LESSONS FOR THE FUTURE

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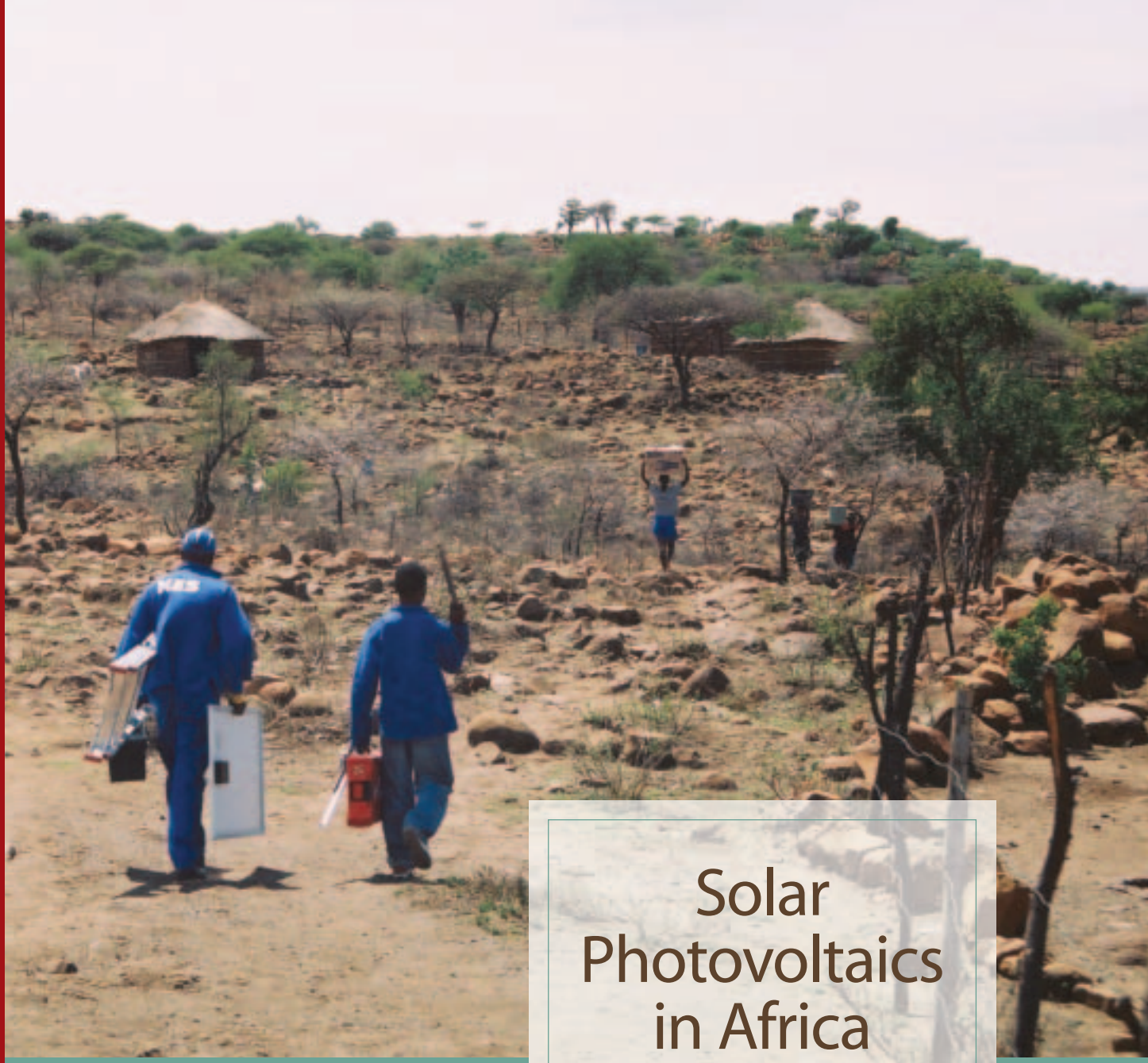

Solar Photovoltaics in Africa

EXPERIENCES WITH FINANCING AND DELIVERY MODELS

United Nations Development Programme

Global Environment Facility

GLOBAL ENVIRONMENT FACILITY (GEF)

The Global Environment Facility was established to forge international cooperation and finance actions to address four critical threats to the global environment: biodiversity loss, climate change, degradation of international waters, and ozone depletion. Launched in 1991 as an experimental facility, the GEF was restructured after the 1992 Earth Summit in Rio de Janeiro. The facility that emerged after restructuring was more strategic, effective, transparent, and participatory. During its first decade, GEF allocated $4.5 billion in grants, supplemented by more than $13 billion in additional financing, for more than 1200 projects in 140 developing countries and transitional economies as well as 2,800 projects in 60 countries which participate in the GEF Small Grants Programme, managed by UNDP. In 2002, donors pledged $3 billion to finance projects from 2002 to 2006.

