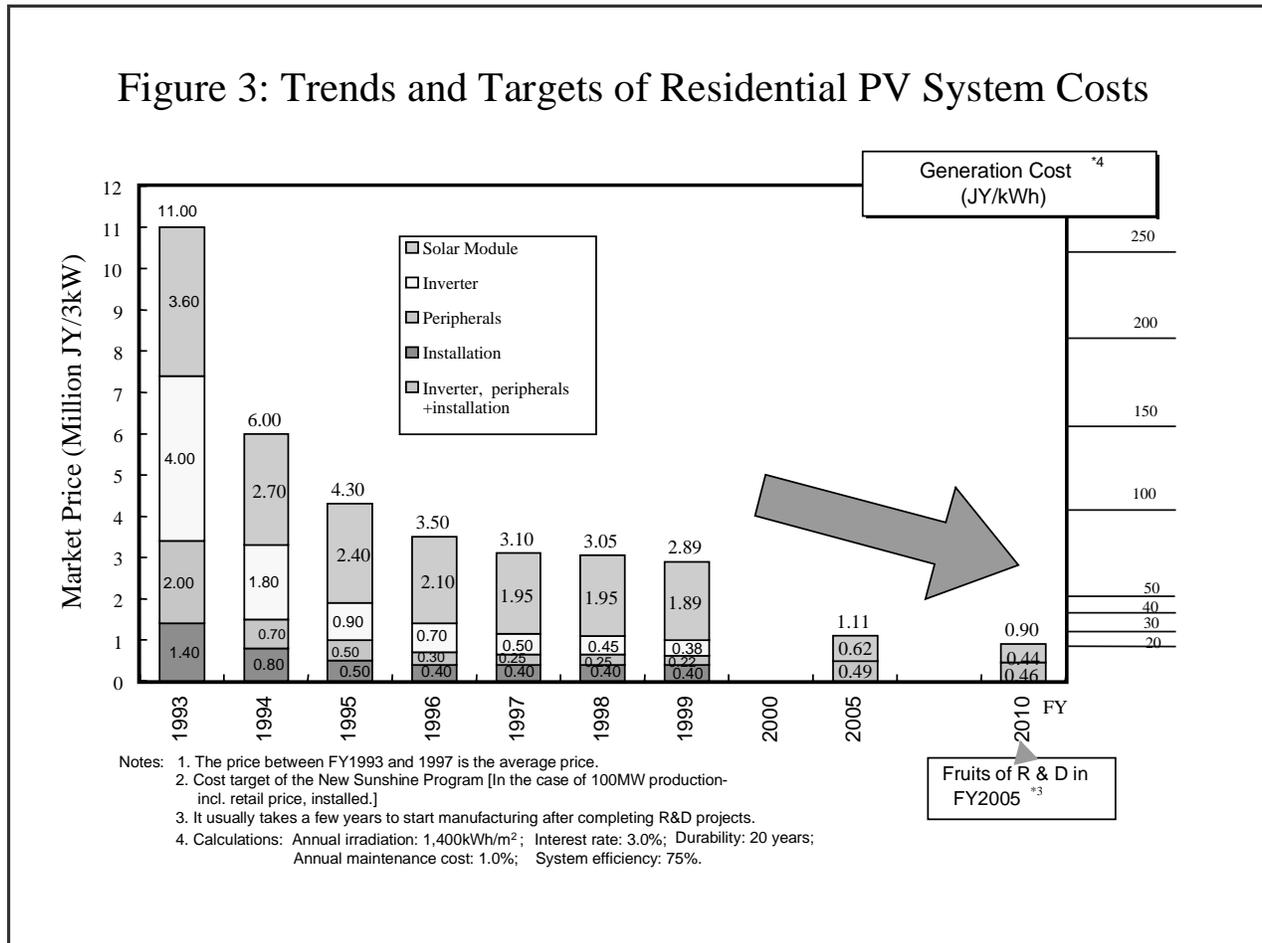
Table A5 Current and Potential Future Prices for PV Home Systems

System	1999 Price (Yuan/Wp)	1999 Price (\$/Wp)	Brightness Program Price (Yuan/W)	Brightness Program Price (\$/W)	Percent Reduction
20-25 Wp	95-110	11.5-13.3	63-75	7.6-9.1	32
80 Wp	80-90	9.7-10.9	58-68	7.0-8.2	25
500 Wp	82	9.9	66	8	20

⁷ Beijing JKD Renewable Energy Development Center, July 1999. The First Phase Plan of Brightness Program.

Japan New Energy & Industrial Technology Development Organization (NEDO) Projection⁸

The Japan New Energy & Industrial Technology Development Organization (NEDO) projects that with research and development and its large scale residential rooftop program with the goal of installing 5,000 MW of capacity by 2010 the installed cost of grid-connected PV systems will decrease by 60 percent from \$8.7/Wp to \$3.4/Wp from 1999 to 2005 and by 2010, the installed cost will \$2.7/Wp. Figure 3 shows this projection in Japanese Yen and Table A6 provides the cost data in US\$.



⁸ New Energy & Industrial Technology Development Organization (NEDO), Presented at APEC Renewable Energy Working Group Meeting, November 3, 2000, Cuernavaca, Mexico.

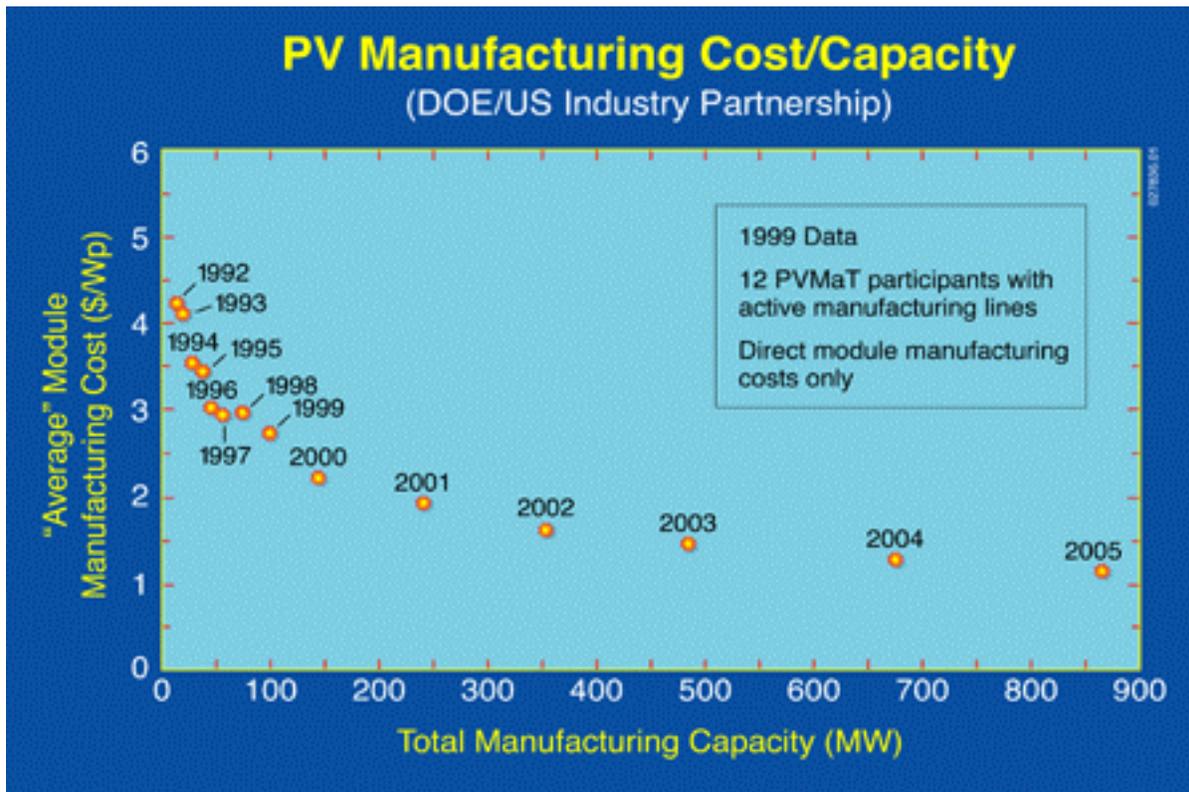
Table A6 Installed Price Projection of Grid-connected PV Systems in Japan

	1997	1999	2005	2010
Solar Module Only (\$/W)	5.9	5.7	1.9	1.3
Inverter (\$/W)	1.5	1.1		
Peripherals (\$/W)	0.8	0.7		
Installation (\$/W)	1.2	1.2		
Inverter, peripherals, and installation (\$/W)			1.5	1.4
Installed System Cost (\$/W)	9.4	8.7	3.4	2.7

(110 JY = \$1)

Module Manufacturing Cost Decline in the U.S.⁹

Module manufacturing cost in the United States is also expected to decline by 60 percent in the 6 years from 1999 to 2005. The figure below shows total manufacturing capacity versus average direct costs for module manufacturing. The plot is based on data from twelve active manufacturers of PV modules in the US. The value of “average module manufacturing costs” is a weighted average based on the manufacturing capacity of each of the manufacturers. The weighted-average cost for PV modules has been reduced by 36 percent from \$4.23 to \$2.73 per peak watt from 1992 to 1999. Projections through 2005 indicate a steady decline to an average module manufacturing cost of \$1.16 per peak watt at 865 MW of manufacturing capacity.



⁹ U.S. Department of Energy Photovoltaic Manufacturing Technology (PVMAT) R&D project, 1999.

Annex III Results of Studies on Embedded Energy in PV Systems

The energy payback time (EPBT) for crystalline silicon PV systems was found to be almost 4 years for ground-mounted systems¹⁰. The study predicts that in 2020 EPBT may be less than 2 years for ground-mounted crystalline PV systems.

For thin film solar cell modules (amorphous silicon and cadmium telluride), Alsema¹¹ calculated that EPBT is less than two years, and in the near future, EPBT is projected to fall below 1 year.

Through an empirical study, Siemens Solar¹² calculates that EPBT for its single crystalline silicon PV modules is approximately 3.3 years and its thin film copper indium diselenide modules is 1.8 years assuming 1,700 kWh/m²/yr solar insolation (4.7 sun-hrs/day).

Crystalline silicon PV system energy payback time (EPBT) is approximately 7 years (includes energy for production of metallurgical and electronic grade silicon, Czochralski growth method for PV silicon, cell fabrication, panel assembly, and balance of system); 60 percent of the energy is used to make silicon wafers. EPBT for crystalline silicon PV system may drop to approximately 2 years by 2010 with balance of system contributing close to 50 percent of the energy requirement¹³.

¹⁰ Alsema, E.A. and E. Nieuwlaar, Energy viability of photovoltaic systems, *Energy Policy*, 28, p. 999-1010, 2000.

¹¹ Alsema, E.A., Energy Requirements of Thin-Film Solar Cell Modules - A Review, *Renewable and Sustainable Energy Reviews*, 1998. 2(4): p. 387-415.

¹² Knapp, K.E. and T.L. Jester, "Initial empirical results for the energy payback time of photovoltaic modules," Energy and Environmental Economics, Inc. and Siemens Solar Industries.

¹³ Blakers, A. and K. Weber, "The Energy Intensity of Photovoltaic Systems," Centre for Sustainable Energy Systems, Engineering Department, Australian National University, Canberra 0200, October 2000.

Annex IV Analysis of PVMTI Deals for Cost of Carbon Abatement

	A	B	C	D	E	F	G	H	I
				Cost of Abatement (US\$/t C)					Baseline
PVMTI Deal Code	FIRR before PVMTI	FIRR after PVMTI	Equivalent reduction in capital cost (%)	Discount rate (DR)	Full lifecycle (FL)	KP, 2008	KP, 2012	FL, 0% DR	"Kerosene" or "Diesel"
RQDH	10%	16%	-5% (PV & SCN)	15%	26.7	50.4	35.2	6.6	Kerosene
RGZJ	11%	16%	-37% (SCN)	15%	15.6	32.4	21.3	5.0	Kerosene
RGDK	14%	19%	-30% (SCN)	15%	21.3	43.6	29.0	5.7	Kerosene
ZPTZ	11%	18%	-8% (PV & SCN)	15%	117.5	235.6	158.5	19.7	Diesel
ZCKH	12%	17%	NA	15%	110.2	169.0	132.9	25.3	Diesel
LTQZ	10%	15%	NC	15%	16.0	28.3	20.5	3.0	Kerosene
JBAB	7%	10%	NC	15%	14.5	27.5	19.2	2.6	Kerosene
JBAR	7%	15%	NC	15%	25.0	41.9	31.3	5.0	Kerosene
JBAJ	10%	17%	NC	15%	17.4	33.6	23.1	3.0	Kerosene
AZQB	7%	15%	NC	15%	17.4	33.6	23.1	3.0	Kerosene
RQLN	15%	20%	-50% (SCN)	15%	5.9	11.4	7.8	1.0	Kerosene
MNNQ	15%	20%	-50% (SCN)	15%	5.9	11.4	7.8	1.0	Kerosene
SNSZ	15%	20%	-50% (SCN)	15%	5.9	11.4	7.8	1.0	Kerosene
ZEQH	15%	20%	-50% (SCN)	15%	5.9	11.4	7.8	1.0	Kerosene
RNLD	15%	20%	-50% (SCN)	15%	5.9	11.4	7.8	1.0	Kerosene

Column notes

- A Ex-ante forecast financial internal rate of return (FIRR) before PVMTI financing as estimated by project model developed by External Management Team (EMT).
- B Ex-ante forecast FIRR after PVMTI financing as estimated by project model developed by EMT.
- C This column estimates the reduction in project capital cost necessary, in terms of PV systems (PV) and/or service centre network (SCN), to increase FIRR A to FIRR B. In some cases this calculation is not possible as either the business model is not yet fully defined (NA) or the project involves negligible capex (NC) because the network is already in place and the PV systems are leased or sold.
- D Discount rate at which the subsidy flows and Carbon emission reduction are discounted. This variable can be adjusted to test sensitivities.
- E Calculated as the Net Present Value (NPV) of the subsidy cash flows divided by the NPV of the Carbon savings over the full life cycle of the PV systems.
- F Calculated as the NPV of the subsidy cash flows divided by the NPV of the Carbon savings from the PV systems up to the end of 2008.
- G Calculated as the NPV of the subsidy cash flows divided by the NPV of the Carbon savings from the PV systems up to the end of 2012.
- H Calculated as the NPV of the subsidy cash flows divided by the total Carbon savings from the PV systems during their lifecycle (not discounted).
- I Assumes a baseline of either (1) kerosene lamps; or (2) a diesel generator for electricity. This can be adjusted to test sensitivities.

Comments on Deals

- (1) The deals shown are from India, Kenya and Morocco
- (2) The types of deal include (a) solar home systems (SHS) in rural areas; (b) SHS in urban areas; (c) PV water pumping; (d) PV advertising signs.

Comments on PV Cost/Price Changes

- (1) The cost of production of PV systems is assumed to fall by 1-3% per year in real US\$ during the course of the project (depending on country and project).
- (2) Wholesale PV prices on the other hand are assumed to remain constant in US\$ terms until 2003 due to ongoing supply/demand imbalance in the industry. Post-2003 PV prices are assumed to fall in line with costs (see 1)

General comments on results

- (1) INDIA has proven to have the highest cost of abatement reflecting the perceived risk level of the sector and the competition with other energy sources.
- (2) KENYA has a lower cost of abatement reflecting the lack of alternatives in the power market and recent failures of the national electricity system.
- (3) MOROCCO appears to have the lowest of cost of abatement but this does not include the subsidy from the Moroccan electricity utility (ONE) of 4,500 dirham (US\$ 450) per system which equates to a lifecycle value of \$190/tC (kerosene) or \$750/tC (diesel).

