GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET

Naoko Ishii
CEO and Chairperson

February 25, 2016

Dear Council Member,

The UNDP as the Implementing Agency for the project entitled*: **Nigeria: Promoting Low Carbon Energy Solutions in Nigeria Energy/Power Supply,*** has submitted the attached proposed project document for CEO endorsement prior to final Agency approval of the project document in accordance with the UNDP procedures.

The Secretariat has reviewed the project document. It is consistent with the project concept approved by the Council in November 2013 and the proposed project remains consistent with the Instrument and GEF policies and procedures. The attached explanation prepared by the UNDP satisfactorily details how Council's comments and those of the STAP have been addressed.

We have today posted the proposed project document on the GEF website at www.TheGEF.org for your information. We would welcome any comments you may wish to provide by March 24, 2016 before I endorse the project. You may send your comments to gcoordination@TheGEF.org .

If you do not have access to the Web, you may request the local field office of UNDP or the World Bank to download the document for you. Alternatively, you may request a copy of the document from the Secretariat. If you make such a request, please confirm for us your current mailing address.

Sincerely,

Naoko Ishii
Chief Executive Officer and Chairperson

Attachment: GEFSEC Project Review Document
Copy to: Country Operational Focal Point, GEF Agencies, STAP, Trustee

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REQUEST FOR CEO ENDORSEMENT

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

For more information about GEF, visit TheGEF.org

PART I: PROJECT INFORMATION

Project Title: **Derisking Renewable Energy NAMA for the Nigerian Power Sector**			
Country(ies):	Nigeria	GEF Project ID:[1]	5345
GEF Agency(ies):	UNDP	GEF Agency Project ID:	5243
Other Executing Partner(s):	Federal Ministry of Environment, Federal Ministry of Power, Energy Commission of Nigeria, Nigerian Electricity Regulatory Commission.	Submission Date:	18 January 2016
GEF Focal Area (s):	Climate Change	Project Duration(Months)	60
Name of Parent Program (if applicable): ➢ For SFM/REDD+ ☐ ➢ For SGP ☐	N/A	Agency Fee ($):	418,000

A. FOCAL AREA STRATEGY FRAMEWORK[2]

Focal Area Objectives	Expected FA Outcomes	Expected FA Outputs	Trust Fund	Grant Amount ($)	Cofinancing ($)
CCM-3	Favourable policy and regulatory environment created for renewable energy investments	Renewable energy policy and regulation in place	GEF TF	2,058,965	3,000,125
CCM-3	Investment in renewable energy technologies increased	Volume of investment mobilised	GEF TF	2,341,035	210,549,875
		Total project costs		4,400,000	213,550,000

B. PROJECT FRAMEWORK

Project Objective: The objective of the project is to support the Federal Government of Nigeria (FGN) in the development and implementation of a NAMA in the energy sector, namely a RE NAMA for the Nigerian Power Sector (NPS).

Project Component	Grant Type[3]	Expected Outcomes	Expected Outputs	Trust Fund	Indicative Grant Amount ($)	Indicative Cofinancing ($)
1. Design and development of a power sector renewable energy NAMA supported by DREI analysis.	TA	A coherent derisking approach is established for catalysing private sector investment to implement renewable energy power	1.1 At least 3 policy and financial derisking instruments have been assessed using DREI analysis based on work initiated for solar PV in the development of the project document. The DREI analyses will be replicated for on-grid wind energy and renewable biomass power generation.	GEFTF	1,108,200	675,000

[1] Project ID number will be assigned by GEFSEC.
[2] Refer to the Focal Area/LDCF/SCCF Results Framework when completing Table A.
[3] TA includes capacity building, and research and development.

		sector NAMA.	1.2 Development of a set of guidelines to establish national NAMA eligibility and design criteria. 1.3 An MRV mechanism is developed for the power sector, including a standardized baseline for national grid is developed and updated on a yearly basis. 1.4 Development of three comprehensive sectoral NAMA action plans for solar PV, wind and biomass (or Technology Action Plans).			
2. Policy and institutional framework for private investment in on-grid renewable power generation.	TA	Public instruments are developed and implemented for derisking the national policy environment.	2.1 A study on the financial sector reform to unlock local capital is carried out. 2.2 A GIS based tool is developed to identify practicable RE (PV, wind and biomass) sites in Nigeria 2.3 A set of social and environmental safeguard guidelines is developed for all utility-scale RE based on international standards (e.g. World Bank) 2.4 The Lagos Energy Academy is capacitated to deliver RE trainings to IPPs, undergraduate students, and public institutions on a cost-recovery basis 2.5 A lessons learned report is developed to capture best practices for dissemination (website, publications, manuals, participation in national, regional and international conferences and fora etc.) and to demonstrate an architecture for leveraging private investments and climate finance using a risk-adjusted approach	GEFTF	852,300	2,250,000
3. First commercial on-grid RE projects.	Inv	The NPS RE NAMA is operationalised by demonstrating a proof-of-concept grid connected solar PV plant with quantified GHG emission reductions.	3.1 One private-sector supported solar PV energy project (100 MW in Bauchi State) is implemented to validate the adopted framework and methodologies. 3.2 Interface electronics installed to match the voltage of renewable electricity with that of the national grid. 3.3 Robotic dust cleaning technology tested on part of the installations as	GEFTF	2,230,000	200,022,500

			proof of concept and for further replication. 3.4 Application of anti-sand-blasting (anti-abrasive) coatings tested on the PV facility.			
Subtotal					4,190,500	202,947,500
Project Management Cost (PMC)[4]				GEFTF	209,500	10,602,500
Total Project Cost					4,400,000	213,550,000

