Terminal Evaluation Report

'Promoting the Use of Electric Pumps for Irrigation in Sudan'

Terminal Evaluation Timeframe	June 2022 to October 2022
Project Implementation Timeframe	February 2016 to May 2022
GEF Project ID:	5673
UNDP PIMS Project ID:	5324
Country:	Sudan
Region:	Africa
Focal Area:	Climate Change
FA Objectives, (OP/SP):	CCM-3, Promote investment in renewable energy technologies
Executing Agency:	Ministry of Water Resources Irrigation and Electricity (Currently Ministry of Energy and Petroleum)
Other Partners involved:	Ministry of Finance and National Economy, Ministry of International Cooperation, Ministry of Petroleum and Gas, Ministry of Agriculture and Forestry, National Energy Research Centre, Ministry of Environment, Forestry and Physical Development, Higher Council for Environment and Natural Resources, Ministry of Agriculture Animal Resources & Irrigation - Northern State, Central Bank of Sudan.

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Disclaimer

The analysis and recommendations of this report do not necessarily reflect the views of the United Nations Development Programme, its Executive Board, or the United Nations Member States. This publication reflects the views of its author.

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LIST OF ACRONYMS

AfDB	African Development Bank
CO	UNDP Country Office
CO_2	Carbon dioxide
CSP	Concentrating Solar Power
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
ha	Hectare, a unit of measure of land area equal to 10,000 square meters
HCENR	Higher Council for Environment and Natural Resources
IEA	International Energy Agency
KOICA	The Korea International Cooperation Agency
M&E	Monitoring and Evaluation
MEFPD	Ministry of Environment, Forestry and Physical Development
MoP	Ministry of Petroleum
MoSC	Ministry of Science and Communications
MWRE	Ministry of Water Resources, Irrigation and Electricity
MFNE	Ministry of Finance and National Economy
MOAARI	Ministry of Agriculture Animal Resources & Irrigation - Northern State
MRV	Monitoring, Reporting and Verification
MW	Megawatt
NAMA	Nationally Appropriate Mitigation Action
NEC	National Electricity Corporation
NERC	National Energy Research Centre
NGO	Non-Governmental Organization
O&M	Operations & Maintenance
PIR	Project Implementation Review
PMU	Project Management Unit
PPG	Project Preparation Grant
PPP	Public Private Partnership
PB	Project Board
PV	Photovoltaic
QPR	Quarterly Progress Report
RCU	UNDP Regional Coordination Unit
RE	Renewable Energy
RTA	UNDP Region-Based Technical Advisor
SDG	Sudanese Pound
SWH	Solar water heater
TPR	Tripartite Review
TTR	Terminal Tripartite Review
TWh	Terawatt-hour
WB	World Bank
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

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EXECUTIVE SUMMARY

Project summary table

Table 1: Project Summary

Project Title:	**Promoting the use of electric water pumps for irrigation in Sudan**			
			at endorsement (USD)	*Realized at completion (USD)*
GEF Project ID:	5673	GEF financing:	4,365,753	3,041,417
UNDP PIMS Project ID:	5324	UNDP contribution:	550,000	0
Country:	Sudan	Government:	5,350,000	2,260,000
Region:	Africa	National Energy Research Centre	250,000	0
		Other partners, Sudanese Bank, ANAI, BFFC (private)	14,000,000	0
Focal Area:	Climate Change	Total co-financing	20,150,000	2,260,000
FA Objectives, (OP/SP):	CCM-3, Promote investment in renewable energy technologies	TOTAL PROJECT COST	24,515,753	5,301,417
Executing Agency:	Ministry of Water Resources Irrigation and Electricity (Currently Ministry of Energy and Petroleum)	GEF endorsement:	14.01.2016	
		ProDoc Signature (date project began)	28.02.2016	
Other Partners involved:	Ministry of Finance and National Economy, Ministry of International Cooperation, Ministry of Petroleum and Gas, Ministry of Agriculture and Forestry, National Energy Research Centre, Ministry of Environment, Forestry and Physical Development, Higher Council for Environment and Natural Resources, Ministry of Agriculture Animal Resources & Irrigation - Northern State, Central Bank of Sudan.	Closing date	28.02.2021 (Original Planned) 28.05.2022 (Actual)	

Introduction and brief description of the project

The project, 'Promoting the use of electric pumps for irrigation' has been implemented in Sudan. The project aimed to support the adoption of solar PV technology for water pumping for irrigation in agriculture in Sudan, particularly in the Northern State of the country.

The project aimed to help Sudan and Sudanese farmers reduce their reliance on fossil fuels, reduce their cost of production (via decreased diesel expenditures), increase the sustainability of water use, and increase their income. Given that agriculture is a main component of the economy in Sudan, the project aimed to help increase Sudan's energy security and decouple its GDP from fluctuations in fossil fuel prices and availability. The project has been designed to play a catalytic role in the transformational scaling up of solar power for productive use in Sudan's agricultural sector.

The project was to promote investment in Renewable Energy Technologies, leading to the avoidance of GHG emissions (due to the operation of diesel-operated irrigation pumps).

The project has been nationally executed by the Ministry of Water Resources, Irrigation and Electricity (Currently: Ministry of Energy and Petroleum), under the National Implementation Modality (NIM) of UNDP. According to the approved work plan for the project, UNDP was accountable for the disbursement of funds and achievement of the project goals.

As the project implementation has come to an end, 'Terminal Evaluation' of the project has been carried out to ascertain the outcomes and impact of the programme, measured against its original purpose, and objectives whilst in the process, capturing the evaluative evidence of the relevance, effectiveness, efficiency, and sustainability of the results of the project, which will set the stage for future similar initiatives. This is per the standard practice for all UNDP-GEF projects. The target audiences for the terminal evaluation are funding agencies, project partners and beneficiaries, GEF, UNDP CO at Sudan, UNDP at regional and HQ levels, and UNDP Evaluation Office. The broader defined objectives of the terminal evaluation are to compare planned outputs and outcomes of the project to actual outputs and outcomes and (if applicable) identify the causes and issues which contributed to the non-achievement of the desired results and targets of the project. One of the other objectives of the evaluation is to draw lessons that can both improve the sustainability of benefits from the project, and aid in the overall enhancement of UNDP programming.

The Terminal Evaluation has been carried out by a team of independent evaluators comprising an international consultant (Dinesh Aggarwal, India) and a National Consultant (Dr. Quosay A Ahmed). The evaluation has been carried out as per the provisions in the 'Guidance for Conducting Terminal Evaluations of UNDP-Supported, GEF-Financed Projects – 2020 ' (Guidance Document). This report provides the findings of the TE, a summary of which is given in this chapter of the report.

Project Objectives, Logical Frame Work and Achievements

The objective of the project was to replace diesel-based water pumps for irrigation, with solar photovoltaic (PV) powered pumps, using promotional activities. The project comprised four outcomes.

Under the first outcome, solar PV-based pumps were to be installed on a pilot basis to demonstrate the technology and to create a financing mechanism with subsidy. It was expected that the initial set of demonstration pumps, when supported by the subsidy would lead to the installation of additional solar PV pumps.

The second outcome of the project was aimed to reduce the risks associated with solar PV pumping by providing quality standards, testing and certification, training, and capacity building. The second outcome also included activities to increase the efficiency of water use, thereby increasing the overall sustainability of pumping practices and reducing the size (and therefore cost) of solar PV pumps.

The third outcome of the project was focused to develop a UNFCCC standardized baseline for solar PV water pumping and implement it within a NAMA to support the development of appropriate MRV protocol for solar pumping.

The fourth outcome of the project was to support the scaling-up and expansion of the project to other states in Sudan.

Table 2, below provides the Project Objectives along with the summary of the planned outcomes and outputs. It also shows the corresponding set of indicators for monitoring and verification of the achievements against the Objectives, the Outcomes, and the Outputs. The Terminal Evaluation of the project has been carried out keeping in mind the expected Outcomes and Outputs along with the activities which were proposed to be carried out.

Table 2 also provides the level of attainment of the targets (in terms of the indicators) and the rating for the level of achievement of the targets

Table 2: Project Results Framework (as per Project Document) and achievements at TE

	Indicator	Baseline	Targets	Status at TE	Rating at TE[1]
Project Objective: Financing and dissemination mechanism established and operational to support a PV pump installation programme					**MS**
	• Amount of reduced CO_2 emissions reductions from water pumps for irrigation (compared to the project baseline) installed EOP, tons $CO2_{eq}$	• 0	• 313,174	• 12,660 t CO2/20 years lifetime of 28 pumps supported by the project. • There is a further reduction in GHG emissions due to the installation of Solar PV pumps by the farmers, however, they have not been considered, as a contribution towards direct emission reductions. This considering the GEF definition of direct GHG emission reductions	• MU
	• Cumulative installed capacity of off-grid PV solar pumps (kWp)	• 0	• 6,531 kWp as 1,468 pumps	• 258.97 kW, due to 28 pumps supported by the project • There is further capacity creation due to installation of Solar PV pumps by the farmers on their own, however, they have not been considered, as a contribution by the project as no activity was carried out by the project towards achieving this.	• MU
	• Fuel saved	• 0	• 5.9 million liters/year	• 0.24 million liters/year	• MU
	• Number of banks providing finance for solar PV pumps	• 0	• 7	• Several commercial banks in the Northern state are extending loans to farmers for Solar PV pimps, under a micro-financing scheme	• S
	• Reduction of down-time and farmer's time lost to pump repair	• 0	• 80%	• No down time is reported by the farmers	• S
	• Savings due to avoided diesel cost after pumps have been paid off (over 15 years remaining technical life)	• 0	• US$56 million	• Savings due to the installation of 28 pumps supported by the project is much less than the target	Unable to Assess **(U/A)**
	• Number of new suppliers (partnerships) providing equipment financed by National PV Fund mechanism	• 0	• At least 7 (representing a business volume of approximately 200 pumps/supplier, or 50/year)	• The National PV fund is not operational • As the National PV fund could not be made operational, this indicator is no more valid • PV pump suppliers are growing fast in North State and the entire country. However, they are not participating in the National PV fund	Unable to Assess **(U/A)**

[1] GEF Rating Scale: 6 = Highly Satisfactory (HS) - exceeds expectations, no shortcomings; 5 = Satisfactory (S) - meets expectations and no or minor shortcomings; 4 = Moderately Satisfactory (MS) - more or less meets expectations and some shortcomings; 3 = Moderately Unsatisfactory (MU) – somewhat below expectations and significant shortcomings; 2 = Unsatisfactory (U) - substantially below expectations and major shortcomings; 1 = Highly Unsatisfactory (HU) -severe shortcomings; Unable to Assess (U/A): available information does not allow an assessment

	Indicator	Baseline	Targets	Status at TE	Rating at TE[1]
	• Extent of change in modern energy coverage by users and specific sectors	• 0	• 22.5% (representing 1,468 pumps out of an estimated 6,500 existing)	• Going by the solar PV pumps installed by the farmers at their own, the extent of coverage by modern energy for operations of irrigation pumps matches the target	• S
Outcome 1: Financing and dissemination mechanism established and operational to support a PV pump installation programme					• **MU**
	• Investment mobilized for purchase of solar pumps by EOP	• 0	• US$24,190,000	• Investment of about USD 401,000 for the initial set of PV water pumps, plus USD 1,030,000 paid as advance to the supplier of additional 120 PV water pumps. • Cost sharing agreement signed between UNDP and the government, for procurement of more pumps. But no actual investment was made.	• MU
	• Dedicated mechanism for finance of PV pumps established	• None	• At least one national PV pump fund	• PV fund got established but was not adequately funded (government contribution has been as guarantees, rather than the actual funding) • The PV fund has faced rough weather and is not operational	• MU
Outcome 2: Financing and dissemination mechanism de-risked through technical standards and demand-side support					• U
	• Technical quality standards developed and enforced for PV pumps	• None	• Reasonable standards in place to assure quality	• A test lab for testing the solar PV pumps was procured and established. However, the lab could not be operationalized and put to use. • The lab was not operational at the time of the TE	• U
	• Number of entities trained and capable of specifying and supplying solar pumps	• 0	• 3	• There is no evidence to suggest that training to the stakeholders was provided by the project. Further, procurement and use of the software could not be validated at TE	U
	• Number of pumping system using water efficient irrigation methods	• 0	• 1,468	• The procurement and installation of solar PV water pumps under the project have fallen short of the target. • 28 pumps installed by the project in the field mostly use flood irrigation • No activities under the project were undertaken to promote water-efficient methods • On the contrary, due to no cost of energy (solar energy is free), there is a tendency amongst the farmers to keep the pumps operating if the sunshine is available	• U
Outcome 3: Mitigation instrument (NAMA) design elaborated and implemented in support of the PV pump installation programme					• U
	• Development of a standardized baseline for solar PV pumping in Sudan	• None	• Standardized baseline developed and submitted to UNFCCC	• Information about the completion of NAMA and SBL development could not be provided at the time of TE	• U

	Indicator	Baseline	Targets	Status at TE	Rating at TE[1]
	• Development of an MRV mechanism for solar water pumping	• No MRV mechanism	• An MRV mechanism developed and implemented	• TOR for the consultancy was prepared. No further work could be carried out	• U
Outcome 4: Supportive enabling environment and scaled-up implementation					**MS**
	• Inclusion of solar pumps in fiscal concessions lists of the Investment Law and the Agricultural Implements Regulation such that they receive preferential financial treatment	• PV pumps are not included and receive no preferential treatment	• PV pumps exempt from customs and taxes, receive benefits afforded to other agricultural implements	• PV pumps and panels are now exempted from import duty	• S
	• PV Pumping integrated in National Energy Roadmap and Rural Energy Access Strategy	• PV pumping not a part of NER or REAS	• PV pumping integrated into NER and REAS	• There is no document to suggest any activity carried out for achieving the results against this indicator.	U
	• Awareness raising and capacity building carried out		• At least one workshop and demonstration held with the Ministry of Agriculture in each State in Sudan	• No awareness creation and capacity building workshop could be organized by the project	• U

The outcomes of the project, as mentioned in Table 2 were to be achieved through a set of outputs for each of the outcomes. Different outputs, in turn, were to be achieved through a specific set of activities for each of the outputs.

Evaluation Ratings

As per the requirements of the TOR for Terminal Evaluations, Table 3 provides the ratings for relevance, effectiveness, efficiency, impact, and sustainability of the project. The Table also provides the ratings for Monitoring and Evaluation (M&E), Implementing Agency (IA) & Executing Agency (EA) Execution, and Assessment of Outcomes. Ratings have been provided using the obligatory GEF rating scale.

Table 3: Terminal Evaluation Ratings

1. Monitoring and Evaluation	Rating[2]		2. Implementing Agency (IA) & Executing Agency (EA) Execution	Rating
M&E design at entry	S		Quality of UNDP Implementation	MS
M&E Plan Implementation	MS		Quality of Execution - Executing Agency	MU
Overall quality of M&E	MS		Overall quality of Implementation / Execution	MU
3. Assessment of Outcomes	**Rating**		**4. Sustainability**	**Rating[3]**
Relevance	S		Financial resources	L
Effectiveness	MS		Socio-political	L
Efficiency	MS		Institutional framework and governance	L
Overall Project Outcome Rating	MS		Environmental	L
			Overall likelihood of sustainability	L

[2] Ratings for Outcomes, Relevance, Effectiveness, Efficiency, M&E, I&E Execution: Highly Satisfactory (HS): no shortcomings; Satisfactory (S): minor shortcomings; Moderately Satisfactory (MS); Moderately Unsatisfactory (MU): significant shortcomings; Unsatisfactory (U): major problems; Highly Unsatisfactory (HU): severe problems

[3]Ratings for Sustainability: Likely (L): negligible risks to sustainability; Moderately Likely (ML): moderate risks; Moderately Unlikely (MU); significant risks; Unlikely (U): severe risks

Summary of Conclusions

The objective of the project was to support the replacement of diesel-operated water pumps for irrigation with solar PV technology-based water pumps for water pumping in the unelectrified areas of the country, particularly in the Northern State. It was envisaged that the planned intervention, will lead to a reduction in the emission of GHG due to the avoidance of the use of diesel for the operation of agriculture pumps. The development benefits of the project were an increase in farm productivity; an increase in the income of farmers; and lesser imports of diesel helping the economy of the country.

One of the remarkable achievements of the project under its Outcome 1, is the successful demonstration of solar PV pumps for irrigation. Although phase 2 of the demonstration solar PV pumps, could not be installed, even then the demonstration of the technical and financial viability of the solar PV pump technology has been remarkable. Due to the successful demonstration of the solar PV water pumps, there has been exceptional scaling up within the Northern state and replication of the concept in other states of the country. The project has led to the successful proofing of the concept of solar PV water pumps for irrigation in Sudan.

One of the other important achievements of the project is the waiver of customs duty on imports of solar PV water pumps (under Outcome 2 of the project).

There has not been much activity and achievements of the results for the other Outcomes (Outcome 3 and Outcome 4) of the project, but the exceptional demonstration of the concept under Outcome 1 has more than compensated for the leaser achievements under Outcome 3 and Outcome 4. This is evident from two other donor-funded projects (one supported by AfDB and the other one by KOICA) to support the use of Solar PV pumps for irrigation in other states in Sudan.

The project has successfully mainstreamed the use of solar PV water pumps in Sudan as a technically and commercially viable option for irrigation.

Lessons Learned

- Successful demonstration of the results of the pilot, in the early stages of the project implementation, helps in scaling up and replication of the project interventions. The strategy of splitting the pilot activities into two phases, wherein the first phase of the pilot activities was fully funded by the project, helped the project to achieve the scaling up and replication of the interventions, although the second phase of the pilot activities could not be carried out.
- For the projects implemented in countries having a situation of hyperinflation, and where implementation of the project requires the import of equipment (in hard currency), if the procurement is done nationally in local currency, a situation will arise where the selected national suppliers will not be able to meet the commitments made. (Please see recommendation 2)
- While creating testing facilities, it is important to assess the capacity of the organisation/ institution, under which such facilities are being created. It needs to be ensured that the institution which is best equipped (technically and administratively) to operate and manage the test facility should be selected (please see recommendation 3).
- For the projects like solar water pumping, there is a tendency to keep the water pump operating as long as the sunshine is available. This leads to over-exploitation of the water ground resources. This situation can be addressed by providing incentives (the opportunity to use solar PV for uses other than water pumping). Such incentives could include the provision of a facility to upload the surplus power generated to the grid; self-use of electricity generated, and use of electricity for agro-processing (please see recommendation 9)

Gender and Cross-Cutting Issues

- The interventions carried out under the project do not have any specific gender aspects, except for the fact that maintenance of diesel-operated pumps (as in the baseline case) was largely male-dominated activity. With the introduction of solar PV pumps for irrigation, the activity of operation and maintenance of pumps can be carried out by women, leading to increased participation of women in agriculture activities.
- One of the possible adverse impacts of the project is the overexploitation of the ground water (please see recommendation 3).

Recommendations

Table 4: Recommendations

#	Recommendation	Rational and Description	Timing/Dates for Action	Responsible Party
	Corrective actions for the design, implementation, monitoring, and evaluation of the project			
1	It is recommended that the grant funding (the order of the funds available in USD 800,000) pending utilisation be used to provide grants to the farmers who have already applied for loans for Solar PV pumps (there are about 1000 pending applications within the Northern District). This for example can be done based on a decision by the project board and UNDP together.	Given the present situation, it is unlikely that some of the grant funds meant for supporting the installation of solar PV pumps would get effectively utilized by the close of the project, unless adaptive measures are taken.	Immediate, before the closure of the project	UNDP CO, Implementing Partner, Project Board
2	It is recommended to use any of the following options for future project designs involving the situation of hyperinflation and devaluation of the local currency in the country of implementation. a) Procurement is done by the Implementing Agency, internationally in hard currency. This will also avoid the situation of the jurisdiction of local courts, in case of a possible legal issue b) The project team does the procurement in hard currency terms c) A price variation clause is incorporated in the contract, wherein the actual payment is linked to the currency exchange rate	One of the challenges faced by the project was very large fluctuations in the currency exchange rate (USD Vs Sudanese Pound). As there was a very large exchange rate fluctuation, the supply of solar pumps under the second phase of the project faced difficulties (the order to the supplier was in Sudanese Pounds, whereas the need of the supplier of the pumps was to source PV pumps from international markets in hard currency).	At the time of future project design	UNDP CO, Implementing Partner, GEF
	Actions to follow up or reinforce initial benefits from project			
3	The test facilities for solar PV pumps established by the project were not functional at the time of TE. Unless adaptive measures are taken, the testing facilities for solar PV pumps are unlikely to be functional. In this regard following is recommended: a) The testing facilities be transferred to the National Energy Research Centre (NERC). NERC will be in a better position to provide for a couple of missing solar panels and provide for the technical resources (persons) to	The project has supported the establishment of testing facilities for Solar PV-based pumping systems, at Sudan Standards Bureau. This included training the technical staff in the operation of the testing facilities. The idea of the center was avoidance of imports of sub-standard equipment in the country. The test lab is not operational since the time of	Immediate, before the closure of the project	UNDP CO, Implementing Partner, Project Board

#	Recommendation	Rational and Description	Timing/Dates for Action	Responsible Party
	operate the test facility. NERC will also be able to make good use of the testing facilities for the research work b) While the operations of the testing facility are carried out by NERC, the certification can still be done by the Sudan Standards Bureau, based on the test reports produced by NERC. c) Use the concept of brand approval, and third-party certification, to ensure only quality solar pumps and PV panels get imported/manufactured and deployed. The concept of EE rating of the pumps can also be used. This will generate the business volume for the test center. A viable business model for the test center may be worked out to ensure that the test facilities are financially self-sustaining.	its establishment. The reasons include the moving of the staff who was trained; inadequate maintenance; absence of a proper business model for the testing facilities etc. A visit to the test laboratory revealed the need to replace a couple of missing solar panels from the overall test setup. Unless adaptive measures are taken, the testing facilities for solar PV pumps are unlikely to be functional.		
4	It is recommended that some of the ongoing activities being carried out under the project which can be completed during the remaining implementation period of the project be prioritised and dedicated efforts put in to ensure their completion. Procedurally there may be issues to invite fresh bids and awarding fresh contracts for such activities, but for the activities where the process has already been initiated and the activities are ongoing, the process can be taken to its logical conclusion.	Several activities under the project could not be completed (e.g., preparation of the NAMA document), due to a variety of reasons (including Covid 19). Some of such activities are at different levels of implementation. It will be possible to complete some of such activities during the remaining implementation time of the project. Completion of the activities will enhance the results of the project	Immediate, before the closure of the project	UNDP CO, Implementing Partner
	Proposals for future directions underlining main objectives			
5	It is recommended that the future project design expands the targeted involvement and role of non-governmental stakeholders like private sector trade/industry associations, farmer's co-operatives, NGOs/CBOs, and Academics.	The project design has largely restricted the stakeholders to government organizations (ministries and departments) and Banks. Participation by a wider set of stakeholders (e.g., industry associations, and NGOs) would have enhanced the results of the project.	At the time of future project design	UNDP CO, Implementing Partner, GEF
6	Future project designs of this nature, explore different financial models, e.g., lease based on monthly lease rental charged from the farmers (instead of the sale of the pump), hire purchase schemes offered by the private sector, etc.	Given the higher upfront capital cost of the solar pumps, there are affordability issues with farmers (particularly the farmers with small land holdings).	At the time of future project design	UNDP CO, Implementing Partner, GEF
7	The future project design includes the activity of training the suppliers of pumps and other technicians on system design and on repair and maintenance of the solar pumps.	With the upscaling of solar PV pumps already happening, there is a need to inculcate the capacity in the country to	At the time of future project design or as of other ongoing projects	UNDP CO, Implementing Partner, GEF

#	Recommendation	Rational and Description	Timing/Dates for Action	Responsible Party
	There was a provision for building capacity for system design (software) in the present project, but it did not get accomplished.	repair and maintenance of the solar pumps.		
8	A future project of this nature looks towards the creation of the infrastructure within the country to manufacture/assemble quality Solar PV pumps within the country.	With the successful demonstration by the project and other ongoing programs and the country, the demand for solar PV pumps is expected to increase in Sudan. In the country, manufacturing/ assembly facilities will reduce the import bill for the country.	At the time of future project design or as of other ongoing projects	UNDP CO, Implementing Partner, GEF
	Best/worst practices in addressing issues relating to relevance, performance, and success			
9	To take care of the issue of possible over-exploitation of ground water resources because there is no fuel cost in case of pumping of water using solar PV pumps, the following is recommended; a) Wherever the electric grid is available near the solar PV system, allow the farmers to upload the electricity to the grid on a payment basis. This on one hand will provide additional income to the farmers making solar PV pumps more affordable, while on the other hand, such a strategy will avoid wasteful over-exploitation of water resources. This will also provide the opportunity for the state utility to procure RE-based electricity at a price that is less than its own cost of generation/procurement b) In cases where the grid is not close by (and the farm/household is not electrified), a provision may be made in the existing system to provide electricity for household use (lighting, phone charging, basic appliances) by incorporating a small battery and an inverter. This will on the one hand provide a basic electric supply to the farmer while on the other hand, it will ensure the use of the solar water pump only up to the extend it is required, c) The system design may be modified a bit so that during the part of the year when irrigation requirements are minimal the system generates enough electricity for the home agro-processing.	Given that water pumping using solar PV has no variable cost component. There is a tendency to over-exploit groundwater resources leading to the issue of depletion of groundwater.	At the time of future project design or as for other ongoing projects	UNDP CO, Implementing Partner, GEF

1. INTRODUCTION

1.1 Context, purpose of the terminal evaluation and objectives

The project, 'Promoting the use of electric pumps for irrigation' has been implemented in Sudan. The project, aimed to support the adoption of solar PV technology for water pumping for irrigation in agriculture in Sudan, particularly in the Northern State. The project has been implemented with funding from the Global Environment Facility (GEF), and the GEF Executing Agency for the project was United Nations Development Programme (UNDP). With the project implementation coming to an end a 'Terminal Evaluation' has been organized per GEF and UNDP guidelines and procedures. The evaluation has been carried out as per the provisions in the 'Guidance for Conducting Terminal Evaluations of UNDP-Supported, GEF-Financed Projects – 2020[4]' (Guidance Document).