Annex V

**India, Kenya, and Morocco
Photovoltaic Market Transformation Initiative
(PVMTI)**

Project Document
August 1998

International Finance Corporation
Technical and Environment Department
Environment Division
Environmental Projects Unit

**INTERNATIONAL FINANCE CORPORATION
GLOBAL ENVIRONMENT FACILITY**

**PHOTOVOLTAIC MARKET TRANSFORMATION INITIATIVE (PVMTI)
PROJECT DOCUMENT**

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CURRENCY EQUIVALENT

(April 1998)

Indian Rupee (INR) 39.63 = US\$1.00

Kenyan Shilling (KES) 59.61 = US\$1.00

Moroccan Dirham (MAD) 9.80 = US\$1.00

(All references to “\$” in the document are to US\$)

GLOSSARY OF ABBREVIATIONS

BoS	Balance of Systems
EMT	External Management Team
FCCC	Framework Convention on Climate Change
GEF	Global Environment Facility
IFC	International Finance Corporation
kW, MW	kilowatt, megawatt
PV	Photovoltaic
REEF	Renewable Energy and Energy Efficiency Fund
SDC	Solar Development Corporation
SHS	Solar Home System
SME	Small and Medium Enterprise
UPS	Uninterruptible Power Supply
Wp	Watt Peak

PROJECT SUMMARY

Project Name:	Photovoltaic Market Transformation Initiative (PVMTI)
Project Duration:	10 years
Implementing Agency:	World Bank
Executing Agency:	International Finance Corporation (IFC)
Requesting Countries:	India, Kenya, and Morocco
Eligibility (FCCC Ratification):	India (11/1/93); Kenya (8/30/94); Morocco (12/28/95)
GEF Focal Area:	Climate Change
GEF Programming Framework:	Operational Program #6: Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs

Project Description:

PVMTI is a strategic intervention to accelerate the sustainable commercialization and financial viability of PV technology in the developing world. PVMTI will make selected concessional investments in private sector PV market development projects in India, Kenya, and Morocco. With technical assistance and appropriately structured financing, these projects are eventually expected to provide successful examples of sustainable and replicable business models that can be financed on a commercial basis.

Costs and Financing (in US\$ million):

Implementing Agency Costs: Included in Annual Corporate Budget

Project Allocation:

Preparation (PDF A in 1996 for country consultations)	\$0.05	(0.2%)
Executing Agency Costs	\$3.3	(10.3%)
IFC	\$1.0	
IFC's External Management Team (EMT)	\$2.3	
Technical Assistance	\$3.7	(11.5%)
Investment Funds	\$25.0	(78.0%)
Debt, Equity, Guarantees	\$22.5	
Grants	\$2.5	
Total Project Budget	\$32.05	(100.0%)
Funded from Project Reflows (see below)	(\$2.0)	
Total GEF Funds	\$30.05	

Expected Performance of Non-Grant Investments:

Debt, Equity, Guarantees	\$22.5
Possible Losses on Investments	(\$7.5)
Likely Returns on Performing Investments	\$2.3
Gross Reflows Expected	\$17.3
Reflows Required for Project Execution Costs	(\$2.0)
Contingent Performance-Related Compensation for EMT	(\$1.8)
Expected Amount for Repatriation to GEF	\$13.5

Co-Financing (Private Sector): **\$60-90 million**

Total Project Cost: **\$92-122 million**

I. EXECUTIVE SUMMARY

1. The Photovoltaic Market Transformation Initiative (PVMTI) is a strategic intervention to accelerate the sustainable commercialization and financial viability of PV technology in the developing world. It is based on the premise that private sector project design and financing on a commercial basis will stimulate more sustainable ventures than government or donor financed PV procurements. This direct engagement of the private sector and placement of targeted financing from a limited pool of funds is expected to maximize co-financing and result in support for the most sustainable and replicable projects.

2. Photovoltaics (PV), a modular zero-emission technology that converts sunlight into electricity, has broad applicability in much of the developing world and unrealized potential for significant price reductions. Opportunities to advance PV are larger in the developing world than in OECD countries because of high growth in energy demand and because the relative immaturity of the energy sector provides entry points for alternative energy solutions. The large market potential created by these circumstances offers commercial and near-commercial opportunities to serve these growing energy needs with photovoltaics, while simultaneously improving the availability of PV for global applications and benefits. Potential PV markets now in early stages of development include: a) approximately 300-400 million unelectrified households in developing countries that are unlikely to receive grid power in the near future; b) widespread applications in water pumping and agriculture; and c) stand-alone power for commercial applications and grid-augmentation.

3. PVMTI will use up to \$30 million in funds provided by the Global Environment Facility (GEF) to provide concessional financing of private sector PV market development projects in India, Kenya, and Morocco. It is expected that approximately \$13.5 million of funds recovered from investments and portfolio earnings will be available for repatriation to the GEF by the end of the 10 year operation of PVMTI.

4. Of the GEF funds, \$15 million is allocated for project financing in India, with \$5 million each allocated for Kenya and Morocco. The remaining \$5 million will be used for technical assistance and project execution. Approximately 4 to 7 sub-projects are expected in each country and funds placed in individual sub-projects are expected to range from \$500,000 to \$5 million. IFC will consider investing its own funds on a case-by-case basis in a limited number of PVMTI sub-projects which meet IFC's requirements for commercially viable investments. Additional co-financing of \$60-90 million by sub-project sponsors and other sources (including commercial banks) is expected to result in total project costs of \$85-115 million.

5. PVMTI was endorsed by the respective country governments following consultations undertaken during 1996. The GEF Council approved PVMTI as part of its work program at its meeting in October 1996.

6. Use of the GEF funds is consistent with the GEF Operational Strategy and Operational Programs in climate change mitigation, and is specifically targeted at the reduction of barriers to market penetration of photovoltaic technology. PVMTI addresses *GEF Operational Program #6: Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing*

Implementation Costs. The barriers to PV market development include: high technology cost and transaction costs, lack of affordable and appropriately structured financing (including that for working capital and end-user credit), insufficient management skills, lack of effective distribution and service infrastructure, inadequate standards for design and installation, and a variety of policy barriers. While technology price reductions directly attributable to PVMTI (as addressed in GEF Operational Strategy #7) are expected to be modest, successful examples of market development will continue to be important in translating future price reductions into greater long term market penetration.

7. PVMTI sub-projects will be designed by private sector companies or consortia and submitted in response to a broadly distributed solicitation for project proposals. Financing terms will be flexible, and most investments are expected to request debt at below-market terms. The use of other financing such as partial guarantees, equity, or other instruments will be considered if the benefits justify the additional complexity. Projects will be selected based on their strategic impact in overcoming the barriers and transforming the PV market in a manner consistent with GEF policy and the objectives of Operational Program #6. Criteria will include the assessment of the proposed financial innovation, degree of financial leverage, likelihood of sustainability and replicability on a commercial basis, and the expected level of market growth. Qualifying projects will be considered for investment on the strength of their proposed business plans (including evaluation of the proposed sub-project's financial and technical viability, and the management capability of the sponsors).

8. Sub-projects will be evaluated both in absolute terms and relative to other proposals received. Investment will begin first with "priority track" projects that offer strong business plans and relatively complete financing packages. The portfolio will be completed with "secondary track" projects -- which may require additional assistance to complete their business plans and financing packages, but will be subject to the same evaluation as the priority track projects.

9. PVMTI activities will be similar in all three country markets but the sub-projects selected for funding will be unique to each country due to differences in government policy, demand profiles, and business infrastructure. PVMTI will magnify commercial activities in potentially large market segments now in early stages of development and demonstrate alternative models to grid extension. PVMTI is expected to have a definitive impact in increasing sales and assuring the financial viability of a number of "beacon companies" providing successful and replicable examples of good business and technical practices. The impact in each of the three national markets is expected to be significant, with sales growth over the base case ranging from 33% in Morocco to 55% in India and 66% in Kenya, and a world market increase of 5% over the life of the project. These incremental, but demonstrable, effects on reducing barriers to market growth and availability of capital are expected to accelerate market dissemination and improve the attractiveness of the sector to commercial finance.

10. Following GEF Council's initial approval in October 1996, thorough appraisals in the three countries indicated that a much higher level of engagement over a longer period of time than originally expected would be required given the current stage of development of these markets. For PVMTI to succeed, sector and country-specific expertise similar to that for an investment fund would be needed. As a result, IFC's management decided that an external

management team (EMT) qualified in creating and managing a portfolio of small, innovative renewable energy projects should be retained. This approach would support the efficient, effective execution of the project to achieve GEF's objectives, and as an additional benefit yield the maximum recovery of GEF's funds. Moreover, active engagement, including providing a high level of technical assistance on the ground in-country to the sub-project sponsors, would identify those projects which are most likely to demonstrate financial structures and business approaches that work -- thus forming the basis for long-term sustainability and replicability of projects.

11. The EMT will provide a project investment manager for the duration of the project and three individual in-country managers with significant other local support during the project financing phase, expected to be completed within three years. The EMT will issue the solicitation for sub-projects, review and screen project proposals received, perform due diligence, mobilize co-finance, undertake appropriate environmental review, and structure sub-projects for submission to an IFC investment committee. IFC will closely supervise the EMT and will make all decisions on investment selection, approval, and recovery of funds. The EMT will then monitor the sub-projects over the lifetime of the investments. A significant portion of the EMT's compensation will be deferred and related to its performance in achieving PVMTI's objectives -- not unlike the incentive provide to the manager of a fund. However, this performance-related compensation is driven less by the need to maximize financial performance (as most investment funds require) than to maximize the strategic gains for GEF.

12. PVMTI will provide funds on concessional terms and will operate at a level of investment that is generally smaller and more specialized than that offered by commercial financial channels. It will also provide a higher level of management oversight and technical assistance. While these elements may increase costs above the level normally incurred by a commercial investment fund, these incremental costs are considered key to overcoming market barriers and transitioning PV business activities toward greater commercialization. Over its life, PVMTI expects to recover nearly 70% of the invested funds, with nearly 80% of all recovered funds available for potential repatriation to GEF.

13. The costs of executing PVMTI are expected to be \$3.3 million or about 10% of the total project budget of \$32 million and are within the range indicated in the original Project for Review document provided to GEF Council in October 1996. However, based on the appraisal of the country markets, investee companies will require technical assistance and business advice both before and after receiving funds from PVMTI in order to increase the probability of achieving GEF's strategic objectives. This technical assistance is expected to cost an additional \$3.7 million. Nonetheless, the project has been structured in such a way that the costs required for providing technical assistance and executing the project from the GEF grant remain at \$5 million as originally requested and the total GEF funds required remain at \$30 million. Additional funds required for successful execution of the project will be provided by the reflows from non-grant project financing.

14. The total non-investment costs of the project *including* technical assistance, execution by IFC and the EMT, and the performance-linked compensation for the EMT (payable only from reflows) is the equivalent of about 3.5% each year of the total funds available for investment.

This is comparable to the management costs charged by fund managers for smaller or more innovative fund but *excluding* incentive payments (i.e., carried interest).

15. The outcome of PVMTI project financing will be summarized by the EMT and IFC and presented in the recipient countries as well as internationally at future conferences or seminars. The intent will be to convey the lessons learned to other potential investors, financial institutions, and donor organizations so that they may better understand the actual risks and rewards of engaging in PV financing and continue to respond to new opportunities to replicate or expand successful PV activities financed by PVMTI. IFC will also disseminate PVMTI's outcomes broadly within the World Bank Group and to GEF so that these lessons can be incorporated into the design of new PV and related investment programs.

II. PROJECT BACKGROUND

Photovoltaic Technology

16. Photovoltaics (PV) include crystalline and various emerging thin-film technologies that convert sunlight to electricity. PV manufacturing costs have dropped from several hundred dollars per peak watt (Wp) in the early 1970s to current prices of \$4 to \$5/Wp. Installed costs, including balance of systems (BoS) components such as batteries, charge controllers (and in some cases voltage inverters) range from \$10 to \$12/Wp for many applications. PV has become the least-cost, most dependable energy choice for many applications in remote locations, such as telecommunications, water pumping, cathodic protection, signaling, and housing, as well as a variety of consumer products (e.g. lanterns, walk-lights). Price reductions have also brought PV to the point of becoming cost-competitive for peaking and line augmentation under some circumstances.

Photovoltaic Markets

17. There are approximately 300-400 million unelectrified households worldwide (representing almost two billion people) that are unlikely to be served by grid power in the foreseeable future. In the PVMTI target countries, there are approximately 75 million unelectrified households in India, 3 million in Kenya, and 2 million in Morocco. Economic growth in the rural sectors has created significant demand for access to electrical energy that is often not available from the grid. Overall capacity constraints already faced in many developing countries, coupled with high technical losses and low revenue collection rates, continue to hinder the operation of grid electricity supply systems and slow economic growth. The relatively low energy usage and revenues available from rural customers makes grid extension in large areas a poor economic investment. Fiscal constraints are significantly limiting construction of new generating capacity and plants that are built are highly reliant on fossil fuels.

18. These growth pressures and energy needs in both the grid and off-grid sectors, coupled with liberalization of energy sectors, price reforms, and budget constraints, continue to offer new opportunities for private, commercial power alternatives such as PV that represent a fundamentally different approach to power sector development. While currently small in scale,

PV is a modular technology with broad applicability in much of the developing world at current prices. Commercial opportunities to expand use of PV technology are larger in the developing world because of the relative immaturity of the energy sector compared with developed countries and the enormous growth in energy demand that is outstripping supply. The major off-grid markets for PV in developing countries include telecommunications, village water and irrigation pumping, captive power for commercial applications, and small solar home systems (SHS).

19. Although PV markets are growing, market penetration of PV remains low, and sustained growth may remain elusive unless deliberate actions are taken to develop significant latent markets on a commercial basis and accelerate market penetration. Global PV shipments were about 90 MW annually in 1996, i.e. less than the capacity of a single medium-sized gas fired power plant. Developing country markets now account for about one-half of current PV shipments, and the lack of extended electrical grids in many of these countries makes PV competitive in a broad set of markets even at current prices. Over 500,000 SHS are now installed in developing countries, with over 80,000 systems being added annually.

20. The business-as-usual scenario for PV indicates markets will grow by approximately 15% annually to 600 MWp by the year 2010. In order to expand PV to a scale where it can fulfill its potential as a mainstream zero-carbon energy option with global benefits, both market development and manufacturing investment are required. In particular, increased manufacturing investments in a variety of low cost thin film technologies now emerging could result in considerable price reduction. Accelerated development of markets and financing chains to deliver PV products is a prerequisite for attracting manufacturing investment, regardless of the PV technology utilized.

21. The large market potential that PV offers is currently constrained by high transaction costs due to undeveloped distribution chains, lack of working capital for companies, and lack of finance for customers. Manufacturing remains below optimum scales and faces a dilemma of constructing larger scale manufacturing plants without the sustainable growth in markets that would absorb the increased output. In developing countries there are relatively few examples of sustainable PV enterprise; and business partnerships among manufacturers, suppliers, distributors, service companies -- and particularly financial institutions -- are not well developed. Because of this paucity of business models with a track record of success and also because of the distracting effects of government-program driven procurements and donor activities, most developing country PV companies have not conducted their business in an environment that requires or enforces commercial discipline.

III. PROJECT OBJECTIVES AND BENEFITS

22. PVMTI represents a strategic intervention to stimulate PV business activity in selected countries and to demonstrate that quasi-commercial financing can accelerate its sustainable commercialization and financial viability in the developing world. It is based on the premise that private sector project design and management will result in more sustainable ventures than government or donor financed PV procurements alone could provide. Previous experiences with highly subsidized or give-away systems has not resulted in system longevity or widespread dissemination of the technology. It is believed that private sector sales will result in more

enduring relationships with customers, a stronger sense of ownership on the part of the consumer, and will be more likely to require and sustain an adequate service infrastructure to assure continued performance of systems.

23. Commercial experience in niche markets has shown PV to be reliable and durable, and the technology itself is considered to be mature. While significant advances are still being made in manufacturing which could result in lower costs, the developments required to bring PV to a more commercial status include growth in financing, marketing and infrastructure, support for entrepreneurs, and building customer experience through delivery of value.