In addition to its initial mandate, the May 2003 GEF Council approved two new focal areas for the GEF. The GEF now provides financial assistance for the mitigation and prevention of land degradation and persistent organic pollutants (POPs). GEF funded projects are implemented through the following development agencies: UNDP, UNEP and the World Bank. The GEF also benefits from having the following executing agencies: IDB, AfDB, ADB, EBRD, FAO, IFAD and UNIDO.

The GEF can succeed in its global environmental mission only as part of a worldwide movement towards sustainable development. GEF brings together 166 member governments, leading development institutions, the scientific community, and a wide spectrum of private sector and non-governmental organizations on behalf of a common global environmental agenda.

UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP)

UNDP is the UN's global development network, advocating for change and connecting countries to knowledge, experience and resources to help people build a better life. With 132 country offices, it has long enjoyed the trust and confidence of governments and NGOs in many parts of the developing as well as the developed world. It is typically regarded as a partner rather than an adversary, and its commitment to a universal presence has proven especially useful in post-conflict situations and with States that have otherwise been isolated from the international community.

At the UN Millennium Summit, world leaders pledged to cut poverty in half by 2015. UNDP is charged with helping developing countries monitor their progress in meeting this and other key development goals. Its strategy focuses on six key thematic areas: Democratic Governance, Poverty Reduction, Crisis Prevention and Recovery, Energy and Environment, Information and Communications Technology, HIV/AIDs. Capacity development and gender mainstreaming are cross-cutting issues across the thematic areas.

A trusted source of knowledge-based advice and an advocate of a more inclusive global economy, UNDP provides funds, helps developing countries attract and use aid effectively and promotes South-South cooperation. It seeks to address the many causes of poverty and to promote development, including through the protection of human rights and the empowerment of women.

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MARTIN KRAUSE AND
SARA NORDSTRÖM, EDITORS

MAY 2004

Foreword

This is the second in the *Monitoring and Evaluation Report Series*[1] published under the Lessons for the Future series to present results of analytical work carried around the Global Environment Facility (GEF) portfolio of the United Nations Development Programme (UNDP). The purpose of the series is to disseminate findings of studies based on experiences gained from UNDP-GEF's own projects and programmes, or from activities of our partners and other concerned organizations working in areas relevant to the GEF operations. The publications have various objectives and target groups. First and foremost, it is our intent to make available lessons and good practice from past and ongoing operations to project proponents, designers and implementers, the executing agencies of UNDP-GEF projects, and UNDP staff. Secondly, the monitoring and evaluation (M&E) series is aimed at highlighting key issues and results related to UNDP-GEF work for our principal constituencies, including the GEF Council and global environmental Conventions. Finally, we hope that the reports will equally serve to spread the word of our work to other interested parties, including academic and research institutions, non-governmental organizations (NGOs) and civil society, and the public at large. The reports are published at irregular intervals when relevant materials and studies are completed and become available.

The second issue of this series focuses on solar photovoltaics (PV). After nearly 20 years of supporting PV for use in Africa, the development community needs to take time to carefully take stock of achievements; systematically collect lessons learned; and thoughtfully re-shape policies and activities designed to support the dissemination of PV-based electrification. This publication seeks to contribute to this learning process, hoping to make the lessons learned and experiences gained in the African context more widely available to development practitioners, government departments, consultants, PV suppliers, researchers and experts. In particular, the publication explores questions about the best ways to make PV systems accessible, affordable and sustainable to rural people in developing countries, keeping in mind the constraints, opportunities, and risks prevailing in each region and country.

[1] The first report published in November 2003 was entitled Conserving Forest Biodiversity: Threats, Solutions and Experiences.

This report springs from a UNDP-GEF sponsored workshop on "Financing Mechanisms and Business Models for Photovoltaic Systems in Africa" held in Pretoria, Republic of South Africa, in May of 2003. Representatives of 15 PV programmes in Africa were present at the workshop, and their experiences provided a rich fuel for the ensuing discussion. The goal of the report is to share some of that richness to a much wider audience.

Financial support for the workshop and this publication came from UNDP's Global Cooperation Framework, through the Sustainable Energy Programme of the UNDP Energy and Environment Group, as well as from UNDP-GEF. We acknowledge gratefully this support.

In addition, we would like to thank Martin Krause, UNDP-GEF Regional Coordinator in Climate Change for Eastern and Southern Africa, who conceived of the idea for the learning network of PV projects, and Sara Nordström, UNDP-GEF consultant to the M&E and climate change teams, who worked closely with Martin to bring the workshop and this publication about. We are also greatly indebted to the principal authors, Mark Hankins and Douglas Banks, who shared from their years of experience in producing these papers. We would also like to acknowledge Farid Mohamed, Nikhil Desai, and Ashington Ngigi for their insightful comments on the various drafts of the publication. Finally, all of the participants at the original PV workshop held in Pretoria in May of 2003 deserve a vote of gratitude – we hope that this final product and the experience of the workshop justify their time and effort.