Annex A provides the 'Terms of Reference' for the Terminal Evaluation. The target audiences for the terminal evaluation are funding agencies, project partners and beneficiaries, GEF, UNDP CO at Sudan, UNDP at regional and HQ levels, and UNDP Evaluation Office. The broader defined objectives of the terminal evaluation are to compare planned outputs and outcomes of the project to actual outputs and outcomes and (if applicable) identify the causes and issues which contributed to the non-achievement of the desired results and targets of the project. One of the other objectives of the evaluation is to draw lessons that can both improve the sustainability of benefits from the project, and aid in the overall enhancement of UNDP programming.

A team of consultants, comprising of an international consultant, Dinesh Aggarwal (India), and a national consultant Dr. Quosay A Ahmed (Sudan), was selected and contracted by the UNDP, Sudan country office (CO) to carry out the terminal evaluation. Findings of the TE are presented in this report.

1.2 Scope of terminal evaluation

Table 5: Scope of terminal evaluation

Terminal Evaluation Timeframe	June 2022 to October 2022
Project Implementation Timeframe	February 2016 to May 2022
The period being evaluated,	Entire project implementation duration (from February 2016 to May 2022)
Segments of the target beneficiaries included	Targeted beneficiaries included the farmers, the national counterparts,
The geographic area included, and which components were assessed	The geographic area covered is the entire country for the overall objective of the project and the North State of Sudan for the pilot activities. All the components of the projects as mentioned in the project document were covered in the evaluation.
Country	Sudan
Region	Africa
GEF Focal Area:	Climate Change
FA Objectives, (OP/SP):	CCM-3, Promote investment in renewable energy technologies

[4] Guidance for Conducting Terminal Evaluations of UUDP-Supported, GEF-Financed Projects – 2020. http://web.undp.org/evaluation/guideline/documents/GEF/TE_GuidanceforUNDP-supportedGEF-financedProjects.pdf

1.3 Methodology of the terminal evaluation

As mentioned before, the terminal evaluation has been carried out following 'Guidance for Conducting Terminal Evaluations of UNDP-Supported, GEF-Financed Projects – 2020'. Before the start of the Terminal Evaluation, an inception report was prepared and shared with the UNDP CO in Sudan and the project team. The inception report provided the outlines of the approach and methodology to be followed while carrying out the evaluation. It also provided the proposed timelines for the evaluation. The inception report included a table providing the criteria for the evaluation and the list of main evaluation questions. The table of terminal evaluation criteria and the questions are given in **Annex B**. Accordingly, the methodology for carrying out the Terminal Evaluation was comprised of the following activities:

- **Review of Documents:** Review of 'Project Design Document' and all relevant sources of information including documents prepared during the preparation phase. The review of documents included a review of financial data, the mid-term evaluation report, Project Implementation Reviews, etc. As per the project team, there was a change of the project manager mid-way through the project implementation, due to which, some of the documents required to be reviewed during TE could not be made available (e.g., GEF tracking tool at MTR, project inception report, minutes of some of the project board meetings, back to office reports, etc.). **Annex C** provides the list of documents reviewed. Due to the non-availability of some of the documents for review, greater reliance was put on the information collected during the field mission (please see the following bullet point as well).

- **Mission to Sudan, interviews with stakeholders, and site visits**. A mission to Sudan was organised from 31 July 2022 to 07 August 2022. The mission started with a briefing by the UNDP CO and the project team. After the mission a presentation on the initial findings was made on 07 August 2022 to the UNDP CO, PMU, and other stakeholders, to get feedback on the initial findings and observations during the mission. During the mission, interviews with different stakeholders and project participants were carried out. The mission included discussions with the officials of the organisations (bank officials, suppliers of solar PV pumps, etc.) in the Northern State of Sudan, where the solar PV-based water pumps supported by the GEF project have been implemented. During the field mission discussions were also held with the targeted beneficiaries/farmers at the locations where the pilot activities (installation of solar PV water pumps) under the project were carried out in the Northern State of the country. **Annex D** provides the overall schedule of the missions and the stakeholders interviewed during the mission. The mission also served the purpose of collecting some of the missing documents to be reviewed.

The assessment of project performance has been carried out based upon the expectations set out in the Project Logical Framework/Results Framework which provides performance and impact indicators for project implementation along with their corresponding means of verification, and the review of results that have been delivered by the project. For this purpose, the Logical Framework as provided in the 'Project Document' was referred. There was no change in the Logical Framework of the project at the time of project inception or at the time of the mid-term review of the project.

The review of documents provided basic information regarding the activities carried out to attain the desired outputs and outcomes. However, the mission was needed to verify the information, get missing data, and learn the opinion of stakeholders and project participants to interpret the information. During the mission, the interviews with the key stakeholders'/project participants were based on an open discussion to allow respondents to express what they feel are the main issues. This was followed by more specific questions on the issues mentioned. During the interviews, the evaluation criteria and the questions (Please see **Annex B**) was used as the check list to raise relevant questions and issues.

The limitations of the Terminal Evaluation include the time available for carrying out the field mission. In-person meetings with the stakeholders were carried out during the mission. The evaluation team is

of the view that the meetings and consultations carried out within the available time were sufficient to provide the required level of clarity and information for the TE.

The evaluation was conducted following the principles outlined in the United Nations Evaluation Group 'Ethical Guidelines for Evaluation' as given in **Annex E**.

1.4 Structure of the Terminal Evaluation Report

The structure of the report is as per the format suggested in the Terms of Reference for the terminal evaluation. However, the contents of the chapter on findings have been split into three separate chapters due to the size of the text.

The report starts with a chapter providing an introduction which is followed by a chapter on the project description, and findings. The last chapter of the report provides the conclusions and recommendations. Additional information is provided in the Annexes to the report. An Executive Summary of the report is provided at the beginning of the report. Concerning the discussion of the findings, the report elaborates on three general areas: project formulation, project implementation, and project results, in three different Chapters. The report is organised as follows;

Chapter 1: Introduction to the project
Chapter 2: Project description and development context. Most of the contents of this Chapter come from the Project Document. This chapter provides information about the project, to a reader of the TE report at any point in time.
Chapter 3: Findings: Project design and formulation. This chapter provides an oversite of different 'design aspects' of the project. The aspects covered in this section of the report are termed as 'factors affecting performance'. The role of these aspects (if applicable) is deliberated in Chapter 5 of the TE report. This forms the basis to determine if any of the design aspects have impacted the results of the project (which are covered in Chapter 5 of the report).
Chapter 4: Findings: Project implementation. This chapter of the report provides information about the planned provision in the project design regarding different aspects, like project implementation arrangements, M&V, stakeholder participation, roles of implementing partners and GEF agency, etc. Most of this information comes from the project document.
Chapter 5: Findings: Project results. This Chapter deliberates upon the achievement of results and objectives of the projects. If applicable, an assessment regarding the reasons for the shortfall in performance is carried out in terms of the 'Factors Affecting Performance'.
Chapter 6: Conclusions, recommendations, and lessons. This Chapter provides the conclusions and a set of recommendations

Annex B shows where the main criteria and questions of the Terminal Evaluation can be in different sections of the report.

2. PROJECT DESCRIPTION AND DEVELOPMENT CONTEXT

2.1 Project start and duration

Table 6 provides the details regarding the timelines for project approval and implementation. There is no evidence to suggest that a formal inception workshop for the project got organised.

Table 6: Project Approval and Implementation Timelines

Event	Date
PIF Approval Date	May 21, 2014
CEO Endorsement Date	Jan 14, 2016
Project Document Signature Date (project start date):	Feb 28, 2016
First Disbursement Date	Jul 18, 2016
Expected Date of Mid-term Review	Sep 30, 2019
Actual Date of Mid-term Review	Dec 27, 2019
Expected Date of Terminal Evaluation	Jan 31, 2022
Date of Terminal Evaluation	June to Aug 2022
Original Planned Closing Date	Feb 28, 2021
Revised Planned Closing Date	May 28, 2022

The implementation timelines for the project were extended to 28 May 2022 as per the UNDP GEF Executive Coordinator and Director's approval of the extension request. As the project's implementation is extended to May 2022, the terminal evaluation of the project was rescheduled to the third quarter of 2022.

2.2 Problems that the project sought to address[5]

The focus of the project is replacement the of small and medium diesel pumps for agriculture with PV solar pumps in Sudan (particularly in the Northern State of the country). This is particularly in the areas where presently there is no supply of grid electricity and in the future also extension of the national electricity is not likely. In Sudan generation of electricity is based on Hydro resources. At the same time, fossil fuels are imported. Thus, the use of diesel-operated pumps for agriculture is one of the large sources of GHG emissions.

As per the 'project document' rising costs of fossil fuels have been one of the main drivers of high inflation in Sudan. At the time of the project design, fossil fuels were subsidized in Sudan, with oil subsidies representing 15% of the total government expenditure in 2012. There has been a steady reduction in subsidies, which has resulted in a 45% increase in diesel prices in 2011, and a further 114% increase in 2013. An increase in the cost of diesel has a direct bearing on the cost for the farmers. Increasing prices, non-availability at times, and logistics regarding the transportation of diesel to remote locations, all impact farm productivity.

Given the importance of the agricultural sector to the overall economy, reducing the cost of energy, particularly for small farmers, is a major priority for the continued growth of the sector. The project was targeted to address the problem of the cost of energy, and availability of energy for the agriculture pumps.

There are barriers to the use of Solar PV pumps for agriculture in Sudan. The project aims to address these barriers. The barriers include the following;

- The relatively high capital expenditure required and associated risk;

[5] Based on Project Document

- Lack of low-cost finance and limited experience with long-term finance, especially for PV pumps;
- The novelty of the technology and lack of demonstration and technical experience among all stakeholders; and
- Lack of accurate record keeping and baseline data for diesel irrigation, which inhibits the ability to make well-informed cost-benefit analyses of other options (e.g., investing in solar pumps)

2.3 Immediate and development objectives of the project[6]

The project was expected to contribute to the growth of the agriculture sector in Sudan. As per the project document, the agricultural sector contributed approximately 30% of the Gross Domestic Product (GDP) in the year 2013 and employed 80% of the total workforce. Further, agriculture represents 80% of the non-petroleum export revenues of the country. Because of the size of employment and its contribution to GDP, the development of the agricultural sector is one of the main contributors to poverty alleviation plans in Sudan.

Sudan has significant potential for development in the agricultural sector. Although a significant portion of Sudan's cultivated area is dependent on rain, the irrigated lands contribute approximately 75% of the added value from agriculture.

Given the low rains in Sudan, water pumping is necessary for irrigation. In the baseline, the method used for water pumping is diesel-powered pumps. Pumping of water using diesel as an energy source is high and there are uncertainties due to inflation, availability of fuel, and logistics. In the project, it was envisaged that the use of solar PV technology instead of diesel will not only reduce the cost, but will also provide other advantages like reduced maintenance, increased reliability, and reduced effort and hassle from the farmer.

2.4 Baseline and expected results

The baseline for the project is the use of off-grid, diesel-powered pumps for irrigation. The project targeted only those areas where the grid is unlikely to be extended in the foreseeable future or where the cost of the extension is prohibitive. The potential for solar PV pumps is prioritized for those areas which cannot be economically accessed by the grid. The baseline for these areas is the use of direct-drive diesel pumps (mechanical pumps driven directly by a diesel engine rather than electric pumps driven by a diesel-powered electric generator).

The project is expected to mainstream solar PV technology for water pumping for irrigation in the areas where there is no grid electricity. The project was also expected to lead to a reduction in the dependence of the country on imported fossil fuels and imported electricity.

2.5 Results Framework

The results framework of the project providing the objectives, the expected outputs, and the outcomes along with corresponding indicators is presented in Table 7. No changes in the log-frame were carried out at the time of project inception or at the time of MTR.

Table 7: Results Framework of the project

Strategy	Indicator	Baseline	Targets
Project Objective: Financing and dissemination mechanism established	• Amount of reduced CO_2 emissions reductions from water pumps for irrigation (compared to the project baseline) installed EOP, tons $CO2_{eq}$	• 0	• 313,174

[6] As per project document

Strategy	Indicator	Baseline	Targets
and operational to support a PV pump installation programme	• Cumulative installed capacity of off-grid PV solar pumps (kWp) • Fuel saved	• 0	• 6,531 kWp as 1,468 pumps • 5.9 million liters/year
	• Number of banks providing finance for solar PV pumps	• 0	• 7
	• Reduction of down-time and farmer's time lost to pump repair	• 0	• 80%
	• Savings due to avoided diesel cost after pumps have been paid off (over 15 years remaining technical life)	• 0	• US$56 million
	• Number of new suppliers (partnerships) providing equipment financed by National PV Fund mechanism	• 0	• At least 7 (representing a business volume of approximately 200 pumps/supplier, or 50/year)
	• Extent of change in modern energy coverage by users and specific sectors	• 0	• 22.5% (representing 1,468 pumps out of an estimated 6,500 existing)
Outcome 1: Financing and dissemination mechanism established and operational to support a PV pump installation programme	• Investment mobilized for purchase of solar pumps by EOP	• 0	• US$24,190,000
	• Dedicated mechanism for finance of PV pumps established	• None	• At least one national PV pump fund
Outcome 2: Financing and dissemination mechanism de-risked through technical standards and demand-side support	• Technical quality standards developed and enforced for PV pumps	• None	• Reasonable standards in place to assure quality
	• Number of entities trained and capable of specifying and supplying solar pumps	• 0	• 3
	• Number of pumping system using water efficient irrigation methods	• 0	• 1,468
Outcome 3: Mitigation instrument (NAMA) design elaborated and implemented in support of the PV pump installation programme	• Development of a standardized baseline for solar PV pumping in Sudan	• None	• Standardized baseline developed and submitted to UNFCCC
	• Development of an MRV mechanism for solar water pumping	• No MRV mechanism	• An MRV mechanism developed and implemented
Outcome 4: Supportive enabling environment and scaled-up implementation	• Inclusion of solar pumps in fiscal concessions lists of the Investment Law and the Agricultural Implements Regulation such that they receive preferential financial treatment	• PV pumps are not included and receive no preferential treatment	• PV pumps exempt from customs and taxes, receive benefits afforded to other agricultural implements
	• PV Pumping integrated in National Energy Roadmap and Rural Energy Access Strategy	• PV pumping not a part of NER or REAS	• PV pumping integrated into NER and REAS
	• Awareness raising and capacity building carried out		• At least one workshop and demonstration held with the Ministry of Agriculture in each State in Sudan

2.6 Main stakeholders

Table 8 provides the list of main stakeholders along with the details of their respective roles (as envisaged at the time of project design) in the project

Table 8: List of main stakeholders[7] involved in the Solar PV Power Pump project

Stakeholder	Role
Ministry of Water Resources, Irrigation and Electricity (MWRE)	MWRE is the Government body responsible for electric power in Sudan. MWRE has been implementing the grid-electric pumps programme together with the Northern Sates government to promote electric pumping for large-scale farms. MWRE was the main implementing partners for the project.
The Northern State Ministry of Agriculture, Animal Resources, and Irrigation (NS MAARI)	NS MAARI is the governmental entity that is responsible for the implementation of the Agricultural Strategic Plan in the Northern State. The main target of the plan is to raise the percentage of agricultural land in the country by 70%. The NS MAARI acts as the body responsible for the overall management of agricultural affairs in the Northern State and is the primary State Government liaison with the Farmer's Union of the Northern State.
Ministry of Petroleum (MoP)	MoP was created in 2010 through the division of the Ministry of Energy and Mining into three separate ministries: the Ministry of Water Resources, Irrigation and Electricity, the Ministry of Petroleum, and the Ministry of Mining. Under the MoP's General Directorate of Energy Affairs is the Renewable Energy Directorate. MoP has installed seven PV solar pumps in the past.
Higher Council for Environment and Natural Resources (HCENR)	HCENR oversees the application of environmental laws and regulations to all development projects in Sudan and has particular responsibilities in the climate change area. HCENR serves as the Designated National Authority (DNA) for the Clean Development Mechanism (CDM). It is also the NAMA Focal Point and UNFCCC Focal Point for Sudan. With UNDP support, HCENR has been developing standardized baselines for Sudan. HCENR has also developed a Technology Needs Assessment (TNA) for Climate Change Adaption and Mitigation, funded by the GEF. The Secretory General of HCENR serves as the national GEF Operational Focal Point. In the project, HCENR was to support the development of NAMA
Ministry of Finance & National Economy (MoF)	MoF has the general objective of developing the internal resources of Sudan and utilizing them in the most efficient way possible to support growth. The MoF also directs the customs and tax authorities and thus is responsible for taxation and for exempting strategic goods from customs duties and taxes.
National Energy Research Centre (NERC)	NERC has been active in promoting and developing solar water pumping. NERC has a special department for solar energy equipped with instruments and a mechanical workshop. NERC participated in the installation of solar pumps around Sudan. NERC is tasked with the development of Sudan's future energy resources and securing the energy needed for sustainable growth. It is hosted by the Ministry of Science and Communication.
Sudan Standards and Metrology Organization (SSMO)	SSMO is a government body. It was established to coordinate Sudan's engagement with the International Standards Organization (ISO), the African Regional Organization for Standardization (ARSO), and the Arab Standards and Metrology Organization (ASMO). SSMO is responsible for the development of technical standards and testing within Sudan and ensuring that equipment meets minimum standards for quality, safety, and functionality.
Farmer's Union of the Northern State	The Farmer's Union of the Northern State serves as the body representing Farmers' interests within the state and interfacing with the State Government. The Union coordinates with the Northern State Ministry of Agriculture, Animal Resources and Irrigation on matters relating to farmers' demands and implementation of national programmes which

[7] Source: Project Document

Stakeholder	Role
	impact farmers in the Northern State, such as the extension of the electric grid to reach pumps that can be economically electrified. The head of the Farmer's Union also represents the Union at workshops and stakeholder consultations giving a unified voice to farmers.
Banks	The banks provide general loans and finance to clients. The banks in the Northern State expected to participate were: Bank of Sudan, Agricultural bank, Northern Islamic bank, Agricultural & commercial bank, Al Nile Bank, Sudanese Islamic Bank, Baraka Bank, Al Shamal Islamic Bank, Farmer's Commercial Bank, and Family Bank.

The project design has largely restricted the stakeholders to government organizations (ministries and departments) and Banks. Participation by a wider set of stakeholders would enhance the results of the project. It is recommended (please see recommendation 5) that the future project design expands the targeted involvement and role of non-governmental stakeholders like private sector trade/industry associations, NGOs/CBOs.

2.7 Theory of Change

Based on the project document (including the results framework), the Theory of Change of the project has been prepared at the time of TE. The figure below depicts the 'Theory of Change' of the project

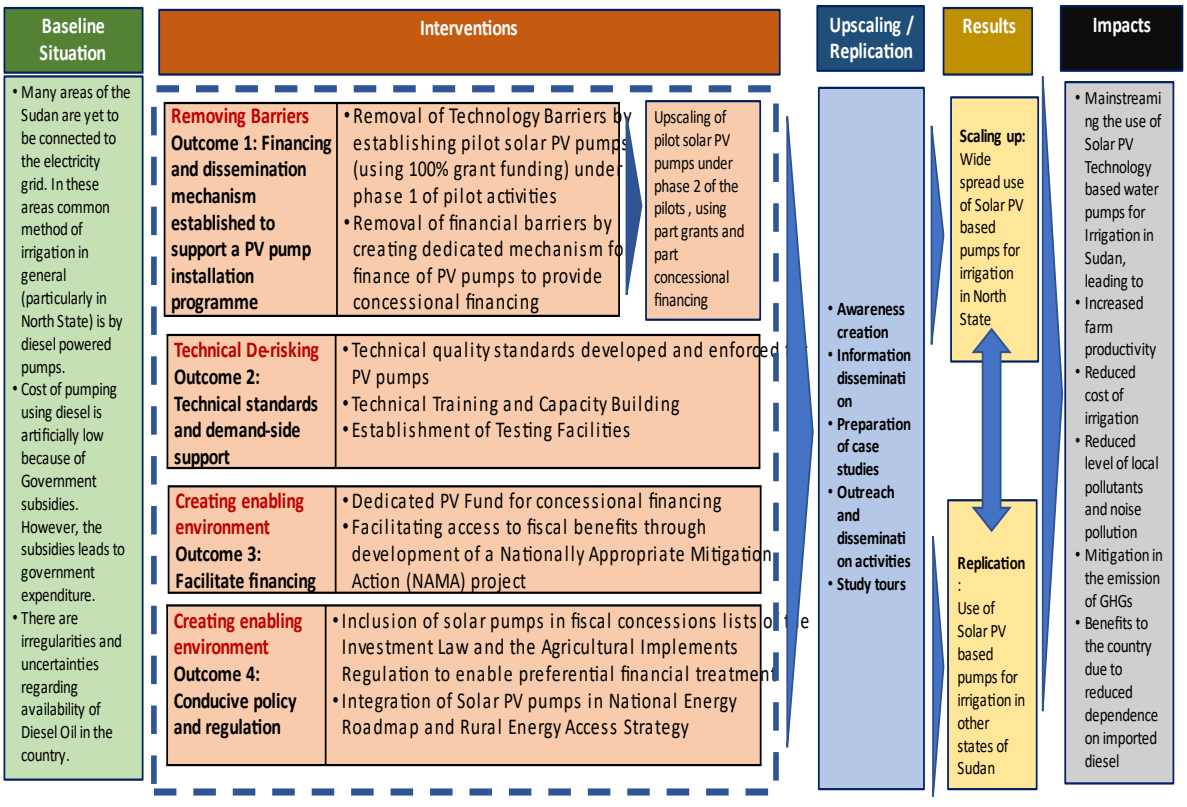


Figure: Theory of Change

As per the project document, the Theory of Change for the project presented a semi-structured map to link strategic actions with desired outcomes. The project sought to enable transformative change. The project sought to transform the way irrigation is done within the North State in Sudan, and ultimately, within Sudan and beyond.

