United Nations Environment Programme

Terminal Evaluation of UNEP GEF Project Solar and Wind Energy Resource Assessment - SWERA

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July 2011

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EXECUTIVE SUMMARY

I. INTRODUCTION AND SCOPE

i. The Solar and Wind Energy Resource Assessment (SWERA) project started in 2001 and was managed by the Division of Technology, Industry and Economics (DTIE) of the United Nations Environment Programme (UNEP) to help advance the large-scale use of renewable energy technologies in developing countries. The SWERA project sought to increase the availability and accessibility of high-quality solar and wind resource information and also provide the tools for analysis and application in promoting renewable energy investments.

ii. The GEF provided a co-financing of US$ 6.8 million of the US$ 9.1 million for the pilot project with the aim of removing the informational obstacles and uncertainties preventing large-scale investment in renewable energy. This support was provided under the GEF Climate Change Operational Focal Area. The thirteen (13) pilot countries were Bangladesh, Brazil, China, Cuba, El Salvador, Ethiopia, Ghana, Guatemala, Honduras, Kenya, Nepal, Nicaragua, and Sri Lanka.

iii. In 2006 SWERA was expanded into a full programme and it attracted support from the US Agency for International Development (USAID) and U.S. National Aeronautics and Space Administration (NASA).

iv. The main literature reviews and field visits for this Terminal Evaluation were initially conducted over a 12-week period (May –July 2010) by a team of two Consultants, a Lead Evaluator and an Associate Evaluator, who together visited six of the pilot project countries: China, Ghana, Kenya, Cuba, El Salvador and Brazil.

v. A breach of contract by the Associate Evaluator occurred along the way so the Lead Evaluator's contract was extended to enable him undertake field trips to three

additional countries (Nepal, Nicaragua and India) and to take full charge of bringing the terminal evaluation exercise to final conclusion.

II.PROJECT PERFORMANCE AND RATING

vi. Ten (10) main evaluation parameters have been used to prepare this report and these may be listed as follows:

- ✓ Attainment of objectives and planned results,
- ✓ Sustainability with respect to financial resources and socio-political issues as well as institutional framework and governance, and environmental impacts,
- ✓ Catalytic role and replication,
- ✓ Stakeholder participation/public awareness,
- ✓ Country ownership/driven-ness,
- ✓ Achievement of outputs and activities,
- ✓ Preparation and Readiness,
- ✓ Assessment, monitoring and evaluation systems,
- ✓ Implementation approach (covering project management and M&E during project implementation), and
- ✓ Financial planning.

vii. The SWERA project has been, generally speaking, a success with all the evaluation parameters being rated Moderately Satisfactory/ Satisfactory /Highly Satisfactory or Moderately Likely/ Likely; none of the evaluation parameters was rated Unsatisfactory or Unlikely.

viii. The project succeeded in making available solar and wind energy resource datasets and maps, together with tools for utilization, thereby contributing significantly to removing key informational barriers and improving confidence in already existing data. Outcomes of the project have resulted in some large-scale investments, particularly in China plus significant policy development in Kenya, and to a lesser extent Ghana.

ix. SWERA has succeeded in bringing solar and wind energy technology to the fore as viable options for meeting some of the energy needs of the pilot countries, and also for diversifying their energy sources. Data generated has encouraged the mainstreaming of RETs into national energy plans, and stimulated the enactment, or the initiation of enactment of policies and laws in a number of countries. SWERA has also incentivized the conduct of additional or confirmatory solar and wind resource measurements with follow-on financing.

x. The project was very clear from the outset on its objectives and the series of activities and related outputs that were needed to accomplish its expected outcomes. The project design identified competent technical partners for the project (NREL, DLR, RISOE, TERI, etc.), whose roles and geographic scope of operation was also well defined.

xi. Considering that SWERA spanned 13 countries with 21 partner agencies, this evaluation considers the project supervision and monitoring to be very commendable as done through global and regional meetings, annual reporting from technical partners on activities in each country/region and also from the host countries themselves, plus field mission reports and PIRs from the SWERA Project Manager.

III. LESSONS LEARNED AND RECOMMENDATIONS

xii. This report puts forward three main lessons to be learned, for the betterment of project implementation in the future:

a. Getting global centres of excellence to share knowledge and tools yields positive results ;
b. Avoid wide disparities in country-level commitment and capacities; and
c. Promote frequent consultations at country and international levels.

xiii. The SWERA project's involvement of competent technical partners for the project (NREL, DLR, RISOE, TERI, etc.) with clearly defined roles and geographic scope of operation is

highly commendable. This harnessing of the global commons for knowledge and expertise is a mechanism that UNEP and others must seek to replicate in future projects.

xiv. The wide variation in as many as thirteen (13) pilot SWERA project countries (Bangladesh, Brazil, China, Cuba, El Salvador, Ethiopia, Ghana, Guatemala, Honduras, Kenya, Nepal, Nicaragua, and Sri Lanka) meant that some were able to go much further along the outcomes-to-impacts pathway than others. In future it would be advantageous to choose countries with similar (or less contrasting) capacities and levels of commitment in order to make it easier to customize project tools and instruments to suit a more homogenous set of demands.

xv. In-country awareness of country-level activities and developments was not broad enough in some pilot countries (e.g. Nepal and Kenya where major private-sector actors had never heard of SWERA or got to know of it by chance) and knowledge of project developments in other pilot countries was effectively non-existent (e.g. in Ghana several persons directly involved in the SWERA were not aware of impressive achievements in China). More dynamic country-level as well as international knowledge networks should be promoted to ensure as many stakeholders as possible become aware of the developments taking place in a project, at both national and international levels, and the tools being developed.

xvi. Two main recommendations are contained in this evaluation report as follows:

a. Update and re-launch SWERA website at global level to ensure that more interested parties are aware of the resources available; and
b. Establish an internet-based knowledge network for all participants in the pilot countries and organize a series of webinars so that experts and interested parties in the SWERA pilot project countries can share developments in their countries or institutions.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the many interviewees in China, Ghana, Kenya, Nepal and Nicaragua, as well as those in TERI, RISO and UNEP Paris, who willingly shared their thoughts on the SWERA Project with him.

In particular the author would like to thank Ms Ma Lingjuan of the Chinese Renewable Energy Industries Association, Mr Kwabena Otu-Danquah of the Energy Commission of Ghana, Mr Daniel Theuri who formerly worked with Practical Action and is now a private consultant, Ms Aruna Awale of the Alternative Energy Promotion Centre of Nepal and Ms Aracely Hernández of Ministry of Energy and Mines in Nicaragua. The author would also like to thank Mr Amit Kumar of The Energy Resources Institute in India, Dr John Christensen of the UNEP Risoe Centre in Denmark, and Mr Mark Radka of the UNEP Office in Paris. Without the contribution of these people, through introductions and facilitation of appointments as well as sharing of their own insights into the project, this report would not be what it has become.

Special thanks are owed to Mr David Ato Quansah, a Fellow of The Energy Center and a lecturer in the Department of Mechanical Engineering at the College of Engineering, Kwame Nkrumah University of Science and Technology, Ghana. David provided invaluable technical support throughout the preparation of this terminal evaluation report and his contribution will forever be cherished by the Lead Evaluator.

ACRONYMS AND ABBREVIATIONS

AEPC	Alternate Energy Promotion Center
AWEA	American Wind Energy Association
CBEE	Brazilian Wind Energy Centre
CPM	Country Project Manager
CREIA	China Renewable Energy Industry Association
CSP	Concentrated Solar Power
DLR	German Aerospace Center, Institute of Technical Thermodynamics
DTIE	Department for Technology, Industry and Economics
EREDPC	Ethiopian Rural Energy Development and Promotion Center
EWEA	European Wind Energy Association
FIT	Feed-in-Tariff
GEDAP	Ghana Energy Development and Access Programme
GIS	Geographic Information System
GIZ	German Agency for International Cooperation
GsT	Geospatial Toolkit
GTZ	German Agency for Technical Cooperation
INPE	National Institute for Space Research, Brazil
IRENA	International Renewable Energy Agency
ISES	International Solar Energy Society
KAMM	Karlsruhe University Atmospheric Meso-scale Model
KNUST	Kwame Nkrumah University of Science and Technology, Ghana
LABSOLAR	Laboratory for Solar Energy
M & E	Monitoring and Evaluation
MARR	Minimum Acceptable Rate of Return
NDRC	Chinese National Development and Reform Commission
NEDPIC	National Energy Data Processing and Information Centre, Ghana
NREL	National Renewable Energy Laboratory, US
PIR	Project Implementation Review
RET	Renewable Energy Technology
RETScreen	Clean Energy Project Analysis Software
Risø-DTU	Risø National Laboratory, Denmark (also spelt Risoe)
ROtI	Review of Outcome to Impacts
RREX	Renewable Energy Resource Explorer
SUNY	State University of New York
SWERA	Solar and Wind Energy Resource Assessment
TERI	the Energy and Resources Institute, India
UNDP	United Nations Development Programme

UNEP	United Nations Environment Programme
UNEP/GRID	UNEP Global Resource Information Database
UNEP-BSP	UNEP Bali Strategic Plan
UNFCCC	UN Framework Convention on Climate Change
USAID	United States Agency for International Development
WAsP	Wind Atlas Analysis and Application Program
WRAMS	Wind Resource Assessment and Mapping System

INTRODUCTION

1. The Solar and Wind Energy Resource Assessment (SWERA) project started in 2001 and was managed by the Division of Technology, Industry and Economics (DTIE) of the United Nations Environment Programme (UNEP) to help advance the large-scale use of renewable energy technologies in developing countries. The pilot project was expected to end in 2004, a planned total duration of 36months, but this evaluation notes the fact that most of the project activities run into 2008.

2. The rationale for the SWERA project was the fact that slowing and eventually reversing growth in global greenhouse gas emissions would require, among other initiatives, the large-scale use of renewable energy technologies for production of thermal energy, electricity, and fuels. Relevant renewable energy technologies were thought to include solar thermal applications for buildings and industry, solar electric power generation (using photovoltaic and solar energy conversion), and wind electric power generation.

3. The SWERA project rationale was built on the assertion that investment in wide-scale intensive application of these technologies in developing countries is inhibited in part by the lack of adequate solar and wind resource data and by the lack of tools to evaluate these data for energy planning. It was therefore argued that without reliable resource information, potential investors will not risk wind or solar project development activities.

4. The SWERA project therefore sought to increase the availability and accessibility of high-quality solar and wind resource information and also provide the tools for analysis and application in promoting renewable energy investments. In particular, the pilot project proposed to establish both the resource data (solar and wind atlases and maps) and the tools for their use, to facilitate and stimulate investment and development of broad scale solar and wind initiatives.

5. The GEF provided a co-financing of US$ 6.8 million of the US$ 9.1 million for the pilot project with the aim of removing the informational obstacles and uncertainties preventing large-scale investment in renewable energy. This support was provided under the GEF Climate Change

Operational Focal Area. The pilot project's objective was to make available reliable, high resolution solar and wind resource data in developing countries to support more informed decision-making, science-and-technology based policy, and increased investor interest in renewable energy. Initial project countries were selected through an invitation that included a partnership agreement between SWERA and each study country. The thirteen (13) pilot countries were Bangladesh, Brazil, China, Cuba, El Salvador, Ethiopia, Ghana, Guatemala, Honduras, Kenya, Nepal, Nicaragua, and Sri Lanka.

6. The project activities were grouped under five (5) main components:
    - Solar resources assessment
    - Wind resource assessment
    - Integration with geographic information system (GIS)
    - National applications of SWERA tools and information
    - Management and coordination

    Detailed description of these project components can be found in the Project Overview presented in Annex A.

7. Wind and solar resource maps and GIS datasets were developed and completed for a number of developing countries along with tools to analyze them. The analysis tools available are:
    - Renewable Energy Resource Explorer *(RREX, a SWERA Web Mapping Tool)*
    - Geospatial Toolkit (GsT, a stand-alone decision and policy support tool for Renewable Energy Technologies)
    - HOMER (Design options tool for both off-grid and grid-connected power systems)
    - RETScreen (A Clean Energy Project Analysis Software)

8. In 2006 SWERA was expanded into a full programme and it attracted support from the US Agency for International Development (USAID) and U.S. National Aeronautics and Space Administration (NASA).

9. The technical team included the US National Renewable Energy Laboratory (NREL), the State University of New York (SUNY), Brazil's National Institute for Space Research (INPE), the Brazilian Wind Energy Centre (CBEE), and the Laboratory for Solar Energy (LABSOLAR) of Brazil. Other

members of the technical team were the German Aerospace Center (DLR), Denmark's Risø-DTU (Technical University of Denmark) National Laboratory for Sustainable Energy (Risø), The Energy and Resources Institute in India (TERI) and the UNEP Global Resource Information Database (UNEP/GRID)-Sioux Falls.

10. SWERA also had National stakeholders which usually included electric power utilities, private sector solar and wind energy technology providers, NGOs, Ministries of Energy, Ministries of Meteorology and other relevant government departments.

SCOPE, OBJECTIVE AND METHODS

11. As required by the TOR, this evaluation is aimed at assessing the magnitude and extent of any project impacts to date and examining the likelihood of future impacts. The evaluation also assesses project performance and implementation of planned project activities by in-country and technical partners, and also outputs related to such activities. The original Terms of Reference (TOR) for the terminal evaluation and an abridged CV of the Lead Evaluator are presented in Annexes B and C, respectively.

12. The main literature reviews and first round of field visits for this Terminal Evaluation were conducted over a 12-week period (May –July 2010) by a team of two Consultants who together visited six of the pilot project countries: China, Ghana, Kenya, Cuba, El Salvador and Brazil. Interviews were conducted with the SWERA Project Manager, Country Project Managers, representatives of relevant Government Agencies as well as technical partners of the SWERA project and the private sector.

13. Unfortunately the Associate Evaluator had to step aside from his assignment following the first round of field visits and UNEP therefore took a decision to extend the Lead Evaluator's contract to enable him undertake field trips to three more countries (Nepal, Nicaragua and India where one more of the project partner institutions, The Energy Resources Institute, was located) and to take full charge of bringing the terminal evaluation exercise to final conclusion. Thus, in total, 8 out of the 13 pilot countries were visited by the evaluators; the Lead Evaluator visited 5 pilot countries while the Associate Evaluator visited 3 pilot countries.

14. Documents reviewed as part of the terminal evaluation included:
    - GEF Monitoring and Evaluation Policy, 2006;
    - UNEP Medium-term Strategy 2010–2013 (Environment for Development);
    - UNEP 2010-11 Draft Programme of Work;
    - SWERA Project Design Document;
    - Implementation reviews and relevant correspondence;

- Bali Strategic Plan for Technology Support and Capacity-building;
- Country SWERA project reports and relevant publications; and
- SWERA Project Steering Committee reports.

15. The evaluation focuses on the following main questions:
    - ✓ To what extent did the project help to reduce uncertainties associated with investment and development decisions for solar and wind projects?
    - ✓ To what extent did the project increase awareness of key stakeholders and decision makers about the solar and wind resources and the relevance of the resource information to the development and deployment of various solar and wind technologies?
    - ✓ Did the project produce consistent, reliable, verifiable, and accessible global data sets for international and in-country investors and other stakeholders?
    - ✓ To what extent did the project increase capacity for making solar and wind energy plans on the local, provincial, national, and regional levels?

16. A set of more direct questions was prepared and used as a guide for interviews with Country Project Managers (CPM), stakeholders and representatives of the technical partners. These more direct questions may be listed as follows:
    - What were the main outputs and outcomes of the SWERA project and follow-up activities?
    - What has been the impact to-date and what are the reasons?
    - Based on the reasons given, what are the key intermediate states that have led to or impeded progression from outcomes to impacts?
    - For each of the intermediate states what are or would be the main drivers and what would need to be in place (assumptions) to ensure achievement?
    - What is your general impression about the project and what would you do differently if the project were to be redesigned today?

17. Using the questions listed above, a number of stakeholders were interviewed by the evaluators in each of the pilot countries visited as part of this terminal evaluation process. The stakeholders were drawn from government, private sector and academia/civil society. A list of organizations and persons interviewed is provided in Annex D.

18. The stakeholder responses to the questions above together with findings from the review of documents listed further above were used to assess the extent to which the project outcomes have been achieved and their progress towards eventual impacts, and to establish whether any large-scale investments in Renewable Energy Technologies (RETs) is attributable to the SWERA project or rather to other initiatives.

19. Detailed information from interviews conducted in five countries (Ghana, Kenya, Nepal, Nicaragua and China) plus 3 countries where technical partners were based (India, France and Denmark) is incorporated directly in this report. Only anecdotal information has been available from Cuba, El Salvador and Brazil.

20. The report has been prepared with respect to ten (10) main evaluation parameters, namely,
    - ✓ Attainment of objectives and planned results,
    - ✓ Sustainability with respect to financial resources and socio-political issues as well as institutional framework and governance, and environmental impacts,
    - ✓ Catalytic role and replication,
    - ✓ Stakeholder participation/public awareness,
    - ✓ Country ownership/driven-ness,
    - ✓ Achievement of outputs and activities,
    - ✓ Preparation and Readiness,
    - ✓ Assessment monitoring and evaluation systems,
    - ✓ Implementation approach (covering project management and M&E during project implementation),
    - ✓ Financial planning, and
    - ✓ UNEP supervision and backstopping.

21. Another parameter covered in the evaluation is Complementarity with the UNEP Medium Term Strategy and Programme of Work.

22. The rating of the evaluation parameters were based inter alia on interviews, using the questions presented earlier, with project "players" and other stakeholders listed in Annex D. This rating also took into account the Project Implementation Reviews (PIR) obtained from the UNEP Office in Paris, and publications (including presentations) by SWERA project personnel and others obtained either directly from UNEP personnel or from public sources like published journals and articles freely available on the world wide web.

23. The responses from the interviews were used in the Review of Outcomes to Impacts (ROtI), an approach advocated by the UNEP Evaluation Office, to identify various intermediate stages, impact drivers and assumptions along the project's impact pathway. The ROtI approach takes full cognizance of the fact that the full impacts of a project often accrue only after considerable time-lags so that at the time of terminal evaluation, which is usually a few years after project completion, the possibilities for evaluation of the project's outcomes are often more limited and the feasibility of assessing project impacts is usually severely constrained. The ROtI approach also facilitates rigorous review of project progress along the pathways from outcome to impact; it helps to identify the sequence of conditions and factors deemed necessary for project outcomes to yield impact and thus makes it possible to assess the current status of and future prospects for results.

24. In the application of the ROtI approach in this terminal evaluation, close attention was paid to the principle of attribution by which any "SWERA-intended" benefits identified were examined to see if they could be linked back to the SWERA project exclusively or if SWERA only played a contributory role in the realization of such benefits, and the strength of such linkages. A country-specific ROtI diagram was produced for China, Ghana and Kenya as the interviews proceeded and then towards the end of the visit a draft ROtI was presented to the Country Project Manager for his/her comments, based on which the final country-specific ROtI was prepared. A more generalized ROtI diagram for the SWERA project as a whole was produced after completion of the field visits in the first phase. The completed ROtI analysis served as a critical element in assessing

most of the evaluation parameters and determining, in particular, whether or not the SWERA project has made a tangible contribution to any of the Expected Accomplishments specified in the UNEP Medium Term Strategy.

25. A slightly different approach was adopted during the visits in the second phase (period following the exit of the Associate Evaluator) mainly because the first draft report had already been prepared complete with lessons learned and recommendations. Emphasis during the second phase visits was placed on "validating" the issues raised under lessons learned in the first draft report and testing the reactions of interviewees to the recommendations. The scope of the more direct questions was expanded to take this new emphasis into account and the findings were used to refine the relevant sections of this report.

PROJECT PERFORMANCE AND IMPACT

3.1 Attainment of Objectives and Planned Results

3.1.1 Effectiveness

26. The immediate impact of the SWERA Project in facilitating investment in large-scale use of solar and wind technologies in developing countries and the potential for longer-term impacts are assessed here in terms of effectiveness. This is noteworthy in view of the fact that this evaluation is taking place not-long after the completion of the project (in fact in China the project had financial closure as recently as April 2010). The ROtI Method was used in each of the countries visited to identify the actual outcomes of the project, the achievement of impacts, necessary intermediate states and the assumptions and drivers that are needed for or have aided progression from outcomes to the desired project impacts. The corresponding ROtI diagrams for China, Nicaragua, Kenya, Ghana and Nepal (in order of progress from outcomes to impacts) are presented in Annex E and these form the basic building blocks for assessment of the effectiveness of the project.

