REQUEST FOR CEO ENDORSEMENT

PROJECT TYPE: FULL-SIZED PROJECT
TYPE OF TRUST FUND: GEF TRUST FUND

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PART I: PROJECT INFORMATION

Project Title: Promoting the use of electric water pumps for irrigation in Sudan			
Country(ies):	Sudan	**GEF Project ID:**[1]	5673
GEF Agency(ies):	UNDP	**GEF Agency Project ID:**	5324
Other Executing Partner(s):	Ministry of Water Resources and Electricity	**Submission Date:** **Resubmission Date:**	December 7, 2015 December 21, 2015
GEF Focal Area (s):	Climate Change	**Project Duration(Months)**	60
Name of Parent Program (if applicable): ➢ For SFM/REDD+ ☐ ➢ For SGP ☐ ➢ For PPP ☐	n/a	**Project Agency Fee ($):**	414,747

A. FOCAL AREA STRATEGY FRAMEWORK[2]

Focal Area Objectives	Expected FA Outcomes	Expected FA Outputs	Trust Fund	Grant Amount ($)	Cofinancing ($)
CCM-3	**Renewable Energy:** Promote investment in renewable energy technologies	Renewable energy capacity installed Renewable energy policy and regulation in place	GEFTF	4,365,753	20,150,000
		Total project costs		4,365,753	20,150,000

B. PROJECT FRAMEWORK

Project Objective: To replace diesel-based irrigation water pumping through the promotion of photovoltaic pumps						
Project Component	**Grant Type**	**Expected Outcomes**	**Expected Outputs**	**Trust Fund**	**Grant Amount ($)**	**Confirmed Cofinancing ($)**
1. Pump installation programme enabled through targeted subsidies and the design and implementation of micro-finance lending	INV	Financing and dissemination mechanism established and operational to support a PV pump installation programme	1.1 28 pumps installed as part of a pilot phase 1.2 National PV Fund and coordinated loan facility established and capitalized to promote concessional lending to farmers for PV pump equipment 1.3 A minimum of 1,468 [3]off-grid PV pumps ranging in size from 3.12-29.6 kWp installed in farms in the Northern State of Sudan with support from the National PV Fund	GEFTF	2,755,853	17,000,000

[1] Project ID number will be assigned by GEFSEC.
[2] Refer to the Focal Area Results Framework and LDCF/SCCF Framework when completing Table A.
[3] The 1,468 pumps include the 28 pumps installed as part of a pilot phase under Output 1.1.

2. PV pump installation programme put on a sustainable footing through risk reduction measures	TA	Financing and dissemination mechanism de-risked through technical standards and demand-side support	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 2.2 SSMO test and certification laboratories strengthened to test and label PV pump components 2.3 Software tool for pump sizing according to farm and hydrological conditions developed and implemented 2.4 Training and certification scheme for PV pump installers (including local retailers, technicians and pump rental companies) developed and implemented. 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. 2.6 Promotion of sustainable pumping practices based on outputs of the Nubian Sandstone Aquifer System from a separate GEF project (ID 4736).	GEFTF	746,544	1,106,875
3. Mitigation instrument design elaborated and implemented in support of the PV pump installation programme	TA	Mitigation instrument design elaborated and implemented in support of the PV pump installation programme	3.1. Development of a standardized baseline for pump fuel-switching, applicable to Sudan and the wider region 3.2. Implementation of the standardized baseline within a NAMA	GEFTF	396,310	123,000
4. Supportive enabling environment and scaled-up implementation	TA	Supportive enabling environment and scaled-up implementation	4.1. Inclusion of PV pumps in the fiscal concessions lists of the Investment Law and the Agricultural Implements Regulation 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	GEFTF	259,243	769,000
			Subtotal		4,157,950	18,998,875

Project management Cost (PMC)[4]	GEFTF	207,803	1,151,125
Total project costs		4,365,753	20,150,000

C. SOURCES OF CONFIRMED COFINANCING FOR THE PROJECT BY SOURCE AND BY NAME ($)

Please include letters confirming cofinancing for the project with this form

Sources of Co-financing	Name of Co-financier (source)	Type of Cofinancing	Cofinancing Amount ($)
National Government	Ministry of Water Resources and Electricity	Cash	1,500,000
National Government	Ministry of Environment, Higher Council for Environment & National Resources	Cash	500,000
National Government	Ministry of Petroleum	Cash	200,000
National Government	Ministry of Finance and National Economy	Cash	3,000,000
Local Government	Ministry of Agriculture, Animal Resources and Irrigation , North State	In-kind	150,000
Private Sector	Sudanese Banks (Al Nile, Al Shamal Islamic, Baraka, Family, Farmer's Commercial, Savings and Social Development, Sudanese Islamic)	Soft Loan	14,000,000
GEF Agency	UNDP	Cash	550,000
Others	National Energy Research Center	Cash	250,000
Total Co-financing			20,150,000

D. TRUST FUND RESOURCES REQUESTED BY AGENCY, FOCAL AREA AND COUNTRY[1]

GEF Agency	Type of Trust Fund	Focal Area	Country Name/ Global	(in $)		
				Grant Amount (a)	Agency Fee (b)[2]	Total c=a+b
UNDP	GEFTF	CCM-3	Sudan	4,365,753	414,747	4,780,500
Total Grant Resources				4,365,753	414,747	4,780,500

[1] In case of a single focal area, single country, single GEF Agency project, and single trust fund project, no need to provide information for this table. PMC amount from Table B should be included proportionately to the focal area amount in this table.
[2] Indicate fees related to this project.

F. CONSULTANTS WORKING FOR TECHNICAL ASSISTANCE COMPONENTS:

Component	Grant Amount ($)	Cofinancing ($)	Project Total ($)
International Consultants	135,000	45,000	180,000
National/Local Consultants	110,000	62,000	172,000

G. DOES THE PROJECT INCLUDE A "NON-GRANT" INSTRUMENT? No

(If non-grant instruments are used, provide in Annex D an indicative calendar of expected reflows to your Agency and to the GEF/LDCF/SCCF/NPIF Trust Fund).

PART II: PROJECT JUSTIFICATION

[4] PMC should be charged proportionately to focal areas based on focal area project grant amount in Table D below.

A. DESCRIBE ANY CHANGES IN ALIGNMENT WITH THE PROJECT DESIGN OF THE ORIGINAL PIF[5]

A.1 National strategies and plans or reports and assessments under relevant conventions, if applicable, i.e. NAPAS, NAPs, NBSAPs, national communications, TNAs, NCSA, NIPs, PRSPs, NPFE, Biennial Update Reports, etc. The project is anticipated to be developed within the national policies and guidelines described in the PIF.

A.2. GEF focal area and/or fund(s) strategies, eligibility criteria and priorities. No changes

A.3 The GEF Agency's comparative advantage:

The two relevant advents since the submission of the PIF are UNDP's initiative, presently in the PIF stage of submission to GEF, to enable implementation of the Regional Strategic Action Plan for the rational and equitable management of the Nubian Sandstone Aquifer System; and UNDP's GEF-supported initiative in Morocco, under the "Promoting the development of photovoltaic pumping systems for irrigation" project (presently in the PPG phase).

The Nubian Sandstone Aquifer System (NSAS), covering approximately 2.6 million square kilometers (approximately 1,600 km East to West and North to South) of Northeast Africa in Chad, Egypt, Libya and Sudan, is one of the largest fossil freshwater aquifer systems in the world with reserves estimated at over 500,000 km3. The thickness of the aquifer varies from a few hundred meters at the southern peripheries to several kilometers in the center and northern region. The four countries sharing the aquifer system face similar problems of arid climate, scarce surface water resources, persistent droughts and fragile ecosystems. The aquifer is a critically important source of water in this arid desert region and will be increasingly in demand in the future. A fossil resource recharge of the aquifer is believed to have last occurred during the last ice age. All four countries have given priority to linking the NSAS groundwater exploitation to national development strategies and plans. Growing pressures on the NSAS poses threats to both the quantity and quality of the resource and could, if not appropriately managed, lead to transboundary tension.

The four countries, with the support of the GEF, have undertaken a Transboundary Diagnostic Analysis (referred to as a Shared Aquifer Diagnostic Analysis - SADA) and developed a Strategic Action Programme (SAP) that was adopted by ministers from each country in September, 2013. The SADA identified five transboundary and/or shared problems: (i) Declining water levels; (ii) Damage or loss of ecosystem and biodiversity; (iii) Water quality deterioration; (iv) Climate change; and (v) Changes in groundwater flow regime (this last problem was not pursued further as it was recognized from the model's results that the problem did not occur outside the immediate area of well fields). These problems were then addressed through a high-level SAP with agreed outline mitigation measures.

The project being proposed to GEF, under a separate PIF (PIMS 4736), will enable implementation of the Regional Strategic Action Plan for the rational and equitable management of the Nubian Sandstone Aquifer System.

Implementation of the proposed NSAS project will strengthen UNDP's ability to execute this project by providing greater local involvement of UNDP staff and projects in the region and by providing added information and insight into the sustainability of the underground water aquifer which will inform the design of the pumping systems and possibly suggest limits on pumping if necessary. The information obtained from the proposed NSAS project will help support decisions under this project on where to install pumps, how many, and in what pumping capacities.

The "Promoting the development of photovoltaic pumping systems for irrigation" project in Morocco seeks to create a conducive framework conducive to the implementation of the Moroccan national programme of photovoltaic pumping for drip irrigation. The project strengthens the capacities of the various actors concerned, raises awareness of operators and farmers on economic and environmental

[5] For questions A.1 –A.7 in Part II, if there are no changes since PIF and if not specifically requested in the review sheet at PIF stage, then no need to respond, please enter "NA" after the respective question.

benefits of solar pumping, puts in place financing mechanisms facilitating the acquisition of PV pumping systems, standardizes solar installations for irrigation, develops skills of private operators to ensure supply of quality services and implements a monitoring framework of project impacts as regards GHG emission mitigation. Many of these activities are very similar to the present project. Both projects are under the same regional office and it can be expected that experience from the projects will significantly benefit each other. As soon as both projects start implementation a more structured platform for collaboration and knowledge sharing between them will be established.

Finally also worth noting is the development of a Diesel to Solar (D2S) Initiative in several Arab States supported by UNDP and the Cairo-based Regional Center for Renewable Energy and Energy Efficiency (RCREEE), an independent not-for-profit regional organization that aims to enable and increase the adoption of renewable energy and energy efficiency practices in the Arab region. The D2S initiative – launched this year - is part of UNDP and RCREEE's ongoing efforts to enable private investments in sustainable energy solutions. This market-based initiative aims to scale up the market of diesel to solar retrofits through the promotion of scalable, sustainable business models suitable for the region. To understand the market potential for diesel to solar (D2S) retrofits, a group of researchers at RCREEE conducted a market Assessment in four countries: Djibouti, Egypt, Sudan and Yemen. The study included a preliminary assessment of solar PV pumping technologies and market development. Funding is currently being sought to develop a regional project and – if successful – collaboration between this project and the D2S will be established when appropriate.

A.4. The baseline project and the problem that it seeks to address:

The baseline project and the problem it seeks to address remain largely unchanged compared with the information in the PIF. The only material change has been the preparation of a GEF PIF (as already mentioned) on "Enabling implementation of the Regional SAP for the rational and equitable management of the Nubian Sandstone Aquifer System (NSAS)". As a result, the present project does not include any components to study underground water sources and will instead rely on the outputs of the NSAS project. Study of underground water sources was not a component of this project at the PIF phase, but was originally intended to be undertaken early in the PPG phase.