24. **Barriers to Market Development:** There are a number of barriers endemic to the introduction of renewable energy technologies. These barriers pose particular obstacles to small companies of the kind engaged in delivery of PV-based services that cannot absorb these costs as readily as larger, conventional energy project sponsors. The primary barriers include:

- **Technology cost**, while declining, remains relatively high. In spite of life-cycle costs that are competitive with power sources such as diesel, the up-front costs of PV are substantial.
- **Lack of successful (and profitable) business models** for PV enterprises discourages investors and financing institutions from providing commercial financing for companies engaged in PV businesses. This lack of good business practice goes hand-in-hand with poor technical practice that harms the reputation of the technology.
- **Appropriate financing** for consumer credit or working capital remains expensive or unavailable, resulting in customers unable to amortize system costs over time and companies without funds to finance expansion of operations. Due to the small scale of the market and lack of familiarity with PV, banks tend to overprice the risk of operating in this sector or do not lend at all. Companies find borrowing costs prohibitive and instead finance growth out of cash flow which is usually meager. As a result, financial linkages remain undeveloped and consumer credit is generally unavailable.
- **Low product volume**, combined with the difficulties of developing a consistent supplier-dealer chain, results in high unit transaction costs and continues to hinder the expansion of the market. Consumer awareness also remains low.
- **Managerial and technical skills** remain limited among many companies selling and installing PV systems, resulting in inadequate business planning and poor cost and quality control. PV manufacturing firms, while often larger and with stronger management, typically lack the broad market reach to develop consistent and profitable distribution chains. Companies also face investments which can be considered, in part, as public goods (e.g. the benefits of raising consumer awareness or training personnel may not accrue to the company making the investment).

- **Policy barriers** remain widespread and create an uneven playing field for PV and other renewable energy technologies. These include market distortions in electricity tariffs, subsidies for conventional fuels, and high import taxes on PV modules, materials, and BoS components such as batteries or efficient lighting fixtures.
- **Standards**, certification, and accepted system design and installation guidelines are incompletely developed and are erratically applied in much of the developing world, with a detrimental effect on system performance and quality.

25. Further investment by national governments in both fossil fuel-fired generation plants with 25+ year lifetimes and grid extension or connection strategies will continue to contribute to significant growth in emissions of greenhouse gases (GHG). India, for example, currently produces over 70% of its power by burning poor quality coal and ranks second (behind China) in its rate of growth in both the power sector and aggregate GHG emissions. While developing world options for avoiding growth in carbon emitting technologies are relatively limited and require difficult economic tradeoffs, PV offers an alternative to continued, uneconomic grid-extension that can relieve some of the pressure of this growing dilemma.

IV. RATIONALE FOR GEF FINANCING

26. A central objective of the GEF Operational Strategy is to promote sustainable growth in development and financing of renewable energy as direct alternatives to fossil fuel combustion -- the main source of CO₂ emissions implicated in global warming. Growth of fossil fuel-fired power generation in the developing world has particular ramifications due to its high rate of growth, even if broad opportunities for energy efficiency are availed.

27. PVMTI specifically addresses *GEF Operational Program #6: Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs*. GEF funds will be primarily directed towards market development projects (not manufacturing) as this is the area considered most productive in terms of reducing barriers and increasing dissemination of PV. Successful market development projects will indirectly stimulate additional manufacturing and technical improvements, resulting in the secondary benefit of long-term cost reductions (as targeted by Operational Program #7).

28. In terms of reducing and overcoming barriers to building PV markets, the private sector is considered the best agent to catalyze investment and business activity to accelerate this important zero-GHG emission technology. PVMTI's solicitation and selection approach provides a competitive element that is expected to maximize financial leverage from the private sector and deliver near-commercial projects. Consistent with other GEF-supported IFC initiatives now under implementation (such as the Renewable Energy and Energy Efficiency Fund and the Terra Capital Biodiversity Fund), the results of implementing projects directly with the private sector are expected to be larger and more enduring than those that could be achieved through grants or through projects implemented by country governments with donor support.

29. In accordance with the GEF Operational Program #6, PVMTI will only fund sub-projects where the presence of recognized market barriers are impeding their development and they would

otherwise be unlikely to be initiated. Appropriately-structured financing along with significant technical assistance in the form of management, technical, and financial guidance is required to support and nurture models of sustainable commercial PV enterprises. Starting with near-commercial projects that can then be replicated and sustained on a commercial basis will ultimately accelerate market transformation. PVMTI investments must be close to “market ready” in that they meet the criteria for commercial investing, but for a particular market barrier or cost disadvantage that prevents them from obtaining all of the needed financing on terms that produce an acceptable risk-adjusted rate of return.

30. PVMTI’s approach is not based on a general procurement or a broad infusion of funds, but instead will offer selective investment in markets with strong economic potential while providing active investment management to assist sub-project sponsors in addressing barriers endemic to their particular project. GEF financing will not be applied to compensate for market distortions (for example, where import and other taxes are excessively high) nor to invest in “opportunistic” projects where market demand is inherently weak and GEF support is unlikely to catalyze further commercial investment.

31. PVMTI is also consistent with GEF's focus on strategic investment in technologies with substantial future potential (despite high present costs or a low present level of market development). Among the technologies fitting this description (e.g. solar thermal electric, biomass gasification, and fuel cells), PV is particularly attractive because it is modular (in applications ranging from less than 10 Wp to potentially millions of Wp), versatile (capable of operating in stand-alone applications, in hybrid configurations, or connected to the grid), uses a solar energy resource broadly available throughout the developing world and has high potential for significant cost reduction.

V. PROJECT DESCRIPTION

Project Background

32. PVMTI is designed to encourage private companies offering innovative PV goods and services by providing them with concessional financing which is not available from the market or other sources. The competitive basis created by the sub-project selection process is focused on identifying investments and modalities most likely to result in sustainable and replicable market development vehicles. As PVMTI funds are limited, some companies will receive financing and others are likely to be passed over, but successful project financing support should result in a stronger market which will eventually benefit many other market participants.

33. PVMTI will operate at a level of financing activity that is too small for most traditional IFC investment channels or international investors and in a sector that is too specialized or too risky for local commercial financial institutions. Although the average financial rate of return for PVMTI is expected to be below market rates and may include higher losses than would be expected in commercial loans or investments, the financing rationale for PVMTI is based on overcoming the barriers described above. The rate of return differential to be absorbed by PVMTI and the higher rate of sub-project losses are justified by: (1) allowing PV companies to

expand their existing activities more rapidly than they otherwise could have; (2) permitting financial institutions to gain experience that will enable them to price their risk accurately and thus fund PV companies on a commercial basis; and (3) broadening markets resulting in increased consumer awareness of the benefits of PV.

Country Markets: Expected Deal Flow and Business Case

34. Information gathered on appraisal missions during the summer of 1997 demonstrated a potential deal flow and business case consistent with PVMTI's financing approach. About 25 projects totaling nearly \$175 million (of which more than \$100 million were in India) were identified -- even after excluding projects with a low probability of being implemented. This preliminary assessment indicates that the market should be sufficient to absorb the \$25 million of PVMTI funds.

35. The initiative has been favorably received during appraisal in the target countries as a cost-competitive financing source which is directly responsive to the financial needs of the PV industry. A wide variety of business plans showing innovation and commitment to market development have already been presented and discussed. In India in particular, a number of companies expressed a desire to diversify away from government and donor supported markets and presented viable business approaches to take advantage of significant new market niches.

36. However, a number of PV operations will find it difficult or risky to expand operations or to mobilize a high level of co-finance, and there may be a greater reluctance to form consortia than was originally expected. The current small size of many operations and the undeveloped state of many markets will likely require that PVMTI provide financing on a staged disbursement basis, especially in Kenya (discussed in greater detail below).

37. PVMTI activities will be similar in all three country markets, but the types of sub-projects which are funded will be unique to each country due to differences in government policy, demand profiles, and business infrastructure. In India, PVMTI will likely stimulate investments and activities in new commercial (not government driven) sectors as well expand existing sectors. In Kenya, it is expected to provide working capital and end-user financing to a market dominated by small-scale enterprises that is thriving but constrained by inadequate sources of funding. In Morocco, there is a particular potential to demonstrate private franchise models and guarantee facilities (with national utility support) to finance alternatives to non-viable grid-extension. In all countries significant opportunities have been identified to involve financial institutions including but not limited to banks, non-banking finance companies, and leasing companies. There is a significant need for assistance to help financial institutions understand the different financial requirements of customers and companies involved in the PV businesses, so they can better evaluate the risks associated with providing the necessary commercial financing. This can be achieved by involving some of them in PVMTI investments and having a wider impact by having demonstrated successful and sustainable models of business enterprise from some of its investments.

38. At the conclusion of the PVMTI appraisals in the three countries, it became clear that a simple "award" approach as proposed originally (albeit on concessional terms rather than as

outright grants) was insufficient and inappropriate given the current stage of development of these markets. The appraisal findings strongly indicated that a much higher level of engagement by IFC in the project's execution would be necessary over a longer period of time to make PVMTI succeed in meeting its objectives as a GEF project. IFC concluded that to address the significant barriers facing these markets, a near-commercial approach with a much more active role by IFC (and its agents) in making and managing these investments was required. A more active execution role would significantly increase the chances of achieving the GEF's objectives of demonstrating financial structures and business approaches that work and which would form the basis for long-term sustainability and replicability of such projects. As an additional benefit, this approach would also increase the probability of realizing a significant level of reflows. The actual implementation modalities are discussed later in Section VI. The remainder of this section discusses the business case and the deal flow likely for PVMTI in the three target countries.

India

39. With about 11 MW in annual sales, India is the largest developing country market for PV and represented about 12% of world PV sales in 1996. It is unique in the developing world in having a complex PV industry with multiple suppliers and many market segments. Government equipment procurements, 100% first year depreciation for corporate-owned renewable energy projects, and low cost financing (in part financed by an earlier World Bank/GEF project) available through the Indian Renewable Energy Development Agency (IREDA) have resulted in rapid growth to the current installed PV capacity of 27 MW. In response to these incentives, and given strong import tariffs on modules, over a dozen cell and module manufacturers have emerged, with almost the entire market served by indigenous manufacturing companies.

40. However, the annual market of approximately 11 MW uses less than half the available module manufacturing capacity. Approximately 80% of wafers and 50% of cells are imported, as are virtually all glass and lamination materials, so a large portion of the PV manufacturing industry consists of basic assembly operations. Module quality and efficiency are mixed, and relatively few companies would be price-competitive in world markets. The attractive government incentives have also served to distract some companies from quality and customer value. Many systems are poorly installed and do not perform well. The overall Indian market suffers from high customer dissatisfaction and limited market penetration outside of government purchases. As in the rest of the developing world, the SHS market and consumer financing modalities have not been well developed. The "business as usual" scenario for India is that growth would continue to rely on government subsidies and PV would fail to capitalize on the potential to benefit from the acute shortfall in electricity supply.

41. Despite these shortcomings, India remains an attractive market. While 85% of villages are nominally on the grid, household connections are very limited, and power quality and availability are low. There is a burgeoning middle class desiring and able to afford small power systems, and household, commercial, and agricultural customers alike are increasingly frustrated with the inability of the grid to deliver reliable power. India also has a developed financial sector with experience in consumer finance and leasing. It is expected that PVMTI will encourage

some of these organizations to offer PV financing services either on a stand-alone basis or in conjunction with PV companies.

Table 1: Anticipated Deal Flow for India				
Sponsor	Project	Project Cost (US\$)	Potential Volume Increase	Potential for PVMTI Investment (US\$)
PV manufacturer + distributor	Solar home system retailer	10 m	0.8 MW	2.5 m
PV manufacturer + NGOs	Build network of off-grid dealerships	55 m	17.5 MW	5.0 m
PV manufacturer	Solar home system/lantern retailer	5 m	1.0 MW	1.25 m
BoS supplier	Solar home system retail	2.5m	0.8 MW	1.0 m
BoS supplier	Develop market for uninterrupted power supply systems	22 m	1.5 MW	3.0 m
BoS supplier + NGOs	Water pumping systems for housing projects	10 m	1.3 MW	1.0 m
General business conglomerate	PV telecommunications	30 m	2.0 MW	5.0 m Low probability
Pump manufacturer	Develop end-user finance for PV pumping	65 m	12.0 MW	5.0 m Low probability
BoS supplier	Retail networks for PV applications	12 m	2.5 MW	3.0 m Low probability
BoS supplier	Retail networks for PV applications	2.5 m	0.8 MW	0.75 m Low probability
Total 1	All above projects	214 m	40 MW	27.5 m
Total 2	Excl. low probability projects	105 m	22.9 MW	13.8 m
Total 3	Including 35% of low probability project values	143 m	28.8 MW	18.6 m

42. The case for PVMTI in India is predicated on a business environment characterized by a strong financial sector (but one that perceives the PV sector to be too risky) and a broad technical base capable of significant improvements. While business-as-usual in the PV sector is significantly larger in volume compared with the other countries, it is not sustainable as it relies heavily on government assistance and subsidy. Significant additional benefits will include: strengthening existing key players; increasing the range of good quality urban and rural applications of PV; and introducing new organizations to the industry with consumer marketing and customer financing expertise. Sufficient deal flow (summarized in Table 1 above) has been identified to invest all of the available \$15 million of PVMTI funds at an expected leverage ratio of about 3:1. Even though only 4-7 sub-projects are likely to receive PVMTI funds, financing in

these sub-projects is expected to be instrumental in increasing annual sales by more than 50% over the 18 MW annual sales base case projection for 2003.¹⁴

Kenya

43. Kenya is viewed as a true free market for PV products. Three quarters of the population (some 20 million people) live in rural areas, and there are now over 50,000 solar home systems installed. The SHS installation rate exceeds the rate of rural grid connections provided by the government-operated Kenya Power and Light Co. The current market is approximately 0.3 MWp per annum, the majority of which is for small systems often utilizing 12 Wp amorphous silicon modules. Although there is no indigenous cell or module manufacturing capacity, there is some local BoS manufacturing and assembly of widely varying quality. Despite some inconsistencies in import tariffs, the government is broadly supportive of PV technology imports.

44. While Kenya offers a promising private-sector driven market, many Kenyan PV companies are quite small and have inadequate management and technical skills. In many cases, these companies are unable to design and install reliable products. An extremely high level of cost consciousness leads many consumers to purchase PV components and assemble/install systems on their own, resulting in wide variations in quality and the use of undersized and sometimes inferior modules. The majority of sales have been for cash, and financial institutions operating in rural areas have only recently begun to experiment with offering services to the PV sector. While quality problems are acute and could result in long term consumer dissatisfaction, current satisfaction levels with SHS are over 60% and consumers show considerable understanding of the limits and benefits of PV systems.

45. It is anticipated that the majority of proposals submitted to PVMTI will be related to distribution of SHS. In addition to investing in companies directly, there is identified potential for PVMTI to provide capital to Kenyan banking institutions capable of on-lending funds for individual consumer credit and as working capital at affordable rates for companies too small to apply for direct PVMTI financing. Sufficient deal flow (summarized in Table 2 below) has been identified to invest \$5 million of PVMTI funds over time in 4-7 sub-projects at an expected leverage ratio of about 1:1. The size of the sub-projects likely to be proposed and the absorptive capacity of both the market and individual companies indicates that sub-projects selected for PVMTI financing should be undertaken in stages -- with disbursement of funds phased over a longer time period than is expected for India or Morocco. Even though the level of PVMTI financing in individual sub-projects is initially expected to be small, these sub-projects will be instrumental in increasing annual sales by more than 60% over the 0.6 MW base case projections for 2003. It is also strongly recommended that additional training, business advisory, and consumer awareness initiatives be undertaken in Kenya to facilitate sustainable market growth and improve the likely performance of the project portfolio. These services are likely to be

¹⁴ The appraisal team estimated base case or business-as-usual scenarios for each of the country markets from historic growth rates and other information gathered from various reports and meetings with potential private sector investee companies. Actual growth rates could be substantially different depending on world PV prices and availability, the impacts of other PV incentive programs, and economic conditions in the three countries.

subsidized using PVMTI funds (either as direct grants to investee companies or as additional required financing at more favorable terms) and will be provided locally through the EMT or its consultants.