2.8 Key partners involved in the project

Details of the key partners involved in the project are as follows;

Funding Agency	GEF
GEF Executing Agency:	UNDP
Project Implementing Partner	Ministry of Water Resources Irrigation and Electricity (Currently Ministry of Energy and Petroleum)
Other Partners involved:	Ministry of Finance and National Economy, Ministry of International Cooperation, Ministry of Petroleum and Gas, Ministry of Agriculture and Forestry, National Energy Research Centre, Ministry of Environment, Forestry and Physical Development, Higher Council for Environment and Natural Resources, Ministry of Agriculture Animal Resources & Irrigation - Northern State, Central Bank of Sudan.

3. FINDINGS: PROJECT DESIGN AND FORMULATION

The main questions for terminal evaluation are; (please see Annex B)

- **Were the project's objectives and components clear, practicable, and feasible within its time frame?**
- **Were the capacities of the executing institution(s) and its 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 roles and responsibilities negotiated prior to project approval?**
- **Were counterpart resources (funding, staff, and facilities), enabling legislation, and adequate project management arrangements in place at project entry?**
- **Were the project assumptions and risks well-articulated in the PIF and project document?**
- **Whether the planned outcomes were "SMART"?**

3.1 Analysis of LFA/Results Framework

The log-frame of the project providing the objectives, the expected outcomes, and results along with corresponding indicators was presented in an earlier section of this report (please see Table 7). No changes in the log-frame of the project were carried out at the time of project inception and at the time of MTR of the project.

One of the minor issues with the results framework is that the text of the Project Objective and Outcome 1 of the project is the same(although the indicators are different) (please see Table 7). Logically if one of the Outcomes is matching the project objective, there is no need to have other Outcomes for the project. It may, however, be just an oversight at the time of the project design, as elsewhere in the project document, the objective of the project is mentioned as 'replace diesel-based irrigation water pumping through the promotion of solar photovoltaic (PV) powered pumps.' For the TE the text at the project objective level is taken as given in the results framework, as changes in the log-frame are not permissible at the time of TE.

The indicators used in the results framework were SMART. The project objectives and the four outcomes of the project were clear, predictable, and feasible within the implementation timeframe of the project. The Outcomes were predictable meaning that the activities specified in the 'Project Design' were leading to the desired Outcomes of the project.

3.2 Assumptions and Risks

During the project development stage, possible risks toward the smooth implementation of the project were identified and risk mitigation measures were proposed. Different risks that were identified during the project formulation and the recommended mitigation measures are provided in Table 9.

Table 9: Risk Analysis of the Project (as per Project Document)

#	Description	Impact[8]	Countermeasures / Management response
1	The security situation in Sudan may pose some risks or perceived risks. Without general security, the ability to travel, transport goods and work will be restricted. With renewable energy equipment, where the entire capital is procured and installed upfront, theft or damage can mean a complete loss of invested capital.	I = 3	Advice on secure travel routes within Sudan. An escort from MWRE will be provided where necessary. The location of the main activities in the project (Dongola, in the North State) is secure.
2	The Government may fail to subsidize the programme or the Banks may require an interest rate too high to make the project	I = 5	Policy reform and decision-making can be slow in Sudan.

[8] Impact from 1 (low) to 5 (high)

#	Description	Impact[8]	Countermeasures / Management response
	attractive, or diesel subsidies may continue to make diesel artificially inexpensive.		UNDP will rely on close relations with MWRE and other counterparts. Through close participation, UNDP will aim to spur action. The need to replace diesel, and increase agricultural output provides a strong incentive for the adoption of solar pumping.
3	Currency risk	I=3	By establishing a low-cost financing mechanism and removing taxes and duties from PV pumps, the pumps can be shown to be competitive with the price of diesel pumping today. Farmers are eager for an easier-to-use alternative to diesel pumps. If solar PV pumps can be shown to be effective, they may be willing to pay a premium for them, given an efficient financing mechanism.
4	Falling oil prices may mean that diesel prices continue to be low and incentives for Government to lift subsidies on diesel are reduced.	I=4	As with currency risk, if PV pumps can be established as a viable technology with an efficient financing mechanism, they may be adopted even at a premium to diesel.
5	Climate change risk	I=2	Climate change impacts may manifest through one of two ways. Reduced rain water will mean increased reliance on irrigation for pumping. Reduced Nile water flows will mean increased power needed for pumping. The project helps mitigate both aspects by providing a renewable energy source for pumping.
6.	Novelty and adoption risk – individual farmers or banks may be slow to adopt new technology and take-up unfamiliar business models.	I = 4	Farmers are eager to be rid of the burden of diesel fuel and mechanical pumps. If an alternative can be demonstrated to work reliably, they are expected to switch. Banks are apprehensive given the unknowns in the project. Once initial loans are being repaid, the banks will regard this as another money generating investment.
7	Technology risk – Technical failures, either due to equipment failure or bad installation, or bad design/sizing can be ruinous for the farmer and lead to lack of adoption by others and lack of finance by the banks.	I = 3	Consultants hired for the project will be tasked with studying and emphasizing appropriate design/sizing. Pumps may be procured with certain guarantees.
8	Financial Risks – The capital required remains significant. The interest rates typically charged by the banks are too high to make solar pumping attractive.	I = 4	The project will work closely with the banks to provide the confidence they need to lend and with Government and the Bank of Sudan to achieve affordable finance rates and make the investment in solar pumping attractive for farmers.
9	Lack of adequate and reliable market data to facilitate the monitoring of project impacts and planning of further policy measures.	I = 2	Close cooperation with the main participants in the local solar pumping market, in particular the local distribution companies and NERC to obtain the required data will be emphasized. Robust MRV arrangements will be put in place, in particular for the NAMA. GHG monitoring can allow estimations of avoided costs (fuel imports, avoided thermal generation capacity, etc.) to be derived with a fair degree of accuracy.
10	Inadequate and/or non-capacitated human resources to successfully implement the project and support the mainstreaming of its results.	I = 5	Solar pumping is not terribly complex and relies mainly on concepts and components already available – driving electric motors. The remaining parts – solar panels and controller, are encapsulated at the manufacturer. The required local human capacity to operate the systems is limited to “plug and play” interaction. It is expected that technicians servicing diesel pumps will be entirely capable of providing all services. The project includes significant capacity building and outreach components to help overcome this risk. The project will use the individuals trained to implement solar pumps under the project, thereby providing immediate use for the knowledge they have acquired and providing them with immediate income from it.

Apart from the risks identified in the project document, the PIF mentions some additional risks, which include political instability, lack of Government commitment to scaling-up the use of renewable energy technologies, lack of farmer interest in introducing solar pumps for irrigation, lack of technical specifications and standards, financial and credit constraints preventing the banks from financing the adoption of solar energy pumps for irrigation. The risks and assumptions were well articulated in the PIF and the project document.

Although the project design identified the currency risk, it missed out on the possible impact due to the increase in the capital cost of solar PV pumps (which are imported). The project during its implementation did face currency risk and it adversely impacted the implementation of phase 2 of the pilot activities. There were no provisions in the project design to take care of this risk.

The additional risk of political instability, which was identified at the stage of PIF, did impact the implementation and performance of the project. There were changes in the political regimes during the implementation of the project, which led to the change of the persons managing the project-related activities at different implementing partners (including the role and structure of the PMU).

3.3 Lessons from other relevant projects

At the time of project design, Sudan had very limited experience with solar PV pumps. The experience of solar PV in Sudan, (as mentioned in the project document) was the implementation of five PV water pumping stations in the Bara and El Obeid regions, implemented by the Swedish Sudanese Association (SSA). As per the project document, at the time of project design, the Red Sea state in Sudan was working on providing PV pumps for rural communities. The red sea state, also provided solar panels for 10 PV pumps under its 1000 villages PV project. Apart from these, there were a couple of isolated examples of the use of solar PV pumps in private farms. The PPG team visited a private farm using solar PV so that the learnings can be incorporated into the project design. At the PPG stage, the National Energy Research Centre (NERC) of Sudan also had some experience in installing solar water pumps. This experience was considered at the time of the project design.

Apart from the experiences mentioned above, there were no appreciable efforts/projects in Sudan for the promotion of renewable energy. The other renewable project in Sudan "Promoting Utility Scale Power Generation from Wind Energy", was just approved at the time of PPG for the present project. The project document mentions that international experiences and lessons-learned from catalyzing local renewable energy development were considered in the design of the Solar PV water pump project.

3.4 Planned stakeholder participation

In an earlier section of the report (please see section 2.6) the roles of the important stakeholders of the project were highlighted. There are provisions in the project design to implement the mechanisms to ensure effective participation by the stakeholders.

As per the plan, the commencement of the Project was to happen with an inception meeting in which all the important stakeholders were to participate and contribute.

Apart from the planned stakeholder consultations, the project design has provided for a 'project board'. The project board has representation from all the important stakeholders and provides an opportunity for formal and informal consultations amongst the stakeholders. The project document has also provided for regular visits to the sites by the project implementation team and UNDP CO to ensure stakeholder consultations at the district level and with the communities.

3.5 Replication approach

One of the goals of the project is to put in place an enabling environment and scaled-up implementation of Solar PV water pumping in Sudan. This provision has been made in the project design for the replication of Solar PV pumps in other states of the country. To support the replication, the project design, apart from the successful demonstration of the pilots, has provided fiscal concessions for solar PV pumps and the establishment of a PV fund to support the purchase by the farmers.

Outcome 4 of the project, supports the scaling-up and expansion of the project to other states in Sudan. It also includes a structured replication programme to replicate success in the Northern State to other states. The Outputs under Outcome 4 have also provided for developing and documenting the lessons and benefits of the PV program followed by dissemination. This is targeted at promoting the replications. The project design has provided for embedding PV irrigation pumping in the national energy roadmap, rural energy access strategy, and national irrigated agriculture strategy of the country.

Demonstration, and dissemination of the information regarding the avoided costs of infrastructure and fossil fuels, coupled with the environmental benefits of avoiding diesel use, will provide incentives to the governments in other states to adopt and facilitate solar PV-based water pumps.

Thus, the project has provided for a bottom-up approach within the overall policy/investment framework that is envisaged to be developed under the project, to promote Solar PV based water pumps for irrigation.

3.6 UNDP comparative advantage

UNDP's work on sustainable energy spans two decades. UNDP is an accredited multilateral development agency of the Global Environment Facility (GEF) and is also accredited by the Green Climate Fund. In this capacity, UNDP offers countries specialized integrated technical services for eligibility assessment, programme formulation, mobilization of co-financing, implementation oversight, management of results and evaluation, and knowledge management. UNDP has considerable experience in deploying policy instruments to de-risk renewable energy investments in developing countries.[9]

UNDP has on-the-ground experience supporting solar PV-based water pumping projects in developing countries. The Solar PV water pump project in Sudan was a direct application of UNDP's work in this area in several countries (e.g., Ghana, Lebanon, Morocco, Sierra Leon, Pakistan) in the past. UNDP's strengths lie in its extensive experience assisting governments with designing and implementing policies and regulations,

3.7 Linkages between project and other interventions within the sector

As was mentioned in section 3.3, in the past a few small isolated efforts were made for solar PV-based water pumping in Sudan. Based on the successful demonstration of the present GEF project, a couple of other initiatives have come up in Sudan for providing water for irrigation using solar PV technology-based pumps. The two notable projects in this regard are as follows:

- The Korea International Cooperation Agency (KOICA) and UNDP funded (US$6.4 million and US$0.6 million respectively) project endeavours to directly benefit 450 small and medium landholding farmers in River Nile State in Sudan. The project aims to develop and accelerate the adoption of off-grid solar pumping for irrigation by providing demonstration units, technical capacity building, and a quality-assurance mechanism. The project will expand the use of Solar PV systems in the River Nile State to replace the diesel-based irrigation water pumps

[9] UNDP (2013), De-risking Renewable Energy Investment.

- The African Development Bank is funding USD 21.815 million for the installation of 1,170 solar pumps in the North and West Kordofan States. The project's goal is to use solar water pumps for irrigation to replace either diesel-generated electricity or grid-based electricity generation for water pumping for irrigation. The use of solar water pumps in irrigation would lead to substantial greenhouse gas emission reductions. The development objective of the project is to reduce the dependency on imported fossil fuels through the adoption of renewable energy for water supply in irrigation to foster economic and social development by increasing crop production in the agricultural areas around the country and promote a peaceful environment for water resources use.
- Sudan is also included in the global project supported by International Solar Alliance (ISA) to provide 270,000 solar pumps in 10 countries. Sudan has submitted a proposal for 50,000 solar pumps. The project signed an initial phase of conducting feasibility studies and procuring some solar pumps for the 10 participating countries.

3.8 Gender responsiveness at project design

When it comes to gender responsiveness in the project design, there are issues, as there are no specific activities targeted at women's empowerment. The provisions for monitoring and evaluation of gender issues are also non-existent. There are no gender-segregated indicators in the results framework of the project.

The project design has realized the importance of gender mainstreaming in the energy sector. Accordingly, the project design sought to achieve gender equality through the empowerment of women. As the replacement of diesel-operated pumps, with solar PV pumps, does away with the labor-intensive operations of the diesel pumps, the project leads to improved participation of women in agriculture. In Sudan agriculture accounts for 78% of the jobs held by rural working women, thus, the project will raise incomes for women. The project will also lead to positive socio-economic impacts for the smallholder agriculture sector, by increasing income levels. However, there is no provision in the project design to monitor the progress and achievement on this front.

3.9 Management arrangements

The project has been implemented using the 'National Implementation Modality (NIM)' of UNDP with the Ministry of Water Resources, Irrigation and Electricity[10] (MWRE), as the implementation partner. UNDP was responsible for the disbursement of funds and the achievement of the project goals, according to the approved work plan.

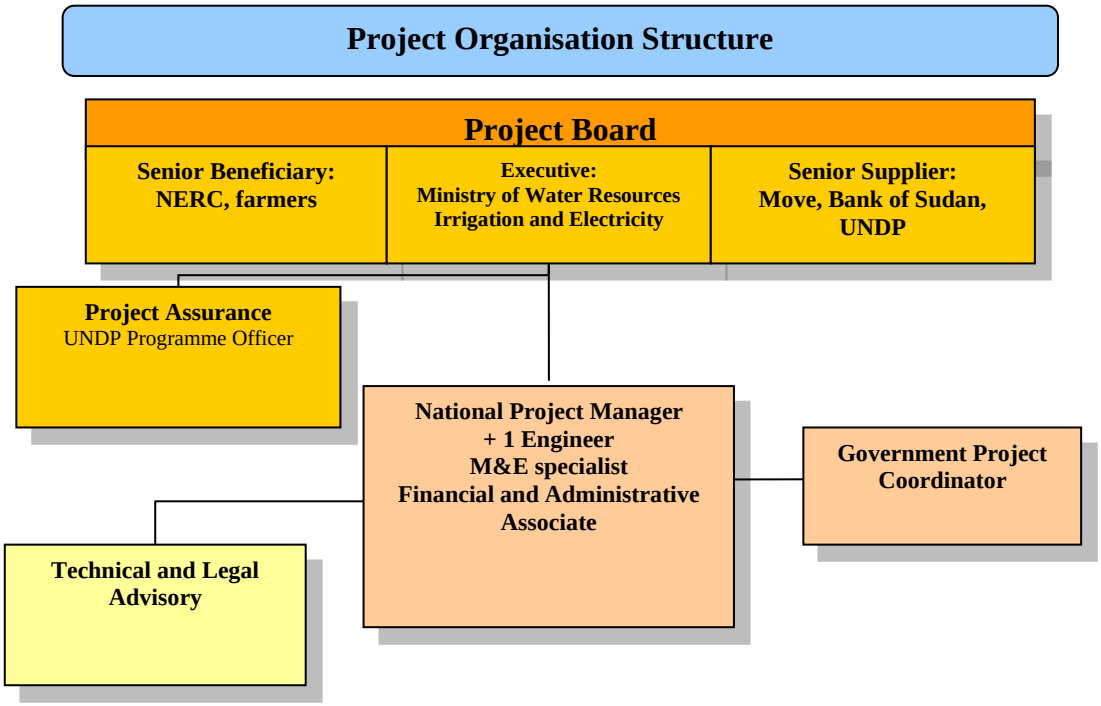
A Project Board (PB) was to be established at the inception of the project to monitor project progress, guide project implementation, and support the project in achieving its listed outputs and outcomes. The project board was to be chaired by an MWRE representative and was to include representatives from MoF, Central Bank of Sudan, NERC, SSMO, HCENR, Northern State Ministry of Agriculture, Animal Resources and Irrigation, and a Project Assurance Officer from UNDP.

The day-to-day management of the project was to be carried out by a Project Management Unit (PMU) under the overall guidance of the PB. The PMU was to be established within MWRE and was to coordinate its work with UNDP, MoP, HCENR, and other stakeholders. The National Project Manager will report to MWRE and the PB.

The national project manager was to be supported by international and national experts taking the lead in the implementation of specific technical assistance components of the project. Contacts with experts and institutions in other countries that have already gained experience in developing and implementing renewable energy policies and financial support mechanisms were also to be established.

[10] Currently Ministry of Energy and Petroleum

The national project manager was to participate in the PB, as a non-voting member and was also responsible for sharing required documents sufficiently in advance of the meeting and compiling a summary report of the discussions and conclusions of each meeting.



A Government Project Coordinator (GPC) was to coordinate project operations and support the NPM with overall administration, oversight, coordination of activities, and maintaining a liaison with UNDP. The GPC was to coordinate the project activities with activities of other Government entities and certify that the expenditures are in line with approved budgets and work-plans.

UNDP was to maintain the oversight and management of the overall project budget. It was responsible for monitoring project implementation, timely reporting the progress to the UNDP Regional Centre and the GEF, as well as organizing mandatory and possible complementary reviews and evaluations on an as-needed basis. UNDP was also to support in procurement of the required expert services and other project inputs and administer the required contracts. Furthermore, it was required to support the coordination and networking with other related initiatives and institutions in the country. Fig 1 provides the organization structure for the implementation of the project.

4. FINDINGS: PROJECT IMPLEMENTATION

4.1 Adaptive management and Feedback from M&E used for adaptive management

The main questions for terminal evaluation are; (please see B)

- **Did the project undergo significant changes as a result of recommendations from the mid-term review? Or as a result of other review procedures? Explain the process and implications.**
- **If the changes were extensive, did they materially change the expected project outcomes?**
- **Were the project changes articulated in writing and then considered and approved by the project steering committee?**
- **Whether feedback from M&E activities was used for adaptive management?**
- **Whether changes were made to project implementation as a result of the MTR recommendations?**

The project start date is 28 Feb 2016 (date of signature of project document). The actual implementation of the project started in June 2016 (as per the annual report for 2016). There is no evidence (inception report, mentioned in any other monitoring document) to suggest that the inception meeting/workshop of the project happened. Thus, there were no changes in the project design at the time of the project's inception.

The Project's independent Mid-Term Review (MTR) took place in December 2019. The MTR recommended several actions to make a better link between the project outcome and impact and to boost the delivery of project results. The management response to the MTR could not be shared at the time of TE. The project did not undergo any significant change as a result of recommendations from the mid-term review.

One of the risks faced by the project was the currency exchange rate. Due to the large variation in the currency exchange rate (USD Vs. SDG), the cost of imports for the Solar PV pumps increased, leading to the situation where the suppliers of Solar PV pumps, on which the order was placed could not meet their commitments to supply the pumps. Adaptive action was taken by reducing the number of pumps to be supplied to match the increase in the cost of imports. Although the project design identified the risk of the currency exchange rate, it missed its likely impact on the imports of the pumps for the pilot activities supports by grants. It is recommended that for the projects which are likely to face the situation of hyperinflation and devaluation of the local currency in the country of implementation provision should be made to take care of this risk (please see recommendation 2).

One of the other adaptive measures which were taken was the creation of a PV fund with UNDP in hard currency, with contributions from the national counterparts. Under the arrangement, a cost-sharing agreement was signed between the government and UNDP by which the government Co-finance in local currency (SDG) and UNDP will do all the procurement processes through its current Long-Term Agreement (LTA) with three local companies. However, as explained further in another section of the report (please see section 5.1.1) the issues arising due to the currency exchange rate could not be addressed fully.

Monitoring and Evaluation activities for the project have been as per the requirements of GEF, however. project inception did not happen formally. PIRs were prepared as per the requirements. No quarterly reports were prepared. The annual progress report got prepared only for one of the implementation years (2016).

There is no evidence to suggest the use of feedback from M&E activities for adaptive management of the project.

No changes were made to the project results framework during its implementation. As the project manager was removed midway through the project implementation there was no fulltime project

manager and no functional PMU. The management of the project was carried out by the officials of the implementation partners on a part-time basis. This is a significant change, there is no evidence that such a change in the implementation arrangement was approved.

4.2 Partnership arrangements

The main questions for terminal evaluation are; (please see Annex B)

- **Were there adequate provisions in the project design for consultation with stakeholder?**
- **Whether effective partnerships arrangements were established for implementation of the project with relevant stakeholders involved in the country/region, including the formation of a Project Board?**
- **Whether lessons from other relevant projects incorporated into project implementation**

In an earlier section of the report (please see section 3.4) details about the provisions made in the project design for consultation with the stakeholders were provided. Section 3.4, also provided details about the planned partnership arrangement with the stakeholders for the implementation of the project and the formation of the project board. As per the project team, the project went ahead with the partnership arrangements as planned. However, at the TE no evidence (documents, reports, etc.) could be shared by the project team to support, the participation of the stakeholders and the partnership arrangements made by the project. It was mentioned by the project team that, no documents are available to support the partnership arrangements made, as the earlier project manager was removed (no proper records and storage of documents was done). The only available evidence is that the board meetings were held with the participation of all the stakeholders.