Table 1 – Changes in co-finance from PIF to CEO Endorsement Request (by donor/funding source)

Source of Co-Financing	PIF Amount (US $)	Actual Amount at CEO ER (US $)	Description
Ministry of Water Resources and Electricity	1,500,000	1,500,000	No change.
Ministry of Environment, Higher Council for Environment & Natural Resources	500,000	500,000	At the PIF stage it was envisioned that this amount would be split between Ministry of Environment, Higher Council for Environment & Natural Resources; Ministry of Petroleum; Ministry of Agriculture; and Sudan Standards & Metrology Organisation. Instead, the entire amount has been contributed by Ministry of Environment, Higher Council for Environment & Natural Resources. Additional funds are contributed by Ministry of Petroleum, Ministry of Agriculture of the North State. The National Ministry of Agriculture and Sudan Standards & Metrology Organisation have not contributed.
Ministry of Finance and National Economy	3,000,000	3,000,000	Originally planned to contribute 50,000 in-kind, the Ministry of Finance has pledged to contribute 3,000,000 in cash to support the creation of a National PV Fund.
Government of the	1,400,000	150,000	Originally intended to contribute 1,400,000, the

Source of Co-Financing	PIF Amount (US $)	Actual Amount at CEO ER (US $)	Description
North State			Government of the North State through its Ministry of Agriculture will contribute 150,000 to be directed towards the development and implementation of water-efficient pumping techniques.
Sudanese Banks	19,507,484	14,000,000	The following banks: Al Nile, Al Shamal Islamic, Baraka, Family, Farmer's, Savings and Social Development Bank, and Sudanese Islamic Bank have each pledged to contribute 2,000,000 in soft loans to a PV fund to help finance PV pumps. The total capital required to install the proposed 1,468 pumps is $24,190,000. This is achieved through a revolving fund of $19,419,000, consisting of $2,419,000 of GEF funds (grants) which will provide a decreasing subsidy to pump units over the life of the project, and $17,000,000 of co-finance ($14,000,000 from banks, and $3,000,000 from MoF) to provide loans. A detailed calculation of the subsidy amount and scheme is provided in the UNDP Project Document.
Ministry of Petroleum	--	200,000	Originally intended to contribute to the 500,000 that the Ministry of Environment has pledged, the Ministry of Petroleum has made a separate pledge for $200,000 through its General Directorate of Energy Affairs.
Elrumayla	1,000,000	--	A private firm, Al Rumayla was originally intended to contribute 1,000,000 in-kind, but has not made a contribution due to the present business climate.
UNDP	550,000	550,000	No change
National Energy Research Center	Part of 2,250,000 in-kind	250,000 in-cash	Originally intended to be part of a group of other contributors in-kind, NERC will be a cash contributor in the amount of 250,000 and will play a significant role in providing the technical expertise
Total	**26,757,484**	**21,150,000**	The change reflects a decrease of $5,607,484, or approximately one fifth of the original amount. Half this amount is a decrease in in-kind co-finance. It is nonetheless possible to maintain the installed capacity target by using a revolving fund such that repayments on the early pumps help to fund later pumps. There has been a slight increase in National Government co-finance, with the Ministry of Petroleum's Directorate of Energy Affairs pledging $200,000 independently of HCENR's $500,000.

A.5. Incremental /Additional cost reasoning: describe the incremental (GEF Trust Fund/NPIF) or additional (LDCF/SCCF) activities requested for GEF/LDCF/SCCF/NPIF financing and the associated global environmental benefits (GEF Trust Fund) or associated adaptation benefits (LDCF/SCCF) to be delivered by the project:

A comparison of project outputs at the PIF and the CEO Endorsement Request stages is detailed in the table below. There are two material changes. The first is the installation of 28 pilot pumps has been included as an explicit output. This was part of the project at the PIF stage, but was not stated as an explicit and independent output. The supply and installation of these pumps will be one of the first activities under the project and is intended to create a demonstration case and serve as proof-of-concept to create demand for the follow-on technology diffusion activities. The second change is the inclusion of a water efficiency output under Outcome 2. This output will serve to decrease the overall cost of the pump and increase the sustainability of water use.

Table 2 - Comparison in Outputs (disaggregated by Component) from PIF to CEO Endorsement Request

Component	Outputs at PIF stage	Outputs at CEO ER	Comments
Outcome 1	1.1 National PV Fund and coordinated loan facility established and capitalized to promote concessional lending to farmers for PV pump equipment 1.2 A minimum of 1,468 off-grid PV pumps ranging in size from 3.12-29.6 kWp installed in farms in the Northern State of Sudan	1.1 28 pumps installed as part of a pilot phase 1.2 National PV Fund and coordinated loan facility established and capitalized to promote concessional lending to farmers for PV pump equipment. 1.3 A minimum of 1,468 off-grid PV pumps ranging in size from 3.12-29.6 kWp installed in farms in the Northern State of Sudan with support from the National PV Fund	The installation of 28 pilot pumps, which was already part of the project at the PIF stage, has been made an explicit output (1.1)
Outcome 2	2.1 Development and implementation of technical quality standards for PV pump components by the Sudan Standards & Metrology Organisation (SSMO), augmented by enforcement support for SSMO, Customs and relevant market observers 2.2 SSMO test and certification laboratories strengthened to test and label PV pump components 2.3 Software tool for pump sizing according to farm and hydrological conditions developed and implemented 2.4 Training and certification scheme for PV pump installers (including local retailers, technicians and pump rental companies) developed and implemented 2.5 Strengthening (or creation) of water user groups as reliable credit counterparties, accompanied by training	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 2.2 SSMO test and certification laboratories strengthened to test and label PV pump components 2.3 Software tool for pump sizing according to farm and hydrological conditions developed and implemented 2.4 Training and certification scheme for PV pump installers (including local retailers, technicians and pump rental companies) developed and implemented. 2.5 Research on development of the most relevant, water efficient, irrigation techniques directly applicable in the North	An additional output has been added to promote sustainable pumping practices (2.6)

	for farmers and water user groups on siting, installation, operation and maintenance of PV pumps	State at minimal cost and dissemination of techniques to farmers. 2.6 Promotion of sustainable pumping practices based on outputs of the Nubian Sandstone Aquifer System from a separate GEF project (ID 4736).	
Outcome 3	3.1 Development of a standardized baseline for pump fuel-switching, applicable to Sudan and the wider region 3.2 Implementation of the standardised baseline within a NAMA	3.1 Development of a standardized baseline for pump fuel-switching, applicable to Sudan and the wider region 3.2 Implementation of the standardized baseline within a NAMA	No change
Outcome 4	4.1 Inclusion of PV pumps in the fiscal concessions lists of the Investment Law and the Agricultural Implements Regulation 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 4.3 Sustainable market dynamic for PV pumps (and other mitigation technologies) created through structured awareness-raising and capacity development activities and through synergies with Government irrigation programmes	4.1 Inclusion of PV pumps in the fiscal concessions lists of the Investment Law and the Agricultural Implements Regulation 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 4.3 Sustainable market dynamic for PV pumps (and other mitigation technologies) created through structured awareness-raising and capacity development activities and through synergies with Government irrigation programmes	No change

A summary of the budget allocations (disaggregated by component) at PIF stage compared with those at CEO Endorsement stage are provided below.

Table 2 - Comparison of GEF Fund allocation at PIF and CEO Endorsement stages.

Component	GEF Funds at PIF stage (US$)	GEF Funds at CEO Endorsement (US$)
Component 1: Financing and dissemination mechanism established and operational to support a PV pump installation programme	2,695,852	2,755,853
Component 2: Financing and dissemination mechanism de-risked through technical standards and demand-side support	746,544	746,544
Component 3: Mitigation instrument design elaborated and implemented in support of the PV pump installation programme	456,221	396,310
Component 4: Supportive enabling environment and scaled-up implementation	259,243	259,243
Project Management	207,893	207,803
Total	**4,356,753**	**4,356,753**

There is very little overall change in the allocation of GEF funds, with the only change being transfer of 60,000 from Component 3 to Component 1. This is in response to comments from GEFSEC advising on the reduction of budget for Component 3.

The project provides excellent "incrementality" as it seeks to help create a revolving and self-sustaining National PV fund that will support the long-term finance of solar PV pumps, even after the conclusion of the project.

The project has been extended from the initially envisioned four years to five years to allow additional time for the uptake of the solar PV pumps and adjustment of the financial scheme according to operational field data collected once the pumps are installed.

Direct GHG Emission Reductions

The calculated global GHG reduction benefits of the project will consist of a combination of:

- Direct GHG emission reduction benefits from the replacement of diesel engines with solar panels through the project.
- Indirect GHG reduction benefits resulting from broader adoption of solar pumping and solar power on the market as a result of project activities.

The data on which the ERs are based is provided below:

Parameter	Value
Specific Diesel Consumption[6]	11 L/day for 3.12 kW pump equivalent 16 L/day for 5.12 kW pump equivalent

[6] As measured by M. Adeen and reported by A. El Amin at two different farms for three days and averaged and for a diesel pump equivalent to a 5.12 kW solar PV pump. Rates for other pumps are extrapolated based on these measurements.

Parameter	Value
	96 L/day for 29.6 kW pump equivalent
Irrigation days per year	270
Emission Factor for Diesel energy conversion	2.66 kg CO2/liter
Installed capacity	1276 × 3.12 kW pumps 128 × 5.12 kW pumps 64 × 29.6 kW pumps
Diesel savings (liters) – lifetime	5,886,720
Total emission reductions due to diesel displacement over lifetime of system (direct)	313,174 tCO_2
Total indirect emission reductions from project – Replication factor of 4 in post-project period (Bottom Up)	1,252,694 tCO_2
Total indirect emission reductions from project – Top Down	2,160,005 tCO_2

Direct CO_2 reductions =
(270 days/year × (1276 × 11 L/day + 128 × 16 L/day + 64 × 96 L/day) × 2.66 kg CO2/L)) × 20 years

The direct CO_2 emission reductions attributed to the replacement of diesel pumps with solar pumps by the UNDP-implemented, GEF-financed project, are calculated to be 15, 659 tCO_2/year, or 313,174 tCO_2 over the 20 year life of the pumps. With a GEF financial contribution of $4,365,753, this translates to a cost of GEF US$13.94/$tCO_2$ abated directly, and US$2.02 - US$3.49/tCO_2 abated indirectly. This does not include reduced diesel consumption by those who may adopt the water saving measures to be promoted by the project even if they do not adopt the solar pumping.

If we further assume, based on data collected, total irrigation days per year of 270 days/year, then the project can be expected to save a total of 5.9 million liters of diesel per year, which translates to an annual GHG reduction of 15,659 tCO_2/year.

The calculation represents the most conservative scenarios in two ways. First, diesel consumption varies widely for pumps depending on usage, age, condition, etc. The calculation uses the most conservative figures by using the lowest reasonable scenarios encountered during the PPG. Other reasonable scenarios exist which could indicate almost twice the carbon reduction. Second, the calculation does not take into account any lifting of customs duties or tariffs on the pump which would have the effect of wider adoption and increased capacity to finance through the National PV fund. Similarly, the estimates for installed capacity are considered conservative. Simple calculation shows that available co-finance could potentially support a larger installed based however the original target is kept with additional funds left as a contingency to for risks such as currency fluctuations.