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	Energy Commission of Nigeria	In-kind	1,500,000
National Government	Federal Ministry of Environment	In-Kind	200,000
GEF Agency	UNDP	Grant	1,500,000
Private Sector	Nigeria Solar Capital Partners	Grant[5]	210,000,000
National Government	Lagos Energy Academy	In-Kind[6]	350,000
Total Co-financing			213,550,000

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

n/a

F. CONSULTANTS WORKING FOR TECHNICAL ASSISTANCE COMPONENTS:

Component	Grant Amount ($)	Cofinancing ($)	Project Total ($)
International Consultants	1,320,000	362,000	1,682,000
National/Local Consultants	785,000	400,000	1,185,000

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

A. DESCRIBE ANY CHANGES IN ALIGNMENT WITH THE PROJECT DESIGN OF THE ORIGINAL PIF[7]

A.1 National strategies and plans or reports and assessments under relevant conventions, if applicable, i.e. N NBSAPs, national communications, TNAs, NCSA, NIPs, PRSPs, NPFE, Biennial Update Reports, etc.

There are no changes concerning alignment of the project design related to national strategies and plans.

The project is supportive of the Nigeria Vision20:2020 that is discussed in Section 1.2.1 of the project document.

[4] $25,000 of the PMC will be Direct Project Costs.

[5] The NSCP co-financing is grant (cash) co-financing as far as the UNDP-GEF project is concerned. It is capital (equity and debt) investment in the baseline project.

[7] 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

The project is also aligned with the National Energy Policy, the National Energy Master Plan, and the low-carbon strategy to achieve NV20:2020. These documents are discussed in Section 1.2.5.3 of the project document. Other complementary national initiatives are discussed in Section 1.3.2.3 of the project document, which covers the NCSA, national communications, the National Climate Change Policy and Response Strategy (NCCPRS), the National Environmental, and the Economic and Development Study (NEEDS) for Climate Change.

A.2. GEF focal area and/or fund(s) strategies, eligibility criteria and priorities.
No changes. In accordance with Objective 3 of the GEF Climate Change Focal Area Strategy for GEF-5, the project will promote investments in renewable energy.

A.3 The GEF Agency's comparative advantage:
No changes. The GEF Agency's comparative advantage is as detailed in the PIF. Having undertaken the project preparation process, including extensive stakeholder consultations, the GEF agency has further strengthened its ties and contacts with the relevant stakeholders, and ongoing initiatives. The initiatives summarised below provide a realistic baseline situation for better contextualising the distinctive advantage of UNDP's DREI methodology that has been used to design the Project Document (please see Section 1.5 and Annex 7.2 of the Project Document).

The formulation of the Project Document has been done through a broad based multi-stakeholder coordination, and especially by engaging with key initiatives that are being carried out in the power sector by other development partners. The initiatives listed below, as well as the GEF-financed projects discussed in Section A.7 below, form part of the UNDP-GEF project baseline. Based on these initiatives, and, in response to the comments made by the GEF Secretariat, the German GEF Council Member and the STAP that are addressed in Annex B, the original project concept that was proposed in the PIF has been redesigned. The changes made in the project design are discussed after elaborating on the initiatives of the AfDB, World Bank, GIZ and DFID.

African Development Bank (AfDB)

As discussed in Section 1.3.1 of the Project Document, the AfDB is actively supporting the 100 MW baseline solar PV project in Bauchi State through the Clean Technology Fund (CTF) and potentially through debt financing. The AfDB is also providing capacity development assistance to the Nigerian Bulk Electricity Trading Plc. (NBET) in terms of managing contractual agreements under PPAs with IPPs,[8] and through the provision of Partial Risk Guarantees (PRGs) on PPAs. These linkages are shown in Figure 9**Error! Reference source not found.** in the Project Document.

World Bank (WB)

Support to NSCP's baseline project and other renewable projects[9]
As shown in **Error! Reference source not found.** of the Project Document, the WB is also supporting Nigeria Solar Capital Partners' (NSCP) 100 MW solar PV project in Bauchi State through the provision of PRGs. Further, the CTF-component of the WB will be used to propose an additional 100 MW solar PV generation capacity that will be configured as solar PV projects in three or four sites, with grid generation near load centers in key regions, showcasing different PPP/PPA IPP configurations. The location of the solar power plants is likely to be in the Northern and Eastern parts of the country (locations contingent on feasibility study recommendations). Three different plant configurations (20-100 MW) are being considered: (1) at single-site, allowing for modular scale-up, phased development in the State of Bauchi; (2) co-generation feeder plants adjacent to the Hydro Power Plant (Shiroro, Jebba, Kainji including exploring upcoming proposed Hydro Power Plants) (grid-connected, centralized &/or distributed); and (3) embedded generation plants within privatized DISCOs (grid-connected, distributed). Due to high supply-demand gap in Nigeria, at the margin, generation using diesel fuel or similar are utilized at a cost higher than that of solar-hydro. The intention is to