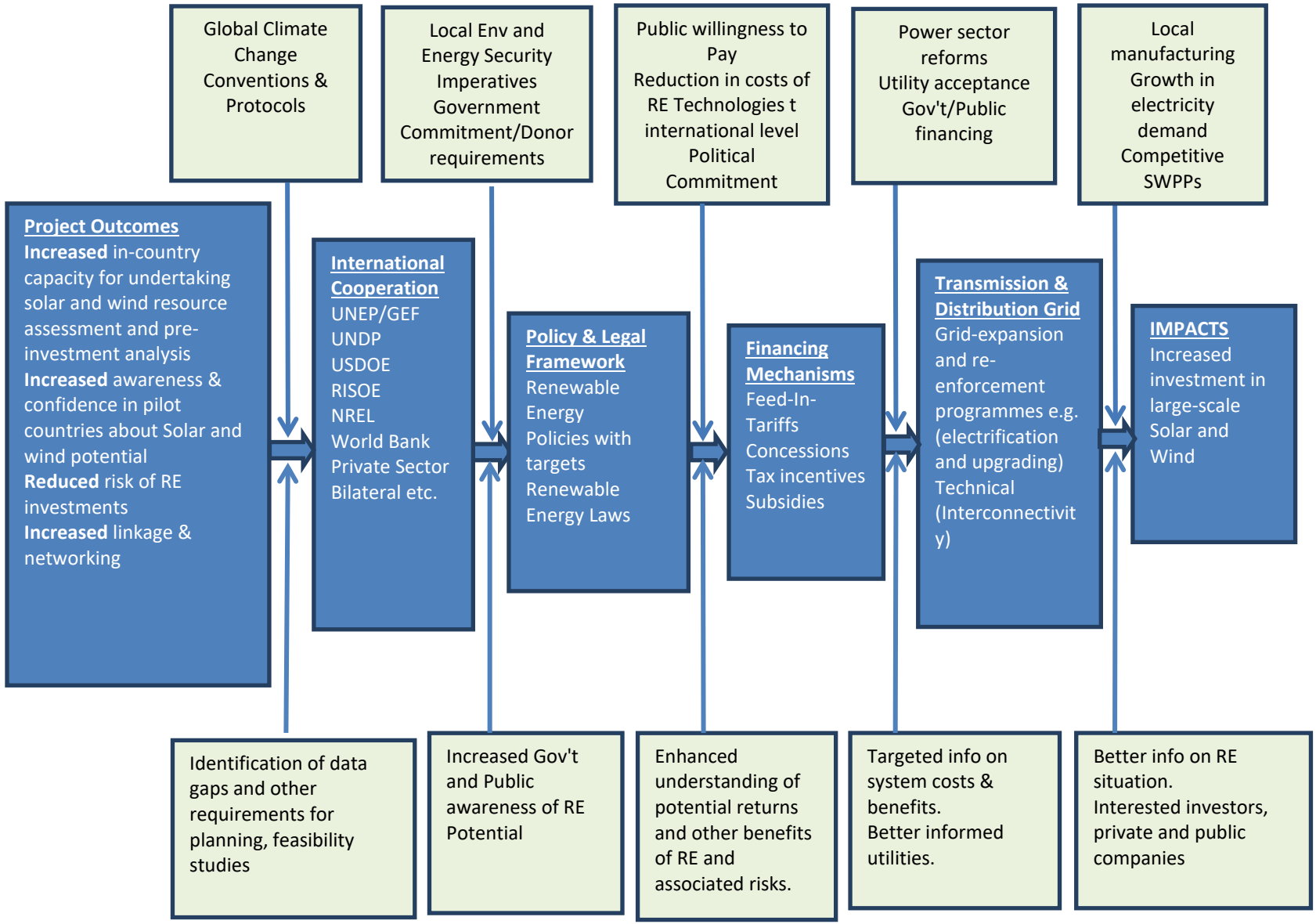
Global Climate Change Conventions & Protocols
Local Env and Energy Security Imperatives Government Commitment/Donor requirements
Public willingness to Pay Reduction in costs of RE Technologies t international level Political Commitment
Power sector reforms Utility acceptance Gov't/Public financing
Local manufacturing Growth in electricity demand Competitive SWPPs
Project Outcomes
Increased in-country capacity for undertaking solar and wind resource assessment and pre-investment analysis
Increased awareness & confidence in pilot countries about Solar and wind potential
Reduced risk of RE investments
Increased linkage & networking
International Cooperation
UNEP/GEF
UNDP
USDOE
RISOE
NREL
World Bank
Private Sector
Bilateral etc.
Policy & Legal Framework
Renewable Energy Policies with targets
Renewable Energy Laws
Financing Mechanisms
Feed-In-Tariffs
Concessions
Tax incentives
Subsidies
Transmission & Distribution Grid
Grid-expansion and re-enforcement programmes e.g. (electrification and upgrading)
Technical (Interconnectivity)
IMPACTS
Increased investment in large-scale Solar and Wind
Identification of data gaps and other requirements for planning, feasibility studies
Increased Gov't and Public awareness of RE Potential
Enhanced understanding of potential returns and other benefits of RE and associated risks.
Targeted info on system costs & benefits.
Better informed utilities.
Better info on RE situation.
Interested investors, private and public companies

Figure 1: Composite ROtI Diagram incorporating various Country Impact-Pathways

27. A composite ROtI Diagram for the SWERA project as a whole is shown in Figure 1 above to summarize the outcomes as identified during the evaluation and the pathway through a number of intermediate states to the SWERA-anticipated impact of large-scale investment in solar and wind energy projects.

3.1.1.1 Achievement of Outcomes

28. Increased in-country capacity for undertaking solar and wind resource assessment and pre-investment analysis: The capacity of local country agencies to conduct their own resource assessment has been increased through targeted capacity building programmes such as the use of the WAsP and also through their collaboration with leading technical partners such as RISO and NREL. Kenya and Ghana are typical examples of this. In Kenya, staff from local agencies have undertaken Pre-investment Analysis for wind projects for a number of potential sites including Ras Ngomeni and Ngong Hills (Kenya) using tools such as WAsP and RETScreen. Similar analyses for Anloga and Mankoadze (Ghana) have also been conducted by staff of Ghana's Energy Commission in collaboration with other local experts. In the case of Ghana further wind data collection and mapping exercise has been undertaken after the SWERA project.

29. In Nepal, SWERA provided training for four persons from the Alternate Energy Promotion Center (AEPC) in the use of WAsP[1], this was aimed at building capacity in wind energy resource and project analysis. It appears however that, not much has been done on large-scale wind energy in Nepal since the SWERA project, and it is unclear to what extent the skills obtained from this training has been utilized or transmitted.

30. China belongs in a class of its own in terms of increased in-country capacity for undertaking solar and wind resource assessment and pre-investment analysis. Experts in China have not only

Southern Regional Office of TERI in Bangalore (30th September – 3rd October 2002). Source: January 2003 Report by Jake Badger, RISO

mastered the software tools like WAsP and RETScreen introduced under SWERA but they have expanded their scope considerably to become experts in the use of other tools like WindPro and WindFarm which have been used to make China the No 2 country in the world as far as wind turbine installations are concerned.

31. Brazil also has superior capacity for undertaking solar and wind resource assessment and pre-investment analysis. Following collaboration with NREL for Solar Resource Assessment activities, Brazil's INPE and LABSOLAR in August 2009 used their own BRASIL-SR model with the SRING Software to generate low resolution data (40km) for the South American region[2]. The numerical models used for the SWERA project became the basis for comparison of outputs of the BRASIL-SR model.

"The BRASIL-SR model (developed by INPE - National Institute for Space Research) and the ARCVIEW software were used to produce the dataset and SHAPE files. …The first phase consisted in an inter-comparison between the core radiation transfer models adopted by the SWERA Project to map the solar energy in the various countries participating in the project."[3]

32. Increased awareness and confidence in pilot countries about solar and wind potential: China had traditionally estimated its onshore wind energy potential at about 250GW, this estimate has now been raised to over 1000 GW and the Chinese Renewable Energy Industries Association (CREIA) acknowledges the important role SWERA played in making available high quality data. This increased confidence was translated into concrete targets for renewable energy in the 11th Five-Year Plan (2006–2010) of the Chinese Government's National Development and Reform Commission (NDRC). Under targets proposed in the Chinese Government's Medium- and Long-Term Development Plan for Renewable Energy, total installed wind power capacity is mandated to reach 5 GW in 2010 (a goal that was increased to 10 GW in 2008, although actual capacity reached 12 GW by the end of 2008) and 30 GW in 2020. The General Secretary of the China Renewable

[2] http://swera.unep.nzet/index.php?id=35&idx=390
[3] http://en.openei.org/datasets/node/738

Energy Industry Association (CREIA)[4] Li Junfeng credits SWERA for the role it played in contributing significantly towards the realization of these highly-impressive achievements.

33. Even though there is also increased awareness and confidence about solar and wind potential in the other pilot countries visited, this is nowhere near the levels attained in China. Experts in Kenya and, to a lesser extent, Ghana have seen some increases in their levels of awareness and confidence but the absence of large-scale investments in both countries tends to dampen the confidence levels in particular and some doubts still linger on concerning the contributions that solar and wind can make to the energy mix in the two countries.

34. In Nicaragua, SWERA assessments of wind resources demonstrated a much greater potential than the 200 megawatts (MW) estimated in the 1980s. The results prompted the Nicaraguan National Assembly to pass the *Decree on Promotion of Wind Energy of Nicaragua 2004* that gives wind generated electricity "first dispatch", meaning it has the first priority over other options when fed into electricity grids. Causality or influence factor is rated quite high.

35. Reduced Investment Uncertainties and Risk: The availability of solar and wind energy data in the pilot countries has provided a basis for potential investors to conduct their own pre-feasibility studies to have an idea of the potential output of systems they intend to deploy and also to check if the preliminary data meets their Minimum Acceptable Rate of Return (MARR).

36. In Kenya the main national electricity generating company, KenGen, has already made one relatively small wind power investment and is planning a bigger one while the Lake Turkana private company is far advanced in the preparatory works for a 300 MW wind farm. In Ghana a wind energy investor NEK Ltd of Switzerland has indicated that though it started its own measurements back in 1999, the output of SWERA along the eastern coast has given them confidence in the data they already had and they have taken the decision to go ahead with a

[4] CREIA was the main implementing agency in China which partnered other local agencies including *China Hydropower Consultants, LTD, Beijing JIKE Energy New Technology LTD, Centre for Renewable Energy Development, State Power Corporation and Centre for Wind and Solar Recourse Assessment in China* for the SWERA Project

50MW wind project, pending the passage of the Renewable Energy Law and other enabling legal instruments.

37. Increased Linkages and Networking: Locally and internationally the SWERA project created and strengthened important linkages and networks that are continuing to yield benefits for the participating countries and agencies. In Ghana, the SWERA project established linkages between the Energy Commission and the Department of Geomatic Engineering in the College of Engineering at the Kwame Nkrumah University of Science and Technology (KNUST) which assisted it with Activity Component 3, there had been no formal collaboration between the two public institutions prior to the SWERA project. The College of Engineering has continued since completion of the SWERA project to collaborate with the Energy Commission on other projects such as the National Energy Data Processing and Information Centre (NEDPIC) project.

38. The agencies involved in the Nepalese project provided a very good example of both local and international cooperation and networking. While RISO, NREL and DLR were all involved in SWERA-Nepal, local agencies were also in active collaboration.

"A Memorandum of Understanding (MoU) between Alternative Energy Promotion Center (AEPC) and Center for Energy Studies (CES), Institute of Engineering (IOE) was signed on 10 March 2004 to carry out the data analysis of Solar and Wind Energy Resource Assessment (SWERA) in Nepal."[5]

39. As it is with many things where China is involved, cooperation and networking between organizations, both national and international) is at a much higher level, one example being the partnership with RISO National Laboratory of Denmark for further development of tools for wind data analysis.

3.1.1.2 Impacts (to date)

40. There have been remarkable impacts since resource data became available from the SWERA project, though it is mostly on the wind energy side, because of the relatively high cost of solar

[5]SWERA Final Report, Nepal, Dec 2006

energy technology. Overall impact has been satisfactory, though varying in extent across the various pilot project countries.

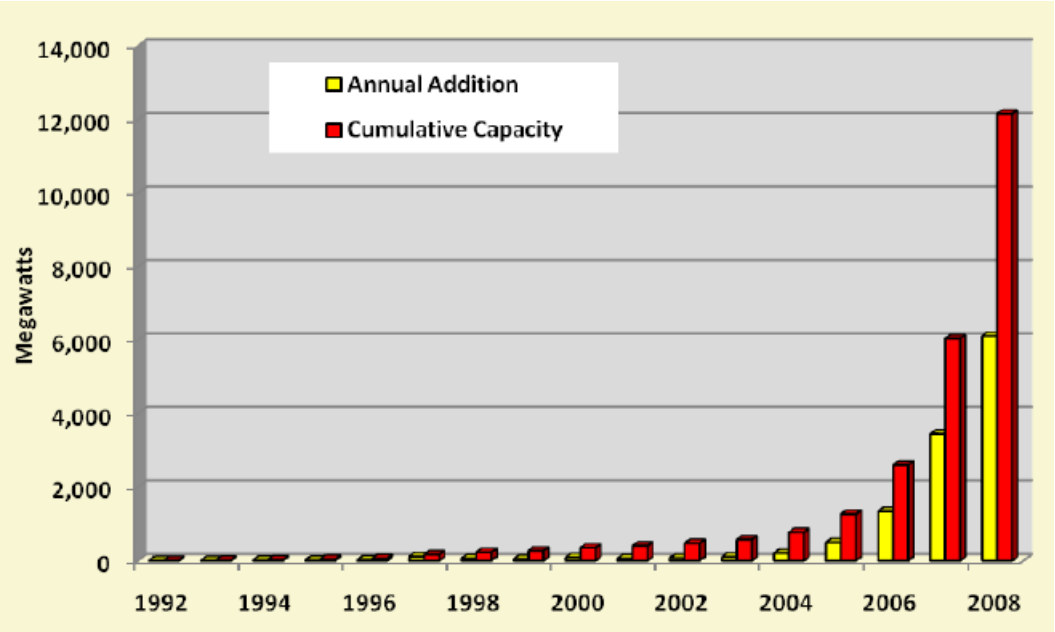

Figure 2: Evolution of Wind Energy Installation in China (REN21, 2009)

41. China stands out with a phenomenal large-scale development of wind and some solar energy projects. China as of 2009 had risen to become the world's second largest in the deployment of wind turbines, having a total cumulative capacity of over 26GW installed. This is more than double its installed capacity of 12.21GW the previous year (2008), shown in Figure 2. Though there had been previous solar and wind energy data collection programmes with agencies such as the GIZ (formerly GTZ)[6] and ongoing programmes which paralleled SWERA (such as the UNDP/GEF)[7], SWERA is acknowledged as having contributed data for the formulation of policies and laws that have transformed the renewable energy industry since 2006 when the Renewable Energy Law came into force.

[6] GTZ supported wind measurements in Hubei Province between 2000 and 2002.

[7] The wind measurements were taken at ten sites between 2002 and 2005, with support from GEF/UNDP

42. CREIA acknowledges the usefulness SWERA data in the feasibility study of *t*he 66MW Yunnan Shilin Solar PV[8] project by the Yunnan Power Investment New Energy Development Company. Kenya has an ongoing 300MW wind energy project in its Lake Turkana Region[9], while the national power utility, KenGen has since August 2009 been operating a 5.1MW wind farm in the Ngong Hills generating 8.9GWh during the first six months of operation with a reported[10] emissions reduction of 4,300TCO_{2eq} . The Lake Turkana Region project developers are definite about not drawing whatsoever from the SWERA dataset while KenGen acknowledges the importance of the SWERA project in contributing towards their wind energy project development efforts.

43. Unlike China and Kenya which have something to show in terms of real investments in Solar and Wind projects, Countries like Ghana are yet to achieve such impacts, though prospects exist and are assessed in the next section. Data from SWERA was cited in a project proposal which secured funds from the World Bank for the Ghana Energy Development and Access Project (GEDAP). Provision is made in GEDAP for 8.5MW of wind and 450kWp of solar PV systems, but besides the installation of small stand-alone systems for rural health centres and schools no major (large-scale) investments have been made under GEDAP. The Energy Commission in Ghana is pursuing a pilot matching grants funding scheme under which close to 40 kWp of grid-connected solar PV systems have been installed and plans are afoot to scale up this project in the years ahead.

44. Nicaragua, has recorded impressive progress with legislative and policy framework with the Government granting several wind energy licenses in 2008 and 2009 to bring current installed capacity of wind power to 63 MW. The Nicaraguan Government estimates absorptive capacity for wind power within the national interconnected system at 140MW, even though the resource potential is much higher, and there are several national as well as international investors currently preparing their feasibility studies with planned implementation in the next year or so.

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[8] Though CREIA reports 66MW; other sources report 166MW of which 100MW is being implemented by another group, Huaneng Group:

- http://www.commodityonline.com/news/China-opens-Asia's-largest-solar-power-plant-28605-3-1.html
- http://jiakr.com/article?u=asia-39-s-biggest-solar-power-station-settled-in-yunnan-map&v=3
- http://www.gokunming.com/en/blog/item/609/chinas_largest_solar_power_station_to_be_built_in_shilin
-

[9] The project developers do not credit SWERA for the data used in their pre-investment analysis. It is clear however that they have benefited from policies such as the RE Law and Feed-In-Tariffs that have been facilitated by information from the SWERA project.

[10] KenGen News, First Quarter (April 2010)

3.1.1.3 Likelihood of Impacts: Intermediate States, Impact Drivers and Assumptions

45. The outcomes of the SWERA project has led to the creation of some intermediate states that have enabled the achievement of the impacts mentioned in the preceding paragraphs. The ROtI diagram in Figure 1 outlined the major intermediate states that connect the pathway between project outcomes and impacts. It also included intermediate states that need to be created to ensure project impacts taking into account the *Impact Drivers* (Project related drivers) and *Assumptions* (Non-project drivers).

46. International Cooperation: Driven by international Climate Change and Environmental Conventions, and the need for further support for developing countries to bridge acute knowledge and technology gaps among others, there has been ongoing bilateral and multilateral support in a number of SWERA project countries within the framework of such Conventions and Protocols. The Chinese have ongoing collaboration with RISO, while Ghana is being supported by the World Bank and the Spanish Government to implement solar energy projects.

47. Policies and Legal Frameworks aimed at facilitating the adoption and rapid diffusion of renewable energy have been established in a number of countries. China and Kenya have both passed renewable energy laws and set targets for wind and solar energy in their national energy plans. Ghana has not performed well in the establishment of Policies and Laws for Renewable Energy as it is yet to pass such legislation - a draft bill has been sent to Parliament and is yet to be passed into law. Table 1 gives a summary of targets set by some of the SWERA Project countries.

48. Nicaragua has passed a Law for the promotion of Electricity Generation from Renewable Energy Sources (Law 532 of 2005); in addition to the Specific policy of support for Development of Wind and Run-of-River Hydroelectric Resources (Law 12 of 2004) this established a series of fiscal incentives for investment in wind and run-of river power generation. Nicaragua actively acknowledges the role SWERA played in removing informational barriers with regards to wind and

solar energy resources. In the 2006 publication of the Nicaraguan National Energy Commission[11], Electricity Generation from Renewable Energy Sources - The Investor's Guide.

49. "In October 2002, the National Energy Commission signed an agreement with the United Nations Environmental Programme (UNEP) for the Solar and Wind Resource Assessment (SWERA) project whose principal goal has been to provide high resolution data on solar and wind resources at national level."[12]

"In providing information on existing potential of solar and wind energy, the project has helped in the promotion of large-scale investments in solar and wind power projects, and provided tools for the formulation of national policies and decision-making on renewable energy issues." [13]

Table 1: Renewable Energy Targets by Some SWERA Countries

Country	Target
China	30 GW of wind power by 2020
Kenya	300 MW of cogeneration by 2015
Ghana	10% of generation mix by 2020
Nepal	N/A
Nicaragua	94% of energy by 2017[14]

50. Financing Mechanisms have also been instituted in countries such as Kenya and China, who have published Feed-In-Tariffs (FITs). Kenya first published its FITs (including wind and other renewables like geothermal, small hydro and biomass) in March 2008 and revised it January 2010. Kenya's FIT for solar electricity recognized "the relative high cost of this technology" and hence limited the tariff to "isolated/off-grid stations, to partly displace the thermal generation,". [15] China has issued FITs for wind energy but issues concessions for solar energy development.

[11] Electricity Generation from Renewable Energy Sources - The Investor's Guide. National Energy Commission of Nicaragua (2006), page 36.
[12] ibid
[13] Ibid
[14] http://www.raleighinternational.org/news-centre/news/320-nicaragua-sets-new-renewable-sources-target
[15] Ministry of Energy, Kenya, 2010, "Feed-In-Tariffs Policy on Wind, Biomass, Small-Hydro, Geothermal, Biogas and Solar Resource Generated Electricity".

51. The Nepalese Government in its request to promote renewable energy deployment instituted a subsidy scheme[16] to open up financing options. The policy however targets small systems for purposes of rural electrification. Similar measures, when tailored towards large-scale projects, could yield positive results.

52. An important stage along the Outcome-Impact pathway is the electricity transmission and distribution system. It was found that in China, the harmonization of technical standards for interconnectivity by different operators remains a problem which needs to be addressed to ensure continued benefits from Solar and Wind energy projects. Kenya on the other hand needs to expand its transmission system to connect locations with good solar and wind energy potential. A case in point is the Lake Turkana project, where developers have to incorporate the cost of power transmission lines into the project. In Ghana's case the transmission system is fairly good in terms of geographical coverage. It is also known that solar energy projects have suffered with grid-extension to areas that were previously supported by solar PV systems, as the panels are abandoned when the national grid is extended to these previously off-grid locations. Policies and plans will have to be made to ensure that such systems are connected to the grid to ensure continued benefits.

53. A number of project drivers (drivers that could be influenced by the project activities/outputs/outcomes) and non-project related drivers (drivers that are beyond the project's scope of influence) have been identified (See Figure 1) as crucial for the progress from outcomes to impacts. Among these are: proper identification of existing data and knowledge gaps, Increased government awareness and political commitment, enhanced understanding of potential returns on investment and other benefits (as well as risks) associated with RE, etc.

54. One such driver which has been key in Kenya is the increased government awareness of the RE potential and the very high government/political commitment to harnessing the benefits of renewable energy. This commitment was translated into action by the setting up of a high level

[16] Subsidy Policy for Renewable (Rural) Energy 2009 (2066 BS). Government of Nepal (2009) Ministry of Environment, Alternative Energy Promotion Centre

National Task Force on Accelerated Development of Green Energy by the Prime Minister of Kenya and was gazetted on 19th June 2009, see Box 1.

55. Table 2 presents a rating of outcomes and progress towards intermediate states. The project's expected outcomes were largely achieved:
    - Reduced uncertainties associated with investment and development decisions for solar and wind projects,
    - Increased awareness by key stakeholders and decision makers,
    - Increased capacity for making solar and wind energy plans.

Box 1 National Task Force of the Green Energy Development Campaign in Kenya

The Task Force consists of a Steering Committee (providing policy guidance), an Experts Group (provision of technical advice) and a secretariat undertaking the implementation of activities. The Expert Group works under the guidance of the Steering Committee while the Secretariat is guided by the Expert Group. The Steering Committee is chaired by the Prime Minister, and consists of Ministers for Finance, Local Government, Energy, Industrialization, Agriculture and Environment; as well as two private sector representatives.

The Experts Group is co-chaired by the Permanent Secretary, Ministry of Energy and the Economic Advisor to the Prime Minister. Its members consist of representatives of the relevant government agencies and the private sector. The Task Force is assisted by a small number of external advisers (experts) and is expected inter alia to promote the rapid expansion of the national generation of green energy.

56. The project was designed to feed into a continuing process of increasing interest in Renewable Energy resource development across the pilot countries and beyond; but did not have a clear strategy to ensure the persistence and progress of SWERA outcomes and their progress to intermediate states. A rating of **B** is assigned to achievement of expected project outcomes.