The project will take appropriate precautions that the old diesel pumps replaced by solar pumps are not recirculated on the market as very low-cost alternatives for pumping water. Such precautions may eventually include a scrapping programme or requiring farmers to turn-in their diesel pumps as part of entering into a finance agreement for a solar PV pump, potentially after a trial period to ensure the solar pump is working adequately. Initially, farmers may be allowed to keep their diesel pump, provided that it is connected on the same well or source as the solar pump and therefore would only be used as backup or when solar radiation is not sufficient. It is entirely plausible that a farmer would legitimately wish to retain their diesel pump as backup. The matter is sensitive because farmers could risk loss of crop if for any reason the solar pump were not to pump for an extended period. Hence, the matter is not easily decided and will take a few years of

operation to adequately sort in a way that gives farmers appropriate assurance and at the same time ensures there is not "leakage" of emissions reductions through the availability of scrap diesel pumps on the market.

Indirect GHG Emission Reductions

Bottom-up analysis:

The GEF guidelines provide a formula for bottom-up emissions assessment as:

CO2 indirect BU = CO2 direct * RF

where RF is a Replication Factor.

Assuming a replication factor of 4, a further 1,252,694 tCO_2 can be calculated as indirect GHG emission reductions.

Top-Down analysis:

There are an estimated 6,500 pumps in the Northern State. Assuming conservatively that one quarter of these can be converted to solar, this provides a further 1,625 pumps. Further assuming that in each of Sudan's 17 states one third of this figure, 500 pumps, will be converted to solar PV this provides a total of 10,125 pumps. Assuming a pump size distribution similar to that proposed in the Northern State, this results in a reduction of 2,160,005 tCO_2 over the 20 year lifetime of the pumps.

Under a business-as-usual scenario, farmers would continue to use diesel pumps where electricity from the grid cannot be connected. This would result in further increase of diesel usage and the corresponding diesel supply chain. The pumps also require intensive use of lubricants, oils, and rubber belts to transmit power. Hence, an overall reduction of materials and oil based goods can be achieved.

A.6 Risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and measures that address these risks:

A detailed risk assessment is presented in the Project Document. The table below summarizes those risks as well as those presented at the PIF stage.

#	Description	Date identified	Type	Impact & Probability	Countermeasures / Management response	Owner	Submitted, updated by	Last Update	Status
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.		Political/ Operational	May prevent access to certain areas for implementation of projects. P[7] = 2 I[8] = 3	Advice on secure travel routes within Sudan. An escort from MWRE will be provided where necessary. The location of main activities in the project (Dongola, in the North State) is secure.	Project Board		N/A	N/A
2	The Government may fail to subsidize the programme or the Banks may require an interest rate too high to make the project attractive, or diesel subsidies may continue to make diesel artificially inexpensive.		Regulatory	Lack of policy basis to catalyze adoption of solar energy P = 2 I = 5	Policy reform and decision making can be slow in Sudan. 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.	Government		N/A	N/A
3	Currency risk		Financial	The price of diesel is fixed in local currency while the price of pumps (which are imported) fluctuates with the currency. P=3 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				

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

#	Description	Date identified	Type	Impact & Probability	Countermeasures / Management response	Owner	Submitted, updated by	Last Update	Status
					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.		Financial	P=2 I=4	As with currency risk, if PV pumps can be established as a viable technology with efficient financing mechanism, they may be adopted even at a premium to diesel.				
5	Climate change risk		Environmental	P=1 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.	NA			
6.	Novelty and adoption risk – individual farmers or banks may be slow to adopt new technology and take-up unfamiliar business models.		Organizational	Slow uptake of solar water pumping by market participants. P = 2 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	Project Board		N/A	N/A

#	Description	Date identified	Type	Impact & Probability	Countermeasures / Management response	Owner	Submitted, updated by	Last Update	Status
					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.		Technological	Lower than anticipated water volumes out of the pumps installed. P = 2 I = 3	Consultants hired for the project will be tasked with studying and emphasizing appropriate design/sizing. Pumps may be procured with certain guarantees.	NA		N/A	N/A
8	Financial Risks – The capital required remains significant. The interest rates typically charged by the banks are too high to make solar pumping attractive.		Financial	Lack of financing is likely to mean low adoption rates as farmers are not likely to have the capital to purchase solar pumps. P = 2 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.	Government			
9	Lack of adequate and reliable market data to facilitate the monitoring of project impacts and planning of further policy measures.		Operational	Reduced information on the reaction of the market to the measures implemented. P = 2 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.	National Project Manager (NPM)			
10	Inadequate and/or non-capacitated human resources to successfully implement the		Operational	Project not meeting the stated targets.	Solar pumping is not terribly complex and relies mainly on concepts and components	National Project Manager (NPM)		N/A	N/A

#	Description	Date identified	Type	Impact & Probability	Countermeasures / Management response	Owner	Submitted, updated by	Last Update	Status
	project and support the mainstreaming of its results.			P = 1 I = 5	already available – driving electric motors. The remaining parts – solar panels and controller, are encapsulated at the manufacturer. Required local human capacity 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.				

In addition, the Project Document identifies the following social and environmental risks

QUESTION 2: What are the Potential Social and Environmental Risks? *Note: Describe briefly potential social and environmental risks identified in Attachment 1 – Risk Screening Checklist (based on any "Yes" responses).*	**QUESTION 3: What is the level of significance of the potential social and environmental risks?** *Note: Respond to Questions 4 and 5 below before proceeding to Question 6*			**QUESTION 6: What social and environmental assessment and management measures have been conducted and/or are required to address potential risks (for Risks with Moderate and High Significance)?**
Risk Description	***Impact and Probability (1-5)***	***Significance (Low, Moderate, High)***	***Comments***	***Description of assessment and management measures as reflected in the Project design. If ESIA or SESA is required note that the assessment should consider all potential impacts and risks.***
Risk 1: Extraction of Ground Water	I = 5 P =5	Moderate	The project is based on using solar pumps to irrigate where there is no grid. A large portion of these will pump ground water. Despite this, significance is rated as moderate because this ground water would be pumped with diesel powered pumps in many cases. While solar pumping is "free" once the pump is installed. It is also self-limiting in that it runs only during the day. The implementation of the project will reduce water extraction by employing efficient irrigation techniques. But will also allow cultivation of larger land area, extracting more water.	A separate project is being undertaken (in the PIF stage to GEF) to study in detail the Nubian Sandstone Aquifer System which the pumps would extract water from and determine sustainable levels of extraction. The project is expected to proceed largely in parallel with this project. As part of the PPG process, a study of underground water wells and pumping rates was undertaken. The study indicates based on the drawdown rates that the wells can support the present extraction rates. The solar pumps are not expected to increase the extraction rates but rather decrease it as a result of efficient irrigation methods that will be put in place as part of the project implementation.
Risk 2: Forced evictions	I = 5 P = 1	Low	Forced eviction may occur where a farmer uses his land as collateral for a loan to buy a pump and for any reason is unable to repay the loan triggering repossession of the land by the lender.	The project is undertaking measures to provide banks with alternative collateral, such as the pump itself, thereby insulating farmers from this risk while still providing the bank with the guarantees needed to lend and ensuring the farmers are sufficiently engaged.

Risk 3: Inequitable adverse impacts on farmers living in poverty	I = 2 P =2	Low	Impoverished farmers may not be able to obtain loans from banks thereby leaving them at a competitive disadvantage to farmers who are able to use solar pumping and reduce their cost.	The project seeks to enable all those who can benefit from loans to obtain them. Farmers unable to obtain loans may apply through cooperatives or other means. The impact of the probability and impact are rated as moderately low because farming on credit is the prevailing method, so all impoverished commercial farmers rely on some form of credit for things like fertilizer. Those who do not likely engage in some kind of subsistence farming and are not likely to be directly affected. These farmers are also unlikely to be planting plots of land using a dedicated pump. Still, the project will explore possibilities for providing these farmers with a mechanism to obtain solar pumps as a cooperative.

A.7. Coordination with other relevant GEF financed initiatives

In addition to the coordination with other relevant GEF financed initiatives presented in the PIF, the project will coordinate with the GEF initiatives described under Section A.3.

B. ADDITIONAL INFORMATION NOT ADDRESSED AT PIF STAGE:

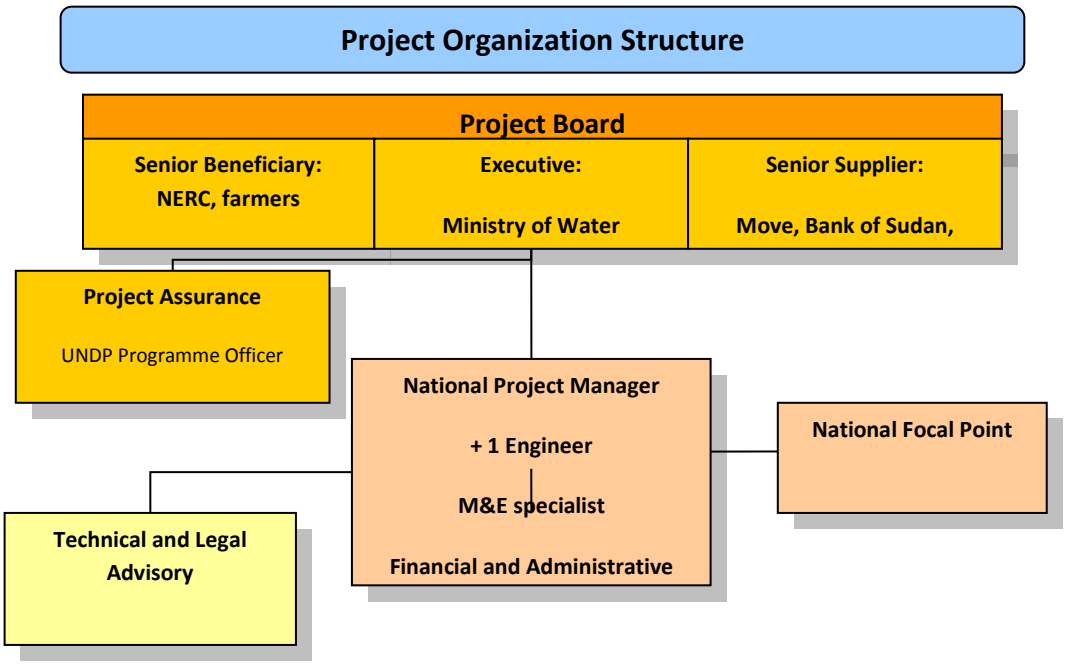
B.1 Describe how the stakeholders will be engaged in project implementation.

Extensive stakeholder consultations were carried out during the PPG phase, including two visits to Dongola, in the North State where the project will be carried out. These included stakeholder consultation workshops there with attendees from Local Government, Civil Society, Farmers Association, and the general public.