We sincerely hope that the research presented in this report will be of use to everyone concerned with solar PV development in Africa and beyond. Your comments on the present study, and the Lessons for the Future/M&E Report Series in general, will be most appreciated.

Juha I. Uitto
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Abbreviations and Acronyms

AFC	Agricultural Finance Corporation
Ah	Ampere hour: amount of electrical charge that is stored in a battery
BBS	Battery-based systems
DANIDA	Danish International Development Agency
ERT	Energy for Rural Transformation
ESCO	Energy service company
ESMAP	Energy Sector Management Assistance Program
GEF	Global Environment Facility
GHG	Greenhouse gas
IEA PVPS	International Energy Agency Photovoltaic Power Systems Programme
IFC	International Finance Corporation
HP	Hire purchase
kW	Kilowatt: Unit of power
kWh	Kilowatt hour: Unit of electrical energy
LPG	Liquefied petroleum gas
MDGs	Millennium Development Goals
MFI	Micro-finance institution
MW	Megawatt: Unit of power
NGO	Non-governmental organization
Nuon RAPS	A joint venture between Nuon, the largest Dutch utility, and Rural Areas Power Solutions
ODA	Official Development Assistance
PMU	Project management unit
PPP	Public-private partnership
PSF	Private Sector Foundation
PV	Photovoltaic or solar electric
PVMTI	Photovoltaic Market Transformation Initiative
REF	Rural energy fund
RET	Renewable energy technology
SACCO	Savings and credit cooperative
SDG	Solar Development Group
SHS	Solar home system
SIDA	Swedish International Development Cooperation Agency
SME	Small and medium-sized enterprises
SWH	Solar water heater
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNOPS	United Nations Office for Project Service
UPPPRE	Uganda Pilot Photovoltaic Project for Rural Electrification
V	Volts: A measurement of the 'strength' of electricity.
VAT	Value-added tax
WB	World Bank
Wh	Watt hours: Measure of electrical energy
Wp	Peak watts rating
12VDC	Twelve volts direct current electricity
240VAC	Two hundred and forty volts alternating current electricity

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Chapter 3 Douglas Banks

Photovoltaic System Delivery Methods for Rural Areas in Africa

Executive Summary

Since 1991, the GEF has provided grant financing of more than US$200 million towards the total cost of nearly US$1.4 billion of the photovoltaic (PV) projects in its portfolio. Nearly half of these projects are based in Africa, making PV the primary focus of GEF support in the climate change focal area in Africa. While the GEF supports PV projects in order to help households and businesses to obtain modern energy supply, namely electricity, without increasing greenhouse gas emissions, it must be acknowledged that the quantity of greenhouse gases reduced through PV projects is quite small. Most of the PV projects supported by the GEF are designed to stimulate the market for PVs by removing barriers to their expanded use in hopes that a thriving market will develop to supply with electricity the population in Africa currently without electricity at zero net greenhouse gas emissions.

Based upon the experiences in PV markets under GEF projects, projects of other donors, and purely private-sector initiatives, there appear to be three critical questions that have to be answered before a sustainable market for PVs can be stimulated in the rural areas of a developing country.

First, what are the appropriate uses of PVs in rural areas of developing countries and, therefore, what is their priority among the target markets? Many projects in the past have over-stated both the importance and potential of PVs for energy supply in developing countries. Photovoltaics provide a limited amount of expensive electric power that can be used for operating light bulbs, radios, TVs, and other low-load electrical appliances. They generally do not supply not a universal choice. Yet PV does fill an important niche in supplying the rural energy needs in developing countries. However, the size of that niche can be easily overestimated.

Second, how can financing be constructively used to grow the market for PVs in the rural areas of developing countries? In simplest terms, financing should help to expand the market of PVs by helping consumers, communities, businesses, and suppliers to afford the high capital costs associated with PVs. Before jumping to the conclusion that financing will stimulate growth of all nascent PV markets, both the status of the financial sector and the maturity of the PV market must be analysed. With respect to the latter, PV markets can be classified into four categories: pre-commercial; pioneer; emerging; and mature markets. Financing should be tailored differently to fit the state of the PV market under examination. With respect to the former, the level of sophistication of the financial sector and its financial institutions will vary by country. To grow a PV market through financing, attention should be paid to leveraging finance at all stages of the supply chain, not just to the financing of final consumers. Micro-finance entities, national development funds and banks, and commercial banks can all be enlisted to grow a young PV market. Each of these institutions will have certain advantages and disadvantages when operating at a different stage of the supply chain and in a PV market of a given level of maturity. Care must be taken to match the financial institution and instrument with the agent in the market with which it will be most effective – mismatches have been frequent and costly. Six lessons bear repeating in the context of PV projects and financing. One, project objectives