Table 2: Rating of Outcomes and Progress towards "Intermediate States"

<table>
<tr><td>Results rating of project entitled:</td><td colspan="7">Solar and Wind Energy Resource Assessment (SWERA)</td></tr>
<tr><td>Outputs</td><td>Outcomes</td><td>Rating (D – A)</td><td>Intermediary State</td><td>Rating (D – A)</td><td>Impact (GEBs)</td><td>Rating (+)</td><td>Overall</td></tr>
<tr><td>1. Solar energy resource data and maps produced.</td><td>1. Increased awareness of solar and wind energy resource potential</td><td rowspan="5">B</td><td>1. International cooperation programmes and partnerships continuing</td><td rowspan="5">A</td><td rowspan="5">Satisfactory investment in wind energy projects with continuing environmental benefits</td><td rowspan="5">+</td><td rowspan="5">BA+</td></tr>
<tr><td>2. Wind energy resource data and maps</td><td>2.Increased capacity to conduct continued solar and wind resource assessment</td><td>2. Policy and legal framework created/being created</td></tr>
<tr><td>3. GIS datasets and Toolkit available</td><td rowspan="2">3. Availability of solar and wind energy resource and reduced cost and uncertainties associated with projects</td><td>3.Financing mechanisms</td></tr>
<tr><td>5. Global archive of Solar and Wind energy resource established (available on internet)</td><td>4. Transmission and distribution grid expansion and harmonization of standard for interconnectivity</td></tr>
<tr><td>4. Training workshops held on WAsP wind energy analysis software.</td><td>4. Increased linkages among local and international agencies in RE projects</td><td></td></tr>
<tr><td>Justification for rating</td><td colspan="2">Outcomes were achieved and have progressed to various "intermediate states" at different levels in pilot countries. Responsibilities were not assigned for post-SWERA actions.</td><td colspan="2">A number of countries have initiated actions to move towards intermediate states (though not driven entirely by SWERA outcomes), and are likely to yield long-term impacts</td><td colspan="3">Investments recorded in a number of pilot countries – China, Nicaragua, Kenya</td></tr>
</table>

57. Measures designed to move towards intermediate states have started and have produced results, which clearly indicate that they can progress towards the intended long term impact. For instance, increased awareness of solar and wind energy resources in countries such as Kenya, Ghana, Nicaragua and China have led to the establishment of measures (drafting of legislations, setting up of task force on RE, etc) to move the outcomes of SWERA towards the intermediate states. Progress toward Intermediate States is rated **A**.

58. 'Overall likelihood of impact achievement' as a sub-parameter is therefore rated BA (**Highly Likely**) which translates to Highly Satisfactory for purposes of comparison with other sub-parameters under "Attainment of Objectives and Planned Results".

3.1.2 Relevance

59. The project is found to be consistent with the objectives of Operational Programme 6- OP6, *(Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs)* of GEF under its Climate Change Focal Area. The objective of OP6 inter alia is to "*remove the barriers to the use of commercial or near-commercial RETs* [17]".

60. The project is also in line with GEF's work on Climate Change Mitigation focusing on renewables:
"*…The GEF helps countries remove barriers to developing markets for renewable energies wherever cost-effective. Such opportunities can be found in on-grid and off-grid situations, as well as in the area of renewably generated heat for industrial and other applications. In these cases, GEF support helps create enabling policy frameworks, build the capacity for understanding and using the technologies, establish financial mechanisms to make renewable technologies more affordable, and provide incremental support to strategically important investments.*" [18]

61. As pointed out earlier, the project's relevance in terms of country and regional needs and priorities was positive in the sense that it was designed to feed into a continuing process of increasing interest in Renewable Energy resource development across the pilot countries and

[17] http://207.190.239.143/Operational_Policies/Operational_Programs/OP_6_English.pdf
[18] http://www.thegef.org/gef/node/1270

beyond. Some of the pilot countries, like China, Ghana and Nicaragua, had already undertaken basic assessments of their solar and wind energy resources such that the SWERA project came to expand the scope and raise the quality of these activities. Relevance is therefore rated **Highly Satisfactory**.

3.1.3 Efficiency

62. The project was generally cost-effective as the option of deploying wind masts and solar radiation measurement stations across the pilot project countries would be much more expensive than the approach adopted by SWERA – *using satellite generated data with simulation tools*. The UNDP and GIZ (formerly GTZ) are known to have undertaken solar and wind measurements in China but cost-related data on this project is not available for comparative study on relative cost-effectiveness. However the financial audit reports did not make any adverse findings in terms of overpricing or non-effective use of resources.

63. As already pointed out in the introduction, the SWERA project went well beyond the initial 3-year duration ending effectively around 2008 instead of 2004, and indeed the project implementation duration was extended in all project countries. This suggests that the initial duration assigned for the implementation of project activities may have been too ambitious. The delay however did not lead to increase in the budgeted cost to GEF as most partners eventually spent less than the budgeted cost.

64. Project efficiency was nonetheless improved by building upon existing institutions like the Alternate Energy Promotion Center (AEPC) of Nepal and the China Renewable Energy Industry Association (CREIA). Data already collected by meteorological service organizations in the pilot countries were brought into the project, as was the case in Kenya and Ghana; a particularly interesting case is that of the Catholic University of Central America, in Nicaragua, where extensive data on solar radiation collected over more than a decade was brought in to enrich the SWERA database.

65. In the particular case of China, several donor-funded projects in renewable energy data collection and climate change studies built a strong foundation for the SWERA project and enabled it to provide invaluable inputs for the national wind power development programme. Project efficiency is therefore rated **Satisfactory**.

66. In view of the fact that Relevance and Effectiveness as sub-parameters are considered as critical criteria for project success, the "Attainment of Objectives and Planned Results" parameter is given an overall rating of **Highly Satisfactory**.

3.2 Sustainability

67. Sustainability is understood as the possibility of continued long-term project-derived outcomes and impacts after the GEF project funding ends. The evaluation examined factors or conditions that are likely to contribute to, or undermine the persistence of benefits after the project ends. Four aspects of sustainability are considered: financial, socio-political, institutional framework and governance, and environmental.

3.2.1 Financial Resources

68. The risk of the lack of financial resources undermining the persistence of the project outcomes identified in Figure 1 is generally low. The capacity developed, awareness created, linkages and networks formed, etc. do not require much financial resources to maintain, although these could fade with time and non-use.

69. The transition from outcome to actual impacts is however exposed to some risks with regards to financing. The availability of funds for the intermediate states/conditions discussed below would therefore be crucial to the attainment of desired project impact and sustaining it.

70. *Policy and regulatory framework:* The process of developing and implementing policies and regulations for the promotion of RE would require some financial resources. This is however not considered a major financial risk as a number of the SWERA project countries have already passed

such policies and regulations (e.g. Nicaragua, China and Kenya). Admitting that policies are dynamic and would need funding for needed updates, it is not considered a major cost that could threaten continued benefits from the project.

71. *Financing mechanism:* The wide adoption of renewable energy technologies usually require innovative financing mechanisms (such as Feed-In-Tariffs, capital subsidies, interest rate buy-down, etc.) to make them competitive against conventional power generation technologies. These require financial commitment from governments.

72. The non-availability of funds for this support could hamper SWERA-derived outcomes. This is particularly the case for solar energy projects which require much higher tariffs than conventional power sources would require. The inability of countries to pay for solar FiTs has hampered deployments. This financing barrier persists and remains an obstacle.

73. Kenya has received expression of interest for solar energy projects but has been unable to sign a Power Purchase Agreement because the project developer requested a tariff of US$30 cents, which the Kenyan Authorities found too high. There is also the risk of investments in clean energy projects being affected by the global financial situation: this could affect the availability of funds from global financial institutions and donors.

74. *Expansion of transmission and distribution grid:* A crucial factor that has been identified along the impact path-way is the expansion of transmission and distribution infrastructure. The availability of funds for governments to expand transmission lines for the evacuation of power from locations with high solar and wind potential is important for investment in power projects. The absence of such infrastructure would increase project costs particularly for private investors, and this could be a disincentive. However, since most governments have electrification programs which include the expansion of transmission and distribution systems, it is expected that governments will frantically seek financial resources for particular cases where such infrastructure is needed for investment in solar and wind power projects.

75. *Global Financial Stability:* Large-scale investments in solar and wind power projects usually run into millions of dollars and particularly in view of the fact that SWERA was undertaken in developing countries, private sector investors with access to international capital will be needed for deployment of solar and wind power technologies. Instability on the global financial market could hamper access to capital and consequently investment in developing countries. This risk is considered moderate.

76. *Unwillingness to Pay Higher Tariffs:* In countries where tariffs need to be raised to recover the cost of Solar and Wind power generation, there exists the possibility of public rejection of such tariffs.

77. *Increasing Cost of Solar and Wind Power Technologies:* Increase in the cost of solar and wind energy technologies could erect a barrier to its large-scale adoption, and lower the long-term benefits of the SWERA project. In view of the continually declining prices of solar and wind energy conversion systems, and improvements in conversion efficiencies, this is unlikely to affect the financial sustainability of SWERA outcomes and impacts.

78. The Evaluation considers the financial risks to the sustainability of the benefits of SWERA as low and rates this sub-criterion, financial sustainability, as **Moderately Likely**.

3.2.2 Socio-Political Issues

79. Disruptions in bilateral and multilateral diplomatic relations could jeopardize ongoing or future technical cooperation activities that continue to enhance the capacities built in SWERA project countries. International networks and linkages formed could also be exposed to such disruptions by diplomatic difficulties. This threat to the persistence of SWERA project benefits is considered low, considering that most of the countries are not under any major international sanctions or embargo with the exception of Cuba which has a long-standing diplomatic issue with the United

States[19], and even here, in spite of this, NREL, RISOE and INPE were able to undertake SWERA project activities without any ostensible hindrance suggesting a low level of political risk.

80. The Government of Sri Lanka, which had some armed struggle with the Tamil Tiger rebels, has been able to defeat the rebellion and there are indications that economic activities which suffered as a result of the rebellion is bouncing back[20]. The risk of international investment roll-back due to diplomatic sanctions and political instability classified as low. Nepal's struggle with the Maoist rebels seems to have subsided and peace could be within reach, if the peace deal struck between the rebels and the Government in January 2011 is anything to go by.[21]

81. Some in-country political risks however exist with regards to the passage of bills that seek to establish or update policies and other frameworks that promote Renewable Energy. Ghana is yet to pass a Renewable Energy Law, and there exists the possibility of rejection or delay by legislators who may consider provisions made to incentivize investments in RE as too generous. There is however considerable political commitment to renewable energy projects across the SWERA project countries as the centrality of energy to poverty alleviation and economic development is clearly recognized. The risk of acquisition of large areas of land for big solar energy projects and possible relocation of farmlands as well as problems with payment of compensation could also lead to social problems if not properly managed.

82. The evaluation considers the socio-political risks to be low and rates this sustainability sub-criterion as **Moderately Likely**.

3.2.3 Institutional Framework and Governance

83. Institutional arrangements and governance structures in the energy sector have improved quite significantly since the close of the SWERA project; this has occurred at both National and Regional

[19] There are signs of warming relations with the United States under President Obama's administration with the lifting of travel restrictions within his first 100days in office.
http://www.cnn.com/2009/POLITICS/04/13/cuba.travel/index.html

[20] http://www.cnn.com/2010/WORLD/asiapcf/05/20/srilanka.anniversary/index.html
[21] http://www.voanews.com/english/news/asia/Nepal-Rebels-Strike-New-Government-Deal-113614984.html

levels, and has the potential to enhance investment in renewable energy projects including solar and wind. As part of ensuring open and fair access to the electricity transmission lines, a separate entity, the Ghana Grid Company (GRIDCO) has been carved out of the state power generation utility – the Volta River Authority. A Renewable Energy bill is currently before the Ghanaian legislature and has further provisions on institutional arrangements and governance.

84. At the Regional Level in West Africa, for example, the ECOWAS[22] has established the ECOWAS Center for Renewable Energy and Energy Efficiency (ECREEE) for the promotion of renewable energy within the West African sub-region. ECREEE is currently in the process of engaging a consultant to develop a Renewable Energy Policy for the entire ECOWAS sub-region. At the continental level, the African Energy Commission (AFREC) was officially launched on 17 February 2008, in Algiers, Algeria, by the Ministers in charge of Energy of the African Union Member States, after the minimum number of ratifications (fifteen) was obtained[23]. The mandate of AFREC includes assisting in the development and utilization of new and renewable sources of energy.

85. Central America has also seen the operationalization of the Central American Electrical Interconnection System (SIEPAC) which aims to create an integrated regional electricity market among six Central American countries: Guatemala, El Salvador, Honduras, Costa Rica, Nicaragua and Panama.[24]

86. China included firm plans on solar and wind energy in their 11th Five-Year Development Plan and has made a commitment to further expand the development of renewable energy (Wind, Solar and Biomass) in its recently released 12th Five-Year Plan[25].

87. In spite of these positive developments, institutional challenges remain in countries like Nepal (which has quite a number of actors[26]). The risk of overlapping functions could lead to a "power-

[22] Economic Community of West African States
[23] AFREC had been created earlier by the 37th Summit Conference of O.A.U Heads of States in Lusaka, Zambia in July 2001.
[24] The Potential of Regional Power Sector Integration, Economic Consulting Associates Limited, UK, March 2010
[25] KPMG - China's 12th Five-Year Plan: Energy, April 2011.
http://www.kpmg.com/CN/en/IssuesAndInsights/ArticlesPublications/Documents/China-12th-Five-Year-Plan-Energy-201104.pdf

play" and frustrate investment[27]. There is also the possibility of institutional obstacles such as undue delays in the acquisition of environmental clearance, Power Purchase Agreements and operating licenses, in all countries assessed.

88. Nevertheless, quite a high level of political interest has been shown across countries like China, Kenya and to some extent Ghana and Nepal. In China the Government has consistently set ambitious targets for wind power development in its rolling 5-year development plans. In Kenya the Prime Minister has established and chairs the steering committee of a National Task Force of the Green Energy Development Campaign to promote the rapid expansion of green energy (see Box 1 on Kenyan example presented earlier).

89. The evaluation therefore considers the institutional framework and governance structures for long-term benefits as **Moderately Likely**.

3.2.4 Environmental Impacts

90. Large solar and wind energy projects could have a number of environmental impacts which are assessed below.

91. All utility-scale solar power generation facilities require relatively large areas for solar radiation collection. Large arrays of solar collectors may interfere with natural sunlight, rainfall, and drainage, which could have a variety of effects on plants and animals. Solar arrays may also create avian perching opportunities that could affect both bird and prey populations. Parabolic trough and central tower systems typically use conventional steam plants to generate electricity, which commonly consume water for cooling. In arid settings, the increased water demand could strain available water resources[28].

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[26] **Department Electricity Development, Nepal Electricity Authority, Tariff Fixation Commission, Water and Energy Commission, National Planning Commission, etc**

[27] **A similar situation is reported in Nicaragua, between the National Energy Commission (CNE) and the National Energy Institute (INE). Source - ESMAP (2007). Unlocking Potential, Reducing Risk Renewable Energy Policies for Nicaragua.**

[28] http://solareis.anl.gov/guide/environment/index.cfm

92. Concentrating Solar Power (CSP) systems could potentially cause interference with aircraft operations if reflected light beams become misdirected into aircraft pathways. Operation of solar energy facilities and especially concentrating solar power facilities involves high temperatures that may pose an environmental or safety risk.

93. The disturbance of the natural ecosystems and avian collision with wind turbines are concerns that have been raised about wind energy projects. While the issue is still being studied for a better understanding, it has suggested that the killing of migratory birds could be site specific issues which could be minimized by doing a proper selection of sites for wind projects.[29] Such a variation of location for wind turbines could be difficult to implement since available wind resources tend to vary with minor changes in location are also likely to affect the economics of the project. It is also certain to what extent the environmental protection agencies are empowered to undertake such studies and monitoring the 13 developing countries which participated in the SWERA pilot project.

94. Like all electrical generating facilities, solar facilities produce electric and magnetic fields. Construction and decommissioning of utility-scale solar energy facilities would involve a variety of possible impacts normally encountered in construction/decommissioning of large-scale industrial facilities.

95. If new electric transmission lines (as in the case of Lake Turkana Wind Project in Kenya) or related facilities were needed to service a new solar energy development, construction, operation, and decommissioning of the transmission facilities could also cause a variety of environmental impacts.

96. Proper sitting and good environmental due diligence could minimize these adverse effects on environmental sustainability, however many developing countries like those that participated in the SWERA pilot project are likely to put power supply needs ahead of “birds” and “land disturbance”. Despite these likely problems, Solar and Wind Energy Technologies remain less polluting and have significantly less environmental cost (particularly when considered on a life cycle basis).

[29] http://www.awea.org/faq/wwt_environment.html

97. Compared with options such as coal-fired power plants, large-scale Solar and Wind power projects will therefore continue to deliver significant GHG savings. Hence, the evaluation considers the likelihood of sustainable environmental benefits from SWERA to be **Likely**.

3.3 Catalytic Role and Replication

3.3.1 Foundational and Enabling Activities

98. Although SWERA project design activities did not specifically target policy formulation and establishment of regulatory regimes, the data derived from the project has facilitated the formulation of policies on Renewable Energy and other regulatory systems that create an enabling context for solar and wind energy projects. Nicaragua, Kenya and China have all passed enabling legislations. The project also trained persons in the use of WAsP and made the software available. Data generated from SWERA has also been made available through the RETScreen and HOMER softwares for broader use[30]**.** This sub-parameter is **rated Satisfactory.**

1.3.2 Demonstration Activities

99. SWERA's main demonstrational activity was "market barrier removal" through the availability of credible data for pre-investment analysis. Though the evaluation did not find much evidence of investment promotion activities to market the solar and wind energy data, the project largely succeeded in demonstrating the use of WAsP, GIS and RETScreen to undertake project feasibility assessment and use satellite-derived information to assess solar and wind energy potentials. This sub-parameter is **rated Satisfactory.**

1.3.3 Investment Activities

100. Following the activities of SWERA additional support has been obtained by a number countries including Ghana (from the Netherlands and the World Bank), Ethiopia (from GTZ) and China who

[30] Closing Revision to Sub-Project Document, NREL (GFL 4466) page 18

have taken an electrifying pace in the deployment of wind turbines after setting feed-in-tariffs and putting regulations in place.

101. **Incentives**: There is not much evidence of any behavioural change among the project stakeholders as identified and defined in the project document, all project partners and stakeholders had always seen RE as interesting options and SWERA with the data it generated, may have given increased confidence for mainstreaming but not a change of behaviour per se.

102. **Institutional Change**: With the results of SWERA, Solar and Wind energy investment proposals are likely to be given increased institutional facilitation. However, there is no evidence of this happening or the institutions themselves incorporating new operational mechanisms.

103. **Policy Change**: There have been policy developments in a number of Countries to which SWERA has had a positive causality. An example is Nicaragua, where SWERA assessments of wind resources indicated a potential of 800 MW, much greater potential than the 200 megawatts (MW) estimated in the 1980s. The results prompted the Nicaraguan National Assembly to pass the Decree on Promotion of Wind Energy of Nicaragua 2004 that gives wind generated electricity "first dispatch".

104. **Catalytic Financing**: UNEP-SWERA contributed in raising additional US$ 200,000 from the Dutch Government for follow-on projects in Bangladesh, Ethiopia, Ghana, and El Salvador with a further US$ 400,000 for wind development project in Ethiopia. Ghana used data from SWERA in its proposal for World Bank funding for its GEDAP.

105. **Project Champions**: The project benefited from the designation of executing agencies in partner countries and further identification of persons responsible for in-country project activities. In Honduras, the institutional arrangements encountered problems with the change of government, a new Director of Energy agreed to streamline documentation and records to ensure completion of the project[31]. The project generally benefited from clear identification of responsible agencies

[31] Tom Hamlyn: Honduras Trip Report, 13-17 November 2006

and persons, but importantly, the task manager is seen from the records to have done a great job in championing the SWERA Project across the various countries and with the different partners.

106. On the whole the investment activities were well executed and this sub-parameter is rated **Satisfactory.**

1.3.4 Replication

107. The SWERA project is deemed highly replicable as the national agencies have developed or increased capacity to undertake solar and wind resource assessment projects in parts of the countries that were not covered by the SWERA pilot project. Technical partners have also had the opportunity to refine their numerical models by comparing their outputs with ground-based data. Such refinements would make subsequent projects easier and more accurate.

108. In the expanded phase of SWERA, the NREL has replicated solar and wind resource measurements in countries like Pakistan, Afghanistan and Bhutan. The Abu Dhabi Future Energy Company has also funded SWERA-type assessment for the United Arab Emirates[32] under the MASDAR initiative[33]. Ghana is undertaking additional wind measurements along its eastern coast (an area identified by the SWERA project as having good prospect), with the support from the World Bank, although the technique of measurement is the direct mounting of wind masts. This sub-parameter is **rated Satisfactory.**

109. Catalytic Role and Replication as a whole is thus rated **Satisfactory**.

3.4 Stakeholder Participation/Public Awareness

110. The SWERA project design seems to have properly identified suitable technical partners with requisite expertise for its implementation. Country partners were also identified and their roles

[32] User Manual for SWERA: Designing Renewable Resource Assessment Projects and Using Assessment Products http://swera.unep.net/uploads/images/SWERA_Brochure.pdf

[33] MASDAR is an initiative of the Abu Dhabi Government, seeking to create economic diversification of the Emirate. http://www.masdar.ae/en/home/index.aspx

defined. Some in-country stakeholders (such as the major power utilities and private electricity companies) who have interest in energy, environment, policy and investment related issues however do not seem to have been clearly identified at the project design stage[34]. In Ghana, the power generation utility, the Volta River Authority (VRA), does not seem to have been part of SWERA; same can also be said of the Ghana Investment promotion Council (GIPC), which is the government agency in charge of promoting investment opportunities in the country. The evaluation is however satisfied with the scope of stakeholder involvement at the country level particularly in China and Brazil.

111. The evaluation found evidence of active interaction between the Project Manager and sub-project leaders. The same cannot however be said of other project partners, particularly with regards to the discussion and harmonization of wind resource assessment methodologies, and the cross-comparison of the outputs of simulation models for satellite-derived data. This was the case with the WRAMS and KAMM models of NREL and RISOE respectively[35].