Table 2: Anticipated Deal Flow for Kenya				
Sponsor	Project	Project Cost (US\$)	Potential Volume Increase	Potential for PVMTI Investment (US\$)
Battery manufacturer	Develop battery dealerships	1m	0.2MW	0.5m
Battery manufacturer	Develop market for new PV battery	1m	0.15MW	0.5m
PV distributor	Build dealership network	1m	0.15MW	0.5m
PV distributor	Develop solar home system sales and end-user finance	1m	0.1MW	0.5m
Bank	Develop end-user finance schemes	1.5m	0.2MW	0.75m
Bank	On-lend to small distributors	1.5m	0.2MW	0.75m
Bank	On-lend to small distributors, NGOs, tourist operators	1m	0.1MW	0.5m
Bank	On-lend to small distributors, NGOs, large agro-industrial cos.	1m	0.1MW	0.5m
(Reserve)	Quality guidelines, training and standards support as necessary. Reserve funds for additional loans to above companies	1m	0.1 MW	0.5m
Total		10m	1.3MW	5m

Morocco

46. The Moroccan PV market to date has been largely government driven. As of 1997, approximately half of the population has been electrified with a grid that is largely reliable. Building on a sequence of rural electrification programs, the government is committed to electrifying much of the country (an additional 1.6 million households) by 2010, and has indicated that approximately 5 percent of those buildings will likely be electrified using off-grid solar and wind technologies. The state owned electricity provider, the Office Nationale du Energie (ONE), is now willing to contract for private PV-based electricity for these services and has recently undertaken its first such contract on an experimental basis.

47. Sources indicate an installed PV base of 2 MWp with annual installations of around 500 kW. Import of panels by immigrant Moroccans returning from Europe is believed to have

contributed a further 1 MW to the installed base and currently accounts for an additional 500 kW per annum.

48. There is a strong rationale for PVMTI financing in Morocco to be integrated closely with the national commitment to rapid rural electrification, and private sector participation is seen as greatly increasing the chances for success in sectors served by PV. Sufficient deal flow (summarized in Table 3 below) has been identified to invest \$5 million of PVMTI funds at an expected leverage ratio of about 2:1. Even though only 4-7 sub-projects are likely to receive PVMTI funds, the financing in these sub-projects is expected to be instrumental in increasing annual sales by more than 30% over the 1.5 MW base case projections for 2003.

Table 3: Anticipated Deal Flow for Morocco				
Sponsor	Project	Project Cost (US\$)	Potential Volume Increase	Potential for PVMTI Investment (US\$)
BoS Supplier	Retail networks for PV application	5 m	550kW	1.5 m
Solar Home System Retailer	Retail and networks for SHS finance	6.2 m	450kW	1.5 m
Rural Services Company	Village lighting and water supply	44 m	2.1MW	3.0 m
Solar Home System Retailer	Retail and networks for SHS finance	32 m	820kW	2.0
PV Integrator and Distributor	Large-scale village lighting and water supply	4 m	400kW	1.0 m
PV Integrator and Distributor	Rural community and mini-grid services for electricity and water supply	16 m	600kW	1.5 m
Total		107 m	4.9 MW	11.5 m

PVMTI Project Impacts

49. PVMTI will provide financing to private enterprises in India, Kenya, and Morocco engaged in PV market activities including sales, distribution, installation, and service, and in related activities providing financing or leasing services to the PV sector. PVMTI is expected to have a major impact in increasing sales and assuring the financial viability of a number of “beacon companies” providing successful and replicable examples of good business and technical practices.

50. With current global shipments approaching 100 MW per annum and expected to double within 3-5 years, it is expected that PVMTI investee companies will increase those shipments by 11 MW per annum within five years, i.e., approximately 5 percent of the global market at that

time. Although this is not a market transformation in absolute or global terms, the impact in each national market will be significant, ranging from 33% in Morocco to 55% in India and 66% in Kenya. A summary of the expected impact of PVMTI is given in Table 4 below.

Table 4. Expected Impact of PVMTI								
Country	Current Annual Sales (MW)	Sales Expected in 2003 without PVMTI (MW)	Sales Expected in 2003 with PVMTI (MW)	% Increase with PVMTI	PVMTI Investment	Expected Minimum Leverage	Co-financing Likely Over Life of Project (US\$ million)	Total Investment in PVMTI Projects (US\$ million)
India	11.0	18.0	28.0	55%	15	3:1	45-60	60-75
Kenya	0.3	0.6	1.0	66%	5	1:1	5-10	10-15
Morocco	1.0	1.5	2.0	33%	5	2:1	10-20	15-25
Total	12.3	20.1	31	54%	25	2.4:1	60-90	85-115

51. The above estimates do not account for the likely multiplier effects from expansion or replication of successful sub-projects. Over PVMTI’s life, ongoing market analysis should be able to broadly distinguish the growth in turnover that could be attributed to PVMTI investments. Although no market is expected to maintain status quo, it should also be possible to compare these gains with the rate and quality of market growth in similar countries. Industry records and monitoring information gathered for programs such as the Solar Development Corporation (SDC) are likely to provide comparable baseline information for other countries. However, it is clear that PVMTI will not act in isolation over its ten year implementation period. It is anticipated that additional initiatives and investments will be offered in a number of countries, and the availability of PVMTI in the three selected countries may influence other donors or investors to shift their priorities toward other markets or program priorities.

52. By supporting the growth and management of companies, and encouraging the entry of financial institutions into PV financing, PVMTI will be able to demonstrate to other market players how the PV market can be successfully approached. These incremental, but demonstrable, effects on reducing barriers to market growth and availability of capital are expected to accelerate market dissemination and improve the attractiveness of the sector for commercial financing.

53. Long-term results are expected to be based on PVMTI’s role in fostering successful business models in three disparate countries which are indicative of the much larger unserved populations and PV markets in the rest of the developing world. The adoption by other business players and financial institutions of business models successfully demonstrated by PVMTI investments will be a clear measure of PVMTI’s success and long-term impact.

54. At the expected level of increased shipments, PVMTI is unlikely to have a direct impact on technology cost (except in cases where sub-projects are linked to long-term reduced cost supplier commitments). The plethora of influences on the profitability and growth rates of the PV

industry makes it very difficult to predict PV cost points that may occur throughout the ten year life of PVMTI. However, supporting the basis for building successful markets (and the accompanying downward pressure on transaction costs and costs of BoS) is expected to indirectly encourage additional investment in manufacturing.

55. As an IFC-executed, private sector project, direct opportunities for policy intervention are limited. However, by increasing the success and profile of the industry, PVMTI can demonstrate PV's value as an alternative to grid extension and as a commercial focus for local business, and thus may informally be able to influence policy and standards issues.

56. **Global Benefits.** The project is expected to significantly increase market activity in the target countries, reducing market barriers to PV dissemination, and the successful demonstration of private-sector-based financing schemes is anticipated to create a strong multiplier effect. PVMTI will magnify commercial activities in potentially large market segments now in early stages of development and demonstrate alternative models to grid extension. And while many components will remain imported in the near term, PV offers an opportunity to harness -- in many cases with local labor and component inputs -- the solar resource found throughout most of the developing world. An additional potential benefit could be to help effect a shift in other donor funding sources toward more sustainable commercial financing vehicles. The net effect of PVMTI will be to position photovoltaics for significantly accelerated market penetration and orderly development of a non-carbon energy technology.

57. Formal evaluation of the project by an independent consultant will be undertaken 4-5 years from the launch and at the end of 10 years, but anecdotal evidence of PVMTI successes will be available sooner. The outcome of PVMTI financing will be summarized by IFC and the EMT and presented in the recipient countries and internationally at workshops, conferences or seminars. The intent will be to convey lessons learned to additional potential investors, financial institutions, and donor organizations so that they may better understand the demonstrated risks and rewards of engaging in PV financing and continue to respond to new opportunities to replicate or expand these activities. IFC will also communicate the PVMTI outcomes within the World Bank Group and to GEF so that these lessons can be incorporated into the design of new investment activities.

58. **Additional Domestic Benefits.** In-country entrepreneurial interests will be able to respond to expanded opportunities for organizing PV distribution, assembly, and financial enterprises, with associated increases in local employment. Rural energy users will have access to a renewable energy resource with higher lighting values without the smoke and fire risk associated with traditional lighting sources (e.g., kerosene lanterns, candles). Non-rural users -- commercial and private -- will have expanded options to receive reliable power. PVMTI will also help offset requirements for rural grid connections, freeing the power sector to concentrate on more profitable core activities.

Likely Sub-Projects and Participants

59. PVMTI will invest up to \$25 million in GEF funds in PV projects designed by private sector companies or consortia and submitted in response to a request for proposals distributed by

the EMT in all three countries. Of the GEF funds, \$15 million is allocated for project financing in India, with \$5 million each allocated for Kenya and Morocco. The remaining \$5 million will be used for technical assistance and project execution. Approximately 4 to 7 sub-projects are expected in each country and funds placed in individual sub-projects are expected to range from \$500,000 to \$5 million. Additional co-financing of \$60-90 million by sub-project sponsors and other sources (including commercial banks) is expected to result in total project costs of \$85-115 million.

60. Sub-project approaches could include expansion of existing sales and distribution networks or entry into new markets, distribution partnering with manufacturers and integrators of complementary equipment (such as BoS components, pumps, diesel generators, and other consumer products). Sub-projects may include companies organized as mini-utilities and providing PV services through system leases rather than sales or development of franchise territories under arrangement with country utilities. Participants are expected to include manufacturers, distributors, system and service integrators, as well as financial institutions participating directly in sub-projects or on-lending to smaller projects.

61. Off-grid PV projects could aggregate large markets now in very early stages of development, including individual households, farmers, individual entrepreneurs/micro enterprises, commercial enterprises, and community facilities (e.g. schools, clinics, etc.) in regions unlikely to be served by the grid. Major applications include SHS in the 20-500 Wp range; agricultural water pumping to reduce reliance on diesel pump-sets or erratic grid supplies and/or increase crop yield; and small power plants serving commercial end users, municipalities and villages, in the 10 kW to 500 kW range and potentially operating in a hybrid configuration (with wind, diesel, or other power sources).

62. PVMTI will likely provide some financing for sub-projects that include grid inter-connection, such as rooftop installations for peri-urban housing or commercial captive power applications to provide reliable power and/or relieve peak loads. Such sub-projects could augment grid power, and in some cases could include contractual arrangements for feeding excess power to the grid in exchange for payment, for priority dispatch, or other arrangements. However, grid-connected PV power stations -- which would have to compete economically with conventional power sources -- are not considered to offer realistic commercial opportunities at current PV prices and would be ineligible unless they could demonstrate significant "value added" over alternative sources of grid power.

63. PVMTI will consider financing of manufacturing, BoS and systems integration, and PV-related ventures including battery companies. However, financing of free-standing PV manufacturing efforts not explicitly tied to a parallel market development effort will be considered outside the scope of PVMTI.

Types of Financing

64. PVMTI investments will be oriented toward reducing risk and providing financing not available in local markets and will not be provided for restructuring of a company's balance sheet. Financing is expected to be primarily low-cost debt (60-70% of funds). Debt is required

by wholesale distributors of PV systems to overcome cash flow constraints and high costs or poor terms of credit currently available. Funds could be used for downstream credit mechanisms for customers or as working capital for development and expansion of sales and distribution systems.

65. The use of partial guarantees (10-20% of funds) and/or equity (10-20%) will be considered if the specific obstacle or risk to be addressed calls for these types of investments and justifies the additional complexity. Equity could be used to capitalize new ventures or expand existing activities to a scale sufficient to sustain profitable operations and attract commercial debt financing. Partial funding of guarantees may be required to secure end-user credit schemes offering credit or lease financing directly to consumers, and could play an important role in mobilizing commercial capital. About 10% of the investment funds are expected to be provided as grants for technical training, development of standards, or other uses required to support individual sub-projects or the country portfolio. IFC will consult with the GEF Secretariat when a new non-grant financial instrument (other than a concessional loan) is used for the first time in any sub-project.

Sub-Project Solicitation and Selection

66. A formal PVMTI Project Solicitation, or a request for proposals, will be used to solicit innovative private sector sub-projects. The solicitation will be issued through normal media channels, industry listings, and country contacts developed during appraisal missions and other inquiries. The period for response is expected to be approximately three months.

67. The proposed selection process is intended to identify a solid set of proposals for investment rather than to select “winners” of a procurement. The solicitation for sub-projects will encourage competition between market players for the limited GEF funds available. Sub-projects will be selected based on their proposed strategy to address market barriers and the likelihood of strategic and commercial success in developing the market. Investments will then be made on the strength of the proposed business plans and the potential for leveraging GEF resources.

68. Development of evaluation criteria for sub-projects benefited from dialogue with potential private sector participants during appraisal missions. Sub-projects will be selected based on their strategic impact in overcoming the barriers and transforming the PV market in a manner consistent with GEF policy and the objectives of Operational Program #6. Criteria will include the assessment of the proposed financial innovation, degree of financial leverage, likelihood of sustainability and replicability on a commercial basis, and the expected level of market growth. Qualifying sub-projects will be considered for investment on the strength of their proposed business plans (including evaluation of the proposed sub-project’s financial and technical viability, and the management capability of the sponsors). Sub-projects will be evaluated both in absolute terms and relative to other proposals received.

69. Sub-project selection criteria will include but may not be limited to:

- **Identification of relevant market barrier(s)** and justification of how PVMTI assistance will alter the project sponsor's ability to engage in the project and encourage future replication on commercial terms.
- **Proposed strategy to address market barriers** including innovation in approach; introduction of new financial mechanisms for the PV market; financing modality and terms required while minimizing reliance on subsidies/grant financing; longer term quality assurance for products/services provided.
- **Likely strategic/commercial success of project** including the project's impact with PVMTI over business-as-usual; project's ability to sustain growth; and the probability of success and overall riskiness of project.
- **Soundness of proposed business plan** including proposed business strategy; marketing, sales, and distribution plan; sources, reliability, and quality of supply; financial requirements; project cash flow and profitability forecasts; track record of sponsors; and capability of proposed management/technical/financial team.
- **Leveraging of GEF funding** based on the share of PVMTI funds of total project cost; level of risk sharing by sponsors; commercial participation from well-established corporate or government entities (including financial institutions).
- **Compatibility of project** with host government's stated priorities on development and environment.

70. Incremental costs associated with individual sub-projects are primarily the costs of reducing the risks associated with developing PV markets in the face of the various barriers. One approach to measuring this risk is based on the incremental internal rate of return (IRR) required to undertake these projects. A level of support from PVMTI could increase the IRR on many such projects or provide adequate security or credit enhancement to justify investments in projects with lower IRRs, thus lowering the risk threshold to the point where such investments would proceed.

71. Investment terms for the proposed sub-projects will initially be suggested by project sponsors and terms for financing will be flexible and are expected to include features such as below market rates and longer-than-usual maturities. However, as IFC will be providing strategic financing from a limited pool of GEF funds, sponsors will have a natural incentive to maximize the attractiveness to IFC of the terms proposed. IFC will negotiate and approve all investment terms at a level commensurate with the risks associated with the sub-project to avoid windfalls to recipient companies, thereby providing GEF funds in conformance with GEF policy on incremental costs. (See Appendix A on Incremental Costs for more details).

72. In addition, the absence of knowledge about which financing modalities and structures are successful is also a market barrier, especially for institutions providing commercial financing. Thus the ex-post cost associated with some sub-project failures is also an incremental cost for the

project as a whole. The successful investments, however, will adequately demonstrate financial structures and business approaches that work and will form the basis for sustainability and replicability of such projects.

73. Following financial and technical due diligence, qualifying sub-projects will be presented for review to an IFC PVMTI Investment Committee which will consist of representatives from IFC's Environmental Projects Unit, IFC's Power Department, and the World Bank's Global Environment Division with input solicited from the appropriate regional departments at IFC. The appropriate national GEF country focal points will be notified when a sub-project in a particular country is approved for GEF financing.