There is no evidence to suggest, gender considerations during project implementation and while involving the stakeholders in project implementation. This additional information is now included in the TE report.

As mentioned in the earlier paragraph, the 'Project Board' was dully constituted. As per the project team partnership arrangements were dully made with different agencies of the national counterparts for the effective implementation of the project. Some of the partnership arrangements were made, and the roles of the partners in the project are as follows;

Stakeholder	Role
The Northern State Ministry of Agriculture, Animal Resources, and Irrigation (NS MAARI)	NS MAARI provided the logistic support and support for the implementation of the pilot activities (including the selection of the farmers for the pilot activities) in the Northern State. It also provided support for monitoring the performance of the solar PV pumps provided under phase 1 of the pilot activities.
Ministry of Finance & National Economy (MoF)	MoF participated in the creation of the PV fund. Although, the PV Fund did not eventually work
National Energy Research Centre (NERC)	NERC provided technical support for the implementation of the pilot activities under the project. It also provided technical support for the creation of the PV Solar Pump testing facilities at SSMO. Being a member of the Project Board, it provided technical support for the implementation of the project.
Sudan Standards and Metrology Organization (SSMO)	Under the project, testing facilities for testing solar PV Pumps were created at SSMO. The training was also provided to the technical staff of SSMO for the operations of the testing facility. At the time of TE, the testing facility was not operational.
Banks	The Bank of Sudan and the Neil Bank participated in the creation of the PV Fund. Although, the PV fund eventually did not become functional. The Neil Bank provided loans (this activity is independent of the activities carried out by the project) to farmers for buying solar PV pumps at their initiative.

Participation by the NGOs/CBOs, and academic institutions (expect for a minor role of the Energy Centre at the University of Khartoum). There is no evidence to suggest, gender considerations during project implementation and while involving the stakeholders in project implementation. UNDP CO Sudan entered into an agreement with the Sudan Government for the Provision of Support Services during the implementation of the project.

4.3 Project Finance

The main questions for terminal evaluation are; (please see Annex B)

- **Whether there was sufficient clarity in the reported co-financing to substantiate in-kind and cash co-financing from all listed sources?**
- **What are the reasons for differences in the level of expected and actual co-financing?**
- **To what extent project components supported by external funders were well integrated into the overall project?**
- **What is the effect on project outcomes and/or sustainability from the extent of materialization of co-financing?**
- **Whether there is evidence of additional, leveraged resources that have been committed as a result of the project?**

The planned expenditure for the project and its distribution amongst different components of the project is given in Table 10.

Table 10: Project Cost (as per project document) (figures in USD)

Outcome	Fund Source	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Total
Outcome 1	GEF	8,46,227	40,000	6,26,542	6,26,542	6,16,542	27,55,853
	UNDP	0	0	0	0	0	0
	Sub Total 1	8,46,227	40,000	6,26,542	6,26,542	6,16,542	27,55,853
Outcome 2	GEF	31,544	2,80,000	1,50,000	1,45,000	1,40,000	7,46,544
	UNDP	61,000	36,000	36,000	35,000	38,875	2,06,875
	Sub Total 2	92,544	3,16,000	1,86,000	1,80,000	1,78,875	9,53,419
Outcome 3	GEF	98,000	98,310	95,000	50,000	55,000	3,96,310
	UNDP	40,000	25,000	22,000	18,000	18,000	1,23,000
	Sub Total 3	1,38,000	1,23,310	1,17,000	68,000	73,000	5,19,310
Outcome 4	GEF	45,000	40,000	92,000	52,000	30,243	2,59,243
	UNDP	0	6,000	50,000	6,000	7,000	69,000
	Sub Total 4	45,000	46,000	1,42,000	58,000	37,243	3,28,243
Project Management	GEF	41,065	42,364	46,854	36,208	41,312	2,07,803
	UNDP	93,760	13,278	13,154	15,737	15,196	1,51,125
	Sub Total - PM	1,34,825	55,642	60,008	51,945	56,508	3,58,928
Total	**GEF**	**10,61,836**	**5,00,674**	**10,10,396**	**9,09,750**	**8,83,097**	**43,65,753**
	UNDP	**1,94,760**	**80,278**	**1,21,154**	**74,737**	**79,071**	**5,50,000**
	Total	**12,56,596**	**5,80,952**	**11,31,550**	**9,84,487**	**9,62,168**	**49,15,753**

Table 11 provides the details of the financing and co-financing committed by different agencies at the project design and the actual co-financing realised at the time of the Terminal Evaluation.

Table 11: Planned and Actual Co-financing at project design and as TE[11] (figures in USD)

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Confirmed at CEO Endorsement	Investment mobilized	Materialized as of Jun 30, 2022
Recipient Government	Ministry of Water Resources and Electricity	Grants	1,500,000	Recurrent expenditures	50,000
	Ministry of Environment	Grants	500,000	*(Not set or not applicable)*	0
	Ministry of Petroleum	Grants	200,000	Investment mobilized	0

[11] Prepared based on the information provided by PMU as contained in PIR 2022

	Ministry of Finance and National Economy	Grants	3,000,000	Investment mobilized	2,200,000
	Ministry of Agriculture ARI NS	In-Kind	150,000	Recurrent expenditures	10,000
Private Sector	Sudanese Bank ANAI BFFC	Loans	14,000,000	Investment mobilized	0
GEF Agency	UNDP	Grants	550,000	Investment mobilized	0
Others	National Energy Research Centre	Grants	250,000	Recurrent expenditures	0
Total			**20,150,000**		**2,260,000**

The project could not leverage the co-financing as per the commitments made at the time of CEO endorsement. One of the reasons for the lower realisation of the co-finance is no contribution by the banks (private sector). The loans by the banks to the farmers for the purchase of solar PV pumps could not happen due to the non-establishment of the PV fund. The reasons for the non-establishment of the PV fund are discussed elsewhere in the report (please see section 5.1.1).

Financial audits were carried out for the years 2019 and 2020. There were no adverse observations from the financial audits of the project. Except for minor issues like, the Implementing Partner does not maintain a separate bank account for the project. This additional information is now included in the TE report.

Although quite a sizable number of farmers approached the banks and got the loan for buying solar PV pumps, this happened independently of the GEF project, and thus has not been considered as co-financing for the GEF project.

Based on the funding by GEF the project disbursement as of 30/06/2022 is USD 3,041,417. This is equivalent to 69.67% of total committed GEF funding.

4.4 Monitoring and evaluation: design at entry

The main questions for terminal evaluation are; (please see Annex B)

- **Is the M&E plan well-conceived at the design stage?**
- **Is M&E plan articulated sufficient to monitor results and track progress toward achieving objectives?**
- **Was the M&E plan sufficiently budgeted and funded during project preparation and implementation?**
- **How effective are the monitoring indicators from the project document for measuring progress and performance?**

A monitoring and evaluation plan was put in place at the time of project design. There was a provision to review the plan at the time of project inception. The responsibilities of M&E activities were entrusted to UNDP CO. As per the project document, the M&E activities include approving annual implementation work plans, budget revisions, monitoring progress, identifying problems, suggesting remediating actions, project evaluation etc.

As per the plan, the project was to be monitored through periodic quarterly and annual monitoring. There were provisions for the preparation of APR/PIR. The APR/PIR combines both UNDP and GEF reporting requirements. Provisions were also made in the project design for an independent Mid-Term Review and the Terminal Evaluation. GEF Focal Area Tracking Tools (Core Indicators) were also to be prepared before the MTR and at the TE.

The set of indicators to be monitored and the corresponding targets were provided in the log-frame of the project. As mentioned earlier (please see section 3.1) there are no issues with the indictors in terms of achievability and measurability. The results of the monitoring and evaluations were to be provided

to the project board. The project design has not provided gender-segregated indicators for monitoring and verification of the progress and achievement of the results of the project. The monitoring and verification plan for the project does not have any provision for disaggregated data specific to gender, children, indigenous persons, and other vulnerable sections of society.

The M&E plan at the design stage was well conceived. The plan was well articulated and was sufficient to monitor results and track the progress toward achieving the objectives.

Adequate provisions were made in the budget for monitoring and evaluation activities. **The M&E design at entry is rated[12] as Satisfactory**.

4.5 Monitoring and evaluation: implementation

The main questions for terminal evaluation are; (please see Annex B)

- **Whether the logical framework was used during implementation as a management and M&E tool?**
- **What has been the level of compliance with the progress and financial reporting requirements/ schedule, including quality and timeliness of reports?**
- **What has been the effectiveness of the monitoring reports and evidence that these were discussed with stakeholders and project staff?**
- **What is the extent to which follow-up actions, and/ or adaptive management, were taken in response to monitoring reports (APR/PIRs)?**
- **Whether APR/PIR self-evaluation ratings were consistent with the MTR. If not, were these discrepancies identified by the project steering committee and addressed?**

Section 4.4 provided the requirements for monitoring and evaluation as per the design of the project. Evaluation of the actual implementation of the monitoring and evaluation is provided in this section. Evaluation is based on the requirements of monitoring and evaluation, compared to the monitoring and evaluation carried out during the implementation of the project.

Annual PIRs were produced using the set of indicators provided in the log-frame. However, the quarterly monitoring reports were not produced. Project board meetings have been irregular. For example, there were no board meetings for the PIR years 2018 and 2019 (the PIR for the years 2018 and 2019 has not mentioned any board meeting). As per the project team the Project Board meeting in the year 2022 was not held for the individual project, but for the energy pillar (at the UNDP CO level). It was explained by the UNDP team that this is as per the recent practice and approach being followed by the CO. For the board meetings which are put on record in the PIRs (PIR for 2017 and 2020 mentions two board meetings each; one board meeting in PIR 2021; one board meeting in PIR 2022), no formal minutes of the meetings could be shared at the time of TE.

When it comes to monitoring and evaluation, one of the challenges faced by the project is that since July 2021 there is no fulltime project manager and support staff for the project, as the project manager working at that time got removed. Since then, one of the officials of the Ministry of Water Resources Irrigation and Electricity (MWRE) is doubling up as the project manager. At the time of TE, there was no formal PMU. Although the project management is in very capable and competent hands, the project implementation suffers due to the lack of a full-time person responsible. Further, due to the absence of a full-time project manager and the role of the project manager being played on a part-time basis by the staff on the implementing partner, there are no independent views and advise from a professional manager to the project co-ordinator and the project board.

As the project design has not provided gender-segregated indicators for monitoring and verification of the progress and achievement of the results of the project. Also, the monitoring and verification plan

[12] Rating Scale Use: Highly Satisfactory (HS): no shortcomings; Satisfactory (S): minor shortcomings; Moderately Satisfactory (MS); Moderately Unsatisfactory (MU): significant shortcomings; Unsatisfactory (U): major problems; Highly Unsatisfactory (HU): severe problems; Not Applicable (N/A); Unable to Assess (U/A)

for the project does not have any provision for disaggregated data specific to gender, children, indigenous persons, and other vulnerable sections of society. Thus, at the time of TE, no disaggregated data for the assessment of the performance of the project on the gender aspects and other cross-cutting issues were available.

Monitoring of the performance of the solar PV pumps installed under the project has been carried out periodically.

MTR of the project happened on time. TE of the project is currently under way. APR/PIR self-evaluation ratings were consistent with the MTR.

M&E Plan Implementation has been rated as Moderately Satisfactory. The overall quality of M&E is rated as Moderately Satisfactory

4.6 UNDP and Implementing Partner implementation /execution coordination, and operational issues

The main questions for terminal evaluation are; (please see Annex B)

- **Whether there was an appropriate focus on results?**
- **Was there adequate UNDP support to the Implementing Partner and project team?**
- **Quality and timeliness of technical support to the Executing Agency and project team**
- **Were the management inputs and processes, including budgeting and procurement adequate?**

The project has been implemented under NIM by the Ministry of Water Resources Irrigation and Electricity (MWRE) as the national implementing partner (NIP). A Project Management Unit (PMU) was established to oversee the implementation of the project on a day-to-day basis. However, the project manager who was initially appointed resigned after the appointment and the recruitment of the new project manager took time, due to which the implementation of the project got delayed by about seven months.

As was mentioned before (please see section 4.5) during the implementation of the project, there were issues between the implementing partners and the project manager, and the project manager was removed. Since June 2021, there is no fulltime project manager to oversee the implementation of the project and the role of the project manager has been assigned on a part-time basis to one of the government officials from the implementing partner. The operations of project activities in the Northern State are coordinated by the Ministry of Agriculture Animal Resources & Irrigation - Northern State. This arrangement has resulted in a situation where the method of working as per the procedure and line of command is as per the government of Sudan requirements, which at times are not in line with UNDP/GEF requirements or the provisions made in the project design. For example, a project-specific board meeting is absent (a single board meeting was held for all three projects in the energy portfolio of the country).

Apart from the issues with the operations of PMU, there were political issues in the country for quite some time, due to which the implementation of the project suffered. Even the Board Meetings could not happen during 2018 and 2019.

UNDP country office provided overall program, administrative, and financial oversight of the project progress following the common UNDP procedures and tracking tools available in the Atlas system. UNDP CO also provided support for the implementation of the project as per the agreement with the government. The support services provided by UNDP included recruitment, procurement, financial management, etc.

When it comes to oversight support and ensuring that the project follows the requirements in terms of project inception, preparation of periodic progress reports (no quarterly reports, annual reports only for

two years), work planning, and approval, UNDP has fallen short of the requirements. The project inception did not happen, and the project's implementation started late.

Implementation of the project faced a lot of problems (e.g., no inception of the project, no functional PMU, irregular board meetings, non-operation of PV fund, under utilisation of funds, significant unfinished tasks to accomplish the outcomes, no dissemination activities, etc.). There is no evidence to suggest the actions and responsiveness on part of UNDP to address these implementation problems.

The quality of UNDP Execution has been rated as Moderately Satisfactory. The quality of Implementation by the Implementation Agency is rated as Moderately Unsatisfactory.

4.7 Risk Management

As was mentioned earlier in this report (please see section 3.2), during the project development stage, possible risks towards implementation of the project were identified and risk mitigation measures were proposed.

Apart from the risks identified in the project document, the PIF mentions some additional risks, which include political instability, lack of Government commitment to scaling-up the use of renewable energy technologies, lack of farmer interest in introducing solar pumps for irrigation, lack of technical specifications and standards, financial and credit constraints preventing the banks from financing the adoption of solar energy pumps for irrigation.

No specific social and environment risks were identified either at the project design stage or during the implementation of the project (except for the possibility of over-exploitation of the water resources due to zero variable cost of water pumping in the case of solar PV pumps.

During the implementation of the project, the project team and the implementation partners identified the following risks and proposed measures to mitigate the impacts due to the risks

- Risk related to the underground water resource. In response, the RTA recommended a closer oversight and follow-up for the project, and the involvement of in-house safeguard experts to discuss the particular needs of this project. However, no measures were implemented to take care of this environment and social risk.
- The economic situation in the country and high devaluation rates. This risk also could not be addressed and this led to the situation of non-implementation of phase 2 of the pilot activities.
- Political changes in the country led to a change in the governing regime and the movement of government officials. This led to the situation of non-implementation of some of the activities and only partial completion of some of the activities.

As was shared by the project team, to address the risks and challenges faced by the project, discussions were held between the CO and RTA to brainstorm about the challenges and opportunities and come up with a time-bound action plan. However, nothing effective could be worked out.

4.8 Social and Environmental Standards

No specific social and environment risks were identified either at the project design stage or during the implementation of the project (except for the possibility of over-exploitation of the water resources due to zero variable cost of water pumping in the case of solar PV pumps. At the TE, no additional social and environmental risk got identified.

The project did not have any plan for safeguards or a management plan to take care of the social and environment risks of the project. The project did not have any formal mechanism for getting feedback from the stakeholders and the communities and for redressing the grievances.

5. FINDINGS: PROJECT RESULTS

5.1 Overall results

The main questions for terminal evaluation are; (please see Annex B)

- **What have been the achievements of the objectives against the end of the project values of the log-frame indicators, with indicators for outcomes/outputs, indicating baseline situation and target levels, as well as the position at the close of the project?**
- **What are the achievements /Results in terms of contribution to sustainable development benefits, as well as global environmental benefits (direct and consequential GHG emission reduction)?**
- **How do the GEF Tracking Tool/Core Indicators at the Baseline and the one completed right before the Midterm Review compare with that, prepared at the time of Terminal Evaluation?**

The summary of the attainment of the results and project objectives is presented in this section of the report. The achievement of results against the Outcomes of the projects has been presented first, followed by the presentation of the achievement of the project goals and the project objectives. This is because the achievements of the project goals and the objectives have been assessed both, in terms of the indicators (for project goals and objectives as given in the log-frame) and in terms of the achievement of results for different Outcomes. As per the requirements, the evaluation regarding the attainment of the results has been carried out for the four individual outcomes of the project. The assessment regarding the attainment of results has been carried out in terms of the indicators provided in the log-frame. Wherever relevant, the reasons for the non-attainment of the targets have also been provided.

The mandatory ratings for the attainment of overall results have also been provided. Although the rating is not mandatory for achievement against each output/indicator, the rating has been provided. This has been done to facilitate the ratings for the individual Outcome and the project at an aggregate level. The evaluation of the attainment of overall results has been carried out keeping in mind the main questions for terminal evaluation, as given in the Box at the beginning of this section.

5.1.1 Attainment of results– Outcome 1

Outcome 1 of the project aimed to install 28 solar PV pumps as pilots. These pilot installations which were to be funded by the project as a grant were expected to as demonstration units. One of the other aims of Outcome 1 was to create a PV fund (using funds from GEF and part co-financing from the national counterparts), to provide financing to another 1440 solar PV pumps. The first set of 28 pumps and the subsequent 1440 pumps were to be installed in the Northern State. Different activities which were to be carried out for achieving Outcome 1 were as given in Table 12.

Table 12: Planned Outputs and Activities for Outcome 1

Outputs	Activities
1.1 28 pumps installed as part of a pilot phase	1.1.1. Selection of 28 farmers to receive the pilot pumps 1.1.2. Installation of baseline monitoring equipment to establish baseline diesel consumption, water pumped, operating hours, and cost expenditure. 1.1.3. Specification, procurement, and installation of 28 pilot pumps 1.1.4. Monitoring performance of the pilot pumps
1.2 National PV Fund and coordinated loan facility established and capitalized to promote concessional lending to farmers for PV pump equipment.	1.2.1. Support to Ministry of Finance to create national PV fund with appropriate fiduciary and legal standards in place for operation and monitoring 1.2.2. Coordination with North Government State and commercial banks to enact a loan program for PV pumps linked to the PV fund 1.2.3. Establish a set of criteria for PV pump loans 1.2.4. Establish and maintain a monitoring system
1.3 A minimum of 1,468 off-grid PV pumps ranging in size from 3.12-	1.3.1 Implement a subsidy scheme to support installation of 1,468 initial units

Outputs	Activities
29.6 kW installed in farms in the Northern State of Sudan with support from the national PV fund	1.3.2 Provide support to the lenders and users on closing and implementing the initial projects

All the activities for achieving Output 1.1 of the project were carried out and the project has successfully achieved Output 1.1. For achieving Output 1.2, and Output 1.3 the PV fund was created. However, the PV fund created under the project could not be made fully operational. This is explained further in the following paragraphs.

The PV Fund mechanism was approved by the Ministry of Finance and National Economy. The PV Fund was established with the participation of 11commercial banks with the commitment of an initial capital of USD 4 million for the 2018 plan. The Board of Directors was formed under the chairmanship of the Central Bank of Sudan. However, only 8 banks participated by providing SDG 15 M to the PV fund. Thus, the PV Fund got established with a consortium of 8 banks under the auspices of the Central Bank of Sudan with Anil Bank as the leading bank of the PV fund.

The process of providing concessional loans to farmers was started by selecting 400 farmers and a contract was awarded to 5 private companies to procure (import) and install the solar pumps. However, there were difficulties to implement the contract due to large variations in the currency exchange rate. The PV board decided to reduce the number of pumps to 120 to match the increased prices of the solar and a new tender was invited. As a result of the process, one company was contracted in 2021 to procure, supply, and install the PV pumps. The advance payment was transferred to this company (the value of the selected company's bidding price is equivalent to USD 147,950, and the PV fund transferred 70% of the value of the contract to the company). However, still, this did not work and the company did not meet its commitments, sighting the increase in price due to variations in the exchange rate. As far as the capitalisation of the PV fund is concerned, USD 37000 was contributed by the project, and a commitment of USD 120,000 (by guarantees no actual payments) was made by the government, bringing the fund size to USD 157000. Payments to the selected supplier of PV pumps were made by the banks based on the guarantees by the government.

To help the situation and to be able to contract companies in USD a cost-sharing agreement was signed between the Federal Ministry of Finance of Sudan and UNDP. Under the cost-sharing agreement, the procurement of the PV pumps was to be done by UNDP in hard currency and part of the cost of procurement was to be contributed by the government by transferring its part to UNDP. At the time of TE, the required transfer of funds to UNDP was still to happen. Further, at the time of TE, the dispute between the PV Fund and the selected supplier of the PV pumps is presently in courts in Sudan and the fund is not operational.

Given the successful positive demonstration of the initial set of 29 solar PV pumps supported by the project, coupled with the withdrawn of subsidy on diesel by the government and the fact that the farmers have been facing shortages in the availability of diesel, many farmers had at their own gone ahead with the installation of solar PV pumps in the farms. The dissemination of information regarding the success of the pilot solar PV water pumps happened largely by word of mouth. For installing the solar PV water pumps, some of the farmers used their financial resources, while others took financing from the banks under government-backed micro-financing schemes.

With this, the achievement of the project under Outcome 1 is the successful installation and running of 29 solar pumps as demonstration farms in the Northern State. The PV fund which was established signed a contract with the suppliers of the PV Pumps for providing these pumps to the farmers however, the contract could not get implemented due to depreciation in the value of the local currency.

Table 13 provides the details regarding the indicators for Outcome 1 of the project along with the baseline situation, the targets, and the level of attainment of the targets (in terms of the indicators). The

indicators are as per the results framework for Outcome 1. For reference, the values of the indicators at the time of MTR and those self-assessed in PIR for the terminal year (2022) are also provided in the table.

Table 13: Attainment of results: Outcome 1: Outcome 1: Financing and dissemination mechanism established and operational to support a PV pump installation programme

Indicator	Baseline	EOP Target	Status at MTR	Status as per PIR 2022	Status at TE	Rating at TE[13]
• Investment mobilized for purchase of solar pumps by EOP	• 0	• US$24,190,000	• 2,419,001 USD • Cost of 29 pumps is: 401,000 USD • Cost of subsidy for 1,440 pumps is: 1,800,000 USD • **Rating: HS**	• Investment mobilization for the purchase of solar pumps by this reporting period is about USD 4,321,613. This is mostly made available by the Federal ministry of finance (50%) and the North State Government (25%) as a contribution to the State PV fund. • A Cost Sharing Agreement was signed between the MoFEP and UNDP to procure and install 400 pumps, MoFEP availas 1.2 million USD for this purpose. • Besides there are some projects in the pipeline started implementation. these are: • USD7 million project as support from KOICA to provide 450 solar water pumps in River Nile state. • The African Development Bank is funding USD 21.815 million for installation of 1,170 solar pumps in North and West Kordofan States.	• Investment of about USD 401,000 for the initial set of PV water pumps, plus USD 1,030,000 paid as advance to the supplier of additional 120 PV water pumps. • Cost sharing agreement signed between UNDP and the government, for procurement of more pumps. But no actual investment was made.	• MU
• Dedicated mechanism for finance of PV pumps established	• None	• At least one national PV pump fund	• PV Fund has been formulated • **Rating: HS**	• A PV fund was established from a consortium of 7 banks to finance solar water pumps in the Northern state	• PV fund got established but was not adequately funded (government contribution has been as guarantees, rather than the actual funding) • The PV fund has faced rough weather and is not operational	• MU

Based on the achievement of the indicators for different outputs, the achievement of Outcome 1 of the project is rated as Moderately Unsatisfactory (MU).