112. RISOE National Laboratory asserts in its Closing Revision to Sub-Project Document that their methodology "is based on scientific and technical models that are well documented and repeatable, whereas NREL was using a private sector sub-contractor and a methodology that depended on particular experts. The technical review and cooperation turned out not to be workable." Whereas this evaluation does not pronounce on the relative suitability of the simulation models used in data analysis and capacity building for the SWERA project, there is evidence that collaboration between project technical partners could have been better. The extent of collaboration on the Solar Resource Assessment looked quite good as evidenced by the joint publication by staff of DLR, SUNY, INPE and NREL[36].

113. The project does not seem to have done much with regards to outreach to the public. Outreach activities mentioned in the project design were more of a targeted promotion of the data presented to policy makers in the hope of stimulating some policy support for RE and also to

[34] See paragraphs 65-69 of project design document
[35] Closing Revision to Sub-Project Document, RISOE National Laboratory (GFL 4377), page 5
[36] Schillings et al (2002). High Resolution Solar Energy Resource Assessment Within The UNEP-Project SWERA, *a paper presented at World Renewable Energy Congress VII, Cologne, Germany, 29 June - 5 July, 2002*

investors in the hope of securing some investments in large-scale solar and wind energy projects. There is little evidence of this outreach being done. Though some staff of the technical partners and the project manager made presentations on SWERA at international forums, these were more of technical than investment and data marketing presentations. The country project management could have done more to engage stakeholders and potential investors. **RATING: Moderately Satisfactory**

3.5 Country Ownership/Driven-Ness

114. Since all 13 pilot countries had been eligible for GEF funding, they must be signatories to the UNFCCC and therefore broadly subscribe to the international campaign to combat climate change through various strategies and programs that are supported by the GEF.

115. National interest in SWERA's output and commitment to the project could be seen from a number of indicators across the various countries and are presented in Table 3 below. This ranged from very high levels of ownership and commitment in countries like Brazil and China to rather moderate levels in others like Bangladesh, Ethiopia, Ghana, Honduras and Nepal.

116. The levels of ownership/commitment were high in a significant number of pilot countries, namely, Cuba, El Salvador, Kenya, Nicaragua and Sri Lanka. An outstanding example is Brazil, where three different national agencies (INPE, LABSOLAR and CBEE) were actively involved in the assessment, both in Brazil itself and in the South American region. Guatemala established the Centre for Renewable Energy and Investment, following the results of SWERA, which indicated good renewable energy potential.

Table 3: Indicators of Country Ownership and Commitment

Country	*Ownership/Commitment*	*Indicator of Ownership/Commitment*
Nicaragua	*High*	*SWERA data cited in passing Wind Decree, indicating country's utilization of SWERA output.*
China	*Very high*	*Wind and solar measurements predated SWERA and have continued with some partnerships SWERA facilitated. SWERA data influenced RE Law and target increase, particularly for wind*
Ghana	*Moderate*	*Solar and wind measurements predated SWERA, indicating country interest in such data. Data from SWERA has been used by national agencies to seek additional support for other RE projects*
Ethiopia	*Moderate*	*Project was completed and additional support obtained from GTZ for wind project, however Meteorological Agency (ENMSA) lost interest and sold previously free data to SWERA*[37]*.*
Sri Lanka	*High*	*Based on documentation by project manager*[38]
Bangladesh	*Moderate*	*Wind energy measurements had been ongoing under a different project, indicating some level of interest in SWERA's output. Data comparison revealed methodological flaws*
Nepal	*Moderate*	*Additional measurements campaigns were undertaken.*
Kenya	*High*	*Additional and improved data on solar and wind energy used in RE legislative processes and setting of feed-in tariffs. There is high political commitment to RE*
Guatemala	*high*	*Centre for Renewable Energy and Investment established following SWERA wind report indicating good potential (7000MW)*
Honduras	*Moderate*	*Country incorporates wind into national energy planning SWERA data facilitates*
El Salvador	*High*	*additional funds sought for more measurements, Improved interest*
Cuba	*High*	*Considers a 100MW wind project, 6MW under implementation and very high co-financing*
Brazil	*Very high*	*Active involvement of a number of national agencies and continuing measurements and update.*

[37] SWERA Final Report by Endale Gorfu (16th Feb 2010) of the Ethiopian Rural Energy Development and promotion Center (EREDPC). Self-evaluation factsheet for Ethiopia (2004) also complained about institutional problems and attitudes towards the project. This (institutional problems) was confirmed in PIR 2008 (page 4) of the Project Manager, Tom Hamlin. The reported purchase of data from ENMSA does not appear in financials of the closing revision to the sub-project GFL 4765

[38] Mission Report (Tom Hamlin), 13-17 Mar 2005. Posture of Sri Lanka Ceylon Electricity Board on an underperforming wind project at Hambantota gives good indication of country interest in Sri Lanka

117. In Kenya, for instance, there is a high political commitment to RE and additional and improved data on solar and wind energy have been used in RE legislative processes and the setting of feed-in tariffs.

118. Cuba, another example of high levels of ownership and commitment, has 6MW of wind power plants under implementation with very high co-financing and a 100MW wind project under consideration.

119. The evaluation therefore considers the country ownership and commitment/driven-ness to be **Satisfactory**.

3.6 Achievement of Outputs and Activities

120. This section assesses the achievement of the project's anticipated outputs by considering four (4) out of the five (5) project activity components. Namely: Solar Resource Assessment, Wind Resource Assessment, Integration with Geographic Information Systems and National Applications of SWERA Tools and Information. The last one, Component Five (5), Management and Coordination is determined by the attainment of the first four components. Table 4 summarizes the planned outputs of SWERA and compares it with actual verifiable outputs.

121. The evaluation considers achievement of planned project outputs satisfactory. Considering the fact that several of the projects started in 2002/03, the timeliness of the delivery is also good, by 2005[39] most of the basic information had been compiled and loaded to the SWERA website (See Table 4).

122. The technical assessment methodology for both solar and wind resources is considered adequate, as the output of the simulation models were compared with Ground data for validation and Outputs by other simulation models in a cross-validation process. There were however implementation problems with cross-validation and harmonization of wind simulation models from NREL and RISOE.

[39] Although the project was initially designed to end in 2004

123. SWERA was undertaken by the world's leading agencies in solar and wind energy resource development and the credibility of their output is strong. The data and methodology was also presented at international forums of experts and investors. Though the evaluation is not impressed with the delivery of outputs from project activity component 4, the "Achievement of outputs and activities" is generally considered to be good, hence a rating of **Satisfactory**.

Table 4: Achievement of Planned SWERA Project Outputs

Country	Solar Resource Assessment		Wind Resource Assessment		GIS		National Apps	
	Planned Output	**Delivery Status**	**Planned Output**	**Delivery Status**	**Planned Output**	**Delivery Status**	**Planned Output**	**Delivery Status**
Brazil	High res maps by INPE, DLR and SUNY/Albany: Medium res map by LABSOLAR: Long-term time-series data by NREL	Maps and data available at SWERA website loaded in 2005. NREL, LABSOLAR and INPE credited	Wind map by NREL (WRAMS model), KAMM (RISOE) , CBEE/RISOE (WAsP Training)	Maps are regional - there are no country maps. Datasets are however available for mapping with GIS. NREL, RISOE, CEPEL (Brazil)	Development standard GIS datasets, GIS toolkit, Establish Global Archive	Renewable Energy Resource EXplorer (RREX) has been developed online for analysing data sets. A stand-alone interactive application that can be used for decision-making and policy analysis and planning for 8 of the SWERA countries has been developed and loaded to SWERA website by NREL.	Development of Alternative Energy Investment plans and promotion will be lead by TERI and implemented through national agencies in all pilot countries with further assistance from INPE and UNEP/DTIE.	Not much was achieved
Cuba	Medium Maps by NREL (CSR Model), Time Series Data by NREL, NREL Cross-model validation, High Res Map by SUNY/Albany	Data and regional maps loaded in 2003/04 by NREL and SUNY	Regional Wind Maps by NREL using WRAMS, RISOE to provide WAsP training, Technical support CBEE /Risoe					
El Salvador								
Guatemala								
Honduras								
Nicaragua		Maps and data loaded to SWERA website in 2003/04 by SUNY and NREL	NREL-WRAMS, Risoe WAsP training, Technical Support INPE (CBEE) /Risoe					

Country	Solar Resource Assessment		Wind Resource Assessment		GIS		National Apps	
	Planned Output	**Delivery Status**	**Planned Output**	**Delivery Status**	**Planned Output**	**Delivery Status**	**Planned Output**	**Delivery Status**
Ethiopia	Medium resolution maps by NREL (CSR model), Time Series Data by NREL, NREL Cross-model validation, High-Res Maps by SUNY/Albany-DLR (METEOSAT)	Maps and Data loaded in 2005 by NREL and DLR	NREL WRAMS, WAsP training session (Recife or Copenhagen), Technical support Risoe	Country map for Ghana has been loaded. Others are covered in a regional map. Datasets are however available for mapping with GIS. NREL, RISOE	Development standard GIS datasets, GIS toolkit, Establish Global Archive	Renewable Energy Resource EXplorer (RREX) has been developed online for analysing data sets. A stand-alone interactive application that can be used for decision-making and policy analysis and planning for 8 of the SWERA countries has been developed and loaded to SWERA website by NREL.	Development of Alternative Energy Investment plans and promotion will be led by TERI and implemented through national agencies in all pilot countries with further assistance from INPE and UNEP/DTIE.	Not much was achieved
Ghana		Map and data loaded to SWERA website by DLR in 2004 and NREL in 2005/06	NREL WRAMS, KAMM, WAsP training session (South Asia or Copenhagen), Technical support Risoe					
Kenya		Map and data loaded to SWERA website by DLR in 2004 and NREL in 2005/06						

Country	Solar Resource Assessment		Wind Resource Assessment		GIS		National Apps	
	Planned Output	**Delivery Status**	**Planned Output**	**Delivery Status**	**Planned Output**	**Delivery Status**	**Planned Output**	**Delivery Status**
China	Medium Res maps by NREL (CSR model), Time Series Data, Cross-model validation by NREL, High Res maps by SUNY/Albany, DLR (METEOSAT) and TERI (INSAT)	Map and data loaded to SWERA website by DLR in 2004 and NREL in 2005	NREL WRAMS, KAMM, Risoe KAMM low res ocean to coast, WAsP Training	Country maps for China and Sri Lanka have been loaded. The remaining maps are regional. Datasets are however available for mapping with GIS.	Development standard GIS datasets, GIS toolkit, Establish Global Archive	Renewable Energy Resource EXplorer (RREX) has been developed online for analysing data sets. A stand-alone interactive application that can be used for decision-making and policy analysis and planning for 8 of the SWERA countries has been developed and loaded to SWERA website by NREL.	Development of Alternative Energy Investment plans and promotion will be led by TERI and implemented through national agencies in all pilot countries with further assistance from INPE and UNEP/DTIE.	Not much was achieved
Bangladesh	Medium Res Maps by NREL (CSR Model), Time Series Data by NREL , NREL Cross-model validation, High maps by SUNY/Albany, DLR (METEOSAT) and TERI (INSAT)	Data and map loaded by DLR and NREL in 2004/2005	WRAMS Nepal, WRAMS Sri Lanka, KAMM (Nepal, Bangladesh from the ocean to coast)					
Nepal		Data loaded by DLR and NREL in 2004/06						
Sri Lanka		Low resolution data loaded by NREL in 2006						

3.7 Implementation Approach and Project Management

3.7.1 Preparation and Readiness

124. The project objectives and goals were clear as presented in the project design document and also summarized in the TOR: "The SWERA project focuses on removal of information barriers through satellite and computer modeling techniques, and building the capacity in the national collaborating agencies to use this information and contribute to the output of the project."

125. SWERA commendably had partnership agreements with the 13 pilot countries, within which framework the project was executed in each country. Task assignment to identified technical partners and the National Collaborating Agencies were clear from Annexes F[40] and I[41] of the project document. In spite of this, from interviews conducted by the Evaluator, TERI disputed its role as coordinator of Activity Component 4 - Coordination of the National Application of the SWERA tools and information – under which its roles included inter alia:
"*Collation of all the studies into a final report* ***covering all the countries*** *as well as any global or regional conclusions that can be drawn as to the impact and effectiveness of the mapping work and its effect on investment*."[42]

126. Project management was largely done from UNEP/DTIE, which appointed a Manager for the SWERA project and whose functions are stated in Annex F and further elaborated in Annex J of the project document (Terms of Reference for The Project Manager).
"Under the overall guidance of the Executive Coordinator, of the UNEP/GEF Coordination Office, direct supervision of the Director Technology Industry and Economics, and in collaboration with the Energy Coordinator for UNEP, the project manager will manage overall execution of the project and subprojects of the Solar and Wind Energy Resource Assessment." [43]

127. Counterpart funding from the pilot countries were mostly in the form of staff-hours and other in-kind contribution. This ensured that project execution did not suffer from cash flow

[40] Annex F: Implementation Arrangements – Agency Roles
[41] Annex I of SWERA project design document - *Terms of Reference for Collaborating Agencies*
[42] Page 103, SWERA Project design document.
[43] Terms of Reference for The Project Manager, page 111 of project document

problems that could have arisen from delayed release of funds from governments of participating countries, all of whom are "developing" and usually run "tight" budgets.

128. The timeframe for the project implementation 2001-2004 may have been over-ambitious as a significant number of project deliverables from the technical partners became available beyond 2004 with some extending into 2006.

129. The classification of project activities under various Activity Components (Components 1 – 5) enabled the identification of technical partners to execute the specific project activities depending on their expertise and strength, these technical partners (NREL, RISO, DLR, TERI, SUNY, INPE, etc.) were globally recognized centers of excellence and reference points in their respective areas of research and activity. The evaluation deems their capacities to have been properly considered.

130. It is unclear the extent to which lessons from similar projects were incorporated into SWERA, however the inclusion of UNDP and the World bank on the on the Steering Committee and the active awareness by the SWERA project manager of a wind resource energy assessment project undertaken by the UNDP in China indicates that lessons from their parallel efforts may have been passively incorporated and complementarity sought. There is evidence of communication and cooperation between SWERA and GTZ TERNA, which has also been active in wind resource measurements[44]. Partnership arrangements were clear from the project design documentation, which clearly indicated the component activity under which each technical partner was being engaged, including geographical scopes of operation; the in-country partners also had clearly defined roles. The acquisition of Governmental interest and consent was an important step in giving legal support for the SWERA in the various countries. In Kenya, Nicaragua and China, SWERA had a remarkably high Governmental interest. This parameter "Preparedness and Readiness" is therefore rated **Highly Satisfactory (HS).**

3.7.2 Implementation Arrangements and Adaptive Management

131. The project followed its implementation arrangement and agency roles as indicated in Annex F of the project document which is summarized in Table 5 below.

[44] http://www.gtz.de/en/themen/umwelt-infrastruktur/energie/14381.htm

132. Though a number of presentations were made at international fora on the SWERA project, there was no formal engagement of the agencies in Category 6 of Table 5 (AWEA, ISES, EWEA, etc.) for the function and roles they were expected to play in the project execution, although GTZ has some wind project development initiatives in Ethiopia, it appeared that SWERA only took advantage of events and platforms presented by some of these agencies to achieve project visibility.

Table 5: Project Implementation Arrangements

CATEGORY	BODY	FUNCTION	REMARKS
1	UNEP/ DTIE, (Project Manager)	• Manage and co-ordinate the SWERA agencies • Promote SWERA products to governments and investors • Link the SWERA activities to the Sustainable Technology Alternatives Network	Manager was quite effective at project coordination. Not much was done on investment promotion and no evidence of linkage with SANet[45]
2	Steering Committee	Advises UNEP DTIE on management of the project	There were no steering committee meetings as such. However, the steering committee function was covered by discussions during the missions and more importantly the regional meetings.
3	SWERA Technical Support Agencies NREL, INPE, SUNY, DLR, Risø, TERI, UNEP/GRID	Implement the mapping, database, and GIS activities	Roles were well executed. Datasets and maps available to public via SWERA website
4	Regional Coordinators (TERI, INPE)	Co-ordinate and or assist with regional country activities	INPE appears to have been more active in its region. TERI organized a number of training sessions, but seemed unaware of some of its responsibilities. See par 120.

[45] There is no mention of SWERA on SANet website and vice versa (http://www.sustainablealternatives.net/about.cfm). A search for SWERA on the SANet website yielded "no results". Checked on 17 July 2011.

CATEGORY	BODY	FUNCTION	REMARKS
5	Country partners	Execute nationally orientated assessment activities and promote alternate investment opportunities	Generally effective, though some difficulties were encountered in a few countries.
6	Other stakeholders, AWEA, ISES, EWEA, investors, GEF Implementing Agencies, GTZ	Facilitate use of data; project financing initiatives	Not much was done on this[46].

133. As indicated in Table 5, the project did not establish a steering committee as such, contrary to what was anticipated according to the project design document. The *Steering Committee function was covered by* discussions during the missions and regional meetings where changes to the activities were agreed and management addressed difficulties as they arose.

134. The evaluation finds the adaptive management approach of the project commendable, this is in view of some significant mid-stream problems such as political disruptions in Honduras and Nepal, the changing (twice) of key project personnel in Ethiopian Rural Energy Development Promotion Centre (EREDPC) and difficulties encountered with modeling in Nepal due to extreme nature of the topography. The intervention of the Project Manager in these countries helped bring the project back on track. A number of countries also had late start to the project – Kenya and Nepal in March 2003 and Ethiopia in July 2004 (instead of the June 2001 commencement date initially planned). In the absence of a functioning steering committee, information from country project managers, technical partners, etc. was used by the project manager to drive SWERA to the delivery of its expected outputs.

135. Implementation Arrangements and Adaptive Management is therefore given a rating of **Satisfactory** yielding a similar rating overall for Implementation Approach and Project Management.

[46] The evaluation has taken note of the SWERA side event at the Beijing International Renewable Energy Conference reported in the PIR 2007

3.8 Monitoring and Evaluation

3.8.1 M&E design (including budgeting and funding for M&E)

136. This terminal evaluation did not find in the Project Document, any clear arrangements for monitoring and evaluating the performance of the project. This very important part of the project was not properly captured and highlighted at the project design stage. The document did not indicate timelines for reporting by the pilot countries and the technical partners.

137. In spite of this significant omission in the project design, it appears to the Evaluator that the task of continual monitoring and evaluation of the project was implicit in the job description of the Steering Committee and the SWERA Project Manager as indicated in Paragraph 66 of the project design document, i.e.

> *"A Steering Committee will provide advice to the project manager on activities, monitor and guide the implementation of the work plan, review the budget and address significant implementation problems. The Steering Committee will consist of members from UNEP/DTIE, NREL, Risø, TERI, INPE, UNEP/ GRID, and DLR. The World Bank and UNDP will be invited to participate especially for the coordination of country activities."*

138. The design of the project included timelines for the monitoring of deliverables and also in accordance with UNEP project requirements[47], included a logical framework with objectively verifiable indicators, though SWERA predates the most recent publication of the UNEP Project Manual in 2005. Although the project envisaged a key role for the steering committee, there are no records of meetings[48] which covered the responsibilities of the Committee and the role the meetings played in the monitoring and evaluation of the project.

139. The project budget, as indicated in Table 6 below, did not have a line specifically for M&E. However, following the requirements at the time of project design, the costs were incorporated into the project management, with the cost of independent evaluations

[47] http://www.unep.org/pcmu/project_manual/Manual_chapters/project_manual.pdf
[48] Meetings in Chicago (2004), Washington (2005), Miami (2005) and other regional meetings were reported in PIRs.

accommodated in the implementation fee of US$ 480,000.00.[49] The project design also took note of the extra cost that would be incurred by the extensive travels required of a project spanning 13-countries, and with technical partners in 4 other countries DLR in Germany, RISO in Denmark, TERI in India, and NREL/SUNY/USGS in US.

Table 6: SWERA Project Budget

Component	Amount US$ (x1000)
1. Solar Assessment activities	1,842
2. Wind Assessment	2,331
3. Integration with GIS	990
4. National Applications of SWERA	515
5. Networking and coordination	834
TOTAL	**6,512**

140. The evaluator is also satisfied with the performance and achievement indicators that were adopted in the project design. The project incorporated "SMART[50]" monitoring indicators[51] for assessment of progress and achievement (as indicated in Annex B of the project document-page 30) and also incorporated adequate utilization of baseline information into the project, particularly in Activity Components 1 and 2, where already existing data on Solar and Wind energy resources and their associated methodologies were reviewed as part of the project. Installed capacities in the various pilot countries were also considered, to help in assessing project outcomes and impact.

141. Recalling that the key objective of SWERA, was to remove informational barriers and hopefully to attract investment for large-scale solar and wind projects in developing countries under GEF Operational Programme 6 -*Promotion of the adoption of renewable energy by removing barriers and reducing implementation costs.* [52] The performance indicators are therefore capable of measuring the extent to which the activities and outputs of SWERA (data, maps, etc.) have stimulated further activity and investment in the Solar and Wind energy sectors. This criterion is rated **Satisfactory**.

[49] "Executing agency costs for ongoing monitoring are included in the Project Management. Independent evaluations will be carried out by UNEP/GEF Coordination using the Implementation fee." Page 4 of project design document.
[50] SMART indicators are: Specific; Measureable; Achievable and Attributable; Relevant and Realistic; and Time-bound, Timely, Trackable, and Targeted.
[51] The chosen indicators, including; total capacity installed, adoption and reference in bidding documents, together with their means of verification such market surveys and number of website hits/ CD-ROMs sold satisfy the criteria for GEF projects.
[52] http://207.190.239.143/Operational_Policies/Operational_Programs/OP_6_English.pdf

3.8.2 M&E plan implementation

142. Project monitoring was done mainly and quite effectively through the active supervision and field missions of the SWERA Project Manager. Annual reports from technical partners and country project partners (Annual Self-evaluation & Work plan, progress reports, etc) gave a good overview of the level of achievement of project outputs, outcomes, impacts, and any significant obstacles encountered; the closing revisions.