In addition, two extensive workshops were held in Khartoum at the headquarters of the Ministry of Water Resources and Electricity

Project Stakeholder	Relationship With The Project
Ministry of Water Resources & Electricity (MWRE)	The principal role of MWRE is to formulate policies, strategies and action plans for the supply of electricity in Sudan, with a key focus on diversifying Sudan's electricity mix to include renewables. MWRE has been undertaking a pump switching programme in Northern State, assisting farmers to switch from diesel-powered irrigation pumps to grid-connected electric pumps. With the opportunities for further on-grid switching almost exhausted, MWRE is promoting the use of off-grid PV pumps instead. MWRE will be responsible for implementing the GEF project.
Ministry of Environment, Forestry & Physical Development (MEFPD)	MEFPD is the national focal point for the GEF and, under its subsidiary HCENR, the UNFCCC. MEFPD will be involved in technical assistance on the coordinated loan mechanism and on the climate finance elements of the project.
Higher Council for Environment and Natural Resources (HCENR)	As the national focal point for climate change under the UNFCCC, HCENR is responsible for coordinating National Communications, the development of Climate Change Action Plans, NAPAs, Technology Needs Assessments and NAMAs. The GEF project will build on a number of HCENR initiatives, including the development of standardized baselines, the elaboration of a national Low Emission Development Strategy, and the analysis of sectoral NAMA opportunities.
Ministry of Petroleum, Renewable Energy Directorate (MoP)	The Renewable Energy Directorate of MoP has a national mandate for renewable energy resource mapping and off-grid renewables applications. MoP has developed an expertise in rooftop PV systems and has begun to experiment with a limited number (7 to date) of PV irrigation pump units. MoP will assist the GEF project with advisory support, local capacity development and national policy formulation.
Ministry of Agriculture (MoA)	MoA is the implementing body for the Agricultural Strategic Plan (2007-2015), which has the central objective of increasing the amount of farming land in Sudan by 70% and – within that overall target – doubling the amount of irrigated land. MoA operates a number of support programmes for farmers on agricultural practices, including irrigation and water pumping. The GEF project will coordinate its PV pump installations, capacity development and replication programme with MoA's support activities. MoA is also expected to play a key role in the context of liaising with water user groups and coordinating the NAMA, in ensuring inclusion of PV pumps in the Agricultural Implements Regulation.
Ministry of Finance & National Economy (MoF)/Bank of Sudan	MoF will support the establishment of a National PV Fund with technical and financial assistance and may be the custodian of the fund. MoF will assist with finance-related aspects of the project, notably the support to banks and oversight of banks' micro-finance lending and inclusion of PV pumps in the fiscal concessions list of the Investment Law and the Agricultural Implements Regulation. The Ministry also works closely with the Customs Administration, which will enforce the technical standards for PV hardware that will be

	developed by the Sudan Standards & Metrology Organisation. MoF will also assist in establishing National Fund to support the deployment of solar pumps.
National Energy Research Centre (NERC)	NERC (formerly the Energy Research Institute, ERI), under the Ministry of Science and Communication, is the primary institute at the national level for conducting research on renewables in Sudan, as well as pilot project implementation. The Solar PV Encapsulation & Manufacturing Unit is the implementation arm of NERC: it has undertaken a number of PV pump installations in Nile State and Darfur, accompanied by system monitoring and technical performance assessments. NERC will support the GEF project in understanding farmers' technical and operational pumping needs, in designing a pump sizing software tool, in installing and monitoring demonstration PV pump units, and in capacity development.
Sudan Standards & Metrology Organisation (SSMO)	SSMO is a Government body established to coordinate Sudan's engagement with the International Standards Organisation (ISO), the African Regional Organisation for Standardization (ARSO) and the Arab Standards and Metrology Organisation (ASMO). SSMO operates 15 testing and certification laboratories across Sudan. The GEF project will build upon SSMO's mandate and expertise to support SSMO in developing technical standards for the PV pump hardware that will be deployed in Northern State (and subsequently nationally).
Northern State Government	Sudan has a federal governance structure, made up of 18 states with delegated functions and powers. The Northern State Government has been actively promoting grid-connected irrigation pumps as a means of improving farmers' livelihoods and reducing their (and the State's) reliance on diesel fuel, and is now extending this support to off-grid PV pumps in areas where grid extension is infeasible. The GEF project will build on the State Government's established support programme for electric pumps, and will harness the State Government's institutions (e.g. the State Ministry of Agriculture) and agricultural stakeholder networks.
Commercial banks	The Agricultural Bank of Sudan, the Farmers Bank, the Savings Bank and the Islamic Bank have together financed – through ad hoc (uncoordinated) loans to farmers – the installation of approximately 2,000 grid-connected electric pumps in Northern and Nile States since 2011. Seven banks have committed to providing US$2 million each in loans to support the financing mechanism supported under the project. The GEF project will work with the State Government and the banks to coordinate their lending for this purpose, to develop the internal capacities of the banks to structure loan packages and assess loan risks, and to market innovative financial products to drive farmer take-up of PV pump technology.



The project will be nationally executed by the Ministry of Water Resources and Electricity, under the National Implementation Modality (NIM). UNDP will be accountable for the disbursement of funds and the achievement of the project goals, according to the approved work plan. A Government Project Coordinator (GPC) will be appointed by MWRE, to coordinate project operations and support the NPM with overall administration, oversight, coordination of activities and maintaining a liaison with UNDP. The GPC will: (i) coordinate the project activities with activities of other Government entities; and (ii) certify the expenditures are in line with approved budgets and work-plans and his remuneration will be incurred by the government.

The project includes funding for grant mechanism which will be operated by MWRE and the Central Bank in parallel to the project. The selection procedures and eligibility for how targeted beneficiaries can access grant subsidies under Outcome 1 will be done according to transparent and pre-defined criteria established under year 1 of the project and codified as part of the establishment of the national PV fund. The contribution of GEF funds (for subsidies) is likely to be in tranches, based on performance. The funds may either be directed to the Central Bank's national PV fund (at the request and formal delegation of MWRE) and will then be disbursed or advanced against the eligible purchase of each individual solar PV pump and then reconciled on a regular (e.g. quarterly basis) following certification by the PB that proper procedures were followed for selection of beneficiaries. Alternatively a dedicated bank account for the grant subsidies will be set up at UNDP Sudan country office and then the funds could be advanced or disbursed to MWRE (or the Central Bank based on their delegation) following the same procedures and rules.

In the former case the transfer of any GEF funds for equipment subsidies to the national PV fund will only happen upon the provision of proof of the legal establishment of the fund by the executing agency (or their delegated financial custodian) with all requisite fiduciary and legal conditions in place to ensure appropriate disbursement and monitoring of the GEF funds by the fund vehicle according to its intended use. In that case the project will itself not manage the fund but will ensure compliance of fund operations with UNDP/GEF guidelines.

Moreover it is recommended that an Independent Review Mechanism be established by the project for Outcome 1 (within the project and ring-fenced) that will review and endorse the selection of all grant recipients under the grant component and regularly assess the performance of these beneficiaries in managing the assets subsidized by the grants over the course of the project. This mechanism will be established during the first six months of the project and will be condition precedent for the disbursement of any GEF funds for grants. Finally, an exit strategy will be prepared during the last year of the project that will ensure the continued operation of the national PV fund based on a self-sustaining business model and the continued monitoring of solar pump utilization by beneficiaries of grants funded by the project.

A Project Board (PB) will be established at the inception of the project to monitor project progress, to guide project implementation and to support the project in achieving its listed outputs and outcomes. It will be chaired by an MWRE representative and will include representatives from MoF, Bank of Sudan, NERC, SSMO, HCENR, and a Project Assurance Officer from UNDP. Other members can be invited at the decision of the PB on an as-needed basis, but taking due regard that the PB remains sufficiently lean to be operationally effective. The final list of the PB members will be completed at the outset of project operations and presented in the Inception Report by taking into account the envisaged role of different parties in the PB. The national project manager will participate as a non-voting member in the PB meetings and will also be responsible for sharing required documents sufficiently in advance of the meeting and compiling a summary report of the discussions and conclusions of each meeting.

The coordination of the above stakeholders will be carried out by MWRE with the support of UNDP. The coordination will begin with the establishment of a Local Project Appraisal Committee (LPAC) and the invitation of stakeholders to an inception meeting. The PB will identify and put in place steps for initial activities to support, for example, the technical capacity building in the period when the regulatory and financial structures are being developed. One goal of project coordination will be to ensure that the various components of the project are in place when they are needed: e.g. financial instruments are ready when regulations come into place; technical capacity and equipment supply are available at the appropriate time, etc.

The PB will meet semi-annually during project implementation, and it will have the responsibility of coordinating and harmonizing the actions of all the key stakeholders.

The day-to-day management of the project will be carried out by a Project Management Unit (PMU) under the overall guidance of the PB. The PMU will be established within MWRE and will coordinate its work with UNDP, MoP, HCENR, and other stakeholders. The National Project Manager will report to MWRE and the PB. The Terms of Reference of the key project personnel are presented in Annex 8.3 of this Project Document. The project personnel will be selected on a competitive basis in accordance with the relevant rules and procedures and in consultation with the UNDP Country Office, Ministry of Finance, and Government.

The national project manager will 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 are also to be established.

UNDP will maintain the oversight and management of the overall project budget. It will be responsible for monitoring project implementation, timely reporting of 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. It will also support the executing agency in the procurement of the required expert services and other project inputs and administer the required contracts. Furthermore, it will support the coordination and networking with other related initiatives and institutions in the country.

To successfully reach the objective and outcomes of the project, it is essential that the progress of different project components is closely monitored both by the key local stakeholders and authorities as well as by project's international experts, starting with the finalization of the detailed, component-specific work plans and implementation arrangements and continuing through the project's implementation phase. The purpose of this is to facilitate early identification of possible risks to successful completion of the project together with adaptive management and early corrective action, when needed.

In order to accord proper acknowledgement to the GEF for providing funding, a GEF logo should appear on all relevant GEF project publications, including any hardware purchased with GEF funds. Any citation on publications regarding projects funded by GEF should also accord proper acknowledgement to the GEF in accordance with the relevant GEF guidelines.

The international experiences and lessons-learned from catalyzing local renewable energy development have been taken into account in the design of this new project. The activities of other donors and the foreseen synergies and opportunities for cooperation have been discussed in detail in Chapter 1.4 of this project document. During implementation, proper care will be taken to have adequate communication and coordination mechanisms in place to ensure that areas of common interest can be addressed in a cost-efficient way.

B.2 Describe the socioeconomic benefits to be delivered by the Project at the national and local levels, including consideration of gender dimensions, and how these will support the achievement of global environment benefits (GEF Trust Fund/NPIF) or adaptation benefits (LDCF/SCCF):

Once the initial cost of the 1,468 pumps installed under this project is paid, over a 10 year period, the farmers who own these pumps stand to save a collective US$56 million in avoided diesel costs over 15 years of essentially free pump operation (assuming a 25 year life). From the date of installation of the pumps, farmers will be insulated from fluctuations in the price of diesel, oil, and spare parts. They will also be able to more constructively employ their time and effort. Several farmers surveyed as part of the PPG process indicated the time and effort wasted maintaining and operating the diesel pump as a significant nuisance and impediment to their productivity. A somewhat unquantifiable but very noticeable benefit is reduced noise pollution. The silence of the country-side is often shattered by the sound of diesel engines pumping water. The ability for farmers to irrigate and work without the nuisance of noise pollution is perhaps one of the more understated benefits of electric pumping in general, and solar PV pumping in particular.

As a result of the project, capacity will be built in Sudan around solar PV. This is both at the national level and local level. A the national level, institutions such as NERC and SSMO will receive equipment, training, exposure to new technology and a new role within society to support the deployment and adoption of solar PV pumping.