[8] DREI interview carried out with Mr Bokar Ture, Senior Energy Analyst, AfDB on Friday 10 April 2015.
[9] WB & AfDB (2014), pp. 26-29.

develop plants within existing transmission infrastructure set-up, using current policies (e.g. embedded generation, incentives, etc.) and market-based mechanisms. The feasibility studies will be funded by other WB projects such as the NEWMAP and the NETAP (see below).

Nigeria Electricity Transmission and Access Project (NETAP)[10]

The transmission network in Nigeria is not equipped to transmit the volume of power needed to supply the demand. The Transmission Company of Nigeria (TCN), which has remained as a public utility during the reforms, has been placed under a management contract (Manitoba Hydro International) to support its capacity building and to improve the efficiency of the national grid operator, whose technical losses are estimated to be in the range of 12 %. The Federal Government of Nigeria (FGN) intends to combine TCN's reform with a major investment program which will increase the wheeling capacity of the network from the current 4,800 MW to about 13,000 MW by the year 2020, as well as to increase the network's reliability, stability, and efficiency. The NETAP development objective is to improve the capacity and efficiency of the transmission network and increase electricity services. More specifically, the project seeks to (i) increase the transmission network's wheeling capacity; (ii) reduce transmission network losses; and (iii) increase the number of people connected to the grid in a gender-differentiated manner. The NETAP also supports the goals set under the Sustainable Energy for All (SE4All) initiative by assisting in increased power supply and improving access to energy. In achieving these goals, the WB project will also indirectly serve to support the integration of renewable electricity in the strengthened national grid, and support the geospatial development of practicable renewable energy projects in Nigeria. Through technical assistance, the NETAP plans the preparation of a least-cost geospatial implementation plan for grid and off-grid rollout.[11] The UNDP-GEF project will collaborate with the NETAP initiative for developing a geospatially-based map of practical locations for implementing grid-connected renewable energy projects (solar, wind and biomass). NETAP will be implemented between 2015 and 2030.

Power Sector Guarantee Project (PSGP)

Under this initiative, the WB is providing PRGs to support increased private sector participation in the power sector (IPPs, privatized generation, and distribution companies) by supporting improved credit worthiness of the FGN agencies (e.g. NBET). The first two greenfield IPP transactions being supported under the PSGP (Azura Edo IPP and the Exxon Qua Iboe IPP) will increase the installed power capacity of Nigeria by 1,000 MW and mobilize over US$1.7 billion in private capital. The institutional strengthening that will be achieved under the PSGP will also benefit IPPs that will develop renewable electricity generation projects.

Rural Electrification and Renewable Energy Development

The project will build upon the results and lessons learnt from the earlier GEF-financed, World Bank-supported project "Rural Electrification and Renewable Energy Development" (completed in 2011), which supported implementation of pilot off-grid RE projects in rural locations. The project final report states that in the absence of comprehensive public policies to promote RE, scaling-up is not possible. In this context, the focus of the proposed UNDP-GEF project on policy and financial derisking is fully justified and consistent with WB recommendations.

Financial Intermediary Loan for Discos

Discussions with the Nigeria Infrastructure Advisory Facility (NIAF) and the WB revealed that the ability of the electricity off-taker – i.e. NBET – to honour its financial contractual agreements with IPPs was heavily dependent on the ability of discos to recover revenues downstream. Currently, discos have an electricity sales revenue recovery of between 40% and 70%[12] with the discos in southern Nigeria having higher recovery rates. As far as IPPs are concerned, this situation translates into a counterparty risk (see Section 1.5) that eventually increases the cost of capital. Using a value chain approach, the WB is designing a financial intermediary loan scheme of about US$500 million[13] that will be used to enhance the technical, managerial and governance capabilities of discos to increase their revenue collection rates, and hence, their financial wellbeing.

[10] World Bank (2014) NG-Electricity Transmission Project - Report No.: PIDC7335 - http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/AFR/2014/07/16/090224b08259512e/1_0/Rendered/INDEX/Project0Inform0on0Project000P146330.txt - accessed 27 April 2015.

[11] Terms of reference for technical assistance provided by Mr Muhammad Wakil, Energy Specialist, World Bank, Nigeria.

[12] Discussions with NIAF staff in Abuja on Monday 16 March 2015.

[13] Information provided by WB staff (Muhammad Wakil) in Abuja on Thursday 19 March 2015.

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Nigerian Energy Support Programme (NESP)[14]

The NESP supports the Nigerian government, in particular the Federal Ministry of Power (FMP), the Federal Ministry of Finance (FMF), the Nigerian Electricity Regulatory Commission (NERC), the Nigerian Bulk Electricity Trading Plc. (NBET) as well as the Transmission Company of Nigeria (TCN) in designing, structuring and implementing a renewable energy support scheme based on tender processes (in particular for large grid-connected PV solar, wind and hydro power projects).