143. This notwithstanding, Annual Self-Evaluation Reports by Country and Technical Partners, and Project Implementation Reviews (PIRs) by the Project Manager represented good monitoring mechanisms for the project. These reports, in addition to the field visits by the Project Manager, were effective in monitoring the progress of the project, identifying problems facing the project and helping find solutions. These reports captured problems like the difficulty with modeling of Nepalese topography (as reported in section 3.9.1):

> *"Due to the extreme nature of Nepal's topography, mesoscale modeling is difficult but a map was completed and calibrated to measurement data."*[53]

144. Annual Self-Evaluation Reports by Country and Technical Partners, and PIRs by the Project Manager also captured impacts of the SWERA project:

> *"In Nicaragua, SWERA assessments of wind resources demonstrated a much greater potential than the 200 megawatts (MW) estimated in the 1980s. The results prompted the Nicaraguan National Assembly to pass the Decree on Promotion of Wind Energy of Nicaragua 2004 that gives wind generated electricity "first dispatch", meaning it has the first priority over other options when fed into electricity grids."*[54]

145. The impacts in Nicaragua, as reported by the Project Manager in the relevant PIR, were confirmed by the Lead Evaluator during his field visit to Nicaragua as part of this terminal evaluation. M&E plan implementation is therefore rated **Satisfactory**.

[53] Project Implementation Review (PIR), 1 July 2007 to 30 June 2008
[54] Project Implementation Review (PIR), 1 July 2005 to 30 June 2006)

3.9 Financial Planning

146. The project proceeded without any significant financial constraints, and was largely executed within the budgetary provisions with the exception of a few significant notes.

147. DLR in its 2004 self-assessment reported that its efforts had been constrained by the depreciation of the US Dollar against the Euro – it estimated about 35% depreciation. This suggests that the project design did not make provision for exchange rate fluctuations in the course of the project implementation.

148. Significant variations occurred in the financing of sub-project GFL 4376 which was implemented by the Brazilian Wind Energy Center (CBEE), its budget was slashed by over 47% (US$ 66, 402.00) and re-allocated as follows:

- Proj No GFL 4360 (GRID) $25,000
- Proj No GFL 4364 (FAPEU-INPE) $35,000
- Proj No GFL 4334 (UMBRELLA PROJECT) $6,240.92

149. The Ethiopian sub-project GFL 4765 also recorded an overshoot of over 32% of its budgeted GEF Funding, from $44,538.86 to $59,000.00. Ghana, Kenya, China and many of the other subprojects were actually executed with some savings to the GEF Trust Fund- Sri Lanka saving over 14%.

150. On the whole the actual amounts spent compared favourably the budgeted amounts, in spite of delays in the project completion times, as shown in Table 7.

151. The finances on the project were handled from UNEP, which had supervisory role for the project. Financial records, including audit reports were included in closing reports to UNEP for all sub-projects. The audit reports were generally favourable on the management of finances (including accounting procedures) of the project[55].

[55] Although systemic issues were raised in the Kenyan audit report.

Table 7: Project Implementation Timelines and Expenditure Summary

Sub-Project Number	Executing Agency	Geographic Scope	Commencement	Completion	Eventual Completion	Budget (GEF)	Budget (Co-Fin)	Actual (GEF)	Actual (Co-Fin)
4334	Umbrella Project	Global						1,046,192.54	
4360	GRID	Global	Jan-02	Dec-04	Dec-06	345,000.00	47,000.00	345,000.00	47000.00
4361	DLR	Asia, Africa, Central America	Oct-01	Sept-04	Dec-07	370,000.00	152,000.00	370,000.00	179783.33
4362	FAPEU-LABSOLAR	South America and the Caribbean	Oct-01	Sept-04	Dec-05	300,000.00	81,000.00	297,591.84	81000.00
4363	TERI	Global	Oct-01	Sept-04	March-09	278,000.00	60,000.00	290,000.00	40000.00
4364	FAPEU-INPE	South America	Oct-01	Sept-04	June-06	238,000.00	81,000.00	273,000.00	45000.00
4376	CBEE	Brazil, Latin America and Caribbean	Dec-01	Nov-04	June-06	139,000.00	133,400.00	72,598.00	69368.00
4377	Riso	Global	Dec-01	Nov-04	April-08	595,000.00	94,000.00	606,000.00	94000.00
4378	SUNY	Central America, and Caribbean	Jan-02	Dec-04	Aug-05	208,000.00	236,000.00	207,933.65	57000.00
4465	Renewable Eergy Research Center, University of Dakha, Bangladesh	Bangladesh	May-02	Oct-04	March-06	65,000.00	19,000.00	78,000.00	19000.00
4466	NREL	Global	May-02	April-05	March-07	2,146,910.00	1,164,000.00	2,146,910.00	1164000.00
4509	National Engineering Reseach and Develoment Center, Sri Lanka	Sri Lanka	Aug-02	July-05	Sept-07	63,010.00	28,000.00	54,739.76	28000.00
4510	Ghana Energy Commission	Ghana	Aug-02	Dec-04	Sept-07	80,000.00	38,650.00	77,070.03	38650.00
4541	Universidad Centroamericana	El Salvador	Jan-02	Dec-04	Dec-05	57,000.00	16,100.00	57,000.00	16100.00
4542	China Renewable Energy Industry Association	China	Sept-02	Dec-04	Oct-08	140,000.00	87,000.00	139,568.26	87000.00
4543	Ministry of Energy and Mines, Guatemala (with Fondacion Solar)	Guatemala	Oct-02	Dec-04	July-06	68,000.00	40,000.00	68,000.00	40000
4544	National Energy Commission	Nicaragua	Sept-02	Dec-04	Dec-06	45,244.13	30,000.00	46,612.13	30000.00
4579	Center for Management of Prioritized Projects and Programs	Cuba	Nov-02	Dec-04	March-07	78,983.00	99,300.00	78,983.00	99300.00
4580	Sevretaria de Recursos Naturales y Ambiente	Honduras	Nov-02	Dec-04	March-08	57,000.00	16,100.00	56,040.00	17060.00
4625	Alternative Energy Promotion Center	Nepal	March-03	April-05	Dec-07	65,000.00	28,000.00	61,800.79	28000.00
4626	Intermediate Technology Develoment Group (EA)	Kenya	March-03	June-05	Nov-08	79,960.00	36,000.00	79,960.00	36000.00
4765	Ethiopian Rural Energy Develoment and Promotion Center	Ethiopia	April-04	July-05	May-08	44,538.86	26,000.00	59,000.00	26000.00
						5,463,645.99	**2,512,550.00**	**6,512,000.00**	**2,242,261.33**

152. Audit reports were positive as in the case of Guatemala where "after reviewing reports from September 2002 until March 2006, of the referenced project, we have concluded that they show the financial situation in a reasonable way, as well as the operations results in a cash flow, all of these in a generally accepted accounting principles"[56] and for DLR (one of the technical partners) where "…accounting procedures used in the recording of eligible costs and receipts respect the accounting rules of the state in which the contractor is established …"[57] Financial Planning is therefore rated **Satisfactory** with a similar rating overall for M&E.

3.10 UNEP Supervision and Backstopping

153. Considering that SWERA spanned 13 countries with 21 partner agencies, this evaluation considers the project supervision and monitoring to be very commendable as done through Global and Regional meetings, annual reporting from technical partners on activities in each country/region and also from the host countries themselves, field mission reports and PIRs from the SWERA project manager. On the PIRs, the assessment of monitoring indicators, the attribution of causality for positive developments in the RE sector of project countries, and subsequent ratings are deemed to have good basis.

154. With the exception of records of key stakeholder meetings, documentation had been properly kept on project activities and communication in all project countries. On visits to both Kenya and China by the Evaluator, the SWERA project manager was singled out for commendation for his commitment to the success of the project and assistance in resolving problems that arose in the course of project implementation. The Supervision and Backstopping by UNEP is rated Highly Satisfactory (HS).

3.11 Complementarity with UNEP Medium Term Strategy and Programme of Work

155. The focus of UNEP 2010-2013 is to provide leadership in the following six cross-cutting thematic priority areas (as indicated in Paragraph 29)[58]:

A. Climate change;

[56] Audit report – Guatemala (2006)
[57] Audit report – DLR (2007)
[58] http://www.unep.org/PDF/FinalMTSGCSS-X-8.pdf

B. disasters and conflicts;
C. Ecosystem management;
D. Environmental governance;
E. Harmful substances and hazardous waste;
F. Resource efficiency – sustainable consumption and production.

156. The SWERA project is consistent with the objective of under *A. Climate Change* thematic area *(Section III A paragraph 34)* where the UNEP expects inter alia to: "…support countries to make a transition towards societies based on more efficient use of energy, energy conservation and utilization of cleaner energy sources, with a focus on renewable energy, and on improved land management."

157. This objective under *the Climate Change* thematic area has several expectations, the particular one of relevance, (b), being that: "… countries make sound policy, technology, and investment choices that lead to a reduction in greenhouse gas emissions and potential co-benefits, with a focus on clean and renewable energy sources, energy efficiency and energy conservation".[59]

158. SWERA met some of the aspirations of, and incorporated some of the recommended activities of the Bali Strategic Plan (BSP) for Technology Support and Capacity-building, although it pre-dated the UNEP BSP which was adopted in December 2004. The UNEP-BSP has broad objectives which include the following[60], to which SWERA has made some contribution:

a. To strengthen the capacity of Governments of developing countries as well as of countries with economies in transition, at all levels:
b. To provide systematic, targeted, long and short-term measures for technology support and capacity-building, taking into account international agreements and based on national or regional priorities and needs;
c. To provide a framework for capacity-building to ensure the effective participation of developing countries as well as countries with economies in transition in negotiations concerning multilateral environmental agreements;
d. To enhance delivery by UNEP of technology support and capacity-building, within its mandate, to developing countries as well as to countries with economies in transition

[59] Paragraph 35 (a), United Nations Environment Programme , Medium-term Strategy 2010–2013
[60] The order of presentation of the objectives is differs from what is presented in the UNEP-BSP

based on best practices from both within and outside UNEP, including by mainstreaming technology support and capacity-building throughout UNEP activities;

e. To strengthen cooperation among UNEP, multilateral environmental agreement secretariats, taking into account their autonomous decision-making processes, and other bodies engaged in environmental capacity-building. These include the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) in particular, and also bilateral donors, other United Nations bodies, regional or multilateral organizations, international financial institutions, civil society, including the private sector, universities and other relevant stakeholders; and

f. To promote, facilitate and finance, as appropriate, access to and support of environmentally sound technologies and corresponding know -how, especially for developing countries as well as countries with economies in transition.

159. SWERA, which was funded by the GEF Secretariat, provided support which contributed to building the capacity of Governments through the partner agencies (such as National Agencies and Universities) with whom the SWERA technical partners collaborated to provide information that has supported solar and wind energy technology policy and decisions. The inclusion of UNDP in the project design (Steering Committee) and the recognition of its work in wind speed measurements within SWERA reporting are consistent with, and contribute to the achievement of the BSP which strongly advocates cooperation with UNDP and other Agencies and the avoidance of duplication efforts, particularly under Section III paragraph 4- *Strategic considerations*.

160. SWERA activities provided a number of south-south cooperation opportunities which are presented below:

- CBEE of Brazil provided Regional technical assistance for Central America in wind assessment.
- INPE of Brazil provided regional support for in Latin America and the Caribbean in the implementation of SWERA and GsT production.
- LabSolar of Brazil undertook Solar resource assessment (40-km) for South American Region

- TERI of India was Technical Partner in the SWERA project and provided assistance for the development of solar and wind energy alternatives in Brazil and China, and in addition supported the development of GsT for participating countries.

161. These examples of South-South Cooperation within the SWERA project are also consistent with Section IV (E), paragraph 21 of the UNEP-BSP.

MAIN FINDINGS AND CONCLUSIONS

4.1 Project Design and Implementation

162. **Attainment of project objectives and planned results:** The SWERA project succeeded in making available solar and wind energy resource datasets and maps, together with tools for utilization, thereby contributing significantly to removing key informational barriers and improving confidence in already existing data. Outcomes of the project have resulted in some large-scale investments, particularly in China and Nicaragua plus significant policy development in Kenya, and to a lesser extent Ghana and Nepal.

163. **Sustainability:** The benefits of SWERA, its outputs, outcomes and any impacts to date, such as datasets and maps, and increased capacity in host counties do not require much financial resources to maintain. Investments made so far in large-scale wind projects have already crossed the major barrier of most RETs (i.e. high capital investment) and are likely to continue to yield global environmental benefits, at least for the typical economic project-life of 20 – 30 years. There is some moderate risk with the availability of funding for the implementation of legislation and other required intermediate states, particularly for solar in practically all the pilot countries, unless there is high government commitment or generous donor support.

164. **Catalytic Role and Replication:** SWERA has succeeded in bringing solar and wind energy technology to the fore as viable options for meeting some of the energy needs of the pilot countries, and also for diversifying their energy sources. Data generated has encouraged the mainstreaming of RETs into national energy plans, and stimulated the enactment, or the initiation of enactment of policies and laws in all the pilot countries. SWERA has also incentivized the conduct of additional or confirmatory solar and wind resource measurements with follow-on financing in general and private financing for wind power projects in particular.

165. **Stakeholder Participation/ public awareness:** The project identified and engaged technical partners with requisite expertise for its implementation but it is not always clear that due recognition was given, as in the case of TERI getting no mention along with others in the SWERA brochure on official project website. Communication between project coordinators, technical partners and other stakeholders remained fluid, although there were some hitches with the

model cross-validation process, particularly for wind. The project also had a good level of visibility with presentations at international fora.

166. **Country Ownership/ Driven-ness:** All pilot project countries were signatories to the UNFCCC and applied to be part of the SWERA project, which constituted an initial expression of interest in the immediate objectives and long-term impacts of the project. However, there is a wide gap between the degree of ownership and commitment in countries like China and Nicaragua on the one hand and others like Ghana and Nepal on the other hand. Nevertheless, the output of SWERA has contributed to varying degrees, to policies and projects, and the pilot countries have used the data to initiate further activity on their own.

167. **Achievement of Activities and Outputs:** The delivery of the outputs of SWERA is considered good and commendable. By 2005 practically all the activities and outputs had been achieved and most of the information generated by SWERA including Solar and Wind Resource data and maps, Geospatial Toolkits, documentation, etc., had been loaded to the website http://swera.unep.net/. The delay to the closure of the project for most countries was due mainly to "paper work".

168. **Preparation and Readiness:** The project was very clear from the outset on its objectives and the series of activities and related outputs that were needed to accomplish its expected outcomes. The project design identified competent technical partners for the project (NREL, DLR, RISOE, TERI, etc.), whose roles and geographic scope of operation was also well defined.

169. **Assessment, Monitoring and Evaluation Systems:** The design of the project included timelines for the monitoring of deliverables and also in accordance with UNEP project requirements, included a logical framework with objectively verifiable indicators, though SWERA predates the most recent publication of the UNEP Project Manual in 2005. The reporting and monitoring mechanisms adopted by the project, including: field missions of the Project Manager, Project Implementation Reviews (PIR), Self-Evaluation Reports, etc., gave a good overview of project implementation status, the achievement of outputs and expected outcomes.

170. **Implementation Approach:** The project largely followed its implementation arrangements, with each technical partner and collaborating agency playing the roles assigned to them within

the specified countries and regions. Exception was the case of TERI which disputed its role for all pilot countries as coordinator of national application of the SWERA tools and information of the impact and effectiveness of the mapping work and its effect on investment. *Steering Committee function was replaced by* discussions during the missions and regional meetings which enabled the Project Manager to bring "challenged" projects back on course.

171. **Financial Planning:** With the exception of a few cases such as the financial constraint reported by the DLR due to currency depreciation and the budget overshoot of up to about 32% in Ethiopia; the project generally proceeded without financial difficulties and the Audit Reports that accompanied the closing revisions did not report financial mismanagement or misconduct.

172. **UNEP Backstopping and Supervision:** Considering that SWERA spanned 13 countries with 21 partner agencies, this evaluation considers the project supervision and monitoring to be very commendable as done through Global and Regional meetings, annual reporting from technical partners on activities in each country/region and also from the host countries themselves, plus field mission reports and PIRs from the SWERA Project Manager.

4.2 Overall Project Performance and Summary of Ratings

173. The project as a whole has been a success, keeping in mind the issues raised and the few shortcomings and other mid-stream difficulties. Table 8 summarizes the ratings for the various evaluation parameters and shows a majority of the parameters scoring either Highly Satisfactory or Satisfactory.

174. As indicated in the preceding section, SWERA project parameters with ratings of Highly Satisfactory are Attainment of project objectives and results, and UNEP Supervision and backstopping. The project scored Satisfactory ratings for Catalytic role and replication, Country ownership / driven-ness, Achievement of outputs and activities, Implementation approach and project management, Monitoring and Evaluation, and Financial planning.

Table 8: Overall Ratings

Criterion	Evaluator's Rating
A. Attainment of project objectives and results (overall rating)	HS
A. 1. Effectiveness - overall likelihood of impact achievement (ROtI rating)	HS
A. 2. Relevance	HS
A. 3. Efficiency	S
B. Sustainability of project outcomes (overall rating)	ML
B. 1. Financial	ML
B. 2. Socio-political	ML
B. 3. Institutional framework and governance	ML
B. 4. Environmental	L
C. Catalytic role and replication	S
D. Stakeholders participation	MS
E. Country ownership / driven-ness	S
F. Achievement of outputs and activities	S
G. Implementation approach and project management (overall rating)	S
G.1 Preparation and readiness	HS
G.2 Implementation Arrangements and Adaptive Management	S
H. Monitoring and Evaluation (overall rating)	S
H.1 M & E Design (including budgeting and funding for M&E)	S
H.2 M & E Plan Implementation	S
I. Financial planning	S
J. UNEP supervision and backstopping	HS

Legend:

HS	-	*Highly Satisfactory*
S	-	*Satisfactory*
MS	-	*Moderately Satisfactory*
HL	-	*Highly Likely*
L	-	*Likely*
ML	-	*Moderately Likely*

175. Nevertheless, the Sustainability of Project outcomes was rated as Moderately Likely, pointing to some deficiencies in the project design and follow-up actions. The socio-political factors in particular are worthy of note given the fact that some pilot countries such as Sri Lanka and Kenya experienced political instability and one or two like Nepal still continue to do so.

176. Stakeholders Participation was also rated as Moderately Satisfactory, a reflection of inadequacy in participation of the private sector in particular.

4.3 Concluding Remarks

177. This section addresses the main questions which formed the focus of this evaluation as set out in the opening sections of this report. This is done in order to set the tone for lessons learned and also point in the right directions for recommendations that will enhance the likelihood of achieving more project impacts.

178. ***To what extent did the project help to reduce uncertainties associated with investment and development decisions for solar and wind projects?*** In practically all the pilot countries the SWERA project succeeded in producing outputs by way of solar and wind energy resource datasets and maps, together with tools for their utilization, which helped to reduce uncertainties associated with solar and wind investment. The SWERA project also contributed significantly to policy development in many of the pilot countries, particularly China, Nicaragua and Kenya, and to a lesser extent Ghana and Nepal. Data generated by SWERA has encouraged the mainstreaming of RETs into national energy plans, and stimulated the enactment, or the initiation of enactment of policies and laws making it easier for large-scale renewable energy investments in most of the pilot countries.

179. ***To what extent did the project increase awareness of key stakeholders and decision makers about the solar and wind resources and the relevance of the resource information to the development and deployment of various solar and wind technologies?*** The SWERA project contributed significantly towards increased awareness of key stakeholders and decision makers in the pilot countries. This is evidenced in the studies commissioned and reports prepared by in-country stakeholders, notably in the Government agencies and academic institutions. Many of the stakeholders, particularly the policy makers, have gone on to initiate further activity on their own in developing the necessary policy framework and facilitating investment projects particularly in wind.

180. ***Did the project produce consistent, reliable, verifiable, and accessible global data sets for international and in-country investors and other stakeholders?*** The SWERA project succeeded in making available solar and wind energy resource datasets and maps, together with tools for utilization. By 2005 practically all the activities and outputs had been achieved and most of the information generated by SWERA including Solar and Wind Resource data and maps, Geospatial Toolkits, documentation, etc., had been loaded to the website

http://swera.unep.net/. However, not all the subsequent datasets and maps were uploaded onto the website leaving some hurdles in the way of access to SWERA datasets.

181. ***To what extent did the project increase capacity for making solar and wind energy plans on the local, provincial, national, and regional levels?*** The benefits of SWERA, its outputs, outcomes and impacts to date, such as datasets and maps, increased capacity in host countries for making solar and wind energy plans. SWERA succeeded in bringing solar and wind energy technology to the fore as viable options for meeting some of the energy needs of the pilot countries, and also for diversifying their energy sources. Nevertheless, a few of the pilot countries have, to date, not been able to develop solar and wind energy plans at any level, be it local, provincial, national or regional.

LESSONS (TO BE) LEARNED

5.1 Getting global centres of excellence to share knowledge and tools

182. The SWERA project's involvement of competent technical partners for the project (NREL, DLR, RISOE, TERI, etc.) with clearly defined roles and geographic scope of operation is highly commendable. Harnessing of knowledge resident in these global centres of excellence was an excellent thing to do and this made it possible for otherwise resource-strapped institutions like the KNUST Department of Geomatic Engineering to gain access to world class knowledge and tools.

183. This harnessing of the global commons for knowledge and expertise is a mechanism that UNEP and others must seek to replicate in future projects, not just multi-country projects like SWERA but even national projects where knowledge and expertise resident elsewhere can be tapped for the benefit of the local target groups. Some carefulness will always be required in order not to use global powerhouses as far as knowledge and skills are concerned to suffocate or exclude in-country centres of excellence, and in the end a judicious blend of the two.

5.2 Avoiding wide disparities in country commitment and capacities

184. There were as many as thirteen (13) pilot SWERA project countries including a wide range of countries: Bangladesh, Brazil, China, Cuba, El Salvador, Ethiopia, Ghana, Guatemala, Honduras, Kenya, Nepal, Nicaragua, and Sri Lanka. The large number of countries made project management a herculean task which fortunately was well done by the project team. The wide variation in countries' fortunes however meant that some were able go much further along the outcomes-to-impacts pathway while others have struggled to take the initial concrete steps along this pathway.

185. In future it would be advantageous to choose countries with similar (or less contrasting) capacities and levels of commitment and avoid putting China and Ethiopia, for instance, in the same boat. Widely varying factors like existence of local manufacturing capacity, public willingness to pay for energy (particularly electricity) and greater Government willingness to allocate resources for "intangible investments" make it difficult to customize project tools and instruments to suit the different demands and this should avoided, or minimized.