74. All uses of GEF funds to support PVMTI's investment activity will adhere to GEF criteria, and will be consistent with the climate change action strategies and programs and energy sector development plans adopted by the respective host countries. IFC will also ensure that all investments conform with the World Bank Group's environmental guidelines, procedures and policies.

75. A limited number of sub-projects received within the initial three-month proposal window are expected to offer strong business plans and relatively complete financing packages. These "priority track" projects will receive preliminary commitments of funds subject to meeting project milestones and coming to financial closure. If all funds are not committed to sub-projects received in the initial 3-month window, PVMTI will continue to accept proposals for investing the balance of the funds on a first-come, first-served basis for up to two years. Business development and technical assistance may be provided by PVMTI to sponsors submitting proposals in this "secondary track" (sub-projects meeting the original submission deadline but not considered ready for investment in the priority track as well as sub-projects submitted following the deadline) to develop proposals to a satisfactory level to meet the criteria described above and/or attract additional co-financing.

PVMTI Investment Issues and Considerations

76. PVMTI is designed to be similar to a fund with a mandate to invest in a specific sector, but one that pursues gains for sustainable dissemination of PV rather than seeking to maximize financial returns for its investors. Recovery of investment funds is considered important, but less for the need to provide this financial return to GEF than for the commercial discipline it imposes on investee companies in operating their businesses as going concerns. The successful business models resulting from PVMTI investments will demonstrate to financial institutions that companies can engage in successful PV businesses and service their financial obligations including commercial debt. Relevant issues and considerations for PVMTI investments are discussed below.

77. **Size of Investment:** The absorptive capacity of individual country markets estimated during appraisal provided guidance on the overall size of sub-projects and potential for leverage. To maintain a scale of financing conducive to market development and to limit the transaction costs associated with selecting and managing a portfolio of projects, PVMTI will require a minimum level of PVMTI investment for each country. The proposed minimum size of an

investment is \$1 million in India, where PV companies are of a significant size and the deal flow is expected to be strong and \$0.5 million in Morocco and Kenya, where PV companies are smaller and less numerous. IFC may consider lowering this requirement at a later stage should an adequate deal flow not be forthcoming.

78. **Concessionality:** Determination of the appropriate level of concessionality will rely initially on the competitive outcome of the solicitation. Overall interest rates charged are generally expected to be below prevailing commercial rates, and will vary among countries as a function of current market rates and risks in each country. The competitive element of the solicitation will act as a disincentive for companies to request excess concessionality and IFC's right to negotiate the final terms will act as a check to avoid any windfall gains to companies. Lending rates and terms will largely be based on requirements of the sub-project as negotiated by IFC with the sub-project sponsor to maximize cost-effectiveness and strategic gains for GEF.

79. Smaller, indigenous companies are generally expected to require a higher degree of concessionality, while larger, multi-national participants teaming with in-country partners are likely to have fewer financial constraints and may therefore be expected to require a lower level of concessionality. PVMTI does not expect to invest in sub-projects where participants are likely to pursue the project anyway. However, as the risks of entering evolving PV markets remain high, it may be strategically important to include larger multi-national players in order to expand local markets that attract and enable local players.

80. **Grants:** Although the majority of PVMTI's investment funds (90-95% of the \$25 million available) are expected to be utilized for project finance, 5-10% may be provided as grants -- either directly or as an added layer of concessionality in the financing package. Grants will be limited to non-commercial activities believed important to support individual PVMTI investments. These uses could include technical and business training, technology validation or certification, public awareness, and support of policy initiatives. Where possible, such use of funds will be incorporated into the sub-project financing packages. Should the deal flow from the initial solicitation be inadequate, additional small grants may be considered for further development of business plans. PVMTI's preference will remain that these activities be supported by the applicants themselves, or if necessary, by interested bilateral donors.

81. **Level of Leverage:** In addition, sub-project evaluation criteria will consider the presence of financing from other sources. Leverage of at least 1:1 will be required in all countries, and sub-projects with additional leverage to magnify PVMTI investment and share risk will be considered more favorably. The expected leverage level for India, where many PV companies have strong balance sheets and financial institutions are relatively sophisticated, is 3:1. For Kenya and Morocco, where PV companies have weaker balance sheets and there are few financial institutions operational in the sector, the expected leverage levels are 1:1 and 2:1 respectively. Remaining funds will be provided through: (1) sponsor's own funds (or those of its partners) as equity, in-kind services, or other risk-sharing consideration; (2) commercial financing, (3) government investment (minority basis -- please see below), and (4) additional donor institution investment (only if required and available in a non-distorting form). IFC will consider investing its own funds on a case-by-case basis in a limited number of PVMTI sub-projects which meet IFC's requirements for commercially viable investments.

82. As with the level of concessionality required for individual sub-projects, the degree of leverage achieved on PVMTI funds will initially be driven by the competitive aspect of the project solicitation, and will ultimately be determined by the availability of capital from other sources and the efforts of IFC (and its agents) to close deals on such financing. A very low level of leverage (that is concessional PVMTI funds form a large part of the financing required for the sub-project) would ultimately result in one-off projects making them difficult to replicate on commercial terms. Likewise, too much leverage (that is PVMTI funds form a very small part of the financing for the sub-project) would raise questions as to whether the project actually requires assistance from PVMTI. PVMTI will remain open to considering highly leveraged investments if the PVMTI investment mitigates a key risk which would allow commercial investors to provide the financing for the project. It will be necessary to evaluate proposals individually and collectively to determine appropriate targets for leverage, and the indicative levels described in the project document will serve as a starting point.

83. **Co-finance from Donor Sources:** “Double-dipping” or providing co-financing for PVMTI investments from other concessional funding sources will be evaluated on a case-by-case basis. Building projects upon multiple layers of concessional finance may result in viable projects, but these can be expected to be one-off with not many prospects for commercial replicability. However, in the interests of diversifying financing sources and drawing other donor activity toward this kind of private sector-led investment activity, some degree of concessional co-financing from other sources may be acceptable to help build up the market’s infrastructure -- provided that it helps attract additional commercial finance and increase project scale in due course of time. Funds may be available from KfW and other donor sources through the Indian Renewable Development Agency (IREDA),¹⁵ and from co-financing by the Dutch Ministry for Overseas Cooperation in Morocco and Kenya. Such donor funds will only be used if needed and in a way which is consistent with the near-commercial approach adopted by PVMTI. It should also be noted that the availability of donor co-financing appears less likely than originally anticipated.

84. **Government Support:** While the three country governments support the initiative, direct government investment is expected to be minimal as PVMTI is primarily a private sector initiative. Government involvement and support in India may be through minority participation of state-owned PV manufacturing companies in PVMTI sub-projects, in Kenya through streamlining of the customs and import duty structure applicable to PV panels and associated products, and in Morocco by the state-owned utility providing and supporting franchises for PV-based electricity supply in rural areas.

¹⁵ PVMTI is expected to build on the lessons learned in implementation of this program, which primarily provides concessional funds for equipment finance. As an IFC-executed program, PVMTI will respond directly to private sector entrepreneurial requirements (including working capital, end-user credit programs, and financial guarantees) on flexible terms.

VI. PROJECT IMPLEMENTATION AND ADMINISTRATION

Appraisal Findings and Implications

85. Following GEF Council's initial approval of the project in October 1996, thorough appraisals in the three countries strongly indicated that a much higher level of engagement by IFC and an external management team in the project's execution would be necessary over a longer period of time to make PVMTI succeed in meeting its objectives as a GEF project. IFC concluded that to address the significant barriers facing these markets, a near-commercial approach with a much more active role by IFC and its agent in making and managing these investments was required. A more active execution role would significantly increase the chances of achieving GEF's objectives of demonstrating financial structures and business approaches that work -- thus forming the basis for long-term sustainability and replicability of such projects. This approach would also increase the probability of realizing a significant level of reflows. The appraisal yielded two major refinements in the implementation process:

- Need for an External Management Team: The appraisal indicated that for PVMTI to succeed it would require sector and country-specific expertise similar to that used in an investment fund. Given this requirement, IFC's senior management decided that an external management team (EMT) should be retained as there were insufficient in-house resources to accomplish this task. -- especially to provide the level of technical assistance required in-country. It was considered inefficient to create a new group within IFC for this specific project when the relevant expertise and services were available from the private sector. Further, the specific learning associated with undertaking PVMTI would be more beneficial to future activities if it remained in the private sector and not available only from IFC. The team chosen to be the EMT had to be qualified in creating and managing a portfolio of small, innovative renewable energy projects with a long-term commitment to achieving the GEF's objectives. An EMT was competitively selected to undertake the role of an active investment manager (including a presence in each country) with final investment approvals and oversight by IFC. To ensure long-term commitment and performance by the EMT, part of the compensation was deferred to later years of the project and linked to the EMT's performance.
- Extended Implementation Period: In addition to the quality of the EMT chosen, it was also considered important that PVMTI be executed over 10 years (instead of 5-7 years as indicated in the document approved by GEF Council) to allow for PVMTI's involvement in a sub-project to be effective and to maximize recovery of GEF funds. This time-frame is also similar to those for other IFC/GEF venture funds such as the Renewable Energy and Energy Efficiency Fund (REEF) and Terra Capital Fund.

86. These refinements notwithstanding, it is important to note that PVMTI remains consistent with the original objectives as proposed to, and approved by, the GEF Council prior to the appraisal. These modifications are also consistent with advice provided to Council in the Project for Review document, which indicated that the final implementation structure for PVMTI was subject to outcome of the appraisals.

Implementation Approach

87. PVMTI is not designed to operate as a commercial fund such as REEF because most PV businesses have not yet reached a level of commercial maturity and competitiveness which would attract commercial investors. This pre-commercial nature explains why GEF is providing all of the funds for PVMTI, hence allowing for leverage only at the sub-project level instead of supplementing other funding sources (as in REEF, which has leverage at both the fund and sub-project level). For the same reason, it is deemed appropriate for the decision-making regarding investments to remain with IFC -- as it does for the GEF component of REEF. Looking to a more concessional approach, PVMTI shares certain characteristics with the IFC/GEF Small and Medium Scale Enterprises (SME) Program, especially in the level of the technical assistance and involvement required. On balance, the proposed project execution structure developed for PVMTI is a hybrid of REEF and the SME Program.

88. The proposed approach calls for the EMT to function as a cross between a consultant and a fund manager undertaking the evaluations of investments, in-country technical assistance services, and long-term sub-project monitoring functions -- all under IFC's close supervision. In addition, some of the EMT's compensation is deferred to later years of the project and linked to the performance of the project (discussed in further detail in the next section). IFC will retain overall project responsibility and final selection and approval of sub-projects, and will also undertake supervision of the EMT and the portfolio. IFC will also provide the significant level of legal services associated with making 15-20 non-grant investments. The EMT's and IFC's roles in executing PVMTI are discussed in further detail below.

Role of the External Management Team (EMT)

89. The EMT will execute and manage PVMTI for its duration in the three countries under close monitoring and supervision by IFC. The EMT will be responsible for soliciting investments, performing technical reviews and due diligence, structuring investments, mobilizing co-finance, recommending investments to IFC, and working closely with companies once investments have been made. Subject to IFC's preliminary approval of candidate investments, the EMT will complete investment negotiations and provide additional support in preparing investments for consideration by the PVMTI investment review committee, including preparation of legal and environmental review documentation. Final approval of all investments shall remain the sole authority of IFC. To administer the project, the EMT will hire an Investment Manager based at its home-office operations and individual Country Managers in each of the three countries on a full-time basis during the investment phase which is expected to last the first 3 years of the project. The Investment Manager and the Country Managers will be supported by the EMT's principals at the home-office, as well as additional professional staff and services in the individual countries.

90. **In-Country Assistance:** The Country Managers will act as the direct contact with potential investee companies. In addition to providing technical, financial, and business development assistance through the solicitation and investment phases, the Country Manager will advise the investment manager on the unique features of the PV market in the respective countries. A full-time professional will also be recruited locally in each country to assist the

Country Manager. This deputy will have expertise in the analysis, structuring and negotiation of investments, financial modeling, and business development with at least five years of relevant investment experience. It is expected that this individual will assist the Country Manager in financial due diligence of the potential sub-projects, and preliminary structuring of investment terms as well to help potential sponsors in making their projects more bankable. Additional technical and business consulting to the country managers will be contracted in-country as required, and will include development of relationships with a local affiliate organization capable of providing limited long-term in-country technical assistance and also maintaining contact with investee companies after the country managers departure at the end of the investment phase. The assistant to the Country Manager is expected to revert to the employment of this local affiliate organization at the end of the investment phase and provide continuity for ongoing monitoring of the sub-projects on a consulting basis.

91. The proposed Investment Manager at the home-office will be a full-time professional with significant and varied investment analysis, structuring, and negotiation experience with experience in making both debt and equity investments -- as well as someone capable of autonomous action and decisions regarding PVMTI investments. The candidate will be inclined to considering riskier-than-normal investments in small projects in developing countries utilizing non-standard approaches and technologies. While investment experience in developing countries is considered essential, experience with PV projects will not be a pre-requisite. The Investment Manager will be housed at the EMT's home-office operations and will receive pro-active support from the EMT's principals so as to operate effectively within the PVMTI context and to have access to the EMT's corporate network for raising co-finance. The Investment Manager will also supervise and coordinate the activities of the three Country Managers as well as be responsible for mobilizing co-finance from international sources. Following the investment phase, the Investment Manager will remain assigned to the project on a half time basis for the remaining 7 years.

92. On the basis of a limited competitive solicitation, IFC selected a consortia including Impax Capital Corporation and IT Power Ltd. as the EMT candidate. This team worked as the lead consultants during the appraisal phase and offers a broad range of experience and qualifications in business development, PV specific technical and applications skills, financial engineering and capital mobilization experience, project management abilities, and direct business experience in the target countries.

93. **Impax Capital Corporation Ltd.** provides fund raising and financial advisory services for environmental investments. The company has a track record of structuring and arranging finance for developers of projects in renewable energy, waste management, and wastewater treatment, and to date has secured over \$150 million for its clients. Impax is authorized by the UK Securities and Futures Authority to provide investment services.

94. **IT Power Ltd.** is a leading energy consulting firm which specialized in renewable energy engineering and related economic, financial, commercial and environmental considerations. Since its formation in 1981, IT Power has completed over 500 projects for numerous government and private sector clients in over 60 countries. The company's expertise spans market analysis,

project identification and project management in a spectrum of renewable energy technologies, including PV, solar thermal, wind, biomass, small-scale hydro, tidal and wave power.

IFC's Role in Executing PVMTI

95. The EMT will be closely supervised by IFC which will make all final decisions relating to investment and recovery of PVMTI funds. While the EMT will review and recommend sub-projects to IFC, final sub-project selection and approval of all terms and conditions of investments will remain solely an IFC responsibility.

96. One staff member from IFC's Environmental Projects Unit will coordinate PVMTI activities, devoting significant time during the investment phase which will decline to a smaller supervisory role in later years. This project officer staff person will be responsible for overseeing the activities of the EMT, as well as be the interface to IFC's internal processes including the review and presentation of the proposed investments to the Investment Committee. The project officer will work directly with the EMT in reviewing, selecting, and making the investments during the investment phase while simultaneously providing IFC's control of the EMT. Tasks will include project oversight and supervision, independent review of each proposed investment, documentation, preparation for PVMTI investment review committee meetings, presentation of proposed projects, and facilitating signing of agreements and disbursements on approved sub-projects. The IFC project officer will also be a significant (albeit selective) participant in field work undertaking trips to each country and the EMT's home-office operations every year. The duties will decline over time although the project officer will still provide a long-term, real-time point of contact within IFC -- making it possible to establish and maintain sufficient knowledge of the country markets, as well as each individual investee companies, within the institution to efficiently supervise the EMT and the portfolio.