Regarding the RE support scheme, the NESP scope of activities includes the following tasks:

1. Conceptual preparation and structuring of a RE tender process (for large scale PV, wind and small hydro power plants) in line with the Regulation for the Procurement of the Generation Capacity 2014. This comprises among other tasks the following key activities:
   a. Support NERC in conducting economic impact assessment calculations and analysis (in line with activities listed under 2. and 3.)
   b. Assist stakeholders in establishing financial security and support instruments in cooperation with their partners (in line with activities listed under 2.)
   c. Design and structure competitive procurement concept (technical, commercial and financial design parameters)
   d. Support preparation of technology-specific competitive procurement documentation packages, i.e.
      i. Preparation of a Request for Information (RfI)
      ii. Preparation of an Expression of Interest (EoI)
      iii. Preparation of Non-disclosure Agreements (NDAs) for the parties involved in the process
      iv. Conceptual preparation of a Request for Proposal (RfP) for indicative and binding bids (general requirements, qualification criteria, evaluation) and preparation of RfP documentation, e.g. Implementation Agreement, Grid Connection Agreement (backstopping consultancy), Bid forms (indicative and binding), and Power Purchase Agreement (backstopping consultancy)
   e. Assist in implementation of first competitive procurement window
      i. Organization and moderation of public consultations, bidders' conferences, and question and answer sessions
      ii. Provision of expert staff for the auditors' committee for bid evaluation
      f. Monitoring and assessment of first RE competitive procurement window in Nigeria once first round is completed
2. Support NERC in review of RE feed-in tariffs under Multi Year Tariff Order (MYTO) II for small scale (PV, wind and biomass) projects and review of ceiling tariffs for large scale (PV and wind) projects
   a. Revision of existing tariff calculations and tools (with regard to adequate risk-/cost-reflectivity)
   b. Review of "least to consumer" approach (regulatory impact analysis)
   c. Review of System and Market Operator's data structure to enhance power industry performance data by financial and economic data
   d. Support promotion campaign of RE support mechanism
3. Support to TCN regarding grid and system integration of renewable energy
   a. Review of transmission and distribution grid codes
   b. Conduct Grid availability and capacity studies to define capacity thresholds and regional allocation for on-grid renewable energy projects and estimation of technical and economic impact
   c. Preparation of concept note regarding necessary infrastructure data collection requirements for Market Operator's report to NERC
   d. Support establishment of Market Operator's Annual Report on Power to NERC to create basis for information-based decision making at regulatory level
   e. Support capacity development and training of TCN staff regarding RE grid integration and application of respective planning and analysis tools
   f. Establish GIS based data encoding and analysis system to support grid integration planning of RE generation capacity and development of an institutionalized IRP

[14] Information provided by GIZ staff (Sibylle Hasse and Daniel Werner) on 20 March 2015.

Furthermore, NESP provides the following support to on-grid RE:

- Design of a feed-in tariff for small RE (< 5 MW)
- Organizational development support to the FMP (Renewable Energy and Rural Power Access Department, all RE technologies)
- Support in drafting the National Policy on Renewable Energy and Energy Efficiency, National Action Plans for renewable energy and energy efficiency and further policy documents

NESP Training Programme

In Nigeria, the skills acquisition landscape for renewable energy and energy efficiency is fragmented and inconsistent with market needs. Current offers are either academic, or irregular or focused on poverty alleviation, and ignoring relevant professional groups. With an eye on market needs, NESP seeks to establish nationally recognised training courses that enhance employability and accelerate the deployment of renewable energy and energy efficiency interventions.

NESP will achieve this by developing six curricula and empowering 7 or more Nigerian training academies and research institutions to deliver the curricula (see Table below). Training partners are supported with training syllabi, handbooks and other training material and a training of faculty. Selected partners will also receive hands-on assistance in training delivery and advisory services on commercialisation. NESP is further seeking certification through a national body so as to link current courses to competency standards that are revalidated periodically. The NESP Training Programme will be implemented until 2017.

Table. Proposed curricula and training partners for the NESP Training Programme.

Curricula under development	***Training partners***
1. Add-on qualification as *Off-Grid RE Designer* 2. Add-on qualification as *Solar PV Installer* 3. Add-on qualification for *Small Hydropower Civil Works* 4. Add-on qualification as *Energy Manager* 5. Add-on qualification as *Energy Auditor* 6. Add-on qualification for *Energy Efficient Building Design*	1. Centre for Renewable Energy Technology, Federal University of Technology Akure 2. Sokoto Energy Research Centre (SERC), University of Sokoto 3. National Centre for Energy Efficiency & Conservation (NCEEC), University of Lagos 4. National Power Training Institute of Nigeria (NAPTIN), Kainji 5. Centre for Renewable Energy Research, Umaru Musa Yar'adua University, Katsina 6. National Centre for Energy Research & Development (NCERD), University of Nigeria, Nsukka 7. BAS Consulting, Lagos 8. Green Technology Development Institute, University of Ibadan (*proposed*) 9. International Energy Agency (IEA), Ibadan (*proposed*)