5.3 Promoting frequent consultations at country and international levels

186. Very few in-country stakeholder consultations were held over the 2 – 6 year project lifetime. In-country awareness of country-level activities and developments were therefore not broad enough in some pilot countries (e.g. Kenya where large-scale private developer got to know of SWERA by chance and Ghana where several persons directly involved in the SWERA were not aware of impressive achievements in China).

187. In future more dynamic country and project-level knowledge networks should be promoted to ensure as many stakeholders as possible become aware of the developments taking place in a project and the tools being developed. Where appropriate use of the internet through webinars, for instance, could be employed to reduce the cost of organizing more frequent stakeholder consultations and maintaining dynamic knowledge networks which should in the end prove highly beneficial to the achievement of project impacts.

RECOMMENDATIONS

6.1 Establish SWERA Knowledge Network

188. There is a lot going on in terms of solar and wind energy project development (including resource assessment and investment promotion) in practically all the SWERA countries but this is unknown to people from other countries even where they are in the same region like Ghana and Kenya, both in Sub-Saharan Africa.

189. The active sharing of knowledge and information among peers in different countries will be crucial to the success of renewable energy diffusion at the global level. It is therefore recommended that one of the SWERA partner institutions takes the lead to establish a global knowledge network for all SWERA project team members in the pilot countries. The UNEP Paris Office could facilitate this by putting out a call to all the SWERA partner institutions for expressions of interest based on which the most capable institution could be selected with respect to the level of "investment" they are prepared to make towards operationalization of the SWERA Knowledge Network.

190. Such a global knowledge network could be purely internet-based with a clear focus on information sharing through webinars and similar channels of communication in the 21st Century. Cooperation with the newly established International Renewable Energy Agency (IRENA) is highly recommended.

6.2 Update and Relaunch SWERA Website

191. The SWERA Website has a lot of very useful knowledge resources in the form of solar and wind data, maps and toolkits for various forms of analysis. Unfortunately the website is known to only a few people who are closely associated with the SWERA project and a limited number of members of academia, industry and government institutions in different parts of the world. There were many instances in the course of this evaluation when many people involved in renewable energy project development were encountered but they had no knowledge of the SWERA website. In some cases they knew one or two of the tools but they did not know about the additional store of knowledge also available at the SWERA website.

192. There are instances also where data available to the SWERA project team members cannot be downloaded from the SWERA website. One example in this regard comes from Kenya where the solar and wind maps can be obtained directly from SWERA project team members but are not available on website.

193. It is therefore recommended that staff at the UNEP Paris Office continues to update SWERA website with as much relevant and current information as available on the pilot countries. A major global re-launch of the SWERA website should then be undertaken to ensure that more interested parties are aware of the existence of the website and the resources available at the site. This re-launch should take place in all 13 pilot countries plus a similar number of industrialized countries where many renewable energy project developers reside. Again, cooperation with the newly established IRENA will be advantageous and is therefore highly recommended.

ANNEX A: PROJECT OVERVIEW

Project Objectives

The broad objective of the project Solar and Wind Energy Resource assessment is to make available and accessible reliable, high resolution solar and wind energy resource information, thereby removing a significant barrier to widespread use of clean solar and wind technologies. Thus the project aims at facilitating investment in large-scale use of solar and wind energy technologies in developing countries.

Specific objectives include:

- Development of global, regional, and national solar and wind resource maps
- Development of the GIS framework for planning
- Transfer of the resource data and tools required for use in pre-investment operations

The project will transform the ability of developing countries to assess the technical, economic, and environmental potential for broad scale investments in solar and wind facilities, and amplify their ability to attract private and public sector investments. The goal is to support more informed decision-making, science-and-technology based policy, and increased investor interest in renewable energy. UNEP proposes to engage the solar and wind energy communities (industry, investors, researchers, and government agencies) through a low cost network by which information is continuously shared so that solar and wind energy planning decisions can be made progressively and expeditiously.

The originally estimated project duration was 36 months beginning in June 2001 and ending in July 2004.

Relevance to GEF Programmes

This project falls under the GEF focal area of climate change, more precisely the programming framework OP-6; promoting the adoption of renewable energy by removing barriers and reducing implementation costs.

Executing Arrangements

The Executing Agency of this project was UNEP/DTIE in collaboration with 20 supporting agencies, including NREL, Risø, TERI, INPE, DLR, and national agencies in all pilot demonstration countries. The project's implementing agency was UNEP.

Project Activities

The project had several activities grouped under five different components:

Component 1. Solar resource assessment

- Establish solar methodology and information review panel
- Gather relevant meteorological data from national or other archives
- Develop solar resource maps
- Generate time-series data
- Relate short -term satellite-derived time series to long-term ground-based time series
- Conduct cross-model comparisons and validation studies

Component 2. Wind resource assessment

- Review existing wind surveys and assessment methodologies
- Gather existing relevant wind data
- Process data sets and perform critical analysis of data quality
- Adjust surface observations using WAsP methods
- Generate high-resolution wind maps
- Prepare wind atlas
- Conduct cross-model comparisons and validation studies

Component 3. Integration with geographic information system (GIS)

- Develop standard GIS datasets
- Develop GIS toolkit
- Conduct needs assessment for in-country partners
- Establish global archive

Component 4. National applications of the SWERA tools and information

- Alternative business development scenarios in energy supply
- Marketing and presentation of the alternative energy development projections to investors

Component 5. Management and coordination

- Coordination of project activities
- Meetings

Expected outcomes

The project was designed to lead to the following outcomes:

- Reduced uncertainties associated with investment and development decisions for solar and wind projects. This in turn will decrease uncertainties in the design, cost, and performance of solar and wind systems, and should increase investor confidence, and confidence of key stakeholders, such as government agencies responsible for facilitating clean energy development.
- Increased awareness by key stakeholders and decision makers of the solar and wind resources and the relevance of the resource information to the development and deployment of various solar and wind technologies, (existence of potential resource, inclusion of solar and wind energy technologies in energy planning).
- Consistent, reliable, verifiable, and accessible global data sets for international and in-country investors and other stakeholders.
- Increased capacity for making solar and wind energy plans on the local, provincial, national, and regional levels. The availability of the solar and wind resource data and training in the use of the tools to make use of the data will facilitate better planning for solar and/or wind energy development. In some countries, large-area high-resolution wind and solar resource mapping is expected to reveal far larger commercial wind and solar project development potential than currently thought possible. In order to demonstrate the outputs of SWERA, nationally executed assessments of the potential for solar and wind development will be performed.

Budget

The project's total budget is $ 6,512,000 with co financing of $ 2,508,000.

ANNEX B: TERMS OF REFERENCE FOR THE EVALUATION (ABRIDGED)

1. Objective and Scope of the Evaluation

The objective of this terminal evaluation is to examine the extent and magnitude of any project impacts to date and determine the likelihood of future impacts. The evaluation will also assess project performance and the implementation of planned project activities and planned outputs against actual results. The evaluation will focus on the following main questions:

- ✓ To what extent did the project help to reduced uncertainties associated with investment and development decisions for solar and wind projects?
- ✓ To what extent did the project increase awareness of key stakeholders and decision makers about the solar and wind resources and the relevance of the resource information to the development and deployment of various solar and wind technologies?
- ✓ Did the project produce consistent, reliable, verifiable, and accessible global data sets for international and in-country investors and other stakeholders?
- ✓ To what extent did the project increase capacity for making solar and wind energy plans on the local, provincial, national, and regional levels?

2. Methods

This terminal evaluation will be conducted as an in-depth evaluation using a participatory approach whereby the UNEP/DGEF Task Manager, key representatives of the executing agencies and other relevant staff are kept informed and consulted throughout the evaluation. The consultant will liaise with the UNEP/Evaluation Office and the UNEP/DGEF Task Manager on any logistic and/or methodological issues to properly conduct the review in as independent a way as possible, given the circumstances and resources offered. The draft report will be circulated to UNEP/DGEF Task Manager, key representatives of the executing agencies and the UNEP/Evaluation Office. Any comments or responses to the draft report will be sent to UNEP/Evaluation Office for collation and the consultant will be advised of any necessary or suggested revisions.

The findings of the evaluation will be based on the following:

1. A desk review of project documents including, but not limited to:
   (a) The project documents, outputs, monitoring reports (such as progress and financial reports) and relevant correspondence.
   (b) Notes from the Steering Group meetings.
   (c) Other project-related material produced by the project staff or partners.
   (d) Relevant material published on the project web site: http://swera.unep.net/

2. Interviews with project management and technical support including UNEP/DTIE, NREL, Risø, TERI, INPE, DLR, SUNY, UNEP/GRID, USGS EROS, and national agencies of the demonstration countries.

3. Interviews and Telephone interviews with intended users for the project outputs and with other stakeholders involved, including in the participating countries and international bodies. The Consultant shall determine whether to seek additional information and opinions from

representatives of donor agencies and other organisations. As appropriate, these interviews could be combined with an email questionnaire.

4. Interviews with the UNEP/DGEF project task manager and Fund Management Officer, and other relevant staff in UNEP as necessary. The Consultant shall also gain broader perspective from discussions with relevant GEF Secretariat staff.

5. Field visits[61] to project staff and target audiences; the evaluator will visit key project management staff of UNEP/DGEF and UNEP/DTIE in France and make field visits to selected pilot project countries (China, Ghana, Kenya, Cuba, El Salvador, and Brazil). Key audiences for the project's outputs will be canvassed for their opinions in relation the project in these countries.

Key Evaluation Principles
In attempting to evaluate any outcomes and impacts that the project may have achieved, evaluators should remember that the project's performance should be assessed by considering the difference between the answers to two simple questions ***"what happened?***" and ***"what would have happened anyway?"***. These questions imply that there should be consideration of the baseline conditions and trends in relation to the intended project outcomes and impacts. In addition it implies that there should be plausible evidence to **attribute** such outcomes and impacts **to the actions of the project**.

Sometimes, adequate information on baseline conditions and trends is lacking. In such cases this should be clearly highlighted by the evaluator, along with any simplifying assumptions that were made to enable the evaluator to make informed judgements about project performance.

3. Project Evaluation Parameters and Ratings

The success of project implementation will be rated on a scale from 'highly unsatisfactory' to 'highly satisfactory'. In particular the evaluation shall **assess and rate** the project with respect to the eleven categories defined below:[62]

It should be noted that many of the evaluation parameters are interrelated. For example, the 'achievement of objectives and planned results' is closely linked to the issue of 'sustainability'. Sustainability is understood as the probability of continued long-term project-derived outcomes and impacts and is, in turn, linked to the issues of 'catalytic effects / replication' and, often, 'country ownership' and 'stakeholder participation'.

A. Attainment of objectives and planned results

The evaluation should assess the extent to which the project's major relevant objectives were effectively and efficiently achieved or are expected to be achieved and their relevance.

- *Effectiveness:* Evaluate the **overall likelihood of impact achievement**, taking into account the "achievement indicators", the achievement of outcomes and the progress made towards impacts. UNEP's Evaluation Office advocates the use of the **Review of Outcomes to Impacts (ROtI)** method to establish this rating.

[61] Evaluators should make a brief courtesy call to GEF Country Focal points during field visits if at all possible.
[62] However, the views and comments expressed by the evaluator need not be restricted to these items.

In particular:

- Evaluate the immediate impact of the project on facilitating investment in large-scale use of solar and wind energy technologies in developing countries.
- As far as possible, also assess the potential longer-term impacts considering that the evaluation is taking place upon completion of the project and that longer term impact is expected to be seen in a few years time. Frame recommendations to enhance future project impact in this context. Which will be the major 'channels' for longer term impact from this project at the national and international scales?

- *Relevance*: In retrospect, were the project's outcomes consistent with the focal areas/operational program strategies? Ascertain the nature and significance of the contribution of the project outcomes to GEF focal area of climate change and promoting the adoption or renewable energy.

- *Efficiency*: Was the project cost effective? Was the project the least cost option? Was the project implementation delayed and if it was, then did that affect cost-effectiveness? Assess the contribution of cash and in-kind co-financing to project implementation and to what extent the project leveraged additional resources. Did the project build on earlier initiatives, did it make effective use of available scientific and/or technical information. Wherever possible, the evaluator should also compare the cost-time vs. outcomes relationship of the project with that of other similar projects.

B. Sustainability

Sustainability is understood as the probability of continued long-term project-derived outcomes and impacts after the GEF project funding ends. The evaluation will identify and assess the key conditions or factors that are likely to contribute or undermine the persistence of benefits after the project ends. Some of these factors might be outcomes of the project, e.g. stronger institutional capacities or better informed decision-making. Other factors will include contextual circumstances or developments that are not outcomes of the project but that are relevant to the sustainability of outcomes. The evaluation should ascertain to what extent follow-up work has been initiated and how project outcomes will be sustained and enhanced over time. **Application of the ROtI method** will also assist in the evaluation of sustainability.

Five aspects of sustainability should be addressed: financial, socio-political, institutional frameworks and governance, environmental (if applicable). The following questions provide guidance on the assessment of these aspects:

- *Financial resources:* Are there any financial risks that may jeopardize sustenance of project outcomes and onward progress towards impact? What is the likelihood that financial and economic resources will not be available once the GEF assistance ends (resources can be from multiple sources, such as the public and private sectors, income generating activities, and trends that may indicate that it is likely that in future there will be adequate financial resources for sustaining project's outcomes)? To what extent are

the outcomes and eventual impact of the project dependent on continued financial support?

- *Socio-political:* Are there any social or political risks that may jeopardize sustenance of project outcomes and onward progress towards impacts? What is the risk that the level of stakeholder ownership will be insufficient to allow for the project outcomes to be sustained? Do the various key stakeholders see that it is in their interest that the project benefits continue to flow? Is there sufficient public / stakeholder awareness in support of the long term objectives of the project?
- *Institutional framework and governance:* To what extent is the sustenance of the outcomes and onward progress towards impacts dependent on issues relating to institutional frameworks and governance? What is the likelihood that institutional and technical achievements, legal frameworks, policies and governance structures and processes will allow for, the project outcomes/benefits to be sustained? While responding to these questions consider if the required systems for accountability and transparency and the required technical know-how are in place.
- *Environmental:* Are there any environmental risks that can undermine the future flow of project environmental benefits? The TE should assess whether certain activities in the project area will pose a threat to the sustainability of the project outcomes. For example; construction of dam in a protected area could inundate a sizable area and thereby neutralize the biodiversity-related gains made by the project; or, a newly established pulp mill might jeopardise the viability of nearby protected forest areas by increasing logging pressures; or a vector control intervention may be made less effective by changes in climate and consequent alterations to the incidence and distribution of malarial mosquitoes. Would these risks apply in other contexts where the project may be replicated?

C. Catalytic Role and Replication

The catalytic role of the GEF is embodied in its approach of supporting the creation an enabling environment, investing in activities which are innovative and show how new approaches and market changes can work, and supporting activities that upscale new approaches to a national (or regional) level to sustainably achieve global environmental benefits.

In general this catalytic approach can be separated into are three broad categories of GEF activities: (1) "**foundational**" and enabling activities, focusing on policy, regulatory frameworks, and national priority setting and relevant capacity (2) **demonstration** activities, which focus on demonstration, capacity development, innovation, and market barrier removal; and (3) **investment** activities, full-size projects with high rates of cofunding, catalyzing investments or implementing

> The three categories approach combines all the elements that have been shown to catalyze results in international cooperation. Evaluations in the bilateral and multilateral aid community have shown time and again that activities at the micro level of skills transfer—piloting new technologies and demonstrating new approaches—will fail if these activities are not supported at the institutional or market level as well. Evaluations have also consistently shown that institutional capacity development or market interventions on a larger scale will fail if governmental laws, regulatory frameworks, and policies are not in place to support and sustain these improvements. And they show that demonstration, innovation and market barrier removal do not work if there is no follow up through investment or scaling up of financial means.

a new strategic approach at the national level.

In this context the evaluation should assess the catalytic role played by this project by consideration of the following questions:

- INCENTIVES: To what extent have the project activities provided incentives (socio-economic / market based) to contribute to catalyzing changes in stakeholder behaviors?
- INSTITUTIONAL CHANGE: To what extent have the project activities contributed to changing institutional behaviors?
- POLICY CHANGE: To what extent have project activities contributed to policy changes (and implementation of policy)?
- CATALYTIC FINANCING: To what extent did the project contribute to sustained follow-on financing from Government and / or other donors? (this is different from co-financing)
- PROJECT CHAMPIONS: To what extent have changes (listed above) been catalyzed by particular individuals or institutions (without which the project would not have achieved results)?

(Note: the ROtI analysis should contribute useful information to address these questions)

Replication approach, in the context of GEF projects, is defined as lessons and experiences coming out of the project that are replicated or scaled up in the design and implementation of other projects. Replication can have two aspects, replication proper (lessons and experiences are replicated in different geographic area) or scaling up (lessons and experiences are replicated within the same geographic area but funded by other sources).

Is the project suitable for replication? If so, has the project approach been replicated? If no effects are identified, the evaluation will describe the strategy / approach adopted by the projected to promote replication effects.

D. Stakeholder participation / public awareness

This consists of three related and often overlapping processes: information dissemination, consultation, and "stakeholder" participation. Stakeholders are the individuals, groups, institutions, or other bodies that have an interest or stake in the outcome of the GEF- financed project. The term also applies to those potentially adversely affected by a project. The evaluation will specifically:

- Assess the mechanisms put in place by the project for identification and engagement of stakeholders in each participating country and establish, in consultation with the stakeholders, whether this mechanism was successful, and identify its strengths and weaknesses.
- Assess the degree and effectiveness of collaboration/interactions between the various project partners and institutions during the course of implementation of the project.
- Assess the degree and effectiveness of any various public awareness activities that were undertaken during the course of implementation of the project.

E. Country ownership / driven-ness

This is the relevance of the project to national development and environmental agendas, recipient country commitment, and regional and international agreements. The evaluation will:

- Assess the level of country ownership. Specifically, the evaluator should assess whether the project was effective in providing and communicating information that catalyzed action in participating countries to adopt the use of clean solar and wind technologies.
- Assess the level of country commitment to the adoption of solar and wind technologies and facilitating investments in large-scale use of solar and wind energy technologies.

F. Achievement of outputs and activities

- Delivered outputs: Assessment of the project's success in producing each of the programmed outputs, both in quantity and quality as well as usefulness and timeliness.
- Assess the soundness and effectiveness of the methodologies used for developing the technical documents and related management options in the participating countries
- Assess to what extent the project outputs produced have the weight of scientific authority / credibility, necessary to influence policy and decision-makers, particularly at the national level.

G. Preparation and Readiness

Were the project's objectives and components clear, practicable and feasible within its timeframe? Were the capacities of executing institution and counterparts properly considered when the project was designed? Were lessons from other relevant projects properly incorporated in the project design? Were the partnership arrangements properly identified and the roles and responsibilities negotiated prior to project implementation? Were counterpart resources (funding, staff, and facilities), enabling legislation, and adequate project management arrangements in place?

H. Assessment monitoring and evaluation systems

The evaluation shall include an assessment of the quality, application and effectiveness of project monitoring and evaluation plans and tools, including an assessment of risk management based on the assumptions and risks identified in the project document. The Terminal Evaluation will assess whether the project met the minimum requirements for 'project design of M&E' and 'the application of the Project M&E plan'. GEF projects must budget adequately for execution of the M&E plan, and provide adequate resources during implementation of the M&E plan. Project managers are also expected to use the information generated by the M&E system during project implementation to adapt and improve the project.

I. Implementation approach

This includes an analysis of the project's management framework, adaptation to changing conditions (adaptive management), partnerships in implementation arrangements, changes in project design, and overall project management. The evaluation will:

- Ascertain to what extent the project implementation mechanisms outlined in the project document have been closely followed. In particular, assess the role of the various committees established and whether the project document was clear and realistic to enable effective and efficient implementation, whether the project was executed according to the plan and how well the management was able to adapt to changes during the life of the project to enable the implementation of the project.
- Assess the extent to which the project responded the midterm review / evaluation (if any).
- Evaluate the effectiveness and efficiency and adaptability of project management and the supervision of project activities / project execution arrangements at all levels (1) policy decisions: Steering Group; (2) day to day project management in each of the country executing agencies.
- Identify administrative, operational and/or technical problems and constraints that influenced the effective implementation of the project.

M&E during project implementation

- *M&E design.* Projects should have sound M&E plans to monitor results and track progress towards achieving project objectives. An M&E plan should include a baseline (including data, methodology, etc.), SMART indicators and data analysis systems, and evaluation studies at specific times to assess results. The time frame for various M&E activities and standards for outputs should have been specified.

  The evaluator should use the following questions to help assess the M&E design aspects:

  SMART-ness of Indicators

  - Are there specific indicators in the log frame for each of the project objectives and outcomes?
  - Are the indicators relevant to the objectives and outcomes?
  - Are the indicators for the objectives and outcomes sufficient?
  - Are the indicators quantifiable?

  Adequacy of Baseline Information

  - Is there baseline information?
  - Has the methodology for the baseline data collection been explained?
  - Is desired level of achievement for indicators based on a reasoned estimate of baseline?

  Arrangements for Monitoring of Implementation

  - Has a budget been allocated for M&E activities?
  - Have the responsibility centers for M&E activities been clearly defined?
  - Has the time frame for M&E activities been specified?

Arrangements for Evaluation

- Have specific targets been specified for project outputs?
- Has the desired level of achievement been specified for all Indicators of Objectives and Outcomes?

- *M&E plan implementation.* A Terminal Evaluation should verify that:
  - an M&E system was in place and facilitated timely tracking of results and progress towards projects objectives throughout the project implementation period (perhaps through use of a logframe or similar);
  - annual project reports and Progress Implementation Review (PIR) reports were complete, accurate and with well justified ratings;
  - that the information provided by the M&E system was used during the project to improve project performance and to adapt to changing needs;
  - and that projects had an M&E system in place with proper training for parties responsible for M&E activities.
- *Budgeting and Funding for M&E activities.* The terminal evaluation should determine whether support for M&E was budgeted adequately and was funded in a timely fashion during implementation.

J. Financial Planning

Evaluation of financial planning requires assessment of the quality and effectiveness of financial planning and control of financial resources throughout the project's lifetime. Evaluation includes actual project costs by activities compared to budget (variances), financial management (including disbursement issues), and co- financing. The evaluation should:

- Assess the strength and utility of financial controls, including reporting, and planning to allow the project management to make informed decisions regarding the budget and allow for a proper and timely flow of funds for the payment of satisfactory project deliverables.
- Present the major findings from the financial audit if one has been conducted.
- Identify and verify the sources of co- financing as well as leveraged and associated financing (in co-operation with the IA and EA).
- Assess whether the project has applied appropriate standards of due diligence in the management of funds and financial audits.
- The evaluation should also include a breakdown of final actual costs and co-financing for the project prepared in consultation with the relevant UNEP Fund Management Officer of the project.