97. It is important to note that the IFC project officer's function does not duplicate any function within the proposed EMT structure. Although the Investment Manager in EMT's home-office operations will supervise and coordinate the activities of the three Country Managers, his/her primary role will be that of a senior financial officer with responsibility for analyzing and structuring the individual investments in all three countries. Although a significant level of effort has been delegated to the EMT, IFC will ultimately make each investment decision, signing all legal agreements on behalf of GEF, as well as undertake the disbursing and accounting function. It would require another senior manager within the EMT organization to undertake the supervisory role of the IFC project officer, but is a role that is best kept at IFC itself. A full-time equivalent has been budgeted for at IFC for the investment phase declining to half-time midway through year 3 and quarter-time starting in year 5.

98. An IFC staff counsel (with external support as necessary) will provide PVMTI with legal support to: assist the EMT in structuring investments; prepare and/or review investment documents; review legal opinion from local counsel including their report on local law issues, including security, consents & permits; provide legal support necessary prior to disbursements; review monitoring reports provided by EMT; and after repayment of the investment, assist in the necessary documentation and formalities to close out individual projects.

99. The PVMTI investment review committee referred to earlier will include the head of IFC's Environmental Projects Unit and one nominee each from IFC's Power Department and the World Bank's Global Environment Division with appropriate input from the relevant Regional Investment Department. Preparation of legal documents will be performed primarily by the EMT on the basis of short forms to be developed by IFC's Legal Department. Once the sub-projects are submitted to IFC for consideration, the Legal Department will review and approve the draft documents as well as the basic legal review of other documents and arrangements conducted by the EMT during the course of their due diligence. Environmental reviews will similarly be performed by the EMT (after initial training by IFC) and forwarded to IFC for final approval.

100. It is expected that most sub-projects will be under implementation within the first 3 years of project operation. The EMT will supervise disbursements and monitor repayment schedules over the anticipated 10 year life and provide management and technical advice to sub-projects as necessary to assist them in meeting their business objectives.

VII. PROJECT BUDGET AND USE OF GEF FUNDS

101. Table 5 provides a breakdown of the project budget and the expected use of the funds provided by GEF. Of the \$30 million provided by GEF, \$25 million is intended for direct investment in sub-projects, with approximately 5-10% expected to be used as grants supporting non-commercial activities associated with individual sub-projects (as described earlier). The remaining \$5 million will be reserved for costs associated with providing technical assistance and project execution by the EMT and IFC. In-country technical assistance as discussed previously is expected to cost \$3.7 million -- most of it expended during the investment phase expected to last the first 3 years. Project execution costs for IFC and its EMT are expected to be about \$3.3 million. The additional requirement of \$2 million for these costs -- over and above the \$5 million reserved from the initial allocation of GEF funds -- will be met from funds recovered from investments.

Table 5. Project Budget and Expected Use of GEF Funds*

Project Budget	US\$ (millions)	% of Total Project Costs
Investment Funds		
Debt, Equity, Guarantees (non-grant investments)	22.5	70.3%
Grants	2.5	7.8%
Sub-total (A)	25.0	78.1%
Technical Assistance (B)	3.7	11.6%
Project Execution Costs		
EMA Project Execution Costs	2.3	7.2%
IFC Project Execution Costs	1.0	3.1%
Sub-total (C)	3.3	10.3%
Total Project Costs (D=A+B+C)	32.0	100.0%
Funded from Project Reflows (E) -- see below	(2.0)	(6.3%)
Total GEF Funds Required (F=D-E)	30.0	93.8%

Expected Performance of Non-Grant Investments	US\$ (millions)	% of Total Non-Grant Investments
Debt, Equity, Guarantees (non-grant investments)	22.5	100.0%
Possible Losses on Investments (non-recovery, forex, etc.)	(7.5)	(33.3%)
Returns on Performing Investments (interest income, equity gains)	2.3	10.0%
Total Gross Reflows Expected	17.3	76.7%
Reflows Required for Project Execution Costs -- see above	(2.0)	(8.9%)
Contingent Performance-Related Compensation for EMA	(1.8)	(8.0%)
Expected Amount for Repatriation to GEF	13.5	59.8%

* Numbers may not add due to rounding.

102. Investment terms (as described earlier) are to be proposed by investee companies in response to the PVMTI Solicitation, but will then be negotiated by the EMT and IFC. Debt is expected to include a broad range of below-market rates, and may include longer than usual terms or repayment periods; all funds, however, are expected to be recovered and will be treated as such in all loan covenants. The benefits of using equity investments would need to justify the additional complexity, and such investments would require an exit strategy acceptable to IFC. Likewise, guarantees are expected only to be approved if justified, and will be considered for risk mitigation and not as grants.

103. **Returns on Investments:** To stimulate and support innovative sub-projects, PVMTI will accept average financial rates of return on its financing at below market rates. PVMTI will also operate at a level of investment that is generally too small for traditional IFC channels and in a sector that has generally not been financed by local financial institutions, and will offer a higher level of management oversight and assistance than would ordinarily be offered by a fund targeted at fully commercial investments. While both elements will increase costs above the level normally incurred by a commercial investment fund, they are considered important to enable the sub-projects to overcome the competitive and distorting pressures created by market barriers. This flexible approach, while initially on concessional terms, is directed at transitioning PV business activities toward fully commercial status. Returns on the performing investments are expected to be \$2.3 million or about 10% of the non-grant investments (and are likely to be in the range of \$0.6 to \$4.4 million).

104. **Possible Losses on Investments:** There is potential for part or all of individual investments to not be fully recovered. IFC will mitigate against this risk through appropriate due diligence and risk participation from investee companies or partners. Security mechanisms will be used as available and appropriate. In addition, as PVMTI seeks to develop PV markets that would otherwise rely on financing in the local currency, PVMTI may need to absorb the foreign exchange (forex) risk imposed by using OECD-denominated GEF funds as required. Losses on PVMTI investments are expected to be \$7.5 million or about one-third of the non-grant investments (and are likely to be in the range of \$5.9 to \$11.3 million).

EMT Costs for Technical Assistance and Project Execution

105. The EMT will be compensated for expenses during project execution, including services of the EMT investment manager, three country managers and their locally-recruited deputies; associated overhead costs; costs associated with the extensive amounts of travel required; budgets to support business and technical assistance for investee companies preparing secondary track projects; support provided by the local affiliate organizations; costs associated with local legal counsel; costs associated with raising additional co-financing; marketing and reporting on the project; and ongoing supervision of and support to the investee projects.

106. Cost-based fees for project execution are expected to total \$2.3 million and an additional \$3.7 million will be required to provide the necessary technical assistance. These costs will be paid for partly from the funds reserved for providing technical assistance and project execution (up to \$4 million of the \$5 million reserved), and the balance (of \$2 million) from repayments by investee companies ("reflows"). A contingency plan -- where fees do not exceed a total of \$4 million -- is also in place in the highly unlikely event that all investments fail and no reflows can be expected.

107. As in a typical investment fund, portfolio returns for PVMTI can be expected to rise due to the increased levels of management intervention that are stimulated by performance incentive formulas. Recovery of investment funds is considered important for PVMTI, but less for the need to maximize financial performance (as most funds require) than for the commercial discipline it imposes on investee companies in operating their businesses as going concerns and successfully servicing their debt or other financial obligations -- thereby demonstrating

sustainable business models in the investments and project structures that succeed. A lower level of in-country oversight would result in higher default rates and fewer replicable business models. To ensure this does not happen, the EMT will have a portion of their compensation linked to their performance and the performance of the investee companies.

108. The performance-based compensation will be designed to provide several different incentives to the EMT: 1) to achieve strategic market acceleration goals; 2) to leverage the use of PVMTI funds by attracting additional co-financing; 3) to ensure the commercial viability and replicability of sub-projects regardless of the financial instrument used; and (4) to place the PVMTI funds as quickly and efficiently as possible in each of the three countries. Besides compensating the EMT for the risks taken to ensure the success of PVMTI (below-cost fees, deferred profit, reputation risk, guarantees for project contingency plans), deferral of a portion of the compensation will also provide the basis of a long-term involvement that would be difficult to enforce solely through a fee-for-services contract.

109. This portion of EMT compensation will be derived exclusively from project reflows and will be paid out in a manner that provides adequate incentives at critical junctures in project execution and ensure that the EMT does not concentrate on any one component of project performance or on any one country's portfolio to the exclusion of others. The formulae for performance-based compensation also provide approximate parity with the country specific sub-project selection and performance objectives that IFC will strive to meet on behalf of GEF. While all PVMTI investments will be made in sub-projects that face significant market and project risks, it remains imperative that PVMTI make only those investments that balance these risks with the likelihood of achieving the strategic goals -- as demonstrated by successful business models that can then be replicated on a commercial basis. It is also important that the performance-based compensation for the EMT not result in the EMT being too risk averse in the context of achieving these strategic goals. This is mitigated by the facts that the final decision on all investments rests with IFC and only a portion of the EMT's variable remuneration is linked to the performance of the sub-projects.

110. The proposed performance-based compensation is an incremental cost required to achieve the strategic goals of the project, and will not be paid without attainment of agreed targets. Because the overall level of risks taken by the EMT are not as high as those assumed by a commercial fund manager, the level of performance-based compensation (akin to "carried interest" for a venture fund) is also lower than would be expected for a traditional fund manager. Assuming the criteria described above are met, total performance-based compensation is expected to be \$1.8 million or about 10% of the gross reflows (and are likely to be in the range of \$1.3 to \$2.3 million). Total performance-related compensation will not exceed \$2 million until gross reflows exceed \$20 million.

IFC's Project Execution Costs

111. IFC's direct project execution costs as the executing agency for PVMTI over the 10 year duration of the project are expected to be about \$1 million -- most of which are expected to be expended during the investment phase. These costs will be paid from the \$5 million reserved for technical assistance and project execution costs. About 35% of these costs are expected to be

incurred for the significant legal services to be provided as part of making the investments. PVMTI project funds will not be used to cover IFC's general administrative costs or costs associated with supervision of the project as provided for separately by GEF through the annual budget allocation to the implementing agencies. IFC is also contributing and not recovering significant management time and costs in the execution of the project.

112. Reflows not directly required for project-related technical assistance and execution costs (including EMT's performance-based compensation) will be held by IFC in a separate account. IFC will perform an interim project evaluation in 2003, and at that time will discuss with the GEF Secretariat options for disposition of recovered funds, e.g., repatriate funds to GEF, provide follow-on investment in existing sub-projects or solicit new sub-projects, or other use of funds to be mutually agreed upon with GEF. Additional information on use of GEF funds is included in Appendix A on Incremental Costs.

113. The combined costs of IFC and the EMT to execute PVMTI are expected to be \$3.3 million or about 10% of the project budget. These costs are within the range indicated in the original Project for Review document provided to GEF Council in October 1996. However, based on the appraisal of the country markets, technical assistance to companies which require business advice both before and after receiving funds from PVMTI is needed to increase the probability of achieving GEF's strategic objectives. This technical assistance is expected to cost an additional \$3.7 million. Nonetheless, the project has been structured in such a way that the costs required for providing technical assistance and executing the project from the GEF grant remain at \$5 million as originally requested. Additional funds required for successful execution of the project will be provided by the reflows back to GEF from non-grant project financing.

114. It is expected that approximately \$13.5 million of the \$17.3 million funds recovered from investments and portfolio earnings will be available for repatriation to the GEF by the end of the 10 year operation of PVMTI after utilizing some of the reflows towards project execution costs and for the EMT's performance-related compensation. This could vary depending on the losses on the investments and the returns on the performing portfolio, but is likely to be in the range of \$8.5 to \$18 million.

115. All costs *including* those for technical assistance, project execution by IFC and the EMT, and the performance-linked compensation for the EMT (payable only from reflows) is the equivalent of about 3.5% each year of the total funds available for investment. This is comparable to the management costs charged by fund managers for smaller or more innovative fund but *excluding* incentive payments (i.e., carried interest). Thus, PVMTI is expected to be a relatively efficient mechanism for accelerating development of the market.

VIII. MONITORING AND EVALUATION

116. The EMT will be responsible for day-to-day monitoring of PVMTI investments. Investee companies will be required to present a summary of performance quarterly and a set of audited accounts annually to the EMT, with summary reports provided to IFC. The EMT and IFC will visit a selection of investee companies periodically to verify financial performance and status of sub-project operations.

117. Environmental reviews will be performed by the EMT and approved by IFC. Selected investments will be reviewed periodically over the life of the investment to ensure compliance with environmental policies and guidelines of the World Bank Group.

118. A mid-term project review will be performed in 2003 and a final project review in 2008. Reviews will be contracted by IFC to an independent consultant. They will include analysis of the financial performance of the investments and the overall project, evaluation of the strategic gains of PVMTI in terms of accelerating PV dissemination, and estimation of the GHG reductions associated with the project (direct and induced).

119. Environmental impacts of PVMTI are expected to be minor and primarily related to increased use and disposal of batteries as related to individual system operation. The PVMTI Solicitation will request information on mitigation of this impact in sub-project operations. Some emerging PV technologies, such as Cadmium Telluride, pose potential hazards in the manufacturing process but the risk from completed modules is insignificant. Few such modules are expected to be sold as a direct result of PVMTI.

IX. PARTICIPATION AND SUSTAINABILITY

120. Country consultations supported by PDF Block A funds administered by the World Bank were undertaken in all three countries as described earlier. The consultations resulted in strong expressions of both government and private sector support for the initiative. During appraisal, a variety of government representatives, manufacturers, suppliers, NGOs, and foundations were also consulted by IFC in preparation of PVMTI. Their advice on market development needs and implementation options has been incorporated into project planning and documentation.

121. PVMTI's financing will respond to the business and financing needs as articulated by investee companies themselves and will benefit both the local business and financial sectors. Availability of this financing will directly stimulate applicants to stretch their technological and marketing capabilities in pursuit of profitability, which will provide the greatest possible long-term sustainability. Indirectly, end-use customers will benefit from greater variety in energy choices and an increased ability to have systems maintained by local entrepreneurs. The competitive element of project selection, combined with evaluation factors addressing both normal business criteria and strategic objectives for PV, will result in participation by market players of different sizes and offering a variety of products and services. In particular, PVMTI is expected to assist PV companies to develop a track record that will help them obtain financing at commercial terms and encourage financial institutions to provide financing services to companies and end-use customers. While not all sub-projects are expected to be successful, the business approaches that are profitable will offer attractive potential for replication, either by the original sponsor or by other entrepreneurs and financial institutions seeking to benefit from the lessons learned.

X. LESSONS LEARNED

122. IFC is a leading investor in private power markets through loans and equity, syndication, and participation in infrastructure funds. While much of the PV industry is not currently large or mature enough to benefit from IFC's mainstream offerings in project finance, IFC recognizes the value that PV and other small-scale renewable energy technologies hold for the future and the role these technologies have within IFC's development mandate. PVMTI is a strategic intervention directed at helping to bring PV financing to a scale and maturity where it can be provided by mainstream financial markets. IFC's investment expertise and endorsement of selected sub-projects is seen as a key part of cultivating the commercial discipline required.

123. PVMTI builds on lessons learned from "market pull" initiatives undertaken over the last several years in North America and Europe that utilize financial incentives and private sector engagement to encourage, facilitate, and accelerate market entry of new energy and energy efficiency technologies. PVMTI was initially modeled after the "Golden Carrot" initiative, a \$30 million incentive offered by a consortia of U.S. utilities to stimulate the design and market entry of energy efficient CFC-free refrigerators. Other market pull initiatives in Northern Europe have targeted energy-efficient appliances and lighting.

124. Other World Bank projects (some with GEF support) have had successes in raising customer awareness and installations of PV systems and addressed the up-front pricing barrier by providing subsidy elements and/or equipment finance. However, in some cases, government/donor activities in PV have undermined local price competition and undermined customer ownership (reducing cost recovery required for commercial operation). World Bank procurement guidelines have also hindered the logical development of commercial supply relationships in some cases. In contrast, PVMTI will respond to private sector innovation and financing needs, provide capital for project -- not equipment -- finance, and minimize subsidies to the end user.