Department for International Development (DFID)

Nigeria Infrastructure Advisory Facility (NIAF)

The DFID-financed NIAF was designed to provide access to rapid and flexible consulting expertise to help Nigeria improve its infrastructure through policy and strategy formulation, planning, project implementation and private sector investment. NIAF is designed to implement projects in power, transport, major infrastructure, climate change and cities (urban planning and development) aimed at reducing infrastructure constraints to growth in non-oil gross domestic product and employment, and reduced poverty due to the relaxation of binding infrastructure constraints'.[15] NIAF has been working in the Nigerian electricity sector since 2007 with the objective of reducing the degree to which power shortages impede economic growth across the country. The NIAF Power workstream is divided into three Activity Areas as follows:[16]

- Privatisation – targeting the increasing of private sector participation in the sector.

[15] http://niafng.org/about-2/ - accessed 25 April 2015.

[16] http://niafng.org/sectors-2/power/ - accessed 25 April 2015.

- Market Reform – assisting with the preparation for the commencement of the Transitional Electricity Market (TEM) and then the Medium Term Market (MTM).
- Service Delivery – focusing on the more immediate maintenance and expansion of power generation, transmission and distribution capacity.

Among other projects and initiatives, Adam Smith International, through NIAF, has designed a programme aimed at developing both public and private markets for solar in Lagos and northern Nigeria. Funded by the International Climate Fund (ICF) and DFID, the SolarNigeria Programme will facilitate the sustainable delivery of public services through solar (health clinics and school electrification) and a private sector component to expand the commercial market for solar. For instance, using ICF funding of £37m, SolarNigeria has negotiated Lagos State co-funding of £15m, and expects private sector funding of £90m. The expected outcomes are more than 40MW of installed PV capacity, 3m tonnes of CO_2 abatement, 2.8 million people using solar in the home, 11 flagship rural health centres benefitting from improved services, and more than 3,000 jobs established in the supply chain.[17] NIAF is also collaborating with the WB and the GIZ for developing grid extension investment plans in various Nigerian states.

Changes made in the project design

During the project preparation phase, based on (i) discussions with the FGN and development partners such as GIZ, NIAF/DFID, the WB and the AfDB (please see previous discussions) during an in-country mission carried out in March 2015, (ii) the GEF Secretariat review of the PIF and recommended changes at PPG, (iii) the comments from the GEF Council Member from Germany on the PIF in the November 2013 work programme; and (iv) the STAP advisory response and guidance, the project has been redesigned. The redesigned project, including the reformulated strategic results framework and institutional arrangement, was presented to all the stakeholders, including development partners such as GIZ, at a validation workshop on Friday 20 March 2015. All stakeholders, including the representative o fthe GIZ supported the reformulated project. The main changes that have been carried out are:

1. Component 3 (Grid management to absorb intermittent but predictable renewable energy) in the PIF has been eliminated because all the formerly proposed outputs are already being implemented by GIZ, DFID/NIAF and the WB through the initiatives discussed in section 1.3.2.2. Hence, the reformulated project has only three components as will be discussed below (also see Section 3);

2. UNDP's DREI methodology has been given a more central role in the design of the reformulated project in order to address underlying barriers and resulting risks that lead to the increasing cost of capital for renewable energies. As discussed in Section 1.5 and Annex 7.2 of the Project Document (and Annex E here), the DREI approach is supported by the theory of change that the occurrence of negative events due to underlying barriers, and the financial impacts of these negative events result in higher level of risk that translate to higher costs of capital (equity and debt). In this respect, Components 1 and 2 that were proposed in the PIF have been retained, but interchanged in their respective sequencing in order to reflect the use of DREI as a cornerstone tool in the project redesign. The outputs/activities related to the interchanged Components 1 and 2 have been updated based on a review of the current baselines that have changed since April 2013 when the PIF was cleared; taking into account the ongoing initiatives related to grid-connected electricity generation that are discussed in Sections 1.3.2.2 and 1.3.2.3 of the project Document; and taking into account the needs of national stakeholders. Hence, the new outputs will complement the existing policy and financing derisking instruments that are already in place in the baseline. Based on changes in the baseline and ongoing parallel initiatives by other development partners, the new Component 1 has been reformulated to focus primarily on the design and development of a NAMA for the power sector; and

3. Component 3 (formerly Component 4) of the project has been retained and designed to explain how the outputs from Components 1 and 2 of the redesigned project will either be validated or benefit from the experience of the 100 MW solar PV baseline project. It will be argued using incremental reasoning below that the current design of the 100 MW solar PV project in Bauchi State has deficiencies that will reduce its performance. Through an investment component, these deficiencies will be overcome. The rationale for maintaining an on-grid approach as opposed to an off-grid approach will be discussed below.

The changes proposed in the Project Document address a gap in the baseline, which is the lack of a practical NAMA as a pre-2020 instrument that will allow Nigeria to be better prepared to leverage international climate finance. The focus

[17] http://niafng.org/green-growth-powering-nigerias-future/ - accessed 25 April 2015.

on a NAMA for the power sector is also complementary with the ongoing initiatives discussed in Section 1.3.2 of the Project Document.