As was mentioned in the earlier paragraphs of this section of the report, one of the challenges faced by the project was large fluctuations in the currency exchange rate (USD Vs Sudanese Pound). As there was a very large exchange rate fluctuation, the supply of solar pumps under the second phase of the project faced difficulties (the order to the supplier was in Sudanese pounds, whereas he needed to procure PV pumps from international markets in hard currency). In this regard, it is recommended (please see recommendation 2) to use any of the following options for future project designs involving such situations.

- Procurement be done by the Executing Agency, internationally in hard currency

[13] GEF Rating Scale: 6 = Highly Satisfactory (HS) - exceeds expectations, no shortcomings; 5 = Satisfactory (S) - meets expectations and no or minor shortcomings; 4 = Moderately Satisfactory (MS) - more or less meets expectations and some shortcomings; 3 = Moderately Unsatisfactory (MU) – somewhat below expectations and significant shortcomings; 2 = Unsatisfactory (U) - substantially below expectations and major shortcomings; 1 = Highly Unsatisfactory (HU) -severe shortcomings; Unable to Assess (U/A): available information does not allow an assessment

- The project team does the procurement in hard currency terms
- A price variation clause is incorporated in the contract, wherein the actual payment is linked to the currency exchange rate.

5.1.2 Attainment of results – Outcome 2

Outcome 2 of the project was aimed to reduce the technology risks with the solar PV water pumps, by introducing quality standards for the solar PV pumps, creating the testing and certification facilities followed by training the technical staff. This Outcome of the project also included the promotion of efficient use of water for irrigation. Different activities which were to be carried out for achieving Outcome 2 were as given in Table 14.

Table 14: Planned Outputs and Activities for Outcome 2

Outputs	Activities
2.1 Development and implementation of technical quality standards for PV pump components by the National Energy Research Centre (NERC), augmented by enforcement support from SSMO, Customs and relevant market observers	2.1.1 Development of technical standards for equipment for solar water pumping 2.1.2 Approval of initial equipment suppliers and providers 2.1.3 Training for NERC and SSMO on evaluation of equipment
2.2 SSMO test and certification laboratories strengthened to test and label PV pump components	2.2.1 Evaluation of tests required to be carried out in-country 2.2.2 Establishment of basic testing protocols 2.2.3 Training of personnel to perform and develop tests
2.3 Software tool for pump sizing according to farm and hydrological conditions developed and implemented	2.3.1 Development or integration of solar resource assessment software 2.3.2 Development of a tool, or look-up table, to provide appropriate sizing for flow rate, informed by monitored parameters under Outcome 1.
2.4 Training and certification scheme for PV pump installers (including local retailers, technicians, and pump rental companies) developed and implemented.	2.4.1 Establishment of a training program for installers 2.4.2 Establishment of a testing and certification scheme for installers.
2.5 Research on development of the most relevant, water efficient, irrigation techniques directly applicable in the North State at minimal cost and dissemination of techniques to farmers.	2.5.1 Development of water saving measures at the Agricultural Research Centre in the North State. 2.5.2 Dissemination of such measures to farmers to reduce their need for water and thus capacity and capital cost of a pump.
2.6 Promotion of sustainable pumping practices based on outputs of the Nubian Sandstone Aquifer System from a separate GEF project (ID 4736).	2.6.1 Evaluation of underground water resource and determination of sustainable pumping rates relying on outputs from the Nubian Sandstone Aquifer System.

There is no evidence to suggest that the technical standards for solar PV water pumps got developed. Under the project, a laboratory was established for testing solar PV pumps. The test lab is managed by SSMO. The idea of the lab was to test the pumps and provide certification for the quality of the pumps.

The supplier of the test lab trained the engineers from SSMO in the operation of the lab. However, due to the shifting of staff with SSMO and the moving on of some of the trained engineers the operations of the lab could not happen. During the TE mission, a visit to the lab was made. The lab was not in good shape and seems to have been out of operation for a long time. A couple of solar panels (which are part of the test set up) were missing.

The procurement of software for pump sizing, training of stakeholders on the software, and the use of the software could not be confirmed during the TE.

The idea of Outcome 2 of the project was the avoidance of imports of sub-standard equipment in the country. The purpose is defeated due to the non-development/adoption of the standards and non-functional testing facilities. The test lab established under the project would be useful while implementing the other ongoing solar PV-based water pump projects (please see section 3.7 for details

of the other ongoing projects) in Sudan. It is recommended that the test lab should be made operational (please see recommendation 3). The test lab may be made operational using any (of a combination) of the following approaches.

- The testing facilities be transferred to the National Energy Research Centre (NERC). NERC will be in a better position to provide for a couple of missing solar panels and provide for the technical resources (persons) to operate the test facility. NERC will also be able to make good use of the testing facilities for the research work
- While the operations of the testing facility are carried out by NERC, the certification can still be done by the SSMO, based on the test reports produced by NERC.
- Use the concept of brand approval, and third-party certification, to ensure only quality solar pumps and PV panels get imported/manufactured and deployed. The concept of EE rating of the pumps can also be used. This will generate the business volume for the test center. A viable business model for the test center may be worked out to ensure that the test facilities are financially self-sustaining.

The establishment of the test lab for testing and certification of the solar PV-based water pumps is the highlight of activities under Outcome 2.

Table 15 provides the details regarding the indicators for Outcome 2 of the project along with the baseline situation, the targets, and the level of attainment of the targets (in terms of the indicators). The indicators are as per the results framework for Outcome 2. For reference, the values of the indicators at the time of MTR and those self-assessed in PIR for the terminal year (2022) are also provided in the table.

Table 15: Attainment of results: Outcome 2: Financing and dissemination mechanism de-risked through technical standards and demand-side support

Indicator	Baseline	EOP Targets	Status at MTR	Status as per PIR 2022	Status at TE	Rating at TE
• Technical quality standards developed and enforced for PV pumps	• None	• Reasonable standards in place to assure quality	• National standards for the components of the solar water pumps have been issued and adopted by the SSMO • **Rating: HS**	• A quality standard for solar water pumps was developed in collaboration with SSMO. • A test lab was built for SSMO for the testing and quality assurance of the solar pumps.	• A test lab for testing the solar PV pumps was procured and established. However, the lab could not be operationalized and put to use. • The lab was not operational at the time of the TE	• U
• Number of entities trained and capable of specifying and supplying solar pumps	• 0	• 3	• 0	• There are many experts that are now technically qualified and capable in working in the solar water pumps business. • 4 Engineers from 3 different government entities have been trained on basic information and specifying and supplying solar pumps and how to use software sizing tool (one training course). • 4 Licenses of PVsyst software have been purchased, of which: 2 Licenses of PVsyst software have been grant to The General Directorate of Renewable and	• There is no evidence to suggest that training to the stakeholders was provided by the project. Further, procurement and use of the software could not be validated at TE	**U**

				Alternative Energy. Others 2 Licenses of PVsyst software are with the PMU.		
• Number of pumping system using water efficient irrigation methods	• 0	• 1,468	• 29 pumping systems have been installed. • 400 pumping systems under tendering phase • **Rating: MS**	• Three Pumping system using water efficient irrigation methods on North State. These systems were installed by the farmers using own finance. • The efficient irrigation method is already included and being implemented by the subsequent projects from different donors such as KOICA and AfDB projects	• The procurement and installation of solar PV water pumps under the project have fallen short of the target. • 28 pumps installed by the project in the field mostly use flood irrigation • No activities under the project were undertaken to promote water-efficient methods • On the contrary, due to no cost of energy (solar energy is free), there is a tendency amongst the farmers to keep the pumps operating if the sunshine is available.	• U

The achievement of results for Outcome 2 of the project is rated as U (Unsatisfactory).

5.1.3 Attainment of results – Outcome 3

Outcome 3 of the project was aimed at securing the funding support for the replacement of the electricity/fossil-fuel-based water pumps with solar PV water pumps, beyond the implementation timelines of the present GEF project. The idea was to use NAMA to get the required support., under Outcome 3 of the project, it was proposed to develop and standardized baseline and an M&V protocol for a NAMA project. Different activities which were to be carried out for achieving Outcome 3 were as given in Table 16.

Table 16: Planned Outputs and Activities for Outcome 3

Outputs	Activities
3.1 Development of a standardized baseline for pump fuel-switching, applicable to Sudan and the wider region	3.1.1 Development of emissions standardized baseline according to UNFCCC guidelines 3.1.2 Establishment of additionality criteria according to UNFCCC guidelines 3.1.3 Submission of Standardized Baseline to the Sudan Designated National Authority for submission to UNFCCC
3.2 Implementation of the standardized baseline within a NAMA	3.2.1 Implementation of a NAMA utilizing the Standardized Baseline 3.2.2 Development of an MRV protocol under the NAMA

By the end of the project, not much work and activities could be carried out to achieve the targeted Outcome 3 of the project. The project developed the TOR for the recruitment of a national consultant and an international consultant to develop the standardized baseline and M&V protocol. Inception reports were submitted for both SBL and NAMA, however further work/activities to achieve the Outcome could not be carried out.

Table 17 provides the details regarding the indicators for Outcome 1 of the project along with the baseline situation, the targets, and the level of attainment of the targets (in terms of the indicators). The indicators are as per the results framework for Outcome 3. For reference, the values of the indicators at the time of MTR and those self-assessed in PIR for the terminal year (2022) are also provided in the table.

Table 17: Attainment of results: Outcome 3: Mitigation instrument (NAMA) design elaborated and implemented in support of the PV pump installation programme

Indicator	Baseline	EOP Targets	Status at MTR	Status as per PIR 2022	Status at TE	Rating at TE
• Development of a standardized baseline for solar PV pumping in Sudan	• None	• Standardized baseline developed and submitted to UNFCCC	• Fully achieved at MTR stage already • **Rating: MS**	• A number of steps are taken to develop the standardized baseline emission of solar pumps. • Monitoring systems were installed for the solar pumps to provide data for comparative analysis. • Baseline survey including socio-economic study have been conducted by NewTech Consultancy Company. • National and international consultants were hired to develop standardized baseline within a NAMA and MRV. • Inception report of NAMA and SBL study has been developed. • The studies could not be completed before the end of the GEF project (28th May 2022)	• Information about the completion of NAMA and SBL development could not be provided at the time of TE	• U
• Development of an MRV mechanism for solar water pumping	• No MRV mechanism	• An MRV mechanism developed and implemented	• Partially achieved at MTR stage • On track for full achievement at the end of the project • **Rating: MS**	• Few steps were taken to develop the MRV. • Local consultant of MRV contracted. The inception report was completed. • MRV study could not be completed before the end of the GEF project (28th May 2022)	• TOR for the consultancy was prepared. No further work could be carried out	• U

Achievement of results for Outcome 3 of the project is rated as U (Unsatisfactory).

5.1.4 Attainment of results – Outcome 4

Outcome 4 of the project was aimed at supporting the scaling up and replication of the intervention (replacement of diesel-operated water pumps for irrigation, with Solar PV-based water pumps). Different activities which were to be carried out for achieving Outcome 4 were as given in Table 18.

Table 18: Planned Outputs and Activities for Outcome 4

Outputs	Activities
4.1 Inclusion of PV pumps in the fiscal concessions lists of the Investment Law and the Agricultural Implements Regulation	4.1.1 Develop a set of lessons learned through the implementation of the project 4.1.2 Demonstration of the value and savings in implementation of a PV pumping programme 4.1.3 Presentation to the relevant authorities for inclusion in the fiscal plan and concession lists
4.2 Structured replication programme for other states designed and implemented, including strengthened integration of PV pumping in the Government's national energy roadmap and rural energy access strategy	4.2.1 Demonstration of national benefits and savings in implementation of PV pumping, included avoided infrastructure costs 4.2.2 Presentation to the relevant authorities to support inclusion in national energy roadmap and rural energy access strategy

Although the project did not carry out the activities elaborated in Table 18 above. The scaling up did happen due to outstanding results of the initial set of 28 solar PV pumps provided by the project, coupled with the withdrawal of subsidy on diesel and an increase in the electricity tariff. The removal of the subsidy on diesel and the increase in the electricity tariff increased the cost of irrigation, making the option of a Solar PV water pump more attractive. On top of it, were the irregular supply of electricity

and uncertainties regarding the availability of diesel. This led to an increase in the uptake of Solar PV pumps by the farmers in the Northern State.

Socioeconomic surveys and feasibility studies about the replacement of diesel pumps with solar water pumps were carried out for several other states besides the Northern State. They are North Kordofan, West Kordofan, South Kordofan, and Gadarif States.

With the success of Solar PV pumps in the Northern State, other bilateral and multi-lateral agencies become interested in launching programs for Solar PV irrigation pumps in other states of the country (please see section 3.7 for details)

Table 19 provides the details regarding the indicators for Outcome 4 of the project along with the baseline situation, the targets, and the level of attainment of the targets (in terms of the indicators). The indicators are as per the results framework for Outcome 4. For reference, the values of the indicators at the time of MTR and those self-assessed in PIR for the terminal year (2022) are also provided in the table.

Table 19: Attainment of results: Outcome 4: Supportive enabling environment and scaled-up implementation

Indicator	Baseline	EOP Targets	Status at MTR	Status as per PIR 2022	Status at TE	Rating at TE
• Inclusion of solar pumps in fiscal concessions lists of the Investment Law and the Agricultural Implements Regulation such that they receive preferential financial treatment	• PV pumps are not included and receive no preferential treatment	• PV pumps exempt from customs and taxes, receive benefits afforded to other agricultural implements	• Exemption from customs and other duties has been issued • Fully achieved at MTR stage already • **Rating: MS**	• Cabinet decision for the exemption of solar water pumps and its components from customs duties and taxes was issued in 2017.	• PV pumps and panels are now exempted from import duty	• **S**
• PV Pumping integrated in National Energy Roadmap and Rural Energy Access Strategy	• PV pumping not a part of NER or REAS	• PV pumping integrated into NER and REAS	• 15,000 PV pumps were planned to be included in the MWRIE 5-year strategic plan (2017- 2021) • A 50,000 PV pumps is planned to be included in the long-term strategic development plan for MWRIE • Fully achieved at MTR stage • **Rating: MS**	• Solar water pumps became a priority for the country particularly after the removal of subsidies. It is included in the sector strategy and long-term plan REMP	• There is no document to any activity carried out for achieving the results against this indicator	**U**
• Awareness raising and capacity building carried out	•	• At least one workshop and demonstration held with the Ministry of Agriculture in each State in Sudan	• Partially achieved at MTR stage • On track for full achievement at the end of the project • **Rating: MS**	•	• No awareness creation and capacity building workshop could be organized by the project	• U

There is hardly any activity either carried out or planned for Outcome 4 of the project. However, informally the present project did share information about the success of the project with other donor agencies. Also, informal exchange of information did happen with other states. Over and above this the scaling up and replication of solar PV-based water pumps in Sudan and been quite good. Based on this **the achievement of results for Outcome 4 of the project is rated as MS (Moderately Satisfactory).**

5.1.5 Attainment of project goals, project objectives

Table 20 provides the details of the level of attainment of the indicators (as per the results framework) for project objectives and the project goals. For reference, the baseline values of the indicators and those at the time of MTR and those self-assessed in PIR for the terminal year (2022) are also provided in the table.

Table 20: Attainment of results: Project Objective: Financing and dissemination mechanism established and operational to support a PV pump installation programme

Indicator	Baseline	EOP Targets	Status at MTR	Status as per PIR 2022	Status at TE	Rating at TE
• Amount of reduced CO2 emissions reductions from water pumps for irrigation (compared to the project baseline) installed EOP, tons CO2eq	• 0	• 313,174	• 1,297.95 Tons /20 years' operation • **Rating: MS**	• An estimation of more than 1,000 solar pumps installed by individuals after the pilot phase of the project. The CO2 emission reduction is estimated to be 44,720 ton CO2eq/20year. • With planned installation of 400 solar water pumps, thus will increase the total number of installed pumps to 1,400 and will result in emission reduction of 62,609 ton CO2/20 year.	• 12,660 t CO2/20 years lifetime of 28 pumps supported by the project (please see Table 21 for computations) • There is a further reduction in GHG emissions due to the installation of Solar PV pumps by the farmers, however, they have not been considered, as a contribution towards direct emission reductions. This considering the GEF definition of direct GHG emission reductions	• **MU**
• Cumulative installed capacity of off-grid PV solar pumps (kWp)	• 0	• 6,531 kWp as 1,468 pumps •	• 257.405 Wp • **Rating: MS**	• Once the planned pumps installations in addition to the already installed pump (by the project and individuals), the total number of pumps will be 1429 solar pumps. Thus, add a capacity of 12,683 kWp of solar modules and emission reduction of 63,906 ton CO2 per 20 Years.	• 258.97 kW, due to 28 pumps supported by the project (please see Table 21 for details) • There is further capacity creation due to the installation of Solar PV pumps by the farmers on their own, however, they have not been considered, as a contribution by the project as no activity was carried out by the project towards achieving this.	• **MU**
• Fuel saved	• 0	• 5.9 million liters/year	• 185,619 liters/year	• Not reported	• 0.24 million liters/year	• MU
• Number of banks providing finance for solar PV pumps	• 0	• 7	• 11 • **Rating: MS**	• 7 banks are contributing to the solar water pumps Fund (Mahfazah). Some other commercial banks are providing finance to farmers.	• Several commercial banks in the Northern state are extending loans to farmers for Solar PV pimps, under the micro-financing scheme	• S

Indicator	Baseline	EOP Targets	Status at MTR	Status as per PIR 2022	Status at TE	Rating at TE
• Reduction of down-time and farmer's time lost to pump repair	• 0 •	• 80%	• 83% • **Rating: MS**	• Generally, solar water pumps do not need major maintenance. just minor maintenance like cleaning of modules which is normally done by the farmer and he is trained on that or changing of fuses and this is done by the energy service companies which are already available end existing at local level.	• No down time is reported by the farmers	• **S**
• Savings due to avoided diesel cost after pumps have been paid off (over 15 years remaining technical life)	• 0	• US$56 million	• (8,294,400.00) SDG / 20years • **Rating: MS**	• With the existing installation of 1,029 solar pump, the saving from the avoidance of the diesel fuel is US$ 113 million for the 20 years lifetime. This huge saving from the solar pumps installation is partially due to the subsidy lifting from the oil products	• Savings due to the installation of 28 pumps supported by the project is much less than the target	Unable to Assess **(U/A)** Available information does not allow an assessment
• Number of new suppliers (partnerships) providing equipment financed by National PV Fund mechanism	• 0	• At least 7 (representing a business volume of approximately 200 pumps/supplier, or 50/year) •	• 19 Different local companies have pre-qualified for supply and installation of 400 solar water pumps • **Rating: MS**	• In addition to the already working companies (15 already qualified by the project), many companies were newly established or new branches for solar business branches established.	• The National PV fund is not operations (please see details in Table 13). • As the National PV fund could not be made operational, this indicator is no more valid • PV pump suppliers are growing fast in the North State and the entire country. However, they are not participating in the National PV fund	Unable to Assess **(U/A)** Available information does not allow an assessment
• Extent of change in modern energy coverage by users and specific sectors	• 0	22.5% (representing 1,468 pumps out of an estimated 6,500 existing)	• 0.45% • **Rating: MS**	• Total of 1,029 pumps already installed and 400 pumps are planned to be installed in this year. • Based on the demonstration phase, KOICA and AfDB two agencies started solar pumping projects in other areas of the country. • GoS have built a 5MWp solar plant at AlFashir and another 5MWp PV plant under construction	• Going by the solar PV pumps installed by the farmers on their own, the extent of coverage by modern energy for operations of irrigation pumps matches the target	• **S**

The values of achievement of targets for most of the indicators at TE of the project are not in agreement with PIR for the year 2022. The major reason for the variation in the assessment of achievement between the PIR and TE is that the PIR has considered the installation of 1000 more solar PV pumps over and above the 29 solar PV pumps (28 pumps installed in the farmers' fields and 1 pump installed in the research institute) supported by the project. As was explained in the earlier section (please see section 5.1.1), these 1000 (exact count is not available, the number has been estimated by the project team) additional pumps got established by the farmers using their funds. There was no technical or financial

support for this from the project. This scaling up happened partly due to an increase in electricity tariff and partly due to the removal of subsidy on diesel (leading to an increase in the price).

Although the achievement of the values of the indicators for project objectives has fallen short of the target values, the scaling and replication of the intervention (replacement of diesel-operated pumps with solar PV pumps) have been remarkably high. Given the extraordinary performance of the project on the scaling up and replication front the **achievement of Project Objectives is Rated as Moderately Satisfactory (MS)**

5.1.6 Global environmental benefits

The global environmental benefit of the project is the reduction in the emission of greenhouse gases (GHG) to help the global community address climate change. The GHG emission reduction is due to the replacement of diesel-operated water pumps for farm irrigation with solar PV-powered pumps. Based on the situation and consideration at the time of project design and at the time of TE, the GHG emission reductions due to the project as projected at the time of project design and as assessed at TE are given in Table 21.

Table 21: Targeted and Actual Direct GHG Emission Reductions

	Consideration as per project Document	**Actual at the time of TE**	**Notes**
Diesel Saving for 3.12 kW pump (liters per day) Diesel Saving for 5.12 kW pump (liters per day) Diesel Saving for 29.6 kW pump (liters per day)	11 16 96		
Irrigation days per year	270		
Emission Factor for Diesel energy conversion (kg CO2/liter)	2.66		
Installed 3.12 kW size pumps (numbers) Installed 5.12 kW size pumps (numbers) Installed 29.6 kW size pumps (numbers)	1276 128 64		
Total number of Pumps Installed	1468	28	
Installed kW for 3.12 kW size pumps Installed kW for 3.12 kW size pumps Installed kW for 3.12 kW size pumps Total installed kW	3981.12 655.36 1894.40 **6530.88**	 **258.97**	
Diesel Savings per year - 3.12 kW pumps (liters) Diesel Savings per year - 5.12 kW pumps (liters) Diesel Savings per year - 29.6 kW pumps (liters)	3789720 552960 1658880		
Total Diesel Savings per year (thousand liters)	**6002**	**238**	
GHG emission reductions (tCO2 eq./Year)	15964		
Equipment Life (Years)	20		
Lifetime Direct GHG Emission Reduction (tCO2 eq.)	**319,283**	**12,660**	**(1)**
GHG Emission Reduction due to scaling up (tCO2 eq.)			
Indirect/consequent GHG Emission Reductions (tCO2 eq.)	**1,252,694**	**1,850,000**	**(3)**
Lifetime Emission Reduction per kW installed (tCO2 eq.)	49	49	

	Consideration as per project Document	Actual at the time of TE	Notes
Notes: 1) Direct GHG emission at TE is based on the average lifetime Emission reduction per kW of 49 tCO2eq. This figure has been worked out based on the direct GHG emission reductions and the corresponding kW installed in the baseline case (as provided in the Project Document) 2) Apart from direct GHG emission reductions. The project would lead to consequent GHG emission reductions due to scaling up within the implementation period of the project. Considering that about 1000 solar PV pumps have been installed by the farmers in Northern State. The GHG emission reduction due to these pumps within their lifetime would be about 450,000 tCO2eq. 3) To compute consequent (indirect) GHG emission reductions, the project design has considered a replication factor of 4. At TE the replication factor of 4 is assessed as reasonable and achievable. This is considering the level of interest and activities amongst the farmers and other stakeholders, the replication factor of 4 is reasonable. Thus, at TE the indirect (consequent) GHG emission reduction due to the project is assessed to be (12,660 + 450,000) *4 = 1850 thousand tCO2eq.			