125. PVMTI is directly consistent with other GEF-supported IFC initiatives such as the Renewable Energy and Energy Efficiency Fund (REEF) and the Small and Medium Enterprises (SME) Program. These approaches also engage the private sector to attract sub-projects and provide additional financial intermediation to transition these activities to a more fully commercial status. REEF, now undergoing syndication and expected to begin operations in early 1998, could potentially serve some of the project pipeline addressed by PVMTI. However, REEF will focus on larger projects requiring a lower level of concessionality and management oversight, and will not co-finance PVMTI sub-projects on a concessional basis. SME has invested in an off-grid PV project in the Dominican Republic through an Intermediary and has approved a \$750,000 investment in Grameen Shakti, a Bangladesh SHS distribution effort by an affiliate of the Grameen Bank which has had notable success in micro-credit services to very small enterprises and individuals. These projects are similar to some potential projects expected to be supported by PVMTI but are not in PVMTI countries. SME and PVMTI will not co-finance sub-projects.

126. PVMTI will also serve as proof of concept for the proposed Solar Development Corporation (SDC), a PV business advisory and finance program being developed to operate in

all developing countries. A feasibility study for SDC has recently been completed. Depending on the success of PVMTI, SDC could introduce analogous financing and intermediation in a much broader set of countries and markets, and is likely to be presented for consideration by GEF at the appropriate stage.

XI. PROJECT RISKS AND ISSUES

127. As an investment vehicle, PVMTI poses some unique risks that could potentially impede both investment performance and achievement of GEF strategic objectives.

128. **Deal Flow:** It may prove difficult to attract an adequate number of quality sub-projects with co-financing at the projected levels, or an unexpectedly large number of sub-projects might fail to survive the due diligence process. While the appraisal process identified an adequate deal flow and an acceptably strong business case for PV financing, it may be necessary to extend the period for completing financing with PVMTI funds (through the expected Secondary Track review and preparation of sub-projects) and/or reduce the required levels of leverage from other sources.

129. **Absorptive Capacity:** Most of the market niches identified by the PVMTI appraisal process as commercial opportunities remain small and at very early stages of development. Development of PV markets will be constrained by the pace at which the new technology is adopted by customers, and how new distribution and financing networks can best be extended. Making multiple and simultaneous investments could in some circumstances result in market distortions. IFC will reduce the risk of distortions by communicating the aims and intentions of PVMTI fully to the international community and by negotiating with potential investee companies to ensure that the proposed terms are as close to market norms as possible.

130. **Management Capabilities:** Despite having a sound business plan and stable economic fundamentals, investee companies may fail to deliver as a result of weak management. Technical staff may fail to develop adequate quality assurance systems resulting in poor quality installations. Marketing staff may fail to reach target consumer groups or convince them to make system purchases. Staff responsible for financial control may be unable to manage costs or to ensure repayment of receivables by end users. Finally, top management may be unable to nurture planned partnerships and alliances. IFC will reduce this risk by requiring adequate demonstration of management skill in proposals forwarded by the EMT, and will provide for careful monitoring and early intervention during supervision.

131. **Change in Economic Fundamentals:** As with any investment, investee companies run multiple exogenous risks such as:

- Weakening of demand due to general inflation, poor harvests, or other factors.
- Changes in currency devaluation or availability of foreign exchange for imports.
- Changes in fossil fuel prices or electricity tariffs.
- Retaliation by established competitors (e.g. price cutting by kerosene or diesel suppliers); or unanticipated changes in grid extension plans.

- Changes in financial fundamentals such as interest rates, taxation levels, foreign exchange rates or investment incentives.

It is difficult to mitigate these risks, although a multi-country project such as PVMTI provides certain diversification benefits against individual country risks.

132. **Increased Cost or Unavailability of Materials:** Partly as a result of current attractive subsidy programs in Japan, Western Europe, and the U.S., as well as variations in the cost and supply of silicon related to its use by the semiconductor industry, supplies of raw silicon, wafers, and cells have become erratic and more expensive. PVMTI can reduce this risk by encouraging sub-projects with explicit supply arrangements, but supply issues are expected to have a disproportionate effect on developing country markets for the foreseeable future.

133. **Returns on Investments:** All of these and other factors could result in PVMTI sub-projects failing to grow at the projected pace and/or failing to earn the anticipated returns. Collectively, this set of risks will be addressed by: a) negotiating financial terms mutually acceptable to IFC and the investee company; b) requirements for risk-sharing by investee companies; c) a compensation structure for the EMT based on performance of the investment portfolio.

134. **Budget Risk:** PVMTI relies on project reflows for up to \$2 million of technical assistance and project execution-related costs. It is expected that investments made within the first one to two years of project initiation will be sufficient to provide sufficient reflows to meet this obligation. Should investments take longer to close or fail to perform, a cash-flow constriction could arise. IFC expects to mitigate this risk by approving an EMT base budget spread over a period sufficient to minimize this risk. In the highly unlikely event that no reflows can be expected after the investment phase (first 3 years) is complete, a contingency plan (guaranteed by the EMT by providing additional cost-sharing) allows for the balance of the \$5 million to be sufficient for the additional 3-4 years of a shorter implementation term. All performance compensation for the EMT will rely on reflows, creating a significant incentive for EMT to manage this risk as well.

Appendix A

INCREMENTAL COST ANALYSIS

Types of Incremental Costs

1. Based on prior IFC experience with GEF private sector investment projects, eligible incremental costs for PVMTI are expected to occur both within individual sub-projects and at the level of the financial institution providing or delivering financing. At the commercial enterprise level, incremental costs include the difficulty of attracting financing for projects and offsetting high rates charged. Businesses also face increased business risk in introducing relatively unfamiliar technologies in markets distorted by existing policy and the established advantage of conventional technologies. At the intermediary level (in the case of PVMTI, IFC in combination with the External Management Team), incremental costs include the higher management costs of identifying, processing, and supervising a unique and unfamiliar portfolio while maintaining fiduciary responsibility, and the additional technical or management services required to mobilize co-finance and ensure the performance of funds invested in unfamiliar markets.

Broad Development Goals

2. The overall development goal is the acceleration of PV dissemination through the funding of near-commercial projects that are financially sustainable and replicable. PVMTI's underlying premise is that the private sector is better situated to identify profitable activities (as compared with "model" or "pilot" projects designed by multilateral institutions and implemented through recipient country governments) yet requires specific assistance in overcoming institutional, financing, and scale barriers. PVMTI will leverage GEF funds through private sector capital mobilization, and demonstrate non-grant financing models (loans, guarantees, quasi-equity, micro-credit, etc.) as well as alternatives to grid-connected projects. Successful sub-projects will provide a multiplier effect by demonstrating the potential profitability of PV projects to commercial investors and lenders, hence making financing available more broadly.

3. The respective governments (India, Kenya, and Morocco) are all signatories to the Framework Convention on Climate Change (FCCC), and have endorsed the PVMTI approach of providing financing directly to the private sector. PVMTI is responsive to their respective national energy policies and goals in terms of developing PV technology as part of a diverse and environmentally sound portfolio of energy sources. PVMTI will provide additional resources in addressing such national programs and help develop a private sector-based focus capable of delivering PV technology on a sustainable basis.

Global Environmental Objectives

4. These objectives are described in paragraphs 56-57 in the main document.

Baseline

5. For PVMTI, the baseline situation can be gauged in terms of: (i) the level of current activities of commercial entities undertaking market development and manufacturing expansion; (ii) the failure of households and other users to utilize PV systems because of lack of information, availability of systems or service, high prices, or lack of financing, and (iii) policy and institutional actions of governments in adopting broad based programs and policy adjustments regarding renewable energy. In the absence of GEF support, the baseline scenario for PV is that market risks and obstacles will remain high, and activities by businesses to expand PV sales and markets will continue to be restrained. The resulting small scale of manufacturing, limited market aggregation, and high costs and/or unavailability of finance will continue to limit PV's potential for providing GHG reductions and large scale electrical power generation.

6. Table 4 on page 15 of the main document provides a summary of current PV sales in each of the PVMTI countries, expected sales in 5 years, and additional sales expected as a result of PVMTI investments and related activities in the marketplace. There are significant opportunities in each of the country markets that are expected to be exploited in the near term by existing private sector companies, but market development is expected to remain constrained by the risks of entering and developing significant new market niches and by the difficulties in accessing appropriate financing. While all of the target countries have national energy plans that call for significant increases in renewable energy utilization, these plans generally lack the economic and financial basis to achieve goals without significant private sector innovation and capital mobilization.

The Alternative

7. PVMTI is expected to have a catalyzing effect by providing capital and financing mechanisms that would otherwise be unavailable. Appraisal activities performed during PVMTI preparation assessed the flow of proposed investments and developed estimates of investment and sales believed possible under reasonable growth rates. While changes in market penetration in the first few years of PVMTI operation are likely to remain small, by the end of the fifth year of project operation this additional financial assistance is expected to increase sales above the base case by 33% in Morocco and 55% in India and 66% in Kenya.

8. PVMTI as an alternative to the baseline will catalyze and invest in strategic private sector projects, mobilize additional capital for projects, and provide business development assistance both in proposal development (for Secondary Track sub-projects) and project operation. PVMTI will provide commercial incentives to encourage innovation to benefit the global environment combined with appropriate risk management in the interests of cost-effectiveness, financial sustainability, and future replicability. While resembling a fund, PVMTI will forego some of the usual financial returns of a fund in exchange for achieving strategic growth in PV markets.

9. Based on the significant barriers to commercial financing of PV, a number of potential sub-projects would be justifiable with PVMTI support on a grant basis as eligible incremental costs. However, to lessen local market distortions, increase investment leverage, and make

project outcomes more replicable on a commercial basis, PVMTI will instead provide financing on a concessional but (mostly) cost recoverable basis.

10. PVMTI activities will be similar in all three country markets, but the individual sub-project approaches will be unique to each country. In India, PVMTI will stimulate investments and activities in new commercial (not government driven) sectors. In Kenya, it is expected to provide working capital and end-user financing to a market that is thriving but constrained by cash-flows. In Morocco, there is particular potential to demonstrate private franchise models and possibly guarantee facilities (with national utility support) as alternatives to government grid-extension.

Incremental Cost Estimates

11. The total incremental costs associated with PVMTI include all funds of the initial \$30 million GEF grant that are not recovered for repatriation to GEF. Including expected net investment recovery and all IFC costs and EMT fees and performance compensation, these incremental costs are expected to be \$16.5 million. Incremental costs are expected to include those at the sub-project level as well as costs associated with execution of the project by IFC and the EMT.

12. Actual incremental costs will depend on the performance of the sub-projects in which PVMTI invests; these costs are described in more detail below. The concessionality in project finance is required to overcome additional, unique, and unknown risks of making investments in developing the market for PV. In the face of these risks, traditional market criteria are too conservative to support investment and market barriers may not be appropriately addressed.

13. In addition to this initial concessionality, technical assistance is needed to develop business and technical skills, address individual barriers as encountered, ensure long-term management capability, and facilitate appropriate evaluation of these projects by financial institutions. Finally, various components of performance-related incentives are required to create a vested business interest for the EMT in the outcome of sub-projects and to stimulate the EMT's management and delivery of technical assistance toward the long-term goal of demonstrating successful business models.

14. There is no firm basis to state a priori the total amount of incremental costs under the project. For PVMTI, this is due to the fact that a) the sub-projects themselves are not yet known, b) the actual level of risk encountered by companies in the marketplace remains unknown and the risks to be accepted by PVMTI remain subject to negotiation, c) performance of the investee companies over the life of the sub-project will determine the level of reflows, interest earnings, and equity returns, and d) a portion of incremental costs are for performance-related compensation for the EMT that will be a function of project performance and payable wholly from project reflows. Estimates of the incremental costs expected at the sub-project level and for project execution and performance-related compensation are described below. More refined estimates of incremental costs will be possible at a) the point of sub-project selection (within 1-2 years after implementation begins); and at the point of final repayment or exit (in the case of equity) from investments (up to 10 years).

Project Incremental Costs

15. The PVMTI Solicitation will require that sub-project sponsors justify their request for investment by providing information on their current level and types of activities, the specific barriers faced in expanding these activities, and the level and/or types of activities that they would engage in absent these barriers. These inputs will be compared against market trends and national development plans, and will be used to further define market barriers that are actually faced in each country marketplace and describe the commercial context.

16. To address these barriers and the additional risk of investing in PV projects, IFC will apply investment criteria developed for PVMTI which are less stringent than those usually used in evaluating IFC investments, but which include values for the strategic benefits of projects in accelerating PV dissemination. PVMTI will only invest GEF funds in sub-projects that are commercially viable or nearly so, but that would produce unacceptable risk-adjusted rates of return without some degree of concessional support. In addition to the more usual investment criteria described earlier, IFC will evaluate the internal rate of return (IRR) that would be required to undertake these sub-projects to determine the level of concessional support required (in cost or term of financing, through equity, or other security or credit enhancement) to displace risks to the point where the investment could proceed. IFC will negotiate financing terms that are as close to commercial as possible with the concession sufficient to offset the incremental risk, thus avoiding windfalls to sponsors.

17. Sponsors will be free to propose (within limits) a PVMTI investment more closely correlated to the opportunities and business realities in their selected target market. This approach will minimize grant requests and provide an incentive to sponsors to propose activities that maximize financial returns to PVMTI. Sponsors will be encouraged to stretch beyond their baseline activities in order to receive financing, but will not deliberately exceed their perceived incremental risk. The concession required to support the resulting portfolio of projects provides a proxy for the incremental costs.

18. The form of the investment selected should correspond as closely as possible to the particular market barrier creating the need and justification for the GEF support, such as:

- Longer term debt financing -- where the term credit requirements of commercial lenders require cash flows beyond the ability of the sub-project
- Equity -- where insufficient equity on the part of the sponsor constrains access to affordable commercial debt
- Partial Guarantees -- where the credit worthiness of a sponsor is unproven
- Concessional investment -- where the risk adjusted rate of return is too low for the investment to proceed at commercial rates prevalent in local markets. Concessions can take the form of lower interest rates, longer grace periods, subordination to other investors, reduced guarantee fees, reduced dividends on equity, etc.

19. **Grants:** Grants will be limited to non-commercial activities believed important to support individual PVMTI investments. These uses could include technical and business training, technology validation or certification, public awareness, and support of policy initiatives. Where possible, such use of funds will be incorporated into the sub-project financing packages. Should the deal flow from the initial solicitation be inadequate, additional small grants may be considered for further development of business plans. PVMTI's preference will remain that these activities be supported by the applicants themselves, or if necessary, by interested bilateral donors. Grant allocations will be at the discretion of the EMT with IFC approval; such expenditures are anticipated to total no more than \$2.5 million across all three countries and are likely to be in the range of \$1.25 to \$2.5 million.

20. **Losses on Investments (Non-Recovery and Foreign Exchange Costs):** PVMTI debt and equity investments will be made in good faith and after appropriate due diligence, and are expected to be recovered under the terms of the financing. The absence of knowledge about which financing modalities and structures will be successful is an additional market barrier, especially for institutions providing commercial financing. Losses or write-offs on investments will be the manifestation of the risk of failure inherent in the investee projects and will be the incremental costs ex-post. The successful investments, however, will adequately demonstrate financial structures and business approaches that work and form the basis for sustainability and replicability of such projects. If a sub-project relies on a guarantee mechanism, the amount that is ultimately called (net of any guarantee fees) will be the incremental cost.

21. As the available funds from GEF are in U.S. dollars, the cost of hedging the foreign exchange risk (for borrowing dollar-denominated funds with all revenues in local currency) estimated by potential project sponsors ranges from 8% p.a. (India, Morocco) to over 15% p.a. (Kenya). Providing dollar-denominated funds thus imposes a significant unintended consequence that is not relevant in the local financial markets PVMTI seeks to foster, and project sponsors borrowing dollars instead of local currency would necessarily adjust their proposed financing terms. The costs associated with forex management will be included in the risk management approach and actual rates negotiated for each investment. Project sponsors will continue to face the usual commercial risk effects of foreign exchange fluctuation, including the impact on costs of imported material. Actual forex-related losses could be significantly higher or lower and will depend on the currency values at the time of repayment.