By building on past initiatives (e.g. the GEF-UNIDO biomass project – Section A.7), and collaborating with ongoing initiatives (e.g. GIZ-implemented NESP and the AfDB and WB support to on-grid solar PV, including the baseline 100 MW solar PV project discussed above), the UNDP-GEF project aims to develop a single and coherent Nigerian Power Sector RE NAMA. Solar PV is the chosen technology for demonstrating the development of the NAMA. This approach will serve to market the NAMA as an integrated package to attract financial (international, bilateral, public and private sector) support. The core components of the RE NAMA will cover: clear long-term targets (such as those discussed in Section 1.2.5.3 of the Project Document), a public instrument package to create an enabled investment environment, assessment of costs and incremental costs, assessment of global environmental benefits, and MRV/indicators. The application of these elements of using the example of grid-tied solar PV can be replicated to other on-grid renewables. In fact, the preliminary DREI analyses that have been carried out to design the project will be further detailed during project implementation, as well as an extension of similar analyses to wind and biomass energy. To date, such a holistic approach to derisk on-grid renewable energy investments has not been attempted in the Nigerian power sector. As is discussed in Section B.3, derisking instruments offer a more cost effective approach to catalyzing private investments than for instance a pure tariff compensation in the form of a FiT. Hence, the derisking approach offers the opportunity to design incentives for promoting renewable electricity in a more rational way. Further, it is pointed out that the UNDP is currently designing an off-grid project under GEF-6 for which a Letter of Endorsement has been secured from the Nigerian GEF Operational Focal Point.

The project is designed in two broad elements: (1) technical assistance – to establish the enabling conditions for a Nigerian power sector RE NAMA. This element of the project will also implement targeted public (policy and financial) derisking instruments to remove barriers that exist in the baseline. The reduction of risks and the creation of an enabling environment will reduce the cost of financing for RE technologies, hence making electricity generation from RE sources more competitive, and ultimately creating a positive feedback loop that will further increase investments in RE sources in the power sector; and (2) investment – the elements of the RE NAMA will be tested by supporting one baseline project that has been identified as having several deficiencies. The technical assistance and investment components of the UNDP-GEF project are further detailed in Sections A.4, A.5 and B.3 (please also see Section 2.2 of the Project Document). Section A.4 discusses the baseline project and the ways in which the outputs of Components 1 and 2 either will be validated or benefit from the experience of the 100 MW solar PV baseline project.

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

The PIF makes reference to two baseline projects. However, due to prevailing barriers and risks, only one firm project has been identified for designing the UNDP-GEF project. The baseline consists of a privately-funded 100 MW solar PV plant in the State of Bauchi, and it was already identified in the PIF. The deficiencies that have been identified with the baseline project and the ways in which the GEF funds will incrementally cover these deficiencies to ensure the delivery of global environmental benefits are discussed in Section A.5 below. Here, emphasis is placed on how the baseline project will support the validation of the outputs of Components 1 and 2, as well as how the implementation of Components 1 and 2 will benefit from the lessons learned from the development of the baseline project.

The investment component of the project will achieve three principal impacts: (1) the reliability of renewable electricity generation from the baseline project - 100 MW solar PV plant in Bauchi State will be enhanced as discussed in Section A.5 below, thereby ensuring enhanced GHG emission reduction capabilities; (2) the baseline project will be implemented as part of the Nigerian power sector RE NAMA, with appropriate MRV of emission reductions; and (3) supporting the development of public derisking instruments under Components 1 and 2.

The incremental contributions of the GEF in the baseline project will be a combination of investments and technical assistance targeted at the following:

- As part of the investment component, the UNDP-GEF project will support the installation of interface electronics to match the voltage of renewable electricity with that of the national grid. This will be applied to

the baseline project and, once demonstrated for its effectiveness, interface electronics will be applicable to future RE projects that will form part of the Nigerian power sector RE NAMA;

- Since solar PV modules are mounted at relatively low angles of elevation (10-12°) in the northern parts of Nigeria (and even lower inclinations in the south), natural cleaning by rainfall is inadequate. The conventional way to clean dust is through a combination of mechanical brushing that is very water intensive.[18] Since climate variability and climate change is a threat to water availability, especially in the northern parts of Nigeria,[19] it would be preferable to adopt water efficient cleaning technologies. Cost-effective and water efficient robotic dust cleaning technology now exists for removing dust from utility-scale PV plants with efficiencies reaching up to 99%. Further, such equipment is self-powered using solar energy.[20] While noting that the GEF funding will not be sufficient to fit the entire plant with such cleaning technology, the GEF investment will be used to test the dust cleaning technology on part of the installations as proof of concept and for further replication. The robotic technology is also cloud-based with a system controller that is able to pull meteorological data in order to identify optimal PV plant operating conditions and to deploy robotic cleaning hardware as needed; and
- Also, GEF investment support will be deployed to test the application of anti-sand-blasting (anti-abrasive) coatings on the PV facility in Bauchi State. For control purposes, some PV modules/arrays will not be coated so as to enable comparative analysis. These technical tests will be invaluable for the wider Sahel region, and hence will be published and disseminated for informing technology choices within Nigeria and in the region. Following this line of incremental thinking, it augurs well for the UNDP-GEF project that there is a new PV manufacturing facility in North Africa (Tunisia) claiming to produce "100% desert proof" modules.[21] During implementation, the characteristics of these "desert proof" PV modules will be investigated for potential application in the 100 MW solar PV baseline project;