As can be seen from Table 21, the achievement of the global environment benefits due to the project, measured in terms of direct GHG emission reductions is significantly short (compared to the targets). The reason for this is the lesser number of solar PV pumps getting installed with support from the project. However, the GHG emission reductions when viewed at an aggregate level (GHG emission reductions due to pilots plus due to scaling up and the expected consequent reductions due to replication) are in line with the Global environment benefits targeted at the time of the project design.

5.2 Relevance

The main questions for terminal evaluation are; (please see Annex B)

- **To what extent is the activity suited to local and national development priorities and organizational policies, including changes over time?**
- **To what extent is the project in line with UNDP Operational Programs or the strategic priorities under which the project has been funded?**

The Solar PV Power Pump project and the activities planned within it are highly relevant to the development needs of Sudan. As mentioned in the project document, it is cost-prohibitive to extend the electricity distribution grid of the country to some of the yet-to-be-electrified farm locations. Sudan used to cap electricity and fossil fuel prices, leading to government subsidies for energy. The government has stopped providing subsidies on diesel and has increased the electricity tariff as well. This has led to an increase in the cost of irrigating the farms, using diesel-operated and electrically operated pumps. Further, with the uncertainties regarding the availability of diesel, farm productivity use to suffer. The solar PV water pump project has changed the situation for the farmers, with a huge impact on farm productivity (please see section 5.7 for more details regarding the impacts).

At the time of its design, the project was in line with the UNDP's strategic Plan Outcome 1. The project was in line with Integrated Resource and Results Framework (IRRF) Output 1.5;

- Indicator 1.5.1 Number of new development partnerships with funding for improved energy efficiency and/or sustainable energy solutions targeting underserved communities/groups and women
- Indicator 1.5.2: Extent of change in; a) energy efficiency and/or b) modern energy coverage by users and specific sectors).

The solar water pump project was also in line with UNDAF Outcome 2 (populations vulnerable to environmental risks and climate change become more resilient, and relevant institutions are more effective in the sustainable management of natural resources). The project confirmed to UNDP's

Country Programme Action Plan (CPAP) for Sudan (CPAP Output 2.2 - Investment in green energy and access by needy communities to sustainable energy improved).

Presently the project pertains to UNDAF 2018-2021 (extended up to 2022), Focus Area 2 (Environment, Climate Resilience, and Disaster Risk Management). The project confirms Outcome 1 of UNDAF 2018-21 (people in Sudan, with emphasis on small producers and micro-entrepreneurs, have access to improved productive capacities that contribute to inclusive and sustainable livelihoods, job creation, and ending extreme poverty). The project also confirms Outcome 2 of UNDAF (people's resilience to the consequences of climate change, environmental stresses, and natural hazards is enhanced through strengthened institutions, policies, plans, and programmes).

The project is aligned with the development priorities and organizational policies, of Sudan. Some of the relevant national plans are as follows;

- Darfur Development Strategy (2013-2019) (https://www.humanitarianresponse.info/sites/www.humanitarianresponse.info/files/documents/files/final_english_dds_13.8.13.pdf);
- Nationally Determined Contributions (https://unfccc.int/sites/default/files/NDC/2022-10/Sudan%20Updated%20First%20NDC-12102021.pdf);
- Sudan National Agriculture Investment Plan (http://extwprlegs1.fao.org/docs/pdf/sud201214.pdf) ;
- The Forests and Renewable Natural Resources Act (http://extwprlegs1.fao.org/docs/pdf/sud48812.pdf).

There was participation in the project implementation by a number of national stakeholders (please see Section 4.2). The project is in line with the following Sustainable Development Goals;

- SDG 2: Zero Hunger
- SDG 7: Affordable and clean energy
- SDG 8: Economic Growth
- SDG 13: Climate Action

5.3 Link with GEF strategies and priorities

The GEF focal are of the project is Climate change. The project pertains to the GEF OP 5 programming and the expected GEF Outcome of the project is CCM 3 (Renewable energy: Promote investment in renewable energy technologies. The corresponding GEF outcomes are Renewable energy capacity installed and Renewable energy policy and regulation in place. The project is in line with GEF Strategic Goal 2 (Reduce global climate change risks by stabilizing atmospheric GHG concentrations through emission reduction actions). For GEF-5, the climate change mitigation strategy was designed to help guide developing countries toward a low-carbon development path. The project being evaluated is aligned with this goal.

The relevance of the Solar PV water pump project has been rated as Satisfactory.

5.4 Effectiveness

The project was to support the replacement of diesel-operated water pumps for irrigation with solar PV technology-based water pumps in the unelectrified areas of the country, particularly in the Northern State of Sudan. The project was to demonstrate the use of solar PV technology for pumping water for irrigation. It was envisaged that successful demonstration of the technology will lead to scaling up of the planned interventions and will also lead to replication of the concept in other parts of the country. As was mentioned in the earlier section of the report (please see Section 5.1.1.), the project has not been

able to achieve the targeted outcomes and outputs of the project. The project implementation has not been able to implement phase 2 of the planned pilot activities. The project implementation has fallen short of the targets for all four targeted Outcomes of the project.

The project design and implementation have practically no gender considerations. Also, there was no human rights approach in the design and implementation of the project. Thus, there is no contribution by the project towards gender equality, empowerment of women, and human rights considerations.

Despite many short comings in the achievements, it can be argued that the project has successfully introduced the concept and done the ground work (e.g., private sector participation for supplying the hardware, increased capacity of the government officials, introduction of the business model for the private sector, participation of banks, etc.) for solar PV water pumps for irrigation in Sudan. This paves the way for the smooth implementation of the other ongoing and planned future efforts for solar PV pumps. Apart from the use of solar PV technology for irrigation, the project has also inculcated the general confidence of the stakeholders in the PV technology for other applications e.g., lighting and energy needs.

The Effectiveness of the project is rated as Moderately Satisfactory.

5.5 Efficiency

The main questions for terminal evaluation are; (please see Annex B)

- **To what extent the objectives, expected outcomes and outputs have been achieved?**
- **To what extent the results have been delivered with the least costly resources possible?**
- **What are the positive and negative, foreseen, and unforeseen changes to and effects produced by a development intervention?**

The goal of the project was the reduction of GHG emissions from the agriculture sector in Sudan by replacing diesel-based water pumps for irrigation, with solar PV-based water pumps in unelectrified areas of Sudan.

When it comes to the number of solar PV-based pumps installed, the project has fallen short of expected performance (the number of solar PV pumps whose installation was supported by the project is 28, against the target of 1468). However, the scaling up of the installation of the pumps has been quite good, and a large number (assessed by the project team to be about 1000) of solar PV pumps were installed by the farmers using their resources.

As the installation of the targeted number of solar PV water pumps could not be done by the end of the implementation period of the project, direct GHG emission reductions due to the project have fallen short of the target. However, due to the scaling up of the PV water pumps within the Northern State, there is significant consequent (indirect) GHG emission reduction due to the project.

Due to the exceptional demonstration of technology and the concept and the performance (benefits to the farmers), further scaling up within the Northern state and replication in other states is already happening at scale within the implementation timelines of the project.

Beyond the implementation timelines of the project, more solar PV water pumps for irrigation are going to be installed (please see details of the ongoing programs in section 3.7). This replication and scaling up are completely attributable to the successful demonstration of solar PV water pumps under the project.

The contribution of the project in terms of direct GHG emission reductions within the lifetime of the interventions is 12,660 tCO2e against the target of 319,283 tCO2e (please see Table 21 for details). Apart from the direct GHG emission reductions of 12.660 tCO2e, due to the pilots, there will be a

reduction in the emissions due to 1000 additional PV water pumps, installed by the farmers as a scaling-up activity. Apart from direct GHG emission reductions, the project would lead to a consequent (indirect) GHG emission reduction of 1,850,000 tCO2e.

At the time of project design, with the GEF support of USD 43,65,753, the cost of direct GHG mitigation was estimated to be USD 13.94/tCO2e, while the cost of consequent GHG mitigation was estimated to be USD 3.49/tCO2e. At TE the cost of direct GHG mitigation is estimated to be USD 240/tCO2 (USD 3041417/12660 tCO2), while the cost of consequential GHG mitigation is estimated to be USD 1.64/tCO2e.

Although, the cost of GHG mitigation given in the above paragraph is in line with what was projected in the project design, not all the emission reductions, due to the activities during implementation of the project can be considered as direct GHG emission reductions (e.g., as per GEF definition, the emission reductions due to scaling up do not qualify to be counted as direct GHG emission reductions). Thus, the **efficiency of the project is rated as Moderately Satisfactory.**

5.6 Overall Project Outcome

The assessment of the overall project outcome is based on the ratings for relevance, effectiveness, and efficiency. **Based on the rating for relevance, effectiveness, and efficiency, the Overall project outcome is assessed as Moderately Satisfactory.**

5.7 Country ownership

The main questions for terminal evaluation are; (please see Annex B)

- **Was the project concept in line with development priorities and plans of Sudan?**
- **Were the relevant country representatives from government and civil society involved in project implementation, including as part of the project steering committee?**
- **Was an inter-governmental committee given responsibility to liaise with the project team, recognizing that more than one ministry should be involved?**
- **Have the government(s), enacted legislation, and/or developed policies and regulations in line with the project's objectives?**

As mentioned in section 5.2, the solar PV water pump was in line with the development priorities and plans of the government.

The project design and the implementations were carried out in close coordination and consultation with different government agencies. Several government agencies and institutions were involved in the execution of the project. The representative of the Northern State where the intervention under the project was planned were members of the project board.

The project was implemented under NIP with the Ministry of Water Resources Irrigation and Electricity (Currently the Ministry of Energy and Petroleum) as the implementing partner. The project board had representatives from all the concerned ministries/departments. The country also approved the exemption of customs duty on solar PV pumps. There was the active participation of important government officials in the implementation of the project. There was country ownership for the project.

5.8 Mainstreaming

The main questions for terminal evaluation are; (please see Annex B)

- **How is the project successfully mainstreaming other UNDP priorities, including poverty alleviation, improved governance, the prevention and recovery from natural disasters, and women's empowerment?**
- **Whether it is possible to identify and define the positive or negative effects of the project on local populations (e.g., income generation/job creation, improved natural resource management arrangements with local groups, improvement in policy frameworks for resource allocation and distribution, regeneration of natural**

resources for long term sustainability).

- **If the project objectives conform to agreed priorities in the UNDP country programme document (CPD) and country programme action plan (CPAP) / One Strategic Plan (OSP).**
- **Whether there is evidence that the project outcomes have contributed to better preparations to cope with disasters.**
- **Whether gender issues have been taken into account in project design and implementation and in what way has the project contributed to greater consideration of gender aspects, (i.e., project team composition, gender-related aspects of pollution impacts, stakeholder outreach to women's groups, etc.)**

The project has led to an increase in the income of the farmers due to an increase in farm production (increase in yield, double cropping, increase in the area under cultivation, cash crops); support to alternate means of livelihood (e.g., animal husbandry, commercial crops); savings in the fossil fuels.

In Sudan (particularly in the North State), there is no rain-feed agriculture, Thus, the project does not have any impact due to droughts. The project addresses the issue of interruption in the supply of energy (diesel oil and electricity) due to conflicts, or shortages from time to time.

At the level of UNDP, there is a contribution of the solar PV water pump project towards mainstreaming its other priority areas of work like poverty alleviation, improved governance, prevention and recovery from disasters, gender equality, etc. The project has no negative impact on any of the other development priority areas of the UNDP.

There are no gender-segregated indicators in the results framework of the project. The project design has realized the importance of gender mainstreaming in the energy sector. Accordingly, the project design had made provisions to seek the achievement of gender equality through the empowerment of women. While implementing the project, there were no specific considerations of gender, indigenous people, and other deprived sections of society. The project is not having any disaggregated results/impacts specific to gender, indigenous persons, and other deprived sections of society.

As the replacement of diesel-operated pumps, with solar PV pumps, does away with the labour-intensive operations of the diesel pumps, the project leads to improved participation of women in agriculture. In Sudan agriculture accounts for 78% of the jobs held by rural working women, thus, the project will raise incomes for women. The project will also lead to positive socio-economic impacts for the smallholder agriculture sector, by increasing income levels.

As was mentioned in Section 5.2, the UNDP country program for Sudan includes support for the implementation of the solar PV water project.

5.9 Sustainability

The main questions for terminal evaluation are; (please see Annex B)

- **Are there financial risks that may jeopardize the sustainability of project outcomes?**
- **What is the likelihood of financial and economic resources not being available once GEF grant assistance ends?**
- **Are there social or political risks that may threaten the sustainability of project outcomes?**
- **What is the risk for instance that the level of stakeholder ownership (including ownership by governments and other key stakeholders) will be insufficient to allow for the project outcomes/benefits to be sustained?**
- **Do the various key stakeholders see that it is in their interest that project benefits continue to flow?**
- **Is there sufficient public/stakeholder awareness in support of the project's long-term objectives?**
- **Do the legal frameworks, policies, and governance structures and processes within which the project operates pose risks that may jeopardize the sustainability of project benefits?**
- **Are requisite systems for accountability and transparency, and required technical know-how, in place?**
- **Are there ongoing activities that may pose an environmental threat to the sustainability of project outcomes?**

The achievement of results and Outcomes of the project has fallen short of the targets and the expectations set in the results framework. Thus, deliberations on the sustainability of the results of the project are contentious issues.

The project has introduced the concept of solar PV-based water pumps in Sudan. Successful demonstration of the concept has led to scaling up within the implementation timelines of the project. Some of the success stories of the project include;

- Confidence amongst the farmers regarding solar PV water pumps in terms of the technology, and a cost-effective method for irrigation of the farms
- establishment of a business model for the supply of PV water pumps by the private sector
- funding by banks to the farmers for buying the pumps
- waiver of customs duty on solar PV pumps
- capacity development of the government officials

The Social and Environmental screening of the project, done at the PPG stage did not identify any significant social or environmental risks, other than the possibility of over-exploitation of the water resources due to no variable cost of energy. A review of the PIRs and MTR and the assessment done at the time of TE (through discussions with the stakeholders) did not identify any social or environmental risk for the sustainability of the results of the project. From the social and political viewpoint, there is not much threat to the sustainability of the results and outcomes of the project. Thus, from the viewpoint of the institutional framework and environmental sustainability, the outcomes of the project are likely to sustain.

There is a high level of ownership by the institutional and government stakeholders towards solar PV water pumps as a viable alternative to diesel/electrically operated water pumps, which is evident by the consistent efforts in Sudan towards providing such solutions in different states of the country. No risk is envisaged for the sustainability of the results of the project, due to the lack of interest from the key stakeholders.

As mentioned before in this section of the report, with the increased level of confidence, the commercial banks are now providing funds to the farmers for solar PV pumps. The funding by the banks, in all likelihood, would continue after the project. Thus, from the viewpoint of the availability of finance, the results of the project are likely to sustain.

The legal frameworks, policies, and governance structures and processes for the solar PV water pumps have been introduced by the GEF project. There are no risks to the results of the projects from these viewpoints.

The targeted beneficiaries (farmers) are overenthusiastic about the benefits of solar PV pumps, there are no observations regarding the possible social and political issues regarding the use of PV pumping technology for irrigation. From the socio-political viewpoint, the results of the project are likely to sustain.

The outcomes and results of the solar PV water pump project are Likely to Sustain. The sustainability of the achieved results of the project is rated[14] as likely.

5.10 Impacts

The main questions for terminal evaluation are; (please see Annex B)

- **Whether, the project has demonstrated verifiable improvements in ecological status?**
- **Whether, the project has demonstrated verifiable reductions in stress on ecological systems through specified process indicators, that progress is being made towards achievement of stress reduction and/or ecological improvement?**

[14] Ratings for Sustainability: Likely (L): negligible risks to sustainability; Moderately Likely (ML): moderate risks; Moderately Unlikely (MU); significant risks; Unlikely (U): severe risks

The project has created several positive impacts. The only possible negative impact of the project is the overexploitation of the water resources, due to no variable cost of energy for pumping the water. Given below are the positive and negative impacts of the project.

- A very good demonstration of the positive impacts and advantages of solar water pumps, leading to the establishment of such pumps by the farmers in the neighbouring farms and other villages, using their financial resources/loans from banks (no grants), etc. Increase in the comfort level of the banks to extend loans to farmers to buy solar water pumps. The mandate by the government for providing micro-finance to the agriculture sector coupled with the increased confidence level of the farmers has led to exponential growth in the number of loans to farmers to buy solar PV water pumps. It was gathered that already about 1000 solar PV pumps (either through bank loans or through farmers' resources) are functional in the area. Further, the banks in the area have more than 1000 applications from the farmers, pending loan approval for solar PV pumps. Also, the order books of the suppliers of the solar PV pumps in the region are full with about 300-400 new installations per month
- Savings for the government by way of savings on the subsidy provided on Diesel. Also, savings in fuel due to the avoidance of pumping water in the irrigation canals.
- With the replacement of diesel oil-operated pumps with solar PV pumps, there is a marked improvement in the working conditions at the farm level due to a reduction in the noise level and the local pollutants (particulate matter, SOx, NOx) associated with the use of diesel.
- The successful demonstration of the concept of solar PV for water pumping has led to the expansion of the concept of Solar PV water pumps for other applications (e.g., drinking water, poultry, etc.)
- Given that there is no variable cost for extracting water using a solar PV pump, there is a tendency to keep the pump operating throughout the day (if sunshine is available), even if there is no requirement for water. This leads to the depletion of the groundwater due to the over-exploitation of the groundwater resources. Some of the farmers contacted during the mission have pointed out the water table has already gone down (please see recommendation 9).
- In the baseline case (diesel-operated agriculture pumps) the maintenance of diesel-operated pumps was largely male-dominated activity. With the introduction of solar PV pumps for irrigation, the activity of operation and maintenance of pumps can be carried out by women, leading to increased participation of women in agriculture activities. In Sudan agriculture accounts for 78% of the jobs held by rural working women, thus, the project will raise incomes for women. The project will also lead to positive socio-economic impacts for the smallholder agriculture sector, by increasing income levels.
- The demonstration of the concept of a Solar PV water pump for irrigation, there is replication in other states by other development agencies.
- Given the level of enthusiasm amongst the farmers coupled with the confidence level of the suppliers of PV pumps. The suppliers are already providing solar PV pumps to the weaker sections on a monthly instalment payment basis.
- One of the co-benefits of the project is the availability of safe drinking water to the farming community. Using groundwater as the source.

The impacts of the project are rated[15] as Significant.

5.11 GEF Catalytic effect

One of the goals of the project was to put in place an enabling environment and scaled-up implementation of Solar PV water pumping in Sudan. For this provision was made in the project design for the replication of Solar PV pumps in other states of the country. To support the replication, the project design, apart from the successful demonstration of the pilots, has provided fiscal concessions for solar PV pumps and the establishment of a PV fund to support the purchase by the farmers. Outcome 4 of the project, supports the scaling-up and expansion of the project to other states in Sudan. It also includes a structured replication programme to replicate success in the Northern State to other states.

[15] Rating for Impacts: Significant (S); Minimal (M); Negligible (N)

The project implementation could not carry out the activities meant for achieving the replication and scaling up of the interventions. Also, the project could not implement phase 2 of the pilot activities and other activities like making the concessional finance available.

However, despite not the good performance of the activities targeted at replication, there has been phenomenal replication and scaling up of the intervention. This is due to the successful demonstration of the solar PV water pumps under phase 1 of the pilot activities. There has been exceptional scaling up within the Northern state and replication of the concept in other states of the country. The project has led to the successful proofing of the concept of solar PV water pumps for irrigation in Sudan.

6. CONCLUSIONS, RECOMMENDATIONS & LESSONS

The main questions for terminal evaluation are; (please see Annex B)

- **Did the project provide cost-effective solutions in order to address barriers?**
- **Are these solutions provided in an efficient way?**
- **What are the best and worst practices in addressing issues relating to relevance, performance and success?**
- **Corrective actions for the design, implementation, monitoring and evaluation of the project**
- **Actions to follow up or reinforce initial benefits from the project**
- **Proposals for future directions underlining main objectives**

6.1 Conclusions

The objective of the project was to support the replacement of diesel-operated water pumps for irrigation with solar PV technology-based water pumps in the unelectrified areas of the country, particularly in the Northern State. It was envisaged that the planned intervention, will lead to a reduction in the emission of GHGs due to the avoidance of the use of diesel for the operation of agriculture pumps. The development benefits of the project were; an increase in farm productivity; an increase in the income of farmers; and lesser imports of diesel helping the economy of the country. The project had the following four planned outcomes:

Outcome 1: Financing and dissemination mechanism established and operational to support a PV pump installation programme.
Outcome 2: Financing and dissemination mechanism de-risked through technical standards and demand-side support
Outcome 3: Mitigation instrument (NAMA) design elaborated and implemented in support of the PV pump installation programme
Outcome 4: Supportive enabling environment and scaled-up implementation

One of the remarkable achievements of the project under Outcome 1, is the successful demonstration of solar PV pumps for irrigation. Although phase 2 of the demonstration solar PV projects could not be installed, even then the demonstration of the technical and financial viability of the solar PV pump technology has been remarkable. Due to the successful demonstration of the solar PV water pumps, there has been exceptional scaling up within the Northern state and replication of the concept in other states of the country. The project has led to the successful proofing of the concept of solar PV water pumps for irrigation in Sudan.

One of the other important achievements of the project is the waiver of customs duty on imports of solar PV water pumps (under Outcome 2 of the project).

There has not been much activity and achievements of the results for the other Outcomes (Outcome 3 and Outcome 4) of the project, but the exceptional demonstration of the concept under Outcome 1 has more than compensated for the leaser achievements under Outcome 3 and Outcome 4. This is evident from two other donor-funded projects (one supported by AfDB and the other one by KOICA) to support the use of Solar PV pumps for irrigation in other states in Sudan.

The project has successfully mainstreamed the use of solar PV water pumps in Sudan as a technically and commercially viable option for irrigation.