22. Total costs of portfolio losses and foreign exchange impacts are expected to be \$7.5 million and are likely to be in the range of \$5.9 to \$11.3 million. IFC and the EMT will exert full management effort to reduce these losses even further.

23. **Returns on Performing Investments:** Most PVMTI investments are expected to include below market interest rates, but some returns are anticipated which will offset some of the losses. These gains or returns on the performing portfolio will accrue from interest payments, equity dividends, gains in equity, and guarantee fees. Gains on the performing portfolio are expected to be \$2.3 million and are likely to be in the range of \$0.6 to \$4.4 million. Appropriate incentives exist for the EMT to maximize returns while maintaining a focus on the strategic objectives of PVMTI, and competition for PVMTI funds and/or strong performance in equity investments could result in significantly higher earnings on the portfolio.

24. In a worst case scenario, the PVMTI portfolio would show a total loss of the entire \$25 million placed in sub-projects. A best case scenario would be full reflow of all invested funds with interest and/or equity gains (less minimal amounts for grants and forex costs). While such an outcome would be welcome, returns of this magnitude might indicate that PVMTI had taken on insufficient risk in demonstrating new and innovative business approaches.

Incremental Costs of Technical Assistance and Project Execution

25. The incremental costs at the EMT level include elements of both a fund manager and a financial intermediary. These include:

26. Project execution costs incurred by the EMT which including managerial, administrative, and overhead costs of administering a project in three countries. These costs are expected to be \$2.3 million.

- The extra effort (and cost) of achieving the GEF objectives through the provision of technical assistance. In addition to stimulating non-grant, near-commercial financing modalities, PVMTI's technical assistance provided through the EMT will include assistance with business plan development, financial matchmaking, and attracting co-financing. In its long term supervision of sub-projects, it will include a heightened level of engagement on monitoring and management intervention to ensure sub-project success and demonstration of successful business and investment models. Costs associated with providing technical assistance are expected to about \$3.7 million -- most of it expended during the investment phase (expected to last the first 3 years).
- The extra risk entailed in achieving PVMTI's strategic objectives, compensated for by success incentives. While the EMT will not be investing its own funds in sub-projects, they will operate at cost until sub-projects begin to perform and service their financing. Thus, they incur the risk of failing to achieve compensation above their costs, and the opportunity costs of other more profitable business they may forgo to execute PVMTI. Performance-based compensation for the EMT based on the agreed upon achievement of strategic criteria (including rapid approval of investments in acceptable projects, degree of leverage attained, long-term investment performance, and achievement of PVMTI strategic aims) and derived wholly from project reflows. The basis for justifying performance-related compensation and determining the actual amount are discussed in paragraphs 105-111 of the main document. This portion of the EMT's compensation is expected to be about \$1.8 million.

27. In addition to the EMT's costs, IFC's project execution costs for PVMTI (including significant costs of providing legal services for 15-20 potential non-grant investments) are expected to be about \$1 million and will be provided from the \$5 million reserved for project execution and technical assistance from the original allocation of \$30 million. Along with the EMT's project execution costs of \$2.3 million described above, the total cost for project execution are expected to be about \$3.3 million or about 10% of the project budget.

28. Total in-country technical assistance and EMT/IFC project execution costs total approximately \$7 million. The additional requirement of \$2 million for these costs -- over and above the \$5 million reserved from the initial allocation of GEF funds -- will be met from funds recovered from investments.

29. All costs *including* technical assistance, project execution by IFC and the EMT, and the performance-linked compensation for the EMT (payable only from reflows) is expected to be about \$8.8 million or the equivalent of about 3.5% each year of the total funds available for investment. This is comparable to the management costs charged by fund managers for smaller or more innovative fund but *excluding* incentive payments (i.e., carried interest).

Total Incremental Costs

30. It is expected that \$13.5 million of the initial GEF grant of \$30 million or about 45% of all the funds provided by GEF will be available for repatriation to GEF at the end of 10 years -- after utilizing up to \$3.8 million of reflows for costs associated with technical assistance, project execution, and EMT's performance-based compensation. (This could vary depending on the losses on the investments and the returns on the performing portfolio, but is likely to be in the range of \$8.5 to \$18 million). Based on the \$30 million provided by GEF for PVMTI, this is equivalent to an expected total incremental cost for the project of \$16.5 million (and likely to be in the range of \$12 million to \$21.5 million). These costs are summarized in Table A-1.

Global Environmental Benefits

31. As the exact nature of PVMTI market development sub-projects is not yet known, it is only possible to speculate on the amount and cost of reducing carbon emissions. Because markets for PV systems are currently small and immature, the real benefit of PVMTI is the reduction of market barriers and financing obstacles that hinder the development of these markets. In addition to this long term impact, a direct benefit of PVMTI is the reduction in carbon and other GHG emissions resulting from the installation of a significant number of PV systems.

32. A proxy for these avoided emissions and the cost per ton can be estimated by assuming that all PVMTI installations will be SHS. For a typical 50 Wp PV system, total potential offset of carbon emissions is estimated at 1.83 tons of carbon (based on expected substitution for kerosene (70%), diesel-based battery charging (20%), and other zero-emission sources (10%)). For purposes of this calculation, only half of these potential savings are credited to PVMTI, as many consumers will likely utilize the PV system in part for additional lighting and entertainment purposes and will not eliminate kerosene use entirely. Approximately 66 MWp of PV capacity (above baseline sales) are expected to occur as a direct result of PVMTI installations over the 10-year life of the project, or the equivalent of 1,320,000 50Wp systems. Total carbon emissions avoided would on this basis be 1,207,800 tons. Dividing the \$17,250,000 million in expected incremental costs by the carbon emissions avoided results in a price per ton of \$14.30.

Table A-1. Incremental Costs for PVMTI*

	<u>US\$ (millions)</u>	<u>% of Total Incremental Costs</u>
Total GEF Funds Available (A)	30.0	
Expected Incremental Costs		
Grants	2.5	15.1%
Possible Losses on Investments (non-recovery, foreign exchange, etc.)	7.5	45.4%
Likely Returns on Performing Investments (interest income, equity gains)	(2.3)	(13.6%)
Technical Assistance	3.7	22.4%
IFC and EMA Project Execution Costs	3.3	20.0%
Performance-Related Compensation for EMA (payable only from reflows)	<u>1.8</u>	<u>10.8%</u>
Total Incremental Costs Expected (B)	16.5	100.0%
Expected Amount for Repatriation to GEF (C=A-B)	13.5	
Amount Repatriated to GEF as % of Project Funds (C/A)	44.9%	

* Numbers may not add due to rounding.

33. Compared to previous GEF investments, the cost per ton is low, in part as a result of PVMTI's non-grant approach to investments that are expected to show approximately a 45% net funds recovery. The actual mix of systems will likely be different than described above. The cost per ton could be substantially higher if the projected installation rates are not attained, or less likely, if consumers failed to use the PV systems to offset current kerosene and diesel use.

Appendix B

SUMMARY OF DISBURSEMENT ARRANGEMENTS

The GEF grant of up to \$30 million will be made available to IFC from the GEF Trust Fund through the World Bank's Trust Fund Division. Disbursements are expected to be made as follows:

- **Investments:** Up to \$25 million will be disbursed to investee companies according to the terms of financing approved by IFC. It is expected that most funds will be invested within two years after project initiation, and the remainder invested within three years. IFC will sign all legal agreements on behalf of GEF.
- **Technical Assistance Costs:** Services including technical, financial and business development directly to the investee companies, and provided primarily by the EMT, are expected to total \$3.7 million over the life of the project. These costs will be reimbursed periodically through IFC to the EMT for services rendered according to their contract with IFC. EMT budgets will be reviewed and approved annually.
- **Project Execution Costs:** Over the expected 10 year life of the project, these are expected to include a) IFC's requirements for project execution costs including those associated with providing significant legal services for the investments, to be drawn down as required (up to \$1 million); and b) EMT fees to be paid periodically through IFC to the EMT for services rendered according to their contract with IFC (up to \$2.3 million). EMT budgets will be reviewed and approved annually.

All costs associated with technical assistance and project execution costs in excess of \$5 million (reserved from the original allocation of \$30 million) will be paid from reflows from the sub-projects. Loan repayments will be held in an IFC account until the interim project review in 2003. It is expected that up to \$4-5 million of recovered funds will be utilized for additional fees and performance-related compensation for the EMT according to their contract with IFC. Disposition of remaining funds will be subject to negotiation with GEF.

Appendix C

TIMETABLE OF KEY PROJECT EVENTS

Time taken to prepare the project	2.5 years
IFC management approval granted to project concept	August 1996
GEF Council approval	October 1996
Country appraisals	June-August 1997
Management approval	June 1998
Project implementation initiated	July 1998

Appendix D

Additional Information on Implementation Approach

This section reproduces clarifications provided to the GEF Secretariat on the PVMTI implementation approach. These include: a) use of GEF concessional resources, b) coordination with other bilateral and multilateral activities, and c) monitoring, reporting, and indicators of success for the PVMTI program.

Guidelines on the Use of Concessional Resources

Given that commercial sustainability, expansion, and replication of PVMTI's sub-projects (either by the original sponsors or by other interested parties seeking to emulate the market success of PVMTI sub-projects) is the ultimate goal of this initiative, IFC will seek to minimize the concessionality provided to each sub-project and support those investments that are closest to being market ready. Furthermore, IFC will seek to match the financing modality (e.g., low interest loan) to the barrier or risk (e.g., excessive cost of debt) which is constraining a sub-project's implementation. Minimizing concessionality and assessing the appropriate financing modality will be achieved in several ways. Initially, the quasi-competitive nature of PVMTI's Project Solicitation will provide an incentive to sponsors to request the least amount of concession needed to catalyze their sub-project. The proposals received will provide valuable indications of what the market is likely to bear in each country. The External Management Agent (EMA) and IFC will collectively analyze proposals to determine an "appropriate" level and type of concessionality that brings the project's IRR to an acceptable level capable of attracting other commercial financing. For example, if the financial projections for a project indicate too high an expected return for the sponsors based on the risks inherent in that market, IFC will negotiate a GEF investment with a lower level of concessionality to avoid providing windfalls to sponsor companies and to avoid creating market distortions. The appropriate level of concessionality will also depend on the sponsor's financial status and the requirements of the sector they are addressing. Similarly, the Project Solicitation will request that the sponsor specify -- subject to negotiation by IFC -- the financing modalities (concessional debt, contingent equity, guarantees, grants, etc.) best suited to the requirements of the individual sub-project and market and risk conditions in that country. The issue of the degree of concessionality is discussed in paragraphs 78-79 of the project document.

IFC fully intends to share the lessons learned from PVMTI's experience with concessional finance as the project progresses. IFC's investments for its own account in any PVMTI sub-project will be treated in the same manner as funding from commercial sources of financing.

It is not PVMTI's intention to utilize concessional resources to directly subsidize any segment of the off-grid end-user population. IFC expects that all segments of the off-grid population (including poor households) will ultimately be served by affordable PV service by encouraging the development of the market on a commercially sustainable basis including the development of appropriate credit mechanisms. PVMTI is designed to discourage direct subsidy of the equipment or services provided to the end-users.

Coordination with Other Bilateral and Multilateral Activities

Although PVMTI will make investment decisions independently, IFC and its EMA will coordinate closely with other established donor activities and government programs involved in this sector as appropriate. IFC reviewed all such existing activities as part of its appraisal and clearly recognizes the need to consider this information in making PVMTI investments. PVMTI will welcome proposals that show synergies with existing donor programs and benefit from lessons learned previously. For example, in Morocco, PVMTI is expected to offer practical models for franchise or concessionaire types of service provision in concert with (not in competition with) the national utility. In India, projects may benefit from the wide variety of incentives available there, but the near-commercial orientation required is expected to provide valuable market discipline that will help companies reduce their long-term dependence on subsidies. An independent evaluation of a donor-funded PV credit line in India also strongly supports the PVMTI approach. In Kenya, PVMTI projects will build on the experiences and models demonstrated by the World Bank and other donors in bringing small scale PV to a more commercial status. Finally, IFC's expectation is that PVMTI's private sector orientation can "raise the bar" for future projects and attract future donor financing and government support to more sustainable activities capable of providing significant energy resources on a larger scale.

To avoid "double-dipping" into GEF's limited concessional resources, PVMTI will not provide financing to any project that is receiving (or is likely to receive) GEF funds from another GEF-funded project (through any of the implementing agencies). For example, GEF funds from the World Bank's credit line for PV in India will not be used for the same projects that PVMTI invests in. Similarly, the IFC/GEF SME Program has received requests from PV companies (notably in Morocco) for funding and these companies have been advised that any funding from the SME program will preclude them from applying for a PVMTI investment (or vice versa). For exactly the same reasons, GEF resources available through REEF cannot be co-invested with PVMTI funds. However, as REEF has a significant commercial debt and equity component, PVMTI projects that also meet REEF's criteria for commercial investment could be considered by REEF's management for investment without co-financing from REEF's GEF resources – and will be treated like any other potential (commercial) source of financing including IFC's own funds.

Reporting and Monitoring Between IFC and EMA and Indicators of Success

IFC will monitor PVMTI's execution closely. While IFC will use the services of the EMA to assist with the evaluation, implementation, and monitoring of PVMTI sub-projects, this approach is primarily designed to provide a heightened level of technical assistance and oversight at the country level, as well as to allow for closer monitoring of sub-project implementation in each of the three countries. It is, however, important to note that IFC's oversight and responsibility for PVMTI is no way diminished by using the EMA -- which will act as IFC's agent with all decision-making remaining the sole authority of IFC staff and management. IFC's responsibilities and commitments regarding reporting and monitoring also apply to the EMA by extension and IFC's own oversight of the EMA is described in detail in paragraphs 95-99 of the project document.

The EMA will take the lead in initial screening of proposals received in response to the project solicitation, but will make available all proposals -- with comment -- to IFC for review. Later in the process, proposals forwarded to IFC for consideration by the PVMTI Investment Review Committee

will include the results of the due diligence undertaken by the EMA in a specified format and coordinated with the IFC project officer responsible for PVMTI. The EMA will also periodically provide summaries of all potential projects received, including reasons for rejection if any, prospects, investment status, etc.

After an investment is approved in a project, the EMA will review periodic progress and compliance reports from the investee companies and otherwise monitor compliance of the terms of the investment agreement, and notify IFC immediately of any defaults or potential for default. The EMA will provide quarterly reports on the status of all PVMTI investments and projects in the pipeline, and an annual supervision report on each approved sub-project including information on the achievement of strategic objectives, market activities (sales, technical performance, etc.), financial performance of the investee companies (profitability, repayment history, etc.), and any remedial action required or taken. The EMA will also certify that all conditions precedent to a disbursement have been met and then track all disbursements and repayments in quarterly and annual reports. The IFC project officer will participate in selected appraisal and supervision missions in each country and will arrange for an independent review to assess the program at the mid-point (approximately 2003) and a final review in 2008.

The EMA will also obtain approval from IFC for its annual operating budget and provide quarterly and audited annual reports on its expenses.

IFC believes that PVMTI's expected strategic outcomes, in terms of systems installed, distribution chains developed, and financing modalities established, will tend to be maximized by the competitive nature of the PVMTI concessional investment process. The overall strategic impact of PVMTI will be periodically assessed and reported by IFC. Issues regarding assessment of PVMTI's impacts are discussed in the Project Document in paragraphs 49-58.

The main indicators of success will be based on the rate of market growth in each country, with estimates made on the specific contributions of the PVMTI investments. In each of the three countries, PVMTI is expected to stimulate a significant increase in market growth and number of systems installed over the growth otherwise anticipated during PVMTI's 10-year lifetime. An additional long-term outcome of PVMTI will be the demonstration of profitable business enterprises that competently manage the various technical, marketing, and financing challenges facing PV. These successful business models will help set the stage for large-scale replication on a commercial (or more nearly so) basis.