K. UNEP Supervision and Backstopping

The purpose of supervision is to work with the executing agency in identifying and dealing with problems which arise during implementation of the project itself. Such problems may be related to project management but may also involve technical/substantive issues in which UNEP has a major contribution to make. The evaluator should assess the effectiveness of supervision and administrative and financial support provided by UNEP/DGEF including:

(i) the adequacy of project supervision plans, inputs and processes;
(ii) the emphasis given to outcome monitoring (results-based project management);
(iii) the realism / candor of project reporting and rating (i.e. are PIR ratings an accurate reflection of the project realities and risks);
(iv) the quality of documentation of project supervision activities; and
(v) financial, administrative and other fiduciary aspects of project implementation supervision.

In summary, accountability and implementation support through technical assistance and problem solving are the main elements of project supervision.

L. Complementarity with UNEP Medium Term Strategy and Programme of Work

UNEP aims to undertake GEF funded projects that are aligned with its strategy. Whilst it is recognised that UNEP GEF projects designed prior to the production of the UNEP Medium Term Strategy (MTS)[63] / Programme of Work (POW) 2010/11 would not necessarily be aligned with the Expected Accomplishments articulated in those documents, complementarity may exist nevertheless. For this reason, the complementarity of GEF projects with UNEP's MTS / POW will not be formally rated, however, the evaluation should present a brief narrative to cover the following issues:

Linkage to UNEP's Expected Accomplishments. The UNEP Medium Term Strategy specifies desired results in six thematic focal areas. The desired results are termed Expected Accomplishments. Using the completed ROtI analysis, the evaluation should comment on whether the project makes a tangible contribution to any of the Expected Accomplishments specified in the UNEP MTS. The magnitude and extent any contributions, and the causal linkages should be fully described.

Project contributions that are in-line with the Bali Strategic Plan (BSP)[64]. The outcomes and achievements of the project should be briefly discussed in relation to the objectives of the UNEP BSP.

South-South Cooperation is regarded as the exchange of resources, technology, and knowledge between developing countries. Briefly describe any aspects of the project that could be considered as examples of South-South Cooperation.

The ***ratings for the parameters A - K will be presented in the form of a table***. Each of the eleven categories should be rated separately with **brief justifications** based on the findings of the main analysis. An overall rating for the project should also be given. The following rating system is to be applied:

HS = Highly Satisfactory
S = Satisfactory
MS = Moderately Satisfactory
MU = Moderately Unsatisfactory
U = Unsatisfactory
HU = Highly Unsatisfactory

[63] http://www.unep.org/PDF/FinalMTSGCSS-X-8.pdf
[64] http://www.unep.org/GC/GC23/documents/GC23-6-add-1.pdf

4. Evaluation report format and review procedures

The report should be brief, to the point and easy to understand. It must explain; the purpose of the evaluation, exactly what was evaluated and the methods used. The report must highlight any methodological limitations, identify key concerns and present evidence-based findings, consequent conclusions, recommendations and lessons. The report should be presented in a way that makes the information accessible and comprehensible and include an executive summary that encapsulates the essence of the information contained in the report to facilitate dissemination and distillation of lessons.

The evaluation will rate the overall implementation success of the project and provide individual ratings of the eleven implementation aspects as described in Section 1 of this TOR. ***The ratings will be presented in the format of a table*** with brief justifications based on the findings of the main analysis.

Evidence, findings, conclusions and recommendations should be presented in a complete and balanced manner. Any dissident views in response to evaluation findings will be appended in an annex. The evaluation report shall be written in English, be of no more than 50 pages (excluding annexes), use numbered paragraphs and include:

i) An **executive summary** (no more than 3 pages) providing a brief overview of the main conclusions and recommendations of the evaluation;

ii) **Introduction and background** giving a brief overview of the evaluated project, for example, the objective and status of activities; The GEF Monitoring and Evaluation Policy, 2006, requires that a TE report will provide summary information on when the evaluation took place; places visited; who was involved; the key questions; and, the methodology.

iii) **Scope, objective and methods** presenting the evaluation's purpose, the evaluation criteria used and questions to be addressed;

iv) **Project Performance and Impact** providing *factual evidence* relevant to the questions asked by the evaluator and interpretations of such evidence. This is the main substantive section of the report. The evaluator should provide a commentary and analysis on all eleven evaluation aspects (A − K above).

v) **Conclusions and rating** of project implementation success giving the evaluator's concluding assessments and ratings of the project against given evaluation criteria and standards of performance. The conclusions should provide answers to questions about whether the project is considered good or bad, and whether the results are considered positive or negative. The ratings should be provided with a brief narrative comment in a table;

vi) **Lessons (to be) learned** presenting general conclusions from the standpoint of the design and implementation of the project, based on good practices and successes or problems and mistakes. Lessons should have the potential for wider application and use. All lessons should 'stand alone' and should:

- Briefly describe the context from which they are derived
- State or imply some prescriptive action;
- Specify the contexts in which they may be applied (if possible, who when and where)

vii) **Recommendations** suggesting *actionable* proposals for improvement of the current project. In general, Terminal Evaluations are likely to have very few (perhaps two or three) actionable recommendations.

Prior to each recommendation, the issue(s) or problem(s) to be addressed by the recommendation should be clearly stated.

A high quality recommendation is an actionable proposal that is:

1. Feasible to implement within the timeframe and resources available
2. Commensurate with the available capacities of project team and partners
3. Specific in terms of who would do what and when
4. Contains results-based language (i.e. a measurable performance target)
5. Includes a trade-off analysis, when its implementation may require utilizing significant resources that would otherwise be used for other project purposes.

viii) **Annexes** may include additional material deemed relevant by the evaluator but must include:

1. The Evaluation Terms of Reference,
2. A list of interviewees, and evaluation timeline
3. A list of documents reviewed / consulted
4. Summary co-finance information and a statement of project expenditure by activity
5. Details of the project's 'impact pathways' and the 'ROtI' analysis
6. The expertise of the evaluation team (brief CV).

TE reports will also include any response/comments from the project management team and/or the country focal point regarding the evaluation findings or conclusions as an annex to the report, however, such will be appended to the report by UNEP Evaluation Office.

Examples of UNEP GEF Terminal Evaluation Reports are available at www.unep.org/eou

Review of the Draft Evaluation Report

Draft reports shall be submitted to the Chief of Evaluation. The Chief of Evaluation will share the report with the corresponding Programme or Project Officer and his or her supervisor for initial review and consultation. The DGEF staff and senior Executing Agency staff are allowed to comment on the draft evaluation report. They may provide feedback on any errors of fact and may highlight the significance of such errors in any conclusions. Where, possible, a consultation is held between the evaluator, Evaluation Office Staff, the Task Manager and key members of the project execution team. The consultation seeks feedback on the proposed recommendations and lessons. UNEP Evaluation Office collates all review comments and provides them to the evaluator(s) for their consideration in preparing the final version of the report.

5. Submission of Final Terminal Evaluation Reports.

The final report shall be submitted in electronic form in MS Word format and should be sent to the following persons:

Segbedzi Norgbey, Chief,

UNEP Evaluation Office, P.O. Box 30552-00100, Nairobi, Kenya

Tel.: (254-20) 7623387; Fax: (254-20) 7623158

Email: segbedzi.norgbey@unep.org

The Chief of Evaluation will share the report with the following individuals:

Mark Radka, Head of Energy Branch,

UNEP/DTIE, 15, rue de Milan, 75441 Paris Cedex 09, France

Tel: + 33 1 44 37 14 27; Fax: + 33 1 44 37 14 74

Email: mark.radka@unep.org

Edu Hassing, Task Manager

UNEP/DGEF, 15, rue de Milan, 75441 Paris Cedex 09, France

Tel: + 33 1 4437 1472

E-mail: edu.hassing@unep.org

The final evaluation report will be published on the Evaluation Office web-site www.unep.org/eou and may be printed in hard copy. Subsequently, the report will be sent to the GEF Office of Evaluation for their review, appraisal and inclusion on the GEF website.

6. Resources and schedule of the evaluation

This Terminal Evaluation will be undertaken by an evaluation team composed of a Lead Evaluator (LE) and Associate Evaluator (AE) contracted by the UNEP Evaluation Office. The LE will assess project performance in Ghana, Kenya, and China and meet with the PMO in France, and be responsible for coordinating and leading the review process and prepare the final evaluation report covering the ToR. The AE will assess project performance in Cuba, Brazil and El Salvador and produce a report to be incorporated in the main report, and also annexed.

The contract for the Lead Evaluator will begin on 10th of May 2010 and end on 20th of July (50 days spread over 12 weeks) including 31 days of desk study (9 days for review and preparations, 12 days for writing the draft report and 10 days for finalizing the report) and 19 days of travel (3 days in

Ghana and 4 days in Kenya, France and China respectively, in addition 4 days will be reserved for international travel).

The contract for the Associate Evaluator will begin on 10th of May 2010 and end on 30th of June 2010 (40 days spread over 10 weeks) including 24 days of desk study (8 days for review and preparations, 10 days for writing the draft report and 6 days for finalizing the report) and 16 days for travel (2 days in France, 4 days in Brazil, 3 days in Cuba and 3 days in El Salvador, in addition 4 days will be reserved for international travel).

The AE will submit the draft report to UNEP/EO and LE by 7th of June. The LE will collate the draft reports into one coherent draft report and submit it to UNEP/Evaluation Office by 21st of June. The Chief Evaluation Office will share the draft report with the UNEP/DGEF Task Manager, EATTA/AfDB and key representatives of the executing agencies. Any comments or responses to the draft report will be sent to UNEP / Evaluation Office for collation and the LE will be advised of any necessary revisions. Comments to the final draft report will be sent to the consultant by 5th July 2010 after which, the consultant will submit the final report no later than 20th July 2010.

The evaluators will after an initial briefing with UNEP/Evaluation Office, conduct desk review work and later travel to respective countries to meet with the national partners, including the executing agencies, steering Committee, and the intended users of project's outputs.

In accordance with the evaluation policies of UNEP and the GEF, all GEF projects are evaluated by independently contracted evaluators.

The evaluators should have the following qualifications:

The evaluator should not have been associated with the design and implementation of the project in a paid capacity. The evaluator will work under the overall supervision of the Chief, Evaluation Office, UNEP. The evaluator should be an international expert in renewable energy technology, specifically in solar and wind power issues. The evaluator should have the following minimum qualifications: (i) experience in energy efficiency and environmental management; (ii) experience in solar and wind energy resource assessment; (iii) experience in management and implementation of development projects in developing countries (iv) experience with project evaluation. Knowledge of UNEP programmes and GEF activities is desirable. Fluency in oral and written English is a must.

ANNEX C: ABRIDGED CV OF THE EVALUATOR

FULL NAME: **Abeeku BREW-HAMMOND**

PROFESSION: Energy Technology and Policy Expert/ Mechanical Engineer
GENDER: Male
DATE OF BIRTH: 9 February 1955
NATIONALITY: Ghanaian
CELLPHONES: +233-246-590698 / +44-7963-732955
E-MAIL: abeeku@brewhammond.com

PROFILE

Abeeku Brew-Hammond is an Associate Professor and Director of The Energy Center, KNUST, a multi-disciplinary energy technology and policy research unit in the College of Engineering at Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. Abeeku also serves as Board Chairman for the Energy Commission of Ghana. From September 2004 to June 2006, he was based in the UK where he served as Manager of the Technical Secretariat of Global Village Energy Partnership (GVEP). Abeeku previously founded and served as the Director of KITE, a Ghana-based NGO with a regional outlook specializing in energy policy analysis, project development and knowledge management.

HIGHER EDUCATION

- University of Sussex - SPRU, Brighton, UK, **DPhil** (Science and Technology Policy), 1998
- McGill University, Montreal, Canada, **MEng** (Energy Conversion), 1984
- KNUST, Kumasi, Ghana, BSc (Mechanical Engineering), **First Class Honours**, 1977

EMPLOYMENT RECORD

- Director / Acting Director, The Energy Center, KNUST, Kumasi, Ghana, October 2009 to date (unofficially from October 2006 to September 2009)

- Dean, Faculty of Mechanical and Agricultural Engineering, KNUST, Kumasi, Ghana, August 2007 – September 2009

- Manager, Global Village Energy Partnership (GVEP) Technical Secretariat, Intermediate Technology Development Group / Practical Action, Rugby, England, September 2004 – June 2006 (on leave of absence from KNUST)

- Head, Department of Mechanical Engineering, KNUST, Kumasi, Ghana, October 2002 – August 2004

- Director, Kumasi Institute of Technology and Environment (KITE), Kumasi and Accra, Ghana, March 1998 – August 2004, part-time (full-time from October 2000 to September 2001 on leave of absence from KNUST)

- Various University Teaching Positions, KNUST, February 1980 to date
    - Associate Professor (promoted October 1998)
    - Senior lecturer (promoted October 1987)
    - Lecturer (promoted July 1981)
    - Assistant Lecturer (appointed February 1980)

- Anglophone West African Coordinator, International Young Catholic Students (IYCS) Movement, Kumasi (based in Ghana, responsible for Nigeria/Ghana/Liberia/Sierra Leone/The Gambia), September 1978 – January 1980

- National Organiser, Ghana Young Christian Students (YCS) Movement, Kumasi, August 1977 – September 1978

RECENT CONSULTANCY AND TRAINING PROJECTS

Served as Main Consultant / Project Director from 2007 to date for the following:

1. Solar Capacity Upgrading Project (SolarCUP) supported by the **World Bank** with grant financing of over US$500,000;
2. Renewable Energy Education Project (REEP) with close to €500,000 worth of funding from the EDULink Programme of the **European Union**;
3. GIS-based Support for Implementing Policies and Plans to Increase Access to Energy Services in Ghana, with funding to the tune of €180,000 from the **European Union Energy Initiative Partnership Dialogue Facility (EUEI-PDF)**;
4. Reversing the Brain Drain into a Brain Gain Project, supported by **UNESCO** and Hewlett Packard involving the establishment of grid-computing facilities to support renewable energy research between KNUST faculties and their counterparts in the Diaspora; and
5. Preparation of a "Guidebook on Modern Bioenergy Conversion Technologies in Africa" and paper on "Renewable Energy Technology, Capacity and R&D in Africa", both assignments undertaken for **UNIDO**.

SELECTED JOURNAL ARTICLES AND BOOKS/BOOK CHAPTERS

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7. Brew-Hammond, A., 2010, "Energy Access in Africa: Challenges Ahead", **Energy Policy (an Elsevier Journal)**, Volume 38, pp. 2291–2301.
8. Brew-Hammond, A. and E.N. Kumi, 2009, "Analysis of a Grid-Connected Solar PV System in Ghana using RETScreen Software", **Journal of the Ghana Institution of Engineers**, Volumes 6 & 7, pp. 21 - 24.
9. Brew-Hammond, A. and F. Kemausuor, "Energy for All in Africa - To Be or Not to Be?!" 2009, **Current Opinion in Environmental Sustainability (an Elsevier Journal)**, Volume 1, pp. 83 – 88.
10. Obeng, G. Y., H-D. Evers, F.O. Akuffo, I. Braimah, A. Brew-Hammond, 2008, "Solar photovoltaic electrification and rural energy-poverty in Ghana", **Energy for Sustainable**

Development (Journal of International Energy Initiative), Volume XII No. No. 1, pp. 19 - 30.

11. Brew-Hammond, A. and F. Kemausuor (Eds), 2008, "Renewable Energy for Rural Areas in Africa - The Enterprise Development Approach", **Kwame Nkrumah University of Science and Technology (KNUST) University Press,** Kumasi, Ghana.
12. Tsikata, F. S., A. Brew-Hammond and Y. B. Osafo, 2008, "Increasing Access to Clean Energy in Africa: Challenges and Initiatives". In: Zillman, D. N., C. Redgwell, Y. O. Omorogbe and L. Barrera-Hernandez, "Moving Beyond Carbon: Energy Law in Transition", **Oxford University Press**, pp. 163 - 179.
13. Wamukonya, N., Davidson, O., Brew-Hammond, A., 2007. Réformes du secteur de l'énergie électrique en Afrique subsaharienne: principales leçons et priorités. **Liaison Energie Francophone - Journal of Institut de l'énergie et de l'environnement de la francophonie (IEPF)**, 73 (4), 39 – 44.
14. Derzu, D., H Mensah-Brown and A. Brew-Hammond, 2004, "Wood Waste Cogeneration in Kumasi, Ghana", In: S. Silveira (Ed), "**Bioenergy – Realizing the Potential**", pp. 213 – 219.
15. Edjekumhene, I., M. B. Amadu and A. Brew-Hammond, 2003, "Power Sector Reform in Ghana in the 1990s: The Untold Story of a Divided Country versus a Divided Bank", **KITE Publication**, Kumasi, Ghana.

OTHER PUBLICATIONS

1. Bazilian, M., M. Welsch, D. Divan, D. Elzinga, G. Strbac, M. Howells, L. Jones, A. Keane, D. Gielen, V. S. K. M. Balijepalli, A. Brew-Hammond, and K. Yumkella, 2011, "Smart and Just Grids: Opportunities for sub-Saharan Africa", **Mimeo, The Energy Futures Lab, Imperial College London (available at http://www3.imperial.ac.uk/energyfutureslab).**
2. Brew-Hammond, A., L. Darkwah, G. Obeng and F. Kemausuor, 2008, "Renewable Energy Technology, Capacity and R&D in Africa", International Conference on Renewable Energy in Africa jointly organised by the Government of Senegal, the African Union, German Federal Ministry of Economic Cooperation and Development (BMZ) and the United Nations Industrial Development Organisation (UNIDO), Dakar, Senegal, **Report prepared for UNIDO, Vienna**.
3. Brew-Hammond, A. and T. Osei-Tutu, 2008, "Les Modules de Financement de Services Energétiques Individuels et Collectifs {English translation: Financing Models for Household and Community Energy Services}", (Mainstreaming Energy for Poverty Reduction and Economic Development (MEPRD). **Report prepared for Ministry of Mines, Employment and Energy, Burkina Faso**.
4. Brew-Hammond, A., L. Darkwah, E. Ramde, F. Kemausuor and A. Addo, 2007, "Biofuels Industry Development in Africa", **AU/Brazil/UNIDO High Level Seminar on Biofuels in Africa**, Addis Ababa, Ethiopia, **Report prepared for the African Uniion**.
5. Brew-Hammond, A., S. Häusler and M. A. Dahuenon, 2006, Study on the Regional Agency for Energy Access, **Report prepared for Economic Community of West African States (ECOWAS), Abuja, Nigeria**.
6. Brew-Hammond, A. and A. Crole-Rees, 2004, "Reducing Rural Poverty through Increased Access to Energy Services: A Review of the Multifunctional Platform Project in Mali", **Report prepared for United Nations Development Programme (UNDP), Bamako, Mali**.