6.2 Recommendations

6.2.1 Corrective actions for design, implementation, monitoring, and evaluation of project

#	Recommendation	Rational and Description	Timing/Dates for Action	Responsible Party
1	It is recommended that the grant funding (the order of the funds available in USD 800,000) pending utilisation be used to provide grants to the farmers who have already applied for loans for Solar PV pumps (there are about 1000 pending applications within the Northern District). This for example can be done based on a decision by the project board and UNDP together.	Given the present situation, it is unlikely that some of the grant funds meant for supporting the installation of solar PV pumps would get effectively utilized by the close of the project, unless adaptive measures are taken.	Immediate, before the closure of the project	UNDP CO, Implementing Partner, Project Board
2	It is recommended to use any of the following options for future project designs involving the situation of hyperinflation and devaluation of the local currency in the country of implementation. a) Procurement is done by the Implementing Agency, internationally in hard currency. This will also avoid the situation of the jurisdiction of local courts, in case of a possible legal issue b) The project team does the procurement in hard currency terms c) A price variation clause is incorporated in the contract, wherein the actual payment is linked to the currency exchange rate	One of the challenges faced by the project was very large fluctuations in the currency exchange rate (USD Vs Sudanese Pound). As there was a very large exchange rate fluctuation, the supply of solar pumps under the second phase of the project faced difficulties (the order to the supplier was in Sudanese Pounds, whereas the need of the supplier of the pumps was to source PV pumps from international markets in hard currency).	At the time of future project design	UNDP CO, Implementing Partner, GEF

6.2.2 Actions to follow up or reinforce initial benefits from project

#	Recommendation	Rational and Description	Timing/Dates for Action	Responsible Party
3	The test facilities for solar PV pumps established by the project were not functional at the time of TE. Unless adaptive measures are taken, the testing facilities for solar PV pumps are unlikely to be functional. In this regard following is recommended: a) The testing facilities be transferred to the National Energy Research Centre (NERC). NERC will be in a better position to provide for a couple of missing solar panels and provide for the technical resources (persons) to operate the test facility. NERC will also be able to make good use of the testing facilities for the research work b) While the operations of the testing facility are carried out by NERC, the certification can still be done by the Sudan	The project has supported the establishment of testing facilities for Solar PV-based pumping systems, at Sudan Standards Bureau. This included training the technical staff in the operation of the testing facilities. The idea of the center was avoidance of imports of sub-standard equipment in the country. The test lab is not operational since the time of its establishment. The reasons include the moving of the staff who was trained; inadequate maintenance; absence of a proper business model for the testing facilities etc. A visit to the test laboratory revealed the need to replace a couple of missing solar	Immediate, before the closure of the project	UNDP CO, Implementing Partner, Project Board

#	Recommendation	Rational and Description	Timing/Dates for Action	Responsible Party
	Standards Bureau, based on the test reports produced by NERC. c) Use the concept of brand approval, and third-party certification, to ensure only quality solar pumps and PV panels get imported/manufactured and deployed. The concept of EE rating of the pumps can also be used. This will generate the business volume for the test center. A viable business model for the test center may be worked out to ensure that the test facilities are financially self-sustaining.	panels from the overall test setup. Unless adaptive measures are taken, the testing facilities for solar PV pumps are unlikely to be functional.		
4	It is recommended that some of the ongoing activities being carried out under the project which can be completed during the remaining implementation period of the project be prioritised and dedicated efforts put in to ensure their completion. Procedurally there may be issues to invite fresh bids and awarding fresh contracts for such activities, but for the activities where the process has already been initiated and the activities are ongoing, the process can be taken to its logical conclusion.	Several activities under the project could not be completed (e.g., preparation of the NAMA document), due to a variety of reasons (including Covid 19). Some of such activities are at different levels of implementation. It will be possible to complete some of such activities during the remaining implementation time of the project. Completion of the activities will enhance the results of the project	Immediate, before the closure of the project	UNDP CO, Implementing Partner

6.2.3 Proposals for future directions underlining main objectives

#	Recommendation	Rational and Description	Timing/Dates for Action	Responsible Party
5	It is recommended that the future project design expands the targeted involvement and role of non-governmental stakeholders like private sector trade/industry associations, farmer's co-operatives, NGOs/CBOs, and Academics.	The project design has largely restricted the stakeholders to government organizations (ministries and departments) and Banks. Participation by a wider set of stakeholders (e.g., industry associations, and NGOs) would have enhanced the results of the project.	At the time of future project design	UNDP CO, Implementing Partner, GEF
6	Future project designs of this nature, explore different financial models e.g., lease based on monthly lease rental charged from the farmers (instead of the sale of the pump), hire purchase schemes offered by the private sector, etc.	Given the higher upfront capital cost of the solar pumps, there are affordability issues with farmers (particularly the farmers with small land holdings).	At the time of future project design	UNDP CO, Implementing Partner, GEF
7	The future project design includes the activity of training the suppliers of pumps and other technicians on system design and repair and maintenance of the solar pumps.	With the upscaling of solar PV pumps already happening, there is a need to inculcate the capacity in the country to repair and maintenance of the solar pumps.	At the time of future project design or as of other ongoing projects	UNDP CO, Implementing Partner, GEF

#	Recommendation	Rational and Description	Timing/Dates for Action	Responsible Party
	There was a provision for building capacity for system design (software) in the present project, but it did not get accomplished.			
8	A future project of this nature looks towards the creation of the infrastructure within the country to manufacture/assemble quality Solar PV pumps within the country.	With the successful demonstration by the project and other ongoing programs and the country, the demand for solar PV pumps is expected to increase in Sudan. In country, manufacturing/assembly facilities will reduce the import bill for the country.	At the time of future project design or as of other ongoing projects	UNDP CO, Implementing Partner, GEF

6.2.4 Best/worst practices in addressing issues relating to relevance, performance and success

#	Recommendation	Rational and Description	Timing/Dates for Action	Responsible Party
9	To take care of the issue of possible over-exploitation of groundwater resources, because there is no fuel cost in case of pumping of water using solar PV pumps following is recommended; a) Wherever the electric grid is available near the solar PV system, allow the farmers to upload the electricity to the grid on a payment basis. This on one hand will provide additional income to the farmers making solar PV pumps more affordable, while on the other hand, such a strategy will avoid wasteful over-exploitation of water resources. This will also provide the opportunity for the state utility to procure RE-based electricity at a price that is less than its own cost of generation/procurement b) In cases where the grid is not close by (and the farm/household is not electrified), a provision may be made in the existing system to provide electricity for household use (lighting, phone charging, basic appliances) by incorporating a small battery and an inverter. This will on the one hand provide a basic electric supply to the farmer while on the other hand, it will ensure the use of the solar water pump only up to the extent it is required, c) The system design may be modified a bit so that during the part of the year when irrigation requirements are minimal the system generates enough electricity for the home agro-processing.	Given that water pumping using solar PV has no variable cost component. There is a tendency to over-exploit groundwater resources leading to the issue of depletion of groundwater.	At the time of future project design or for other ongoing projects	UNDP CO, Implementing Partner, GEF

6.3 Lessons Learned

- Successful demonstration of the results of the pilot, in the early stages of the project implementation, helps in scaling up and replication of the project interventions. The strategy of splitting the pilot activities into two phases, wherein the first phase of the pilot activities was fully funded by the project, helped the project to achieve the scaling up and replication of the interventions, even though the second phase of the pilot activities could not be carried out.
- For the projects implemented in countries having a situation of hyperinflation, and where implementation of the project requires the import of equipment (in hard currency), if the procurement is done nationally in local currency, a situation will arise where the selected national suppliers will not be able to meet the commitments made. (Please see recommendation 2)
- While creating testing facilities, it is important to assess the capacity of the organisation/ institution, under which such facilities are being created. It needs to be ensured that the institution which is best equipped (technically and administratively) to operate and manage the test facility should be selected (please see recommendation 3).
- For the projects like solar water pumping, there is a tendency to keep the water pump operating as long as the sunshine is available. This leads to over-exploitation of the water ground resources. This situation can be addressed by providing incentives (the opportunity to use solar PV for uses other than water pumping). Such incentives could include the provision of a facility to upload the surplus power generated to the grid; self-use of electricity generated, and use of electricity for agro-processing (please see recommendation 9)

ANNEX A: TERMS OF REFERENCE

Location :	Khartoum and North State, SUDAN
Application Deadline :	03-Apr-22 **(Midnight New York, USA)**
Time left :	10d 16h 32m
Type of Contract :	Individual Contract
Post Level :	International Consultant
Languages Required :	Arabic English
Starting Date :	31-Mar-2023
(date when the selected candidate is expected to start)	

UNDP is committed to achieving workforce diversity in terms of gender, nationality, and culture. Individuals from minority groups, indigenous groups and persons with disabilities are equally encouraged to apply. All applications will be treated with the strictest confidence.

UNDP does not tolerate sexual exploitation and abuse, any kind of harassment, including sexual harassment, and discrimination. All selected candidates will, therefore, undergo rigorous reference and background checks.

Background

INTRODUCTION

In accordance with UNDP and GEF M&E policies and procedures, all full- and medium-sized UNDP-supported GEF-financed projects are required to undergo a Terminal Evaluation (TE) at the end of the project. This Terms of Reference (ToR) sets out the expectations for the TE of the *full-sized* project titled *Promoting the use of electric water pumps for irrigation in Sudan (PIMS #5324)* implemented through the *UNDP/ Ministry of Energy and Petroleum*. The project started on the 28 Feb. 2016 and is in its 6th year of implementation. The TE process must follow the guidance outlined in the document 'Guidance For Conducting Terminal Evaluations of UNDP-Supported, GEF-Financed Projects' (Guidance for Terminal Evaluations of UNDP-supported GEF-financed Projects).

PROJECT BACKGROUND AND CONTEXT

The project aims to support the adoption of solar PV technology for water pumping for irrigation in agriculture in Sudan, particularly in the North State. Adoption of renewable energies has been identified as a priority in Sudan, as is reduction of dependence on fossil fuels which are imported. The application of solar PV to pumping has been on a relatively limited scale globally but is seeing increased commercial interest in the past years. Solar PV technology in general is not widespread in Sudan.

The project includes four outcomes:

- Outcome 1: Financing and dissemination mechanism established and operational to support a PV pump installation programme.
- Outcome 2: Financing and dissemination mechanism de-risked through technical standards and demand-side support
- Outcome 3: Mitigation instrument (NAMA) design elaborated and implemented in support of the PV pump installation programme
- Outcome 4: Supportive enabling environment and scaled-up implementation

The project aims to help Sudan and Sudanese farmers reduce their reliance on fossil fuels, reduce their cost of production (via decreased diesel expenditures), increase the sustainability of water use, and increase their income. Give that agriculture is a main component of the economy in Sudan, the project will help increase Sudan's energy security and decouple its GDP from fluctuations in fossil fuel prices and availability. The project has been designed to play a catalytic role in the transformational scaling up of solar power for productive use in Sudan's agricultural sector.

The project implementing partner is the Ministry of Water Resources and Electricity. The project is expected to last 60 months.

The project aims to help diversify Sudan's power sources and reduce its reliance on fossil fuels, particularly for future expansion and to reduce greenhouse gas (G H G). The project will therefore help increase Sudan's energy security and support its development. The project has been designed to play a catalytic role in this transformational scaling-up of wind energy, and renewable energies more broadly.

The project is aligned with UNDP Strategic Plan Primary Outcome "By 2021, people's resilience to consequences of climate change, environmental stresses and natural hazards is enhanced through strengthened institutions, policies, plans and programmes" and the SDG7: Ensure access to affordable, reliable, sustainable and modern energy for all" and SDG13 "Take urgent action to combat climate change and its impacts"
The project was signed on the on the 28th of Feb. 2016 and originally planned to be closed in Feb. 28, 2021. However, there are number of risk factors affected the timely implementation of the project and led to extension the project time frame to 28th of May 2022. The following are the most important risk factors:

Economics: Sudan's economy depends on agriculture and mining which drive growth on the supply side, and private consumption and investment on the demand side. The government started a restructuring and gradual liberalization of the economy. The process started with energy sector; removal of subsides on oil derivatives and finally subsidies are removed from the electricity sub-sector. This resulted increased burden on all economic sectors particularly on the irrigated agriculture. The expectation is to achieve some economic benefits in long run. However, due to renewed political unrest the expected economic gains and support from the international communities cannot be ensured.

The project established a solar pump demonstration farm in 29 sites across the 7 localities of the North State. A PV fund was established to with contribution of 7 Commercial Banks. A total of SDG120 Million was mobilized to finance 400 solar pumps and a contract with five companies was signed. However, due to successive devaluation of the local currency, companies were not able to implement this contract and it was finally ended. New ITB was set to procure only 120 solar pumps, the number the available fund can procure, instead of 400. One company was contracted to procure and install the solar pumps.

Political: The overthrown of the military government which rule for 30 Years through a popular uprising and sit-in. The country wide demonstrations, during Dec. 2018 to July 2019, against political failure to stop wars and security deterioration beside the economic hardships. However, this government was also overthrown by the military council in 25th of October 2021. This resulted in the renewal of wide demonstrations and blockage of streets.

Health: The COVID-19 outbreak observed in Sudan in Mid-March 2020 and since then there are several measures taken by the Government of Sudan, UN Country Team (UNCT) to restrict movements, transportation to the states, lockdown, social distancing and safeguarding measures in place and remained in force till the date. The Sudan ports remained closed for domestic and international travels. Government facilities remained mostly closed with very essential staffs only working at the office. UNDP personnel are working remotely from home. This had major impacts on project to carry out its activities with the COVID-19 restrictions. For example, the travel of engineers to China to do the factory inspection of the solar pumps cannot be conducted.

TE PURPOSE

The TE report will assess the achievement of project results against what was expected to be achieved and draw lessons that can both improve the sustainability of benefits from this project, and aid in the overall enhancement of UNDP programming. The TE report promotes accountability and transparency and assesses the extent of project accomplishments.

The TE is also intended to draw lesson learnt from the project experiences in developing conducive policies and regulations to encourage private sector investment and to explore the benefits of IPP to enhance the access to energy to the farmers and rural population. the report will be sued by all stakeholders; the government, the commercial banks and the North State government and the famers association.

Duties and Responsibilities

TE APPROACH & METHODOLOGY

The TE report must provide evidence-based information that is credible, reliable and useful.

The TE team will review all relevant sources of information including documents prepared during the preparation phase (i.e., PIF, UNDP Initiation Plan, UNDP Social and Environmental Screening Procedure/SESP) the Project Document, project reports including annual PIRs, project budget revisions, lesson learned reports, national strategic and legal documents, and any other materials that the team considers useful for this evidence-based evaluation. The TE team will review the baseline and midterm GEF focal area Core Indicators/Tracking Tools submitted to the GEF at the CEO endorsement and midterm stages and the terminal Core Indicators/Tracking Tools that must be completed before the TE field mission begins.

The TE team is expected to follow a participatory and consultative approach ensuring close engagement with the Project Team, government counterparts (the GEF Operational Focal Point), Implementing Partners, the UNDP Country Office(s), the Regional Technical Advisor, direct beneficiaries and other stakeholders. Engagement of stakeholders is vital to a successful TE. Stakeholder involvement should include interviews with stakeholders who have project responsibilities, including but not limited to:

1. Ministry of Energy and Petroleum
2. General Directorate of Renewable and Alternative Energy
3. Higher Council for Environment & Natural Resources
4. Electricity holding Company
5. National Energy Research Centre
6. North State Ministry of Production and economic resources
7. Ministry of Finance and economic planning
8. Alnil Bank
9. Family bank
10. Saving and Social Development Bank
11. Al Shamal Islamic Bank
12. Al Baraka Bank
13. Sudanese Islamic Bank
14. Farmers' Commercial Bank

executing agencies, senior officials and task team/component leaders, key experts and consultants in the subject area, Project Board, project beneficiaries, academia, local government and CSOs, etc. Additionally, the TE team is expected to conduct field missions to *(North State)*, including the following project sites in the following localities:

1. Dongola
2. Elgolid
3. Eldabah
4. Merowie
5. Elbourgaig
6. Delgo
7. Halfa

The specific design and methodology for the TE should emerge from consultations between the TE team and the above-mentioned parties regarding what is appropriate and feasible for meeting the TE purpose and objectives and answering the evaluation questions, given limitations of budget, time and data. The TE team must, however, use gender-responsive methodologies and tools and ensure that gender equality and women's empowerment, as well as other cross-cutting issues and SDGs are incorporated into the TE report.
The final methodological approach including interview schedule, field visits and data to be used in the evaluation must be clearly outlined in the TE Inception Report and be fully discussed and agreed between UNDP, stakeholders and the TE team.

The final report must describe the full TE approach taken and the rationale for the approach making explicit the underlying assumptions, challenges, strengths and weaknesses about the methods and approach of the evaluation.

DETAILED SCOPE OF THE TE

The TE will assess project performance against expectations set out in the project's Logical Framework/Results Framework (see ToR Annex A). The TE will assess results according to the criteria outlined in the Guidance for TEs of UNDP-supported GEF-financed Projects (Guidance for Terminal Evaluations of UNDP-supported GEF-financed Projects). The Findings section of the TE report will cover the topics listed below.
A full outline of the TE report's content is provided in ToR Annex C.
The asterisk "(*)" indicates criteria for which a rating is required.
Findings

1. Project Design/Formulation

- National priorities and country driven-ness
- Theory of Change
- Gender equality and women's empowerment
- Social and Environmental Safeguards
- Analysis of Results Framework: project logic and strategy, indicators
- Assumptions and Risks
- Lessons from other relevant projects (e.g., same focal area) incorporated into project design
- Planned stakeholder participation
- Linkages between project and other interventions within the sector
- Management arrangements

2.Project Implementation

- Adaptive management (changes to the project design and project outputs during implementation)
- Actual stakeholder participation and partnership arrangements
- Project Finance and Co-finance
- Monitoring & Evaluation: design at entry (*), implementation (*), and overall assessment of M&E (*)
- Implementing Agency (UNDP) (*) and Executing Agency (*), overall project oversight/implementation and execution (*)
- Risk Management, including Social and Environmental Standards

3. Project Results

- Assess the achievement of outcomes against indicators by reporting on the level of progress for each objective and outcome indicator at the time of the TE and noting final achievements
- Relevance (*), Effectiveness (*), Efficiency (*) and overall project outcome (*)
- Sustainability: financial (*) , socio-political (*), institutional framework and governance (*), environmental (*), overall likelihood of sustainability (*)
- Country ownership
- Gender equality and women's empowerment
- Cross-cutting issues (poverty alleviation, improved governance, climate change mitigation and adaptation, disaster prevention and recovery, human rights, capacity development, South-South cooperation, knowledge management, volunteerism, etc., as relevant)
- GEF Additionality
- Catalytic Role / Replication Effect
- Progress to impact

Main Findings, Conclusions, Recommendations and Lessons Learned

- The TE team will include a summary of the main findings of the TE report. Findings should be presented as statements of fact that are based on analysis of the data.
- The section on conclusions will be written in light of the findings. Conclusions should be comprehensive and balanced statements that are well substantiated by evidence and logically connected to the TE findings. They should highlight the strengths, weaknesses and results of the project, respond to key evaluation questions and provide insights into the identification of and/or solutions to important problems or issues pertinent to project beneficiaries, UNDP and the GEF, including issues in relation to gender equality and women's empowerment.
- Recommendations should provide concrete, practical, feasible and targeted recommendations directed to the intended users of the evaluation about what actions to take and decisions to

make. The recommendations should be specifically supported by the evidence and linked to the findings and conclusions around key questions addressed by the evaluation.

- The TE report should also include lessons that can be taken from the evaluation, including best and worst practices in addressing issues relating to relevance, performance and success that can provide knowledge gained from the particular circumstance (programmatic and evaluation methods used, partnerships, financial leveraging, etc.) that are applicable to other GEF and UNDP interventions. When possible, the TE team should include examples of good practices in project design and implementation.
- It is important for the conclusions, recommendations and lessons learned of the TE report to include results related to gender equality and empowerment of women.

The TE report will include an Evaluation Ratings Table, as shown below:

ToR Table 2: Evaluation Ratings Table for the project: Promoting the use of electric water pumps for irrigation in Sudan (PIMS #5324)

Monitoring & Evaluation (M&E)	**Rating**
M&E design at entry	
M&E Plan Implementation	
Overall Quality of M&E	
Implementation & Execution	**Rating**
Quality of UNDP Implementation/Oversight	
Quality of Implementing Partner Execution	
Overall quality of Implementation/Execution	
Assessment of Outcomes	**Rating**
Relevance	
Effectiveness	
Efficiency	
Overall Project Outcome Rating	
Sustainability	**Rating**
Financial resources	
Socio-political/economic	
Institutional framework and governance	
Environmental	
Overall Likelihood of Sustainability	

TIMEFRAME

The total duration of the TE will be approximately *(average 35 working days)* over a time period of *8 of weeks* starting on *30 March*. The tentative TE timeframe is as follows:

Timeframe	**Activity**
30/March/2022	Application closes
4/April/2022	Selection of TE team
6/April/2022	Preparation period for TE team (handover of documentation)
20/April/2022	Document review and preparation of TE Inception Report
22/April/2022	Finalization and Validation of TE Inception Report; latest start of TE mission
29/ April /2022	TE mission: stakeholder meetings, interviews, field visits, etc.
30/ April /2022	Mission wrap-up meeting & presentation of initial findings; earliest end of TE mission
1/May/2022	Preparation of draft TE report
2/May 2022	Circulation of draft TE report for comments
4/May/2022	Incorporation of comments on draft TE report into Audit Trail & finalization of TE report
5/May/2022	Preparation and Issuance of Management Response
6/May/2022	Concluding Stakeholder Workshop (optional)
12/ May/2022	Expected date of full TE completion

Options for site visits should be provided in the TE Inception Report.

TE DELIVERABLES

#	Deliverable	Description	Timing	Responsibilities
1	TE Inception Report	TE team clarifies objectives, methodology and timing of the TE	*(22 April 2022)*	TE team submits Inception Report to Commissioning Unit and project management
2	Presentation	Initial Findings	*(29/April/2022)*	TE team presents to Commissioning Unit and project management
3	Draft TE Report	Full draft report *(using guidelines on report content in ToR Annex C)* with annexes	*4/May/2022)*	TE team submits to Commissioning Unit; reviewed by BPPS-GEF RTA, Project Coordinating Unit, GEF OFP
5	Final TE Report* + Audit Trail	Revised final report and TE Audit trail in which the TE details how all received comments have (and have not) been addressed in the final TE report *(See template in ToR Annex H)*	*12/May/2022)*	TE team submits both documents to the Commissioning Unit

*All final TE reports will be quality assessed by the UNDP Independent Evaluation Office (IEO). Details of the IEO's quality assessment of decentralized evaluations can be found in Section 6 of the UNDP Evaluation Guidelines.

TE ARRANGEMENTS

The principal responsibility for managing the TE resides with the Commissioning Unit. The Commissioning Unit for this project's TE is UNDP Sudan CO. The UNDP Sudan CO will contract the evaluators and ensure the timely provision of per diems and travel arrangements within the country for the TE team. The Project Team will be responsible for liaising with the TE team to provide all relevant documents, set up stakeholder interviews, and arrange field visits.

TE TEAM COMPOSITION

A team of *two independent evaluators* will conduct the TE; a Team Leader and a National Expert. The team leader will be responsible be responsible for the overall design and writing up of the TE report and the National Experts will support the leader, in data collection, verifications, documentation and work with the Project Team in developing the TE itinerary, etc.

The evaluator(s) cannot have participated in the project preparation, formulation and/or implementation (including the writing of the project document), must not have conducted this project's Mid-Term Review and should not have a conflict of interest with the project's related activities

Competencies

Corporate Competencies
- Demonstrates integrity by modelling the UN's values and ethical standards;
- Promotes the vision, mission, and strategic goals of UNDP;
- Displays cultural, gender, religion, race, nationality and age sensitivity and adaptability.
- Treats all people fairly without favouritism;
- Ability to work with a multi-cultural and diverse team.