Besides these incremental interventions, the baseline project will be linked with the outputs of Components 1 and 2 in the following ways:

- The private developers (NSCP) of the baseline project have participated in the DREI interviews that were carried out during the project design, and being the first of its kind in Nigeria, the project design has benefited significantly from their unique experience. For instance, the NSCP played an instrumental role in validating the underlying barriers and risks shown in Table 13 of the Project Document, the public instruments shown in Table 14 of the Project Document, and to test the assumptions made in the DREI analyses (Section 1.5 and Annex 7.2 of the Project Document). Please note that a summary of the main results of the DREI analyses is also given in Annex E below;
- Since the baseline project is currently in the process of negotiating a PPA, the results of the derisking analysis may be used to guide the negotiation process. Further, the DREI analysis provides an opportunity for developing incentives in the form of 'proxy FiT' (for more see Section B.3 below) that has better public financing leverage ratios. In collaboration with the NESP initiative of the GIZ, a derisking approach can be used for the review of MYTO-II concerning FiTs for renewable electricity. The baseline project will not receive any financial incentives. The incrementality of GEF investment support to the baseline project is justified on the basis of the specific design flaws that were described above and also in Section A.5;
- As discussed above, the MRV system that will be developed under Output 2.3 will be applied to the baseline project in order to monitor its performance in terms of GHG emission reductions;

[18] Sami Al-Ghannam (2012) Comparison of Different Cleaning Technologies for Photovoltaic Panels of Utility Scale Application.
[19] Second National Communication (2014), pp. 54-58, pg. 66.
[20] For example, see www.ecoppia.com or http://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=232711493 – accessed 13 April 2015.
[21] Please see : http://www.pv-magazine.com/news/details/beitrag/jvg-thoma-establishes-30-mw-pv-module-fab-in-Nigeria_100015094/?utm_source=RCREEE+Newsletter+Subscribers&utm_campaign=4c106893f2-EN_395_21_2014&utm_medium=email&utm_term=0_c4fdb77805-4c106893f2-73390305#ixzz32L0UOX5C1.%09http:/www.pv-magazine.com/news/details/beitrag/jvg-thoma-establishes-30-mw-pv-module-fab-in-Nigeria_100015094/ - accessed 26 May 2014.

- Since the baseline project has completed the social and environmental screening of the WB, its experience will be used to achieve the targets of Output 2.2; and
- Based on its experience in interacting with the WB and AfDB (and other financial institutions), the developers of the baseline project will be closely consulted during the identification of the optimum set of public derisking instruments that will be most effective for solar PV in Nigeria (Component 1).

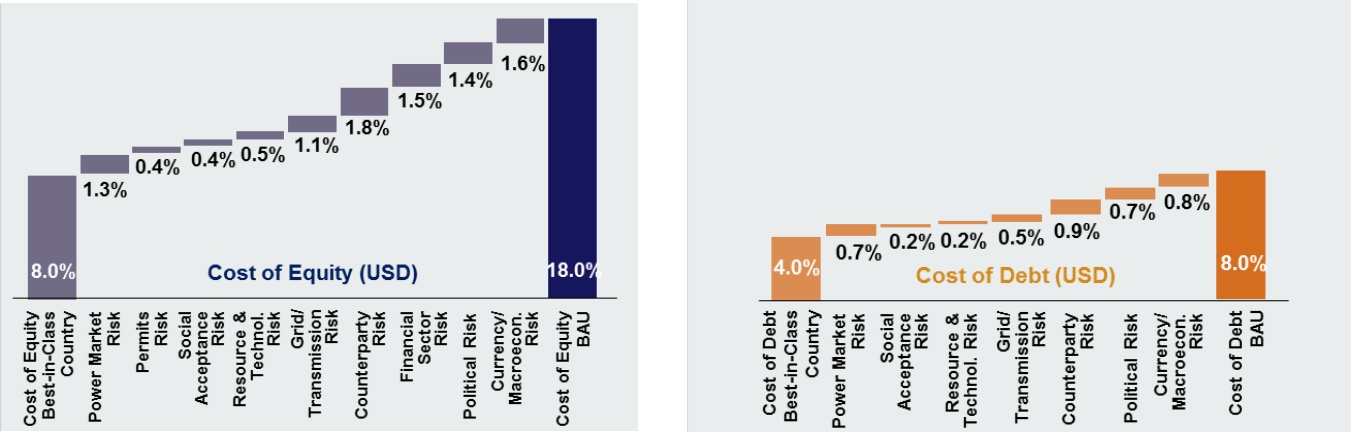
A.5. Incremental /Additional cost reasoning: describe the incremental (GEF Trust Fund/NPIF) or additional (LDCF/SCCF) activities requested for GEF/LDCF/SCCF/NPIF financing and the associated global environmental benefits (GEF Trust Fund) or associated adaptation benefits (LDCF/SCCF) to be delivered by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