At the local level, new means of employment will be created in sizing and installing solar PV pumps. The technical skills developed in carrying out such tasks will transfer directly to the use of solar PV technology for other applications creating opportunities beyond solar pumping. If the estimated installation rate for pumps is 360 pumps per year (one quarter of the target amount per year), this equates to almost 1.6 pumps per working day assuming 220 working days per year. It takes approximately 3 people 3 days to install a pump. It will take approximately 3,600 man-days per year to install the pumps targeted under the present project (9 man-days for 3.12, and 5.12 kW pumps, 25 man-days for a 30 kW pump). Assuming 200 work days per year, and that installers are occupied with installations two-thirds of their working time, this means the direct creation of some 27 jobs for skilled technicians installing PV to meet the project targets in the Northern State. With national replication, this translates to a minimum of 184 skilled technical jobs around the country for PV installation pumps alone. The supply chain to provide the pumps will likely employ a similar number of persons to size, buy, import and handle logistics. Thus, a total of 368 jobs can be expected to be created directly.

Other benefits that can be expected include reduced tanker truck transportation on public roads (transport of some 5.9 million liters of diesel will be avoided, or some 300 tanker loads) as the need to transport diesel from the main cities and ports to agricultural areas is reduced. Also reduced is the risk of soil and ground water contamination due to diesel spillage. Associated national and local benefits include reduced local pollution from the burning of fossil fuels, strengthened national energy security through reduced dependency on imported fuels.

These developments and capacity building will catalyze the adoption of solar technology in general and provide a foundation that allows the widespread use of solar energy either in response to regulatory or market stimuli or simply to provide power where diesel in not cost-effective or not readily available and solar may already be advantageous but is not utilized due to a lack of capacity or awareness.

B.3. Explain how cost-effectiveness is reflected in the project design:

The GEF financing for Outcome 1 (US$2,755,853), represents the bulk of the GEF financing for the project and has been allocated to support the development of pilot solar PV projects. These are seen as the most critical step in launching solar pumping in Sudan by demonstrating to farmers that solar pumping is viable and demonstrating to bankers that it is a reliable, financeable activity. The success of these solar pumping demonstrations will translate to future projects while a failure will setback solar pumping in Sudan by several years.

At present, no entity is willing or capable of putting forth the finance and technical support necessary for such a demonstration. Hence, UNDP-GEF support will be critical in implementing these demonstration systems and doing it in a way that can prove successful and inspire the confidence of future stakeholders. The GEF investment of $2,755,853 in this component will directly mobilize a total $24,190,000 in investments in solar pumps. This financing will in-turn result in fuel savings over the life of the pump of some $90 million, of which $56 million will be retained by farmers once they have paid off the value of their pumps.9

The GEF financing for Outcome 2 ($746,544) assures cost-effectiveness in two principal ways. First, it will serve to guarantee the quality of the $24,190,000 worth of pumps purchased under the project and that they are suitably sized and selected for the conditions of their application. Second, the water efficiency component will ensure that the amounts of water needed are optimized and therefore the pump size, and

[9] Figures are based on 25 year pump life and 10 years loans at 9% cost of finance.

associated capital cost can be minimized for a given crop and area.

The GEF financing for Outcome 3 ($396,310) consists of technical assistance to develop a standardized baseline and Nationally Appropriate Mitigation Actions (NAMA) to secure international carbon finance to support the long term development of solar pumping in Sudan.

The GEF financing for Outcome 4 ($259,243) consists of technical assistance to enable documentation and dissemination of experience gained in the present project in the North State for replication in other areas.

The proposed project is extremely cost-effective as it will utilize relatively limited GEF funds to leverage investments in agriculture throughout Sudan. The potential for replication in Sudan and other areas is significant. Water pumping is problematic and costly in most of Africa and relies on imported, hard to obtain, diesel. With a demonstrated alternative, adoption can be expected to spread quickly. The cost-effectiveness of the project is reflected in its GHG abatement cost of $13.94/tCO2 of direct emissions; and US$2.02 - US$3.49/tCO2 of indirect emissions.

C. DESCRIBE THE BUDGETED M &E PLAN:

The project will be monitored through the following M& E activities. The M& E budget is provided in the table below.

Project start

A Project Inception Workshop will be held within the first 2 months of project signature with those with assigned roles in the project organization structure, UNDP Country Office and, where appropriate/feasible, regional technical policy and programme advisors as well as other stakeholders. The Inception Workshop is crucial to building ownership for the project results and to plan the first year annual work plan.

The Inception Workshop should address a number of key issues including:

Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and RCU staff vis à vis the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff will be discussed again as needed.

Based on the project results framework and the relevant SOF (e.g. GEF) Tracking Tool if appropriate, finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks.

Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.

Discuss financial reporting procedures and obligations, and arrangements for annual audit. Propose implementation and financial arrangement for grant component under Outcome 1 and prepare execution of required agreements or delegation of responsible parties. Prepare roadmap for establishment of an Independent Review Mechanism that will review and endorse the selection of all grant recipients funded by GEF and regularly assess the performance of these beneficiaries in managing the assets subsidized by the grants over the course of the project

Plan and schedule Project Board meetings. Roles and responsibilities of all project organization structures should be clarified and meetings planned. The first Project Board meeting should be held within the first 12 months following the inception workshop.

An Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

Quarterly

Quarterly monitoring procedure includes:

Progress made shall be monitored in the UNDP Enhanced Results Based Management Platform.

Based on the initial risk analysis submitted, the risk log shall be regularly updated in ATLAS. Risks become critical when the impact and probability are high. Note that for UNDP GEF projects, all financial risks associated with financial instruments such as revolving funds, micro-finance schemes, or capitalization of ESCOs are automatically classified as critical on the basis of their innovative nature (high impact and uncertainty due to no previous experience justifies classification as critical). Quarterly reports will include regular monitoring on the grant component under Outcome 1.

Based on the information recorded in Atlas, a Project Progress Reports (PPR) can be generated in the Executive Snapshot.

Other ATLAS logs can be used to monitor issues, lessons learned etc. The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

Annually

Annual Project Review/Project Implementation Reports (APR/PIR): This key report is prepared to monitor progress made since project start and in particular for the previous reporting period (30 June to 1 July). The APR/PIR combines both UNDP and SOF (e.g. GEF) reporting requirements.

The APR/PIR includes, but is not limited to, reporting on the following:

- Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets (cumulative)
- Project outputs delivered per project outcome (annual).
- Lessons-learned/good practice.
- AWP and other expenditure reports
- Risk and adaptive management
- ATLAS QPR
- Portfolio level indicators (i.e. GEF focal area tracking tools) are used by most focal areas on an annual basis as well.

Periodic Monitoring through site visits

UNDP CO and the UNDP RCU will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP RCU and will be circulated no less than one month after the visit to the project team and Project Board members.

Mid-term of project cycle

The project will undergo an independent Mid-Term Review at the mid-point of project implementation (2017). The Mid-Term Review will determine progress being made toward the achievement of outcomes and will

identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the Mid-Term Review will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-Term Review will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Centre (ERC).

The relevant SOF (GEF) Focal Area Tracking Tool will also be completed during the Mid-Term Review cycle.

End of Project

An independent Final Terminal Evaluation will take place three months prior to the final Project Board meeting and will be undertaken in accordance with UNDP and SOF (e.g. GEF) guidance. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the Mid-Term Review, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF.

The Final Terminal Evaluation should also provide recommendations for follow-up activities and requires a management response which should be uploaded to PIMS and to the UNDP Evaluation Office Evaluation Resource Centre (ERC).

The relevant SOF (e.g. GEF) Focal Area Tracking Tool will also be completed during the final evaluation.

During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

Learning and knowledge sharing

Results from the project will be disseminated within and beyond the project intervention zone through existing information sharing networks and forums.

The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons-learned. The project will identify, analyze, and share lessons-learned that might be beneficial in the design and implementation of similar future projects.

Finally, there will be a two-way flow of information between this project and other projects of a similar focus.

Communications and visibility requirements

Full compliance is required with UNDP's Branding Guidelines. These can be accessed at http://intra.undp.org/coa/branding.shtml, and specific guidelines on UNDP logo use can be accessed at: http://intra.undp.org/branding/useOfLogo.html. Amongst other things, these guidelines describe when and how the UNDP logo needs to be used, as well as how the logos of donors to UNDP projects needs to be used. For the avoidance of any doubt, when logo use is required, the UNDP logo needs to be used alongside the GEF logo. The GEF logo can be accessed at: http://www.thegef.org/gef/GEF_logo. The UNDP logo can be accessed at http://intra.undp.org/coa/branding.shtml.

Full compliance is also required with the GEF's Communication and Visibility Guidelines (the "GEF Guidelines"). The GEF Guidelines can be accessed at: http://www.thegef.org/gef/sites/thegef.org/files/documents/C.40.08_Branding_the_GEF%20final_0.pdf

Amongst other things, the GEF Guidelines describe when and how the GEF logo needs to be used in project publications, vehicles, supplies and other project equipment. The GEF Guidelines also describe other GEF promotional requirements regarding press releases, press conferences, press visits, visits by Government officials, productions and other promotional items.

Where other agencies and project partners have provided support through co-financing, their branding policies and requirements should be similarly applied.

M&E work plan and budget

Type of M&E activity	**Responsible Parties**	**Budget US$** *Excluding project team staff time*	**Time frame**
Inception Workshop and Report	▪ National Project Manager ▪ UNDP CO, UNDP-GEF	Indicative cost: 10,000	Within first two months of project start up
Measurement of Means of Verification of project results.	▪ Project Manager will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members.	To be finalized in Inception Phase and Workshop.	Start, mid and end of project (during evaluation cycle) and annually when required.
Measurement of Means of Verification for Project Progress on *output and implementation*	▪ Oversight by National Project Manager ▪ Project team	To be determined as part of the Annual Work Plan's preparation.	Annually prior to ARR/PIR and to the definition of annual work plans
ARR/PIR	▪ National Project manager and team ▪ UNDP CO ▪ UNDP RTA ▪ UNDP GEF	None	Annually
Periodic status/ progress reports	▪ National Project Manager and team	None	Quarterly
Mid-term Review (with particular emphasis on evaluation of Outcome 4 to guide future replication and expansion)	▪ National Project Manager and team ▪ UNDP CO ▪ UNDP RCU ▪ External Consultants (i.e. evaluation team)	Indicative cost: 40,000	At the mid-point of project implementation.
Final Evaluation	▪ Project manager and team, ▪ UNDP CO ▪ UNDP RCU ▪ External Consultants (i.e. evaluation team)	Indicative cost : 40,000	At least three months before the end of project implementation
Project Terminal Report	▪ National Project Manager and team ▪ UNDP CO ▪ local consultant	0	At least three months before the end of the project
Audit	▪ UNDP CO ▪ Project manager and team	Indicative cost per year:	Yearly

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time frame
		3,000	
Visits to field sites	▪ UNDP CO ▪ UNDP RCU (as appropriate) ▪ Government representatives	For GEF-supported projects, paid from IA fees and operational budget	Yearly
TOTAL indicative COST Excluding project team staff time and UNDP staff and travel expenses		US$ 105,000 (~2% of total budget)	

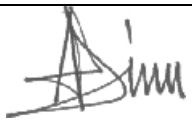
PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT(S) ON BEHALF OF THE GOVERNMENT(S):): (Please attach the Operational Focal Point endorsement letter(s) with this form. For SGP, use this OFP endorsement letter).

NAME	POSITION	MINISTRY	DATE *(MM/dd/yyyy)*
Dr Babiker Abdalla Ibrahim	Under-Secretary, Ministry of Environment, Forestry & Physical Development; GEF OFP	MINISTRY OF ENVIRONMENT, FORESTRY & PHYSICAL DEVELOPMENT	01/20/2014

B. GEF AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF/LDCF/SCCF/NPIF policies and procedures and meets the GEF/LDCF/SCCF/NPIF criteria for CEO endorsement/approval of project.