Functional Competencies:
- Demonstrated experience in technical issues related to climate change
- Demonstrated experience in project evaluation/review
- Demonstrated ability to analyse large amounts of complex and diversified data related to climate change mitigation in least developed countries.
- Demonstrated strong coordination and facilitation skills;
- Proved strong interpersonal skills and the ability to conduct the mitigation training
- Excellent communication skills;

- Demonstrable analytical skills;

Required Skills and Experience

Education

- Master's degree in *(renewable energy, electrical engineering, agricultural engineering)* or other closely related field;

Experience

- Relevant experience with results-based management evaluation methodologies;
- Experience applying SMART indicators and reconstructing or validating baseline scenarios;
- Competence in adaptive management, as applied to *(GEF-5 Climate Change Focal Area Objective #3, to "Promote Investment in Renewable Energy Technologies");*
- Experience in evaluating projects;
- Experience working in *(RBAS*) countries
- Experience in relevant technical areas for at least *10 years;*
- Demonstrated understanding of issues related to gender and *(GEF-5 Climate Change Focal Area);* experience in gender responsive evaluation and analysis;
- Excellent communication skills;
- Demonstrable analytical skills;
- Project evaluation/review experience within United Nations system will be considered an asset;

Language

- Fluency in written and spoken English. Fluency in Arabic language is an asset

Criteria for Selection of the Best Offer

- The assessment will be based on the following criteria:

Assessment Criteria	**Maximum Obtainable Points**	**Weightage** (%)
At least a master's degree in *(Wind Energy Power Generation Engineering)* or other closely related field	10	14.29%
Relevant experience with results-based management evaluation methodologies;	10	14.29%
Experience applying SMART indicators and reconstructing or validating baseline scenarios;	15	21.43%
Competence in adaptive management, as applied to *(GEF-5 Climate Change Focal Area Objective #3, to "Promote Investment in Renewable Energy Technologies");*	10	14.29%
Experience working in *(RBAS*) countries	5	7.14%
Experience in relevant technical areas for at least *10 years*	5	7.14%
Demonstrated understanding of issues related to gender and *(GEF-5 Climate Change Focal Area);* experience in gender responsive evaluation and analysis;	5	7.14%
Project evaluation/review experience within United Nations system	10	14.29%
TOTAL	70	100.00%

Criteria for Selection of the Best Offer

The assessment will be based on the following criteria:

Only those applications which are responsive and compliant will be evaluated. Offers will be evaluated according to the Combined Scoring method – where the educational background and experience on similar assignments will be weighted at 70% and the price proposal will weigh as 30% of the total scoring. The

applicant receiving the Highest Combined Score that has also accepted UNDP's General Terms and Conditions will be awarded the contract.

EVALUATOR ETHICS

The TE team will be held to the highest ethical standards and is required to sign a code of conduct upon acceptance of the assignment. This evaluation will be conducted in accordance with the principles outlined in the UNEG 'Ethical Guidelines for Evaluation'. The evaluator must safeguard the rights and confidentiality of information providers, interviewees and stakeholders through measures to ensure compliance with legal and other relevant codes governing collection of data and reporting on data. The evaluator must also ensure security of collected information before and after the evaluation and protocols to ensure anonymity and confidentiality of sources of information where that is expected. The information knowledge and data gathered in the evaluation process must also be solely used for the evaluation and not for other uses without the express authorization of UNDP and partners.

PAYMENT SCHEDULE

- 20% payment upon satisfactory delivery of the final TE Inception Report and approval by the Commissioning Unit
- 40% payment upon satisfactory delivery of the draft TE report to the Commissioning Unit
- 40% payment upon satisfactory delivery of the final TE report and approval by the Commissioning Unit and RTA (via signatures on the TE Report Clearance Form) and delivery of completed TE Audit Trail

Criteria for issuing the final payment of 40%:
- The final TE report includes all requirements outlined in the TE TOR and is in accordance with the TE guidance.
- The final TE report is clearly written, logically organized, and is specific for this project (i.e., text has not been cut & pasted from other TE reports).
- The Audit Trail includes responses to and justification for each comment listed.

APPLICATION PROCESS

Recommended Presentation of Proposal:
1. **Letter of Confirmation of Interest and Availability** using the template[2] provided by UNDP;
2. **CV** and a **Personal History Form** (P11 form[3]);
3. Brief description **of approach to work/technical proposal** of why the individual considers him/herself as the most suitable for the assignment, and a proposed methodology on how they will approach and complete the assignment; (max 1 page)
4. **Financial Proposal** that indicates the all-inclusive fixed total contract price and all other travel related costs (such as flight ticket, per diem, etc), supported by a breakdown of costs, as per template attached to the Letter of Confirmation of Interest template. If an applicant is employed by an organization/company/institution, and he/she expects his/her employer to charge a management fee in the process of releasing him/her to UNDP under Reimbursable Loan Agreement (RLA), the applicant must indicate at this point, and ensure that all such costs are duly incorporated in the financial proposal submitted to UNDP.

All application materials should be submitted online in the *UNDP Procurement website* indicating the following reference "Consultant for Terminal Evaluation of the project *(Promoting the use of electric water pumps for irrigation in Sudan)*"
Incomplete applications will be excluded from further consideration.

Criteria for Evaluation of Proposal: Only those applications which are responsive and compliant will be evaluated. Offers will be evaluated according to the Combined Scoring method – where the educational background and experience on similar assignments will be weighted at 70% and the price proposal will weigh as 30% of the total scoring. The applicant receiving the Highest Combined Score that has also accepted UNDP's General Terms and Conditions will be awarded the contract.

ANNEX B: TERMINAL EVALUATION CRITERIA AND THE QUESTIONS

Before undertaking the Terminal Evaluation, an Inception Report was presented, including the proposed tasks, activities, and deliverables, as well as a table of main evaluation questions that need to be answered to determine and assess project results. The evaluation/review criteria and questions are presented in the Table below.

Contents	Main questions and Terminal Evaluation Scope
• Title page with basic report information • Table of contents • Acronyms and abbreviations	
Executive Summary • Project Summary Table • Project Description (brief) • Evaluation Rating Table • Summary of conclusions, recommendations and lesson	
1. Introduction • Context; purpose of the Terminal Evaluation and objectives • Scope and methodology of the Terminal Evaluation • Structure of the Terminal Evaluation Report	
2. Project description and development context • Project description and development context (objectives, project participants, objectives and main outcomes; Project duration and timing) • Problems that the project sought to address • Immediate and development objectives of the project • Baseline indicators established • Main stakeholders • Expected Results	
3. Findings: Project Design and Formulation	
• Analysis of LFA/Results Framework • Assumptions and Risks • Lessons from other relevant projects • Planned stakeholder participation • Replication approach • UNDP comparative advantage • Linkages between project and other interventions within the sector • Management arrangements	• Were the project's objectives and components clear, practicable and feasible within its time frame? • Were the capacities of the executing institution(s) and its 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 roles and responsibilities negotiated prior to project approval? • Were counterpart resources (funding, staff, and facilities), enabling legislation, and adequate project management arrangements in place at project entry? • Were the project assumptions and risks well-articulated in the PIF and project document? • Whether the planned outcomes were "SMART"?
4. Findings: Project Implementation	
4.1 Adaptive management	***ADAPTIVE MANAGEMENT*** • Did the project undergo significant changes as a result of recommendations from the mid-term review? Or as a result of other review procedures? Explain the process and implications. • If the changes were extensive, did they materially change the expected project outcomes?

Contents	Main questions and Terminal Evaluation Scope
	• Were the project changes articulated in writing and then considered and approved by the project steering committee? • Whether feedback from M&E activities was used for adaptive management? • Whether changes were made to project implementation as a result of the MTR recommendations?
4.2 Partnership arrangements	***PARTNERSHIP ARRANGEMENT*** • Were there adequate provisions in the project design for consultation with stakeholder. • Whether effective partnerships arrangements were established for implementation of the project with relevant stakeholders involved in the country/region, including the formation of a Project Board? • Whether lessons from other relevant projects incorporated into project implementation?
4.3 Project Finance	***PROJECT FINANCE / CO-FINANCE*** • Whether there was sufficient clarity in the reported co-financing to substantiate in-kind and cash co-financing from all listed sources. • What are the reasons for differences in the level of expected and actual co-financing? • To what extent project components supported by external funders were well integrated into the overall project? • What is the effect on project outcomes and/or sustainability from the extent of materialization of co-financing? • Whether there is evidence of additional, leveraged resources that have been committed as a result of the project?
4.4 Monitoring and evaluation: design at entry	***PROJECT MONITORING & EVALUATION (AT DESING)*** • Is the M&E plan well-conceived at the design stage? • Is M&E plan articulated sufficient to monitor results and track progress toward achieving objectives? • Was the M&E plan sufficiently budgeted and funded during project preparation and implementation? • How effective are the monitoring indicators from the project document for measuring progress and performance;
4.5 monitoring and evaluation: implementation	***MONITORING & EVALUATION (IMPLEMENTATION)*** • Whether the logical framework was used during implementation as a management and M&E tool? • What has been the level of compliance with the progress and financial reporting requirements/ schedule, including quality and timeliness of reports; • What has been effectiveness of the monitoring reports and evidence that these were discussed with stakeholders and project staff; • What is the extent to which follow-up actions, and/ or adaptive management, were taken in response to monitoring reports (APR/PIRs); • Whether APR/PIR self-evaluation ratings were consistent with the MTR and TE findings. If not, were these discrepancies identified by the project steering committee and addressed?
4.6 UNDP and Implementing Partner implementation / execution coordination, and operational issues	***GEF IMPLEMENTING AGENCY EXECUTION - UNDP*** • Whether there was an appropriate focus on results • Was there adequate UNDP support to the Implementing Partner and project team • Quality and timeliness of technical support to the Executing Agency and project team

Contents	Main questions and Terminal Evaluation Scope
	• Were the management inputs and processes, including budgeting and procurement adequate
5. Findings: Project Results	
5.1 Overall results	***OVERALL RESULS*** • What is the achievement of the objectives against the end of the project values of the log-frame indicators for project objectives, outcomes, outputs, indicating baseline situation and target levels, as well as position at the close of the project? • What are the achievements /Results in terms of contribution to sustainable development benefits, as well as global environmental benefits (direct and indirect GHG emission reduction)? • How does the GEF Tracking Tool/GEF Core indicators at the Baseline and the one completed right before the Midterm Review with that Prepared at the time of Terminal Evaluation compare?
5.2 Relevance	***RELAVENCE*** • To what extent the activity is suited to local and national development priorities and organizational policies, including changes over time.? • To what extent the project is in line with UNDP Operational Programs or the strategic priorities under which the project was funded?
5.3 Effectiveness & Efficiency	***EFFECTIVENESS*** • To what extent the objectives, expected outcomes and outputs have been achieved? • To what extent the results have been delivered with the least costly resources possible? • What are the positive and negative, foreseen and unforeseen changes to and effects produced by a development intervention?
5.4 Country ownership	***COUNTRY OWNERSHIP*** • Was the project concept in line with development priorities and plans of Sudan? • Were the relevant country representatives from government and civil society involved in project implementation, including as part of the project steering committee? • Was an inter-governmental committee given responsibility to liaise with the project team, recognizing that more than one ministry should be involved? • Have the government(s), enacted legislation, and/or developed policies and regulations in line with the project's objectives?
5.5 Mainstreaming	***MAINSTREAMING*** • How the project is successfully mainstreaming other UNDP priorities, including poverty alleviation, improved governance, the prevention and recovery from natural disasters, and women's empowerment. • Whether it is possible to identify and define positive or negative effects of the project on local populations (e.g., income generation/job creation, improved natural resource management arrangements with local groups, improvement in policy frameworks for resource allocation and distribution, regeneration of natural resources for long term sustainability). • Do the project objectives conform to agreed priorities in the UNDP country programme document (CPD) and country programme action plan (CPAP)? • Whether there is evidence that the project outcomes have contributed to better preparations to cope with natural disasters.

Contents	Main questions and Terminal Evaluation Scope
5.6 Sustainability 5.7 Impact	• Whether gender issues had been taken into account in project design and implementation and in what way has the project contributed to greater consideration of gender aspects, (i.e., project team composition, gender-related aspects of pollution impacts, stakeholder outreach to women's groups, etc.) ***SUSTAINABILITY*** ***Financial risks:*** • Are there financial risks that may jeopardize the sustainability of project outcomes? • What is the likelihood of financial and economic resources not being available once GEF grant assistance ends? ***Socio-economic risks:*** • Are there social or political risks that may threaten the sustainability of project outcomes? • What is the risk for instance that the level of stakeholder ownership (including ownership by governments and other key stakeholders) will be insufficient to allow for the project outcomes/benefits to be sustained? • Do the various key stakeholders see that it is in their interest that project benefits continue to flow? • Is there sufficient public/stakeholder awareness in support of the project's long-term objectives? ***Institutional framework and governance risks:*** • Do the legal frameworks, policies, and governance structures and processes within which the project operates pose risks that may jeopardize sustainability of project benefits? • Are requisite systems for accountability and transparency, and required technical knowhow, in place? ***Environmental risks:*** • Are there ongoing activities that may pose an environmental threat to the sustainability of project outcomes? ***IMPACT*** • Whether, the project has demonstrated verifiable improvements in ecological status? • Whether, the project has demonstrated verifiable reductions in stress on ecological systems through specified process indicators, that progress is being made towards achievement of stress reduction and/or ecological improvement?
6. Conclusions, Recommendations and Lessons	
	• Did the project provide cost-effective solutions in order to address barriers? • Are these solutions provided in an efficient way? • What are the best and worst practices in addressing issues relating to relevance, performance and success? • Corrective actions for the design, implementation, monitoring and evaluation of the project • Actions to follow up or reinforce initial benefits from the project • Proposals for future directions underlining main objectives
Annexes • TOR • List of people interviewed • Documents reviewed and bibliography • Terminal Evaluation evaluative matric (criteria, questions, indicators) • Signed UNEG code of conduct forms • Other information, as needed	

ANNEX C: DOCUMENTS REVIEWED

Project Design	
	Social and Environmental Screening Procedure Report
	CC Mitigation Tracking Tool at CEO Endorsement
	Council Notification letter (CEO Submission)
	CEO Resubmission
	PIF
	Project Document
Mid Term Review (MTR)	
	MTR Report
Annual Report	
	Annual Report 2016
Annual Work Plans	
	2017
	2019
	2020
	2021
	2022
	Work Plan and Project Extension Budget
Project Implementation Report (PIR)	
	2017
	2018
	2019
	2020
	2021
	2022
Audit Reports	
	2019
	2020
Project Steering/Board Meeting Report	
	2018
	2020
	2021
Quarterly Reports	
	Q4 2016
	Q1 2017
	Q3 2017
	Q1 2018
	Q4 2018
	Q2 2019
Combined Delivery Reports (CDR)	
	2016
	2017
	2018
	2019
	2020

	2021
Technical Reports / Consultancy Reports	
	Baseline Survey Report
Outcome 1 (PV Pumps Procurement)	
	Contract with Nubian Stone
	Contract with Solarman Company
	Contract with Switch Company
	Announcement for Pre-qualification
	Commissioning Data
	Evaluation of tender
	Final Evaluation of Tender
	Measuring System Report
	Summary of Solar Pumps Installed
	Summary of Deliberations of Procurement Committee
	Tender Solar Water Pump 2018
	Tender Document for Solar Water Pump 2017
	Cost Sharing Agreement between M. of Finance and UNDP
Outcome 2 (PV Fund)	
	A Financial Mechanism of the National Fund New tech
	National and State Level Solar Photovoltaic Fund Sudan 20180520 002 004
	PV fund infographic
	Draft Financial Mechanism Report
	Vertical Fund COVID Survey April 2020
Outcome 3 (NAMA)	
	TOR for National Consultant
	TOR for International Consultant for Development of Standardized Baseline
Other Documents	
	Technical and Economic Feasibility for the Replacement of Diesel Water Pumps with Solar 22.4.2022
	TOR -South Kordofan and Al Gadaref Technical and Economic Feasibility for the Replacement of Diesel Water Pumps with Solar Water Pumps
	TOR-National Technical Advisor
	Evaluation Report National Technical Advisor
	Evaluation Report - Qualification of International Consultant - 2018
	Final report - SWPP Lab Equipment Tender Evaluation
	Oversight costs breakdown
	Project Briefing
	Project Extension Request
Other Documents (External to the SE for All project)	
	International Solar Alliance Document
	NAMA Design Guidance – 2016, UNFCCC
	Adopting solar water pumps promising prospects for Africa – Clean Energy 4 Africa
	How Going Solar Boosted Farm Productivity by 50% in Sudan - Renewables in Africa
	GEF – 5 - Focal Area Strategies
	Lessons From CDM Potential Linkage Between CDM and NAMA
	SUDAN - AfDB finances solar irrigation pump project in Sudan

	Techno Economic Analysis of Solar Water Pumping for Farm Irrigation - Case Study in Sudan – Clean Energy 4 Africa
	The benefits and risks of solar powered irrigation a global overview
	UNDP, KOICA Partner in Project to Promote Solar Powered Irrigation for Sustainable Agriculture in Sudan - United Nations Development Programme
	Fifth Overall Performance Study of The GEF - GEF Climate Change Mitigation GHG Analysis
	Overview - General description of the PVsyst Software
	Pump Behaviour Modelling for Use in a General PV Simulation Software, 19th European Photovoltaic Solar Energy Conference and Exhibition, Paris, June 2004
	Sudan UNDAF 2018 - 2021
	SWOT Analysis of Solar Pumping Finance Fund (PV Fund) Authors: Ahmed Abdalla, Affiliations: Omdurman Islamic University, Khartoum, Sudan
	UNDP Sudan Renewable Energy Report – 2020, UNDP

ANNEX D: FIELD VISITS AND LIST OF PEOPLE INTERVIEWED

Date	Meeting	Venue	Attended by
Sunday, 31 July 2022	Discussion of the TE workplan and site visit schedule	UNDP Khartoum	Ms. Hanan Mutwakil, UNDP
			Eng. Tariq, SWP project engineer
			Mr. Gafaar, UNDP
Sunday, 31 July 2022	Discussion with the WSP project management team	RE directorate MoE&P, Khartoum	Eng. Yassir, the project manager
			Eng. Tariq, SWP project engineer
			Mr. Nadir, Project admin and accounting manager
Monday, 1 August 2022	Visiting SWP laboratory	Soba Khartoum	
Monday, 1 August 2022	Visiting the National Energy Research Centre	Soba Khartoum	Dr. Ali Omar
			Dr. Nadia
			Eng. Tariq, SWP project engineer
Tuesday, 2 August 2022	Discussion with Ministry of Finance the PV Fund and remaining balance	MoFNE, Khartoum	Dr. Galal
			Mr. Gareeballah
Tuesday, 2 August 2022	African Development Bank project for SWP in North and West Kurdofan States	Project Office Mugran Khartoum	Dr. Nazar
			Mr. Musab
Tuesday, 2 August 2022	General discussion about the project activities	RE directorat MoE&P, Khartoum	Eng. Yassir, project manager
Wednesday , 3 August 2022	Meeting the Project Rep in Northern State and Climate Resilience Project manager	Agriculture research Centre, Dongola	Eng. Mohamed Hassan, SWP project rep. in NE
			Dr. Elrashid Fagiri, GCF project Manager in NE
			Eng. Yassir, project manager
			Eng. Tariq, SWP project engineer
			Mr. Nadir, Project admin and accounting manager
Thursday, 4 August 2022	Meeting with the project stakeholders	Ministry of Agriculture Northern State, Dongola	Mr. Abdelhadi Alhaj, DG of the Ministry of Agri, NE
			Mr. Albadri Osman, Dongola Branch manager Alnil Bank
			Mr. Osman Hamza, Head of Forsetry dept Ministry of Agri, NE
			Mr. Abdelwahab, Ministry of Agri
			Eng. Mohamed Hassan, SWP project rep. in NE
			Dr. Elrashid Fagiri, GCF project Manager in NE
			Eng. Yassir, project manager
			Eng. Tariq, SWP project engineer
			Mr. Nadir, Project admin and accounting manager
Thursday, 4 August 2022	Meeting with the private sector SWP supplier	NSSRE company office, Dongola City	Mr. Gafar Abdelmajeed, Company Manager
			Mr. Hakim Elyas, Deputy Manager
			Mr. Bahaeldin, Alsilaim Branch manager
			Mr. Ibrahim, Karama Branch Manager
			Mr. Abdelaziz, Elburgage Branch Manager
			Mr. Yassir Ali, Sales Manager
			Ms. Hagir Ibrahim – Executive manager
			Ms. Ishtiaq, Business development
			in addition to the project team and the consultants
Thursday, 4 August 2022	Visiting Farms	Eltayeb Hammad (away from Nile)	One of the 28 SWP
		Silame farm	Beside Zadna Irrigation scheme
		PV system for drinking water	

Date	Meeting	Venue	Attended by
		Musa Narti Site (Island),	
Sunday, 7 August 2022	UNDP Deputy Country Representative	UNDP CO, Khartoum, Sudan	Mr. Thair Shraideh
Sunday, 7 August 2022	Presentation of Initial Findings of TE and Field Mission		Members of the Steering Committee Other invited stakeholders

ANNEX E: SIGNED UNEG CODE OF CONDUCT FORMS

Evaluators/reviewers:

1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded
2. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
3. Should protect the anonymity and confidentiality of individual informants. They should provide maximum notice, minimise demands on time, and respect people's right not to engage. Evaluators must respect people's right to provide information in confidence, and must ensure that sensitive information cannot be traced to its source. Evaluators are not expected to evaluate individuals, and must balance an evaluation of management functions with this general principle.
4. Sometimes uncover evidence of wrong doing while conducting evaluations. Such cases must be reported discreetly to the appropriate investigative body. Evaluators should consult with other relevant oversight entities when there is any doubt about if and how issues should be reported.
5. Should be sensitive to beliefs, manners and customs and act with integrity and honesty in their relations with all stakeholders. In line with the UN Universal Declaration of Human Rights, evaluators must be sensitive to and address issues of discrimination and gender equality. They should avoid offending the dignity and self-respect of those persons with whom they come in contact in the course of the evaluation. Knowing that evaluation might negatively affect the interests of some stakeholders, evaluators should conduct the evaluation and communicate its purpose and results in a way that clearly respects the stakeholders' dignity and self-worth.
6. Are responsible for their performance and their product(s). They are responsible for the clear, accurate and fair written and/or oral presentation of study limitations, findings and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

Evaluation/reviewer Consultant Agreement Form

Agreement to abide by the Code of Conduct for Evaluation in the UN System

Name of Consultant: Dinesh Aggarwal

I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.

(Dinesh Aggarwal)

October 2022

ANNEX F: TE REPORT AUDIT TRAIL

In accordance with the guidelines the audit trail, along with the submission of the final TE report, will be submitted as a separate file

ANNEX G: EVALUATION REPORT CLEARANCE FORM

Evaluation Report Reviewed and Cleared by

UNDP Country Office

Name: _____

Signature: _____ Date: _____

UNDP GEF RTA

Name: _____

Signature: _____ Date: _____