7. Green, J., J. Mariyappan, J. Plastow, H. Mensah-Brown, S. Agbey and A. Brew-Hammond, 2002, “Bundling Small Scale CDM Projects”, **Report prepared for the UK Foreign and Commonwealth Office Climate Change Challenge Fund, IT Power (UK) and KITE (Ghana)**.
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ANNEX D: STAKEHOLDERS INTERVIEWED DURING EVALUATION

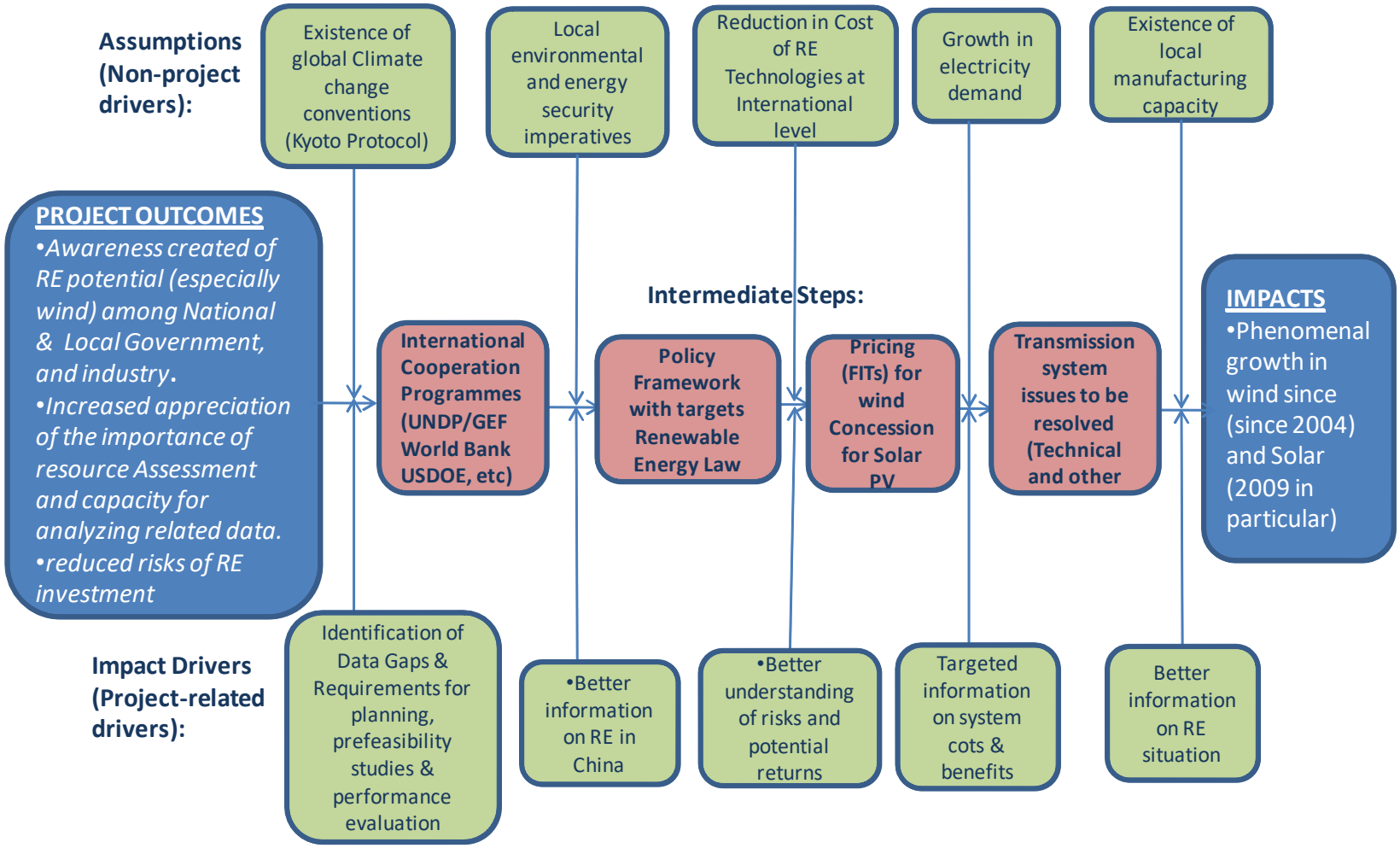
	Contact Person
China	
Country Project Manager	Ma Lingjuan
National Development and Reconstruction Commission	Wang Zhongying
China Electric Power Research Institute	Mr Feng Shuanglei
HydroChina	Shi Pengfei
Solar Energy Consultant	Wang Sicheng
Chinese Renewable Energy Industries Association	Li Junfeng
Denmark	
Risoe National Laboratory	Jake Badger
France	
UNEP Paris Office	Mr Mark Radka and Mr Daniel Puig
Ghana	
Country Project Manager	Mr Kwabena Otu-Danquah
Ministry of Energy (Government Agency)	Mr Wisdom Ahiataku-Togobo
Kwame Nkrumah University of Science and Technology	Prof Fred Ohene Akuffo
NEK (Private Company)	Mr Michael Wuddah-Martey

India	
The Energy and Resources Institute	Mr Amit Kumar, Dr Akanksha Chaurey and Mr K Rajagopal
Kenya	
Country Project Manager	Mr Daniel Theuri
Ministry of Energy	Mr Patrick Nyoike and Eng Khazenzi
Green Energy Task Force (Office of the Prime Minister)	Peter Odhengo
KenGen (Power Generation Company)	David Muthike
Lake Turkana Wind Company	Christopher Staubo
Nepal	
Alternative Energy Promotion Centre	Dr Narayan Prasad Chaulagain, Mr Surya Kumar Sapkota and Ms Aruna Awale
Center for Energy Studies, Tribhuvan University	Dr Tri Ratna Bajracharya and Nawraj Bhattarai
Mirlung Electronics Pvt Ltd	Mr Amrit Sing Thapa
Solar Electric Manufacturers Association	Mr Nabin Bhujel and
Lotus Energy (Solar products Company)	Mr Kiran Pradhan and Mr Khem Raj Bhandari
Practical Action Nepal	Mr Shirish Singh and Mr Pushkar Manandhar

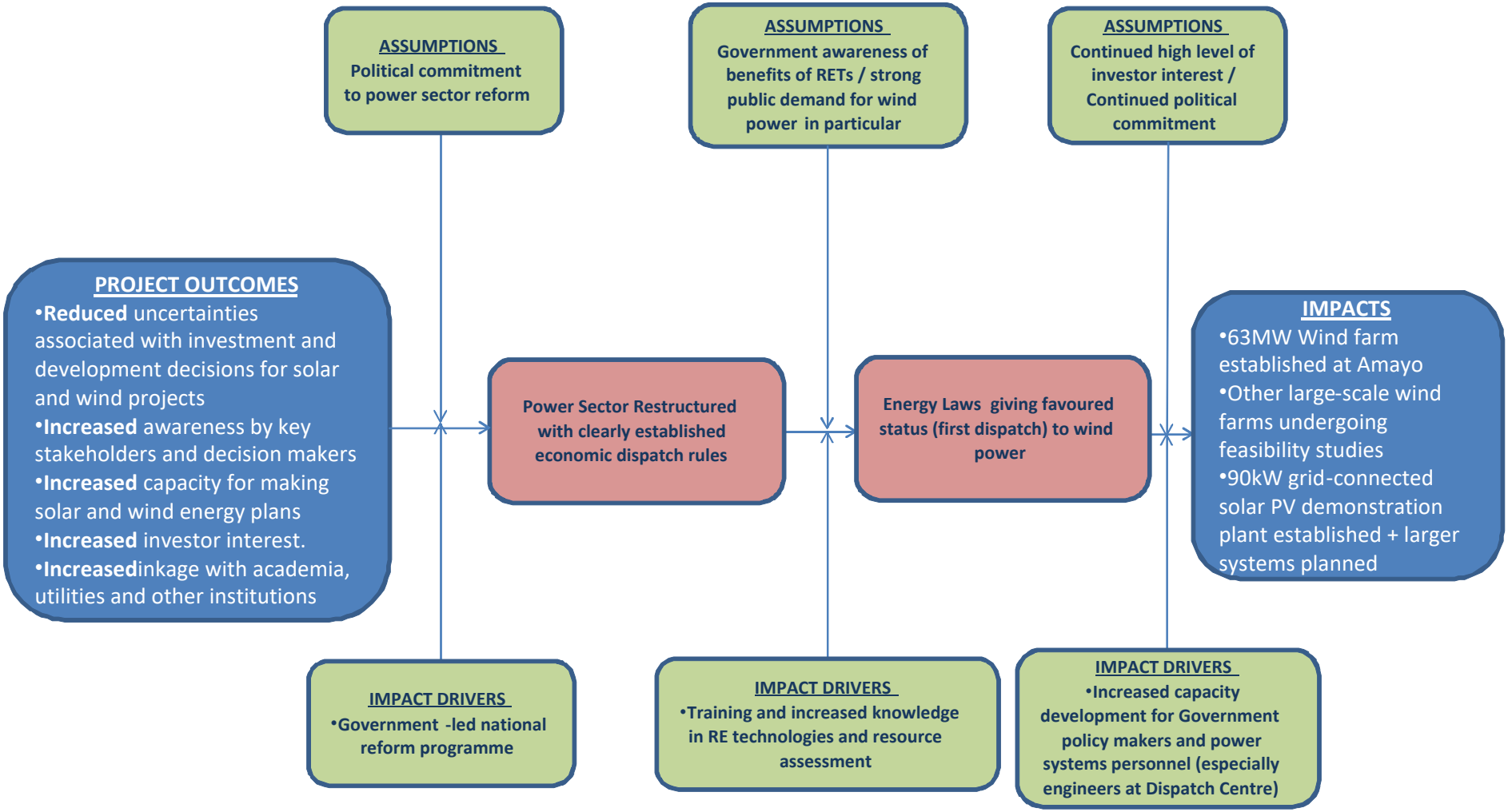
Nicaragua	
Country Project Manager	Ms Gioconda Guevara Alvarez
Ministry of Energy and Mines	Mr Ivan Cortés, Ms Aracely Hernández, Mr Martin Yllescas and Mr Juan Eliezer Blandon
Catholic University of Central America	Fr Julio, Mr Claudio Wheelock and Mr Sergio Torres
Amayo Wind Power Company	Mr Manuel Callejas and Mr Nestor Gómez
Meso America Energy (Wind Power Company)	Mr Marco Amador, Mr Alejo Carazo Cano and Mr Bismark Castro Blandon

ANNEX E: ROTI DIAGRAMS FOR SELECTED COUNTRIES

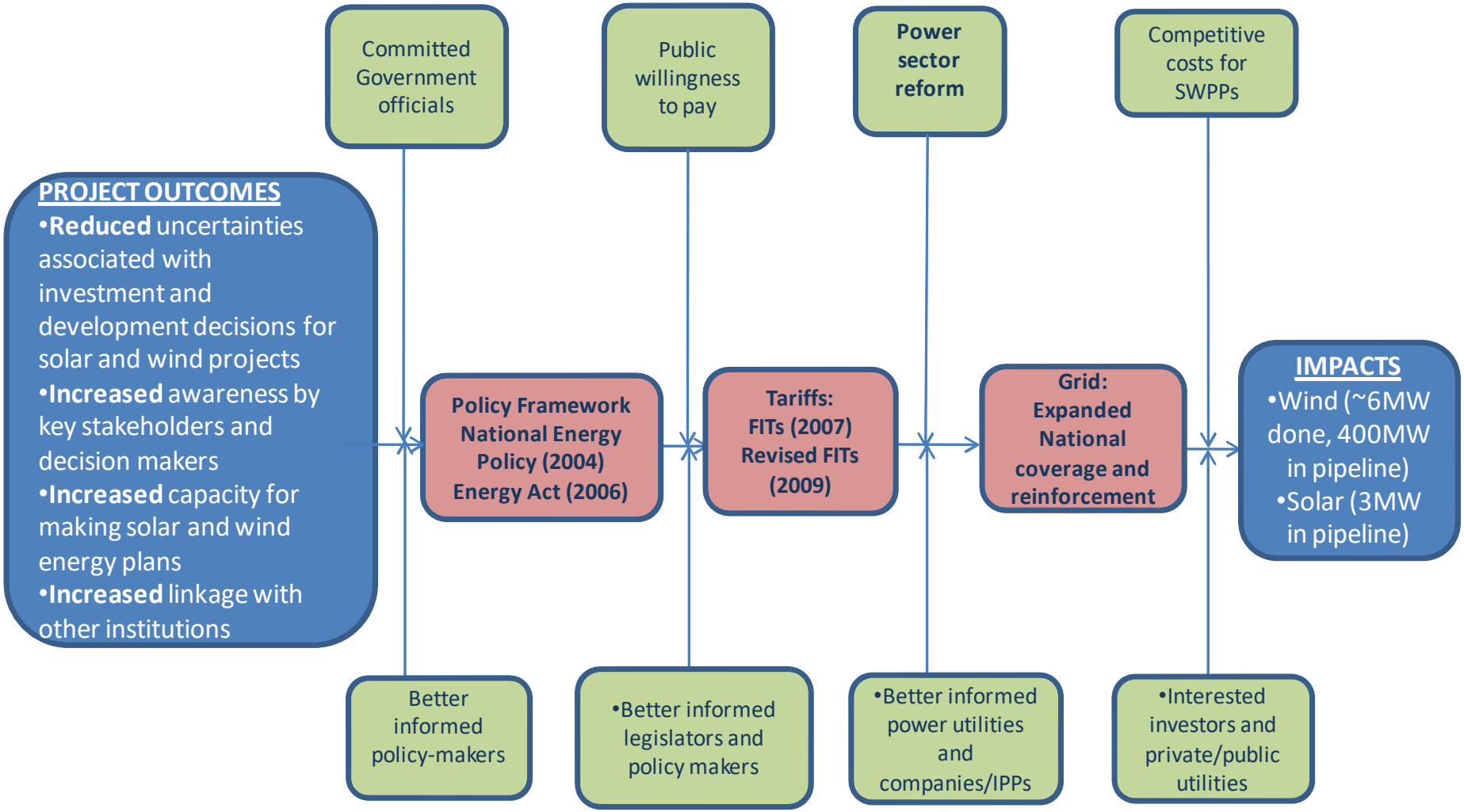
China



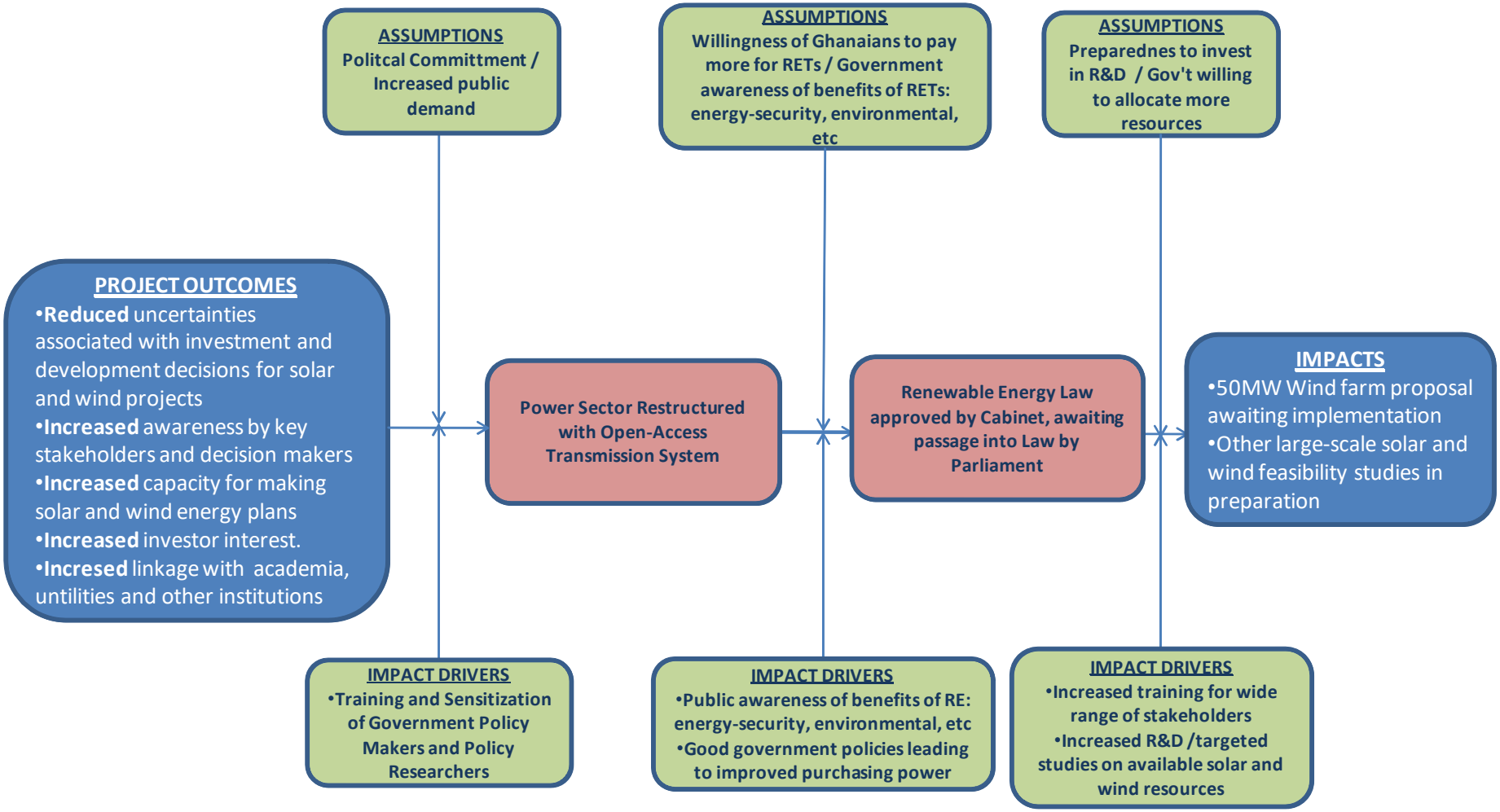
Nicaragua


ASSUMPTIONS
Political commitment to power sector reform
ASSUMPTIONS
Government awareness of benefits of RETs / strong public demand for wind power in particular
ASSUMPTIONS
Continued high level of investor interest / Continued political commitment
PROJECT OUTCOMES
•Reduced uncertainties associated with investment and development decisions for solar and wind projects
•Increased awareness by key stakeholders and decision makers
•Increased capacity for making solar and wind energy plans
•Increased investor interest.
•Increasedinkage with academia, utilities and other institutions
Power Sector Restructured with clearly established economic dispatch rules
Energy Laws giving favoured status (first dispatch) to wind power
IMPACTS
•63MW Wind farm established at Amayo
•Other large-scale wind farms undergoing feasibility studies
•90kW grid-connected solar PV demonstration plant established + larger systems planned
IMPACT DRIVERS
•Government -led national reform programme
IMPACT DRIVERS
•Training and increased knowledge in RE technologies and resource assessment
IMPACT DRIVERS
•Increased capacity development for Government policy makers and power systems personnel (especially engineers at Dispatch Centre)

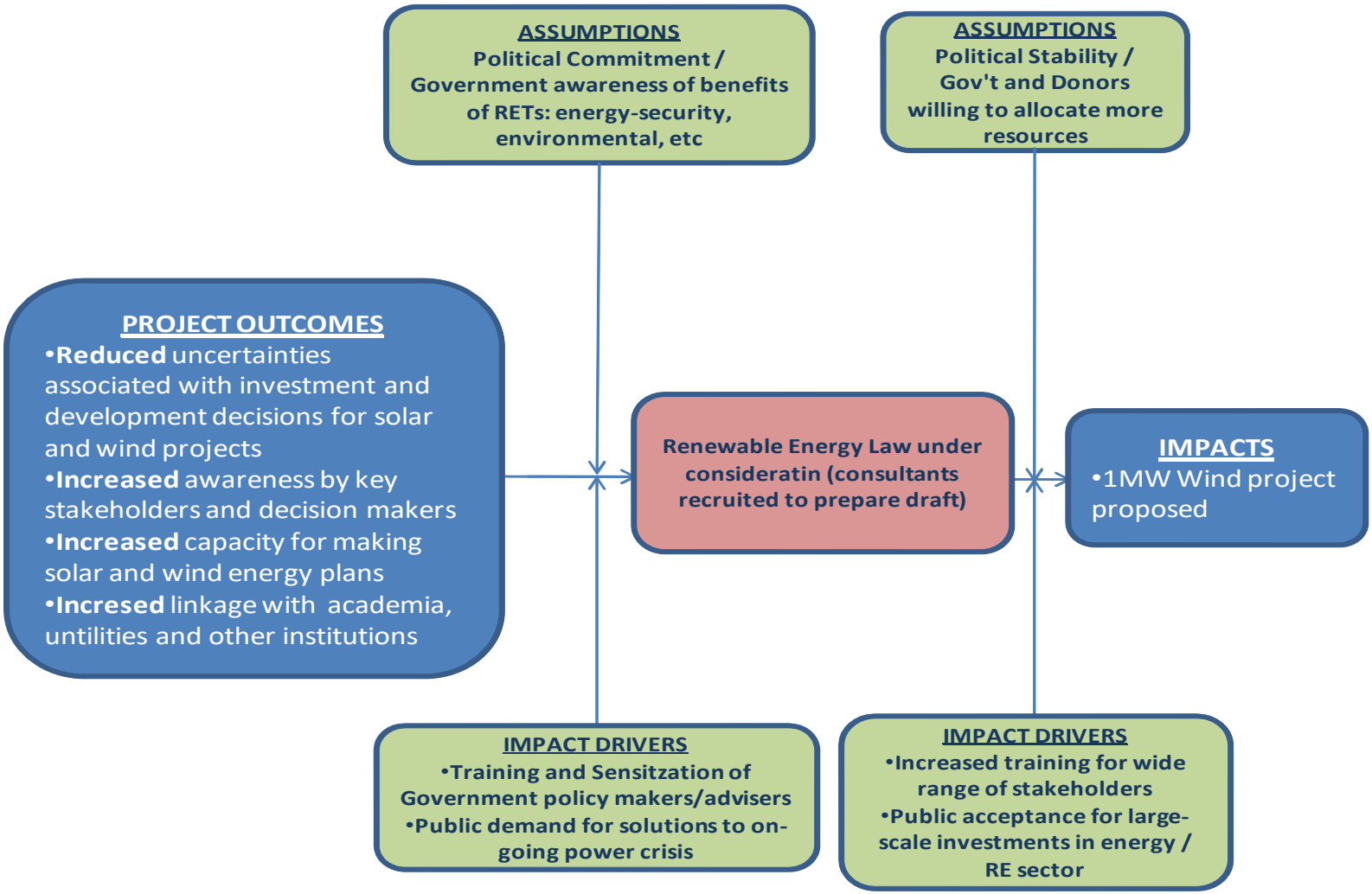
Kenya


Committed Government officials
Public willingness to pay
Power sector reform
Competitive costs for SWPPs
PROJECT OUTCOMES
•Reduced uncertainties associated with investment and development decisions for solar and wind projects
•Increased awareness by key stakeholders and decision makers
•Increased capacity for making solar and wind energy plans
•Increased linkage with other institutions
Policy Framework National Energy Policy (2004) Energy Act (2006)
Tariffs: FITs (2007) Revised FITs (2009)
Grid: Expanded National coverage and reinforcement
IMPACTS
•Wind (~6MW done, 400MW in pipeline)
•Solar (3MW in pipeline)
Better informed policy-makers
•Better informed legislators and policy makers
•Better informed power utilities and companies/IPPs
•Interested investors and private/public utilities

Ghana


ASSUMPTIONS
Politcal Committment / Increased public demand
ASSUMPTIONS
Willingness of Ghanaians to pay more for RETs / Government awareness of benefits of RETs: energy-security, environmental, etc
ASSUMPTIONS
Preparednes to invest in R&D / Gov't willing to allocate more resources
PROJECT OUTCOMES
•Reduced uncertainties associated with investment and development decisions for solar and wind projects
•Increased awareness by key stakeholders and decision makers
•Increased capacity for making solar and wind energy plans
•Increased investor interest.
•Incresed linkage with academia, untilities and other institutions
Power Sector Restructured with Open-Access Transmission System
Renewable Energy Law approved by Cabinet, awaiting passage into Law by Parliament
IMPACTS
•50MW Wind farm proposal awaiting implementation
•Other large-scale solar and wind feasibility studies in preparation
IMPACT DRIVERS
•Training and Sensitization of Government Policy Makers and Policy Researchers
IMPACT DRIVERS
•Public awareness of benefits of RE: energy-security, environmental, etc
•Good government policies leading to improved purchasing power
IMPACT DRIVERS
•Increased training for wide range of stakeholders
•Increased R&D /targeted studies on available solar and wind resources

Nepal


ASSUMPTIONS
Political Commitment / Government awareness of benefits of RETs: energy-security, environmental, etc
ASSUMPTIONS
Political Stability / Gov't and Donors willing to allocate more resources
PROJECT OUTCOMES
•Reduced uncertainties associated with investment and development decisions for solar and wind projects
•Increased awareness by key stakeholders and decision makers
•Increased capacity for making solar and wind energy plans
•Incresed linkage with academia, untilities and other institutions
Renewable Energy Law under consideratin (consultants recruited to prepare draft)
IMPACTS
•1MW Wind project proposed
IMPACT DRIVERS
•Training and Sensitzation of Government policy makers/advisers
•Public demand for solutions to on-going power crisis
IMPACT DRIVERS
•Increased training for wide range of stakeholders
•Public acceptance for large-scale investments in energy / RE sector