Agency Coordinator, Agency Name	Signature	Date *(Month, day, year)*	Project Contact Person	Telephone	Email Address
Adriana Dinu, UNDP-GEF Executive Coordinator		December 21, 2015	Lucas Black UNDP/GEF Regional Technical Advisor –Arab States	+90 538 598 5172	E-mail: lucas.black@undp.org

ANNEX A: PROJECT RESULTS FRAMEWORK (either copy and paste here the framework from the Agency document, or provide reference to the page in the project document where the framework could be found).

This project will contribute to achieving the following Country Programme Outcome as defined in CPAP or CPD: Expected CPAP Output (2.2): Investment in green energy and access by needy communities to sustainable energy improved					
Country Programme Outcome Indicators: Number of communities with access to alternative sources of renewable energy-based services /Baseline: Limited access to renewable energy /Target: 50 communities					
Primary applicable Key Environment and Sustainable Development Key Result Area (same as that on the cover page, circle one): 1. Mainstreaming environment and energy OR 2. Catalyzing environmental finance OR 3. Promote climate change adaptation OR 4. Expanding access to environmental and energy services for the poor					
Applicable GEF Focal Area Objective: GEF-5 FA Objective # 3 (CCM-3): "Promote Investment in Renewable Energy Technologies".					
Applicable GEF Expected Outcomes: Total avoided GHG emissions from off-grid PV pumping.					
Applicable GEF Outcome Indicators: Avoided GHG emissions from off-grid PV pumping (tons CO_2).					
Strategy	**Indicator**	**Baseline**	**Targets**	**Source of Verification**	**Assumptions and risks**
Project Objective: Financing and dissemination mechanism established and operational to support a PV pump installation programme	• Amount of reduced CO_2 emissions reductions from water pumps for irrigation (compared to the project baseline) installed EOP, in tons $CO2_{eq}$	• 0	• 313,174[10]	Project's annual reports, GHG monitoring and verification reports	- It is assumed that the price of diesel fuel will increase through the continued lifting of subsidies. If the price of diesel does not increase, the adoption of solar pumps will be slowed or may be minimal. - Similarly, a drop in the value of the Sudanese
	• 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	Project final evaluation report	
	• Number of banks providing finance for solar PV pumps	• 0	• 7	Project final evaluation report	
	• Reduction of down-time and farmer's time lost to pump repair • Savings due to avoided diesel cost after pumps have been paid off (over 15 years remaining technical life)[11] • Number of new suppliers (partnerships) providing equipment financed by National PV Fund mechanism	• 0 • 0 • 0	• 80% • US$56 million • At least 7 (representing a business volume of approximately 200	Baselines surveys and monitoring information from installed pumps and comparison diesel pumps. Calculation based on installed pump capacity, and actual savings observed in the field.	

[10] GHG emissions reductions are calculated per GEF methodology and reflect GHG reductions from equipment installed during the GEF project over its lifetime, which extends beyond the GEF project. Calculations are for equipment life of 20 years, per GEF guidelines.

[11] Assumes technical lifetime of equipment of 25 years, per manufacturer warranty for solar modules are present diesel prices.

			pumps/supplier, or 50/year)		Pound would increase the cost of solar pumps and likewise inhibit their adoption.
	• 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	Terminal impact assessment	
	• Dedicated mechanism for finance of PV pumps established	• None	• At least one national PV pump fund	Interviews with banks, farmers, and suppliers. Importation records from SSMO, or MoF	
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	Interview with NERC, SSMO. Failure rate of solar pumps.	Assumption: the use of water at present is not optimal and substantial improvements can be made.
	• Number of entities trained and capable of specifying and supplying solar pumps	• 0	• 3	Market survey and adequacy of pumps for their purpose as determined by farmers' reports.	
	• Number of pumping system using water efficient irrigation methods	• 0	• 1,468	Report on water consumption and pumped volumes	
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	UNFCCC database on standardized baselines	
	• Development of an MRV mechanism for solar water pumping	• No MRV mechanism	• An MRV mechanism developed and implemented	Project final evaluation report	
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	National publication of laws and regulations	Cooperation of Government and regulatory bodies
	• 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	Review of the National Energy Roadmap and Energy Access Strategy	
	• Awareness raising and capacity		• At least one workshop	Project record or	

	building carried out		and demonstration held with the Ministry of Agriculture in each State in Sudan	workshops	

ANNEX B: RESPONSES TO PROJECT REVIEWS (from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work program inclusion and the Convention Secretariat and STAP at PIF).

GEFSec Comments at the PIF Work Program Inclusion	Response	Reflection in the Full Project Design
*2.Has the **operational focal point** endorsed the project?* Please provide a letter of endorsement clarifying the source of fund requested, the focal area concerned and the GEF Agency in the financing table.	The GEF Operational Focal Point has re-issued the Letter of Endorsement (attached to this re-submission).	Revised LoE attached to the re-submission – see Prodoc.
5. *Is the project consistent with the recipient **country's national strategies and plans** or reports and assessments under relevant conventions, including NPFE, NAPA, NCSA, NBSAP or NAP?* No. The recent National Communication and Technology Needs Assessments do not mention PV pumping as a priority for the country. Also, emissions from irrigation represent a marginal part of the country's GHG emissions. Please clarify. Please also consider whether a modification of the project scope could be considered to encompass some of the prioritized technologies of the recent TNA for the agricultural/rural sector, (such as improved cook stoves and biogas units).	Water pumping is critical to Sudan's ongoing development. As early as 1992, the Government conducted a national study to explore the techno-economic performance of diesel, solar and wind pumping technologies. The resulting National Comprehensive Strategy (1992-2002) included support to the use of PV pumps for rural water pumping (lack of funds unfortunately hampered implementation of the Comprehensive Strategy). The Renewable Energy Master Plan (2012-2031) specifically includes off-grid solar electrification, as does the Agricultural Strategic Plan (2007-2015). The Assessment of GHG Mitigation Options for NAMAs (2011) identifies solar pumping for irrigation as one of six priority PV applications. The Second National Communication (2013) notes that Sudan's GHG emissions increased by 8% between 1995 and 2000, driven in part by a 10% increase in energy-related fossil fuel emissions. The agricultural sector's importance is highlighted, both in terms of its economic prominence (accounting for more than one-third of GDP and providing 80% of employment and household income in rural areas) and as the second-largest source (after transport) of petroleum product - gasoline, diesel, residual fuel oil, kerosene – CO_2 emissions. The SNC identifies the vulnerability of non-irrigated farming to future climate change, due to expected reductions in rainfall and higher rates of evapo-transpiration. The SNC also identifies Sudan's "immense" solar resource, which it estimates as averaging 6 kWh/m^2, as having a key mitigation role. Both the GEF OFP and the UNFCCC Focal Point have issued letters of support to the project (see attached), emphasizing the project's alignment with Sudan's development and mitigation priorities. Regarding the potential expansion of the project scope to encompass other technologies – such as cook stoves	Please see Section 2.5, Project rationale and conformity, and 2.8 Theory of Change, of the Project Document. Supporting letters from the GEF OFP and the UNFCCC Focal Point attached to the re-submission.

	and biogas units – this was discussed during PIF stakeholder consultations (and again with the GEF OFP and UNFCCC FP this week) and rejected. While there are clear needs with respect to these other technologies, the Government of Sudan and the Government of Northern State believe that the project benefits from a dedicated focus on PV pumping, and builds on the firm baseline projects described in the PIF. The project is innovative in its deployment of micro-finance, climate finance (the NAMA modality) and level of ambition, and the associated implementation risks are more effectively addressed in the context of a focused project. Nonetheless, Sudan does have nascent cook stove and biogas digester 'sectors'. The Technology Needs Assessment identifies upfront cost as being a significant barrier to take-up of these technologies, particularly in the context of digesters (a family biogas digester costs approximately $2,500, as opposed to $5 for a basic improved stove). To date, these sectors have largely been grant-supported by the Government and donors. To achieve genuine sustained market growth, there is a need for commercial financing models to be introduced. Given that, in the context of the GEF project, banks will be enabled to develop and offer standardized finance products for one particular climate change mitigation technology (PV pumps), there may be potential for the banks to extend this learning to other technologies, such as cook stoves and biogas digesters. Consequently, an activity will be incorporated into Output 4.3 to help banks to connect to stakeholders involved in these other technologies for the purpose of catalyzing the development of additional micro-finance credit products.	
7. *Are the components, outcomes and outputs in the* ***project framework*** *(Table B) clear, sound and appropriately detailed?* Component 1: a) Please clarify what are the innovative financial products to be developed by the project to drive farmer take-up of PV pump technology.	As part of a general strategy to broaden the population's access to finance for poverty reduction purposes, the Central Bank of Sudan issued an instruction in 2011 to all commercial banks to allocate 12% of their lending to micro- and small-finance for non-traditional credit consumers. This attention to micro-finance reflects recommendations to this effect made by the Second National Communication, the National Adaptation Programme of Action and the National Capacity Self-Assessment (among others). However, banks have struggled to meet the 12% quota (with preliminary indications suggesting that just 5% of loans have met the definition), largely because of the lack of structured, replicable lending opportunities: the transaction costs of screening and processing individualized, ad hoc micro-finance loan applications	Please see revised project framework.

	covering a diverse range of clients and sectors have proved prohibitively expensive. Although the pumps in the project are beyond the size of "micro-loans", the project will strengthen the banks' ability to lend to individuals, particularly for renewable energy and energy efficiency applications. It will enable banks to systematize their micro-finance lending for PV irrigation pumps, to develop the internal capacities of the banks to structure micro-finance loan packages and assess loan risks, and to market innovative financial products to drive farmer take-up of PV pump technology, thereby opening up a significant and unprecedented opportunity to leverage private sector finance to facilitate the transition to solar pumping. The proposed National PV fund, though not new as a concept, will be innovative in its terms, conditions, and application (typically used for seasonal loans for crops).	
b) The project is designed on the assumption that a limited subsidy (13%) to 1,123 PV pump units will be enough to kick start autonomous market deployment. Since this may not be the case, please consider (i) a robust monitoring of the market develop trends initiated by the project, (ii) a prolonged subsidy scheme with a decreasing subsidy level and support to secure the financing needed for such prolonged subsidy if needed.	In its original design, the project was intending to establish and maintain a central register of qualifying loans so as to monitor PV pump take-up. This monitoring will now be augmented by complementary regular surveys of consumer awareness, customer satisfaction (among farmers who have acquired PV pumps), PV pump equipment market prices, PV pump equipment quality (see Response 7d below) and retailer sentiment. Such robust, broad-based and regular monitoring is intended to facilitate early detection of market developments and to enable programme design adjustments as and where necessary. The subsidy scheme has been amended so as to incorporate a degression scheme. The proposed subsidy level and degression will be validated according to the operational data gathered in the first year of the project, and will continue to be monitored throughout the project. Subsidies are envisioned to commence at 13% in the first year of operation of the finance scheme (Year 2) of the project and will decline by 2% increments annually, such that by the end of the GEF project subsidies are at 7%. The impact of this degression scheme is likely to be a 'fast start' to PV pump take-up (as farmers hurry to benefit from the higher initial subsidies) and freed-up financial resources for subsidizing more pump units. Specifically, the subsidy degression scheme will allow subsidies to be applied to 1,468 units (1,276 3.12 kW units, 128 5.12 kW units and 64 29.6 kW units) at a cost of GEF\$12.1/tCO_2. Compared with the original	Please see Section 2.1 of the Project Document and Annex 9.7 for subsidy calculations and financial analysis.

	project design, this represents a 28% increase in pump numbers and a reduction in carbon cost of GEF$3.4/t$CO_2$. The loan co-finance associated with these 1,468 units is $17 million. The market monitoring scheme to be established by the project will be used to monitor the impact of falling subsidies on adoption and loan default rates.	
c) According to the PIF figures, one PV pump is five times more expensive than a diesel pump and represents 4 years of annual income of a small-scale irrigation farmer. Please clarify how this very high investment level compares to the gains in reduced production costs that may benefit farmers. Please also clarify how such investment can be economically feasible for the targeted small-scale farmers.	Discussion with stakeholders indicates that there is a desire for solar water pumping to relieve the financial pain associated with operating diesel pumps. In addition, the project will help establish a revolving PV fund that will provide continuous finance post-project. Sudan has experience with such funds to finance the production requirements for agriculture. Economic evaluation of using solar pumps instead of diesel pumps shows that with an appropriate loan of 9% cost of finance and 10 year repayment period, the monthly installments on a solar PV pump can be comparable to the operating cost of a diesel pump. As suggested, a prolonged subsidy scheme with decreasing subsidy level and support is envisioned and supported by a revolving National PV Fund which will provide finance to the farmers purchasing the pumps. To be economically feasible to small-scale farmers, such farmers must have access to low-cost loans with extended tenors (the purpose of the finance elements of the project) and must have confidence in the quality and reliability of the pump hardware (the purpose of the certification elements of the project).	Please see Annex 9.2 of the Project Document, Stakeholder Involvement Plan
Component 2: d) Please clarify how the project will ensure the enforcement of the PV pump certification scheme during and beyond project implementation.	Sudan is currently working on the formulation of a Renewable Energy Law, which will include a requirement for certification of all renewable technologies. The project will build on this law to create PV technical specifications (which currently do not exist in Sudan) in conjunction with the Sudan Standards and Metrology Organization (SSMO). SSMO and the Customs Administration are responsible for the clearance of any imported goods into Sudan. For all imported goods, SSMO must issue a letter of Investigation Clearance (IC) confirming compliance with the set standards and specifications. The IC is then presented to the Customs Administration to release the imported goods. The project will provide training for SSMO personnel	Please see Ministry of Finance co-finance letter

	responsible for issuing the Investigation Clearances and also support the provision of measuring and testing equipment. The technical standards developed will also apply to locally-produced components such as solar modules. The project will work with the Consumer Protection Organization, a national and much-respected NGO, to build its capacity to observe the specifications of locally-produced hardware and to work with SSMO and law-enforcement agencies where local firms are found to be producing non-compliant products. This monitoring activity will be embedded in the expanded market monitoring scheme to be established by the project (see Response 7b above). The technical standards established for PV pump components will apply nationally, not just to project participants. As an additional safeguard in the specific context of the project, the banks that issue micro-finance loans to farmers will be required to verify that the farmers are using certified equipment.	
e) Please clarify how the project will ensure that the means (human and financial) for continued training can be sustained beyond project completion, especially for the expected replications.	The project builds on baseline initiatives, such as agricultural extension services, to deliver its training and awareness-raising activities. In doing so, the baseline initiatives will themselves have their capacities strengthened and will be enabled to continue offering capacity development support. The Northern State Government, the Federal Ministry of Agriculture and the Higher Council for Environment and Natural Resources (which has a network of offices in every state) are all committed to sustaining training and technical support beyond project completion. All banks involved in the project have branches located nationwide, in all states. The business processes, learning and capacities developed by the banks in Northern State can therefore be readily transferred to the other states (indeed Component 4 of the project will support them in doing so).	
Component 3: f) Please note that the GEF cannot fund mitigation activities that would lead to CDM credits. The PIF should clarify how the project may mobilize the carbon finance without leading to a risk of double-counting of mitigation efforts.	Acknowledged. Given the current subdued and uncertain state of the carbon market, it is unclear how viable CDM revenues would be even if allowed. The project will continue to develop a standardized baseline according to the UNFCCC approach – which offers a transparent and internationally-recognized means of assessing project additionality and emissions reductions – but will use this standardized baseline in the context of a NAMA, not a CDM project. Since such a NAMA will lead to emission reductions (not emission offsets), there will be no double-counting of mitigation efforts and no CDM credits will be	All references to carbon finance have been removed from the project design.

	generated.	
g) Please justify the relatively high cost of the activities of component 3.	Technical certification will be pursued through NERC and SSMO. These were attributable to the project attempting to address the combined needs of the carbon finance and NAMA modalities. With the carbon finance element now removed from the project design, $60,000 of GEF funding has been removed from Component 3 and re-allocated to Component 2 (broader market monitoring, greater assistance to enforcement of technical standards) and to Component 4 (strengthened national replication support).	$60,000 removed from Component 3 and reallocated to Component 1.
Component 4: h) Please clarify who would benefit from the proposed fiscal concessions. Please also clarify how these concessions would support the replication of PV pumps deployment.	The fiscal concessions granted by the Sudan Investment Act and the exemption from taxes and duties once PV pumps are classified as 'agricultural equipment' will serve to lower hardware prices and will benefit consumers (i.e. farmers), equipment suppliers/retailers seeking to grow the market, and banks providing finance to farmers (shortening loan repayment times and reducing risk exposure). Inclusion in the concessions list will reduce the import duty on small pumps (less than 10 kW in size) from 25% to 10%. For a typical 2kW pump, that will represent a cost saving of approximately $1,700 (compared with a typical annual income of a small-scale farmer of $2,650). How much of that saving is passed onto farmers (as opposed to being held as profit by wholesalers/retailers) will depend on the elasticity of demand. This issue will be explored during the PPG. For conservativeness, the impact of the reduction in import duty has not been incorporated into the pump dissemination/subsidy calculations. But, qualitatively, it is clear that the fiscal benefit will allow more (cheaper) pumps to be subsidized and hence increase the emissions reduction impact of the project. The concessions will have national force and will, therefore, also promote nationwide take-up of PV pumps. Certification enforcement is the duty of SSMO and the Customs Administration as part of their routine work. As discussed above, the project builds on baseline initiatives, such as agricultural extension services, to deliver its training and awareness-raising activities. In doing so, the baseline initiatives will themselves have their capacities strengthened and will be enabled to continue offering capacity development support. The	

	federal Ministry of Agriculture and the Higher Council for Environment and Natural Resources (which has a network of offices in every state) are committed to sustaining training and technical support beyond project completion in all relevant states. The project will also work with the Ministry of Water Resources and Electricity, the Ministry of Petroleum (Renewable Energy Directorate) and the Ministry of Agriculture to embed PV irrigation pumping in the Government's national energy roadmap, rural energy access strategy and national irrigated agriculture strategy so as to – among other benefits – open up a channel for standard, ongoing Government financial support and a window for potential donor funding.	
i) Please clarify how the project will secure the financing necessary for effective replications of its results beyond the Northern State (to cover for the initial subsidy, the training expenses, and the certification enforcement).	All banks involved in the project have branches located nationwide, in all states. The business processes, learning and capacities developed by the banks in Northern State can therefore be readily transferred to the other states to enable replication of the micro-finance lending products. With regard to the initial subsidies that may be required in other states, the Ministry of Finance & National Economy and the Ministry of Agriculture are committed to establishing a national fund (provisionally titled the 'National PV Fund') for this purpose. Both Ministries have hands-on experience establishing such special funds, notably in the context of the Wheat Fund (*Mahfazat El Gamh*) for irrigated agriculture. Given the fact that Sudan is an LDC and Government resources are limited, the likelihood is that the national fund will rely on donor funding for replenishment. If climate finance materializes through the NAMA, climate income will also be channeled into the national fund. The institutional architecture, governance and funding modalities of the national fund will be detailed during the project preparation phase. So as to promote learning-by-doing (effective fund management) prior to national scale-up, the national fund will be established at the beginning of the project and the Northern State subsidies will be channeled through the fund.	
8. *(a) Are global environmental/ adaptation benefits identified? (b) Is the description of the incremental/additional reasoning sound and appropriate?*	With the introduction of a degression scheme for the PV pumps subsidy (see Response 7b above), the subsidies will be able to be applied to 1,468 units (1,276 x 3.12 kW units, 128 x 5.12 kW units and 64 x 29.6 kW units) at a cost of GEF\$13.94/tCO_2. The reduction is not larger because measurements conducted during the PPG phase have shown that fuel	

The project efficiency is rather low compared to other projects ($15/tCO2e). Please address Q5 and Q7 i) and see if this may help improve the estimated emission reduction efficiency.	consumption for pumps is somewhat less than anticipated and was earlier reported. Such estimates will be validated by the large-scale operation data to be collected during the project implementation. The calculation represents the most conservative scenarios in two ways. First, diesel consumption varies widely for pumps depending on usage, age, condition, etc. The calculation uses the most conservative figures by using the lowest reasonable scenarios encountered during the PPG. Other reasonable scenarios exist which could indicate almost twice the carbon reduction but again it was decided to be conservative. Second, the calculation does not take into account any lifting of customs duties or tariffs on the pump which would likely have the effect of wider adoption and increased capacity to finance through the National PV fund. Similarly, the estimates for installed capacity are considered conservative. Simple calculation shows that available co-finance could potentially support a larger installed capacity target; however the original target is kept with additional funds left as a contingency to for risks such as currency fluctuations.	
11. *Does the project take into account potential major risks, including the consequences of climate change, and describes sufficient risk mitigation measures? (e.g., measures to enhance climate resilience).* a) Please clarify what are the water scarcity risks the targeted irrigated zone may face (especially due to climate change).	Climate change is expected to reduce the overall amount of rainfall received in the north of Sudan and also to increase its variance (i.e. rainfall will become more erratic). Irrigation represents an effective adaptation strategy to the increasing risks facing rain-fed agriculture, and is being heavily promoted by the Government for this reason. The water scarcity risk that in turn faces irrigated agriculture is low for the project, for the following reasons: - The project will switch existing or planned pumping systems from diesel to solar power. The project is not expected in itself to expand the area under irrigation beyond what would already happen in the baseline. - For newly-established farms along the Nile, Sudan has still not completely exhausted the country's legal share of Nile waters. According to the Nile Basin Initiative, about 25% of Sudan's share (18 billion cubic meters) of Nile water is not currently exploited. - Nile water flow is regulated through storage dams, of which Sudan has built 5 for power generation and irrigation purposes. - Moreover, the probability of water scarcity is also low due to fact that farms pump water from shallow wells that are annually replenished from the Nile. - The project will put in place water savings methods both to reduce overall water usage and to reduce the size and therefore capital cost of	Output 2.5 modified to focus on efficient water use; Output 2.6 added to integrate information from the study of the underground aquifer (under a separate proposed UNDP GEF project).

	solar pumps. - A parallel project is being undertaken by UNDP in Sudan to study the underground aquifer and threats to its sustainability.	
b) Please clarify what impact the project may have on an eventual overuse of water resources.	The project will have little impact on the overuse of water in Northern State due to the excess capacity from the Nile and the annually replenished shallow wells. However, in the long-run, with expansion of irrigated agriculture in the other states, seasonal draw-down of water levels might be possible. It is, however, important to emphasize that the project itself will have no direct impact on overuse of water levels since it will support sustainable, low-emission pumping in irrigated (or already planned-to-be-irrigated) areas; it will not itself expand the area under irrigation beyond what would already happen in the baseline (only make the irrigation more efficient and low-carbon).	Please see above.
c) Please clarify how the project will mitigate the two risks	The project's focus on appropriate pump sizing (Output 2.3) will ensure that PV pump sizes are designed to cater for seasonal fluctuations in water levels. Moreover, as part of the structured replication programme developed under Component 4, a state-by-state water risk analysis will be undertaken to identify potential water stress hotspots. Where risks are identified, the project will work with the appropriate state and national authorities to put in place mitigation measures (e.g. use of lined water channels, drip irrigation, etc.). An activity has been included in the project to promote efficient water use. In addition, a parallel GEF project has been developed to sustainably manage water in aquifers.	
12. *Is the **project consistent and properly coordinated** with other related initiatives in the country or in the region?* Please strongly consider involving the ministry in charge of taxes and fiscal issues to ensure that the proposed reforms in that domain may be effectively implemented.	Agreed. It was not sufficiently highlighted in the PIF but the Ministry of Finance is one of the project partners. The Ministry will take the lead role in relation to fiscal matters. In addition, the Ministry will support the project with co-finance of US$3 million and will support the exemption of PV pumps from customs duties	See Section B.1 of the CEO ER and Prodoc. Please see MoF co-finance letter.

13. *Comment on the project's* ***innovative aspects, sustainability, and potential for scaling up***. Please address Q5 and Q7.	Please see responses above.	Please see responses above.
16. *Is the GEF funding and cofinancing as indicated in Table B appropriate and adequate to achieve the expected outcomes and outputs?* Please address Q7 g).	Please see responses above. .	Please see responses above.
17. *At PIF: Is the indicated amount and composition of co-financing as indicated in Table C adequate? Is the amount that the Agency bringing to the project in line with its role?* UNDP is bringing 1% of the total cofinancing of $26 million. Please consider increasing the UNDP co-financing.	The UNDP cash co-financing has been increased from $250,000 to $550,000, an increase of 120%. This represents a significant 14% share of UNDP Sudan's total environment programming budget over the 5-year duration of the project.	Table C amended.
25. Items to consider at CEO endorsement/approval. *Details are expected by CEO endorsement request on the following:* *a) The proposed micro-finance products, how they will be made economically attractive to private banks and economically feasible for small-scale farmers given they level of income.*	Numerous examples have been provided showing that with GEF support, loans for PV can be financially viable for the banks and feasible for small-scale farmers. The banks have the precedent of being involved in similar schemes when supported by national funds (as is being proposed in the national PV fund). The financial viability of solar pumping is directly related to the cost of diesel. A premise of the project is that as solar pumps become a known technology in Sudan, and as they are given preferential treatment (removal of customs duties – a part of the project and supported by MoF) the price of solar pumps will become less prohibitive. At the same time, with the already announced removal of subsidies, the price of diesel will increase. These two actions will result in solar pumping becoming more financially attractive..	Please see ProDoc section 2.1.1 – 2.1.6 and Annex 9.7 for financial analysis
b) The proposed subsidy scheme and national PV fund: how they will be implemented and how they will be sustained beyond project completion.	This is addressed in detail in Section 2 of the Prodoc. Sudan has previous experience with national funds similar to the proposed PV fund which have been initiated and supported locally. The project envisions a descreasing subsidy to 7% in the final year. Project sustainability will depend to a large extent on the relative prices of diesel and solar pumping. Even if the price of diesel remains as it is, the anticipated reduction in the price of solar pumping	Please see Section 2.1.8 for information on the operation of the proposed financing mechanism.

	through the life of the project should be sufficient to make a 7% subsidy unnecessary and therefore make the finance of solar pumps viable without a subsidy, and therefore sustainable.	
c) The market monitoring scheme of the project.	Through the loan scheme, the project will be able to track the number of pumps, their specifications, and their pricing. In addition, the project supports the National Energy Research Centre and the Standards Organization which is responsible for approving imports through customs. With these sources of data, the project will be able to monitor development of the market.	
d) How the project may mobilize the carbon finance without leading to a risk of double-counting of mitigation efforts.	The envisaged carbon finance is through the establishment of a NAMA that has a dedicated Monitoring, Reporting, and Verification structure. Carbon finance references are now removed. A NAMA structure would appropriately count reductions and avoid any double-counting in a verifiable manner.	Please see ProDoc page 42, paragraph 111.
e) How the project will facilitate the banks involved in supplying microfinance credit products to extend their lending to other technology categories, such as improved cook stoves and biogas digesters.	The project provides for some innovation in financing similar equipment, for example, by making it registered agricultural equipment. One of the challenges faced during meetings with the banks was to uniquely identify equipment such that it was traceable to its owner. Small cook stoves and biogas digesters are (on average) significantly less capital intensive than solar pumps and thus fall into existing micro-lending schemes which the solar pumps do not qualify for. Nevertheless, the success of the solar pumping project is expected to indirectly open the door as a model for lending to these types of equipment.	
STAP Comments	**Response**	**Reflection in the Full Project Design**
1. It is acknowledged that water scarcity is a problem and will be worse in the future due to increased demand as well as potential impacts of climate change. This project claims that it will not expand the area under irrigation beyond what would happen in the baseline. However, in an earlier section on "Innovativeness, sustainability and potential for scaling up", it is stated that the irrigated sector is expected to grow rapidly - the Government is planning a doubling in spatial extent by 2015. If so, and if that's the baseline, what will be the impact on the water table and water resources in general?	Future water scarcity is certainly a concern as noted. Much of the pumps will be used near the Nile where water is replenished by the flow of the Nile. The use of solar pumps can help to address water scarcity because there is an incentive to use the smallest feasible pump to reduce the initial capital. The role of the National Energy Research Centre is to help put in place the mechanisms and technical know-how for this sizing. In addition, the project has put in place a new output, 2.6, which is aimed at promoting sustainable irrigation practices and water management. This includes	Output 2.5 has been modified to focus on adoption of water efficient irrigation methods Output 2.6 has been added to address sustainable irrigation practices and their impact on the water aquifer. A separate project is

	altering the present flood irrigation methods to methods that use less water, and waste less water (through reduced evaporation and other means). A separate GEF project is being undertaken (at the PIF stage) to study in detail the Nubian Sandstone Aquifer System, from which the pumps would extract water from, and help determine sustainable levels of extraction.	being undertaken to study the Nubian Sandstone Aquifer System.
2. A cost comparison between diesel and solar water pumping for a range of pumped water volumes is not provided but should be undertaken to determine the level of subsidy required. Recent lower PV prices will help the cost effectiveness but balance-of-plant may be costly. It is not clear whether pumping will occur only when solar radiation is available or whether some battery storage for irrigating during the night will be necessary. (Evaporation losses are usually less when irrigating at night). If diesel pumps work 24 hours a day and solar pumps only operate during daytime, larger solar pumps will be needed to pump the same volume of water per day. Therefore, development of the pump sizing software is an important component of the project (though many similar tools already exist).	A cost comparison is provided and used to suggest subsidy levels and loan terms. It demonstrates a an appropriate level of subsidy, loan term, and interest rate that results in financial viability for all stakeholders, is within the proposed project resources, and can be expected to be sustained after project end. Pumping is only expected to occur during sunlight hours. It is correct that evaporation is less at night; however the cost and complexity of battery storage would make solar pumps prohibitively expensive. The present BAU irrigation practices include irrigation during the day and flood irrigation, which leads to large losses over days. As an alternative the project proposes to introduce water efficient irrigation methods to reduce evaporative and other losses. It is correct that larger pumps would be needed to pump the same volume of water during a shorter period. However, the project seeks to reduce the volume of water needed and therefore reduce the size of the solar pump needed and the associated capital cost. The development of pump sizing methods, whether through the use of existing software or new software, is central to the success of the project. This is a main objective of the significant involvement of the National Energy Research Centre.	Please see ProDoc Sections 2.1.1 – 2.1.6 and Annex 9.7 for financial analysis. Please see Annex 9.2 Stakeholder Involvement Plan for NERC's role in developing pump sizing methods. Output 2.5 focuses on developing and disseminating water efficient irrigation methods.
3. It is assumed in the proposal that diesel fuel costs will rise in future years (partly due to the removal of government subsidies). However, other analyses show crude oil prices may not eventuate during the next decade or two, hence a sensitivity analysis should be undertaken. Providing technical support and product certification designed to de-risk the project makes sense.	If diesel prices remain at current levels but solar pump prices are reduced as a result of market dissemination and reduction in import duties and taxes, solar pumps would be viable alternatives to diesel pumps, in particular when the overall cost of ownership is taken into account. Farmers are eager to replace their diesel pumps with solar pumps which are seen as being more reliable and requiring less hassle.	

	Technical support and product certification to de-risk the products are central aspects of the project. In order for the banks to lend, the solar pumps must be on the list of units to be approved by NERC.	
4. GHG emission reduction calculations are relatively simple (not including full life cycle analyses - e.g. for manufacturing, transport of diesel fuel etc.) but are acceptable given the uncertainties involved.	An updated calculation has been presented in line with GEF Guidelines on GHG reduction calculations; however it does not include a life cycle analysis. Per GEF GHG guidelines, emissions factors for generation technologies are used based on the relevant combusted fuel type. It would be more encompassing to include life-cycle analysis; neglecting manufacturing and transport of diesel results in a more conservative estimate. We could not provide accurate full life cycle analyses given the lack of accurate data but will seek to ascertain and track this if possible during project implementation.	Please see Annex 9.4 of the ProDoc for GHG reduction calculation
Council Comments	**Response**	**Reflection in the Full Project Design**
Germany generally supports the STAP's comments and would like to put emphasis on some of them: *• A cost comparison between diesel and solar water pumping for a range of pumped water volumes should be provided in order to determine the subsidy level required.*	Please see response to STAP comments 2 and 3.	Please see above.
• The proposal explains how water scarcity is a problem that will be worse in the future due to increased demand as well as potential impacts of climate change. Therefore, Germany recommends factoring in vulnerability analyses due to climate change, and taking this into consideration when planning the pumping in such a way to avoid overusing available water sources.	Please see response to STAP Comment 1	Please see above.

ANNEX C: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS[12]

A. PROVIDE DETAILED FUNDING AMOUNT OF THE PPG ACTIVITIES FINANCING STATUS IN THE TABLE BELOW:

PPG Grant Approved at PIF: **100,000**			
Project Preparation Activities Implemented	***GEF/LDCF/SCCF/NPIF Amount ($)***		
	Budgeted Amount	***Amount Spent Todate***	***Amount Committed***
Development of Prodoc	62,000.00	62,000.00	0
Institutional and Management Arrangements	18,000.00	18,000.00	0
Finalization and Validation of Key Outputs	20,000.00	16,574.44	3,425.56
Total	100,000.00	96,574.44	3,425.56

[12] If at CEO Endorsement, the PPG activities have not been completed and there is a balance of unspent fund, Agencies can continue undertake the activities up to one year of project start. No later than one year from start of project implementation, Agencies should report this table to the GEF Secretariat on the completion of PPG activities and the amount spent for the activities.

ANNEX D: CALENDAR OF EXPECTED REFLOWS (if non-grant instrument is used**)**

Provide a calendar of expected reflows to the GEF/LDCF/SCCF/NPIF Trust Fund or to your Agency (and/or revolving fund that will be set up)

n/a