The incremental reasoning relating to the baseline project is detailed in Section 2.2 of the Project Document. In brief, the baseline project (100 MW solar PV in Bauchi State) is expected to be implemented in the absence of the UNDP-GEF but with known deficiencies. The principal deficiencies have been identified as being: no planned use of adequate technologies for operating a commercial plant in a climatic zone where dust, especially due to the Harmattan, affects the solar PV yield. This situation is exacerbated by the low latitude that makes natural cleaning unsatisfactory. Further, the poor grid infrastructure in the North Eastern parts of Nigeria makes the integration of solar PV difficult due to fluctuations in grid voltage and frequency. The baseline project does not plan the use of adequate interface electronics to match the technical characteristics of renewable electricity produced by the baseline project to those of grid electricity. The investments under Component 3 of the project will address these technological and technical issues to enhance the performance of the baseline project and thereby ensure delivery of the expected global environmental benefits (see Section 2.4 of the Project Document). The incremental reasoning is also related to scaled-up mitigation action in the Nigerian power sector through the reduction of the cost of capital by putting into place a basket of nationally appropriate policy- and financial-derisking instruments. These are discussed in Sections 1.5 and 2, and Annex 7.2 of the Project Document.

Use of UNDP's Derisking Methodology

An innovative aspect of the project is its use of UNDP's Derisking Renewable Energy Investment (DREI) methodology. The DREI methodology has been used to design the project, and it will also form an integral part of the project implementation, especially under the new Component 1. A preliminary DREI analysis has been performed as part of the Project Document preparation. This analysis: (i) quantifies the current risks to solar PV investment in Nigeria (figure below), (ii) identifies and costs a package of derisking instruments to address these risks and to promote investment to achieve a target of 1,248 MW of on-grid solar PV by 2020, and (iii) calculates the levelised cost of electricity (LCOE) for solar PV, before and after implementation of the derisking instruments. A summary of the results of the DREI analysis is found in Annex E of this document.

Figure: Impact of risk categories on the cost of equity(left) and debt (right) for solar PV investments in Nigeria.



Source: interviews with solar PV investors and developers; modelling; best-in-class country is assumed as Germany; please see Section 1.5 and Annex 7.2 of the Project Document for details of assumptions and methodology.

An overview of the project including the main expected outcomes by the end of the project is discussed in the next section.

Project components

By building on past initiatives (e.g. the GEF-UNIDO biomass project – Section 1.3.2.2 of the Project Document), and collaborating with ongoing initiatives (e.g. GIZ-implemented NESP and the AfDB and WB support to on-grid solar PV, including the baseline 100 MW solar PV project), the UNDP-GEF project aims to develop a single and coherent Nigerian Power Sector RE NAMA. Solar PV is the chosen technology for demonstrating the development of the NAMA. This approach will serve to market the NAMA as an integrated package to attract financial (international, bilateral, public and private sector) support. The core components of the RE NAMA will cover: clear long-term targets (such as those discussed in Section 1.2.5.3 of the Project Document, a public instrument package to create an enabled investment environment, assessment of costs and incremental costs, assessment of global environmental benefits, and MRV/indicators. The application of these elements of using the example of grid-tied solar PV can be replicated to other on-grid renewables. In fact, the preliminary DREI analyses that have been carried out to design the project will be further detailed during project implementation, as well as an extension of similar analyses to wind and biomass energy.

The project is designed in two broad elements: (1) technical assistance – to establish the enabling conditions for a Nigerian power sector RE NAMA. This element of the project will also implement targeted public (policy and financial) derisking instruments to remove barriers that exist in the baseline. The reduction of risks and the creation of an enabling environment will reduce the cost of financing for RE technologies, hence making electricity generation from RE sources more competitive, and ultimately creating a positive feedback loop that will further increase investments in RE sources in the power sector; and (2) investment – the elements of the RE NAMA will be tested by supporting one baseline project that has been identified as having several deficiencies.

The project's primary added-value is to build upon the country's existing NAMA design activities and programmes (Section 1.3 of the Project Document). While there have been a number of prior activities to enhance the NAMA-preparedness of Nigeria, Section 1.5 of the Project Document has shown that significant barriers still prevail. GEF funds will be used to support activities – i.e. incremental investment and removal of the barriers and risks discussed in Section 1.5 of the Project Document – that will not take place in the baseline and yet which will substantially enhance the prospects of both the baseline projects and future projects that all fall under the Nigerian power sector RE NAMA. From this perspective, the incremental contribution of the GEF will be significant for scaling-up mitigation actions through the RE NAMA. By the end of the project, it is expected that:

- The Government will develop and adopt policy and financial derisking instruments that will be conducive for private sector investment in grid-connected renewable electricity. The DREI will provide an evidence-based approach for identifying and implementing these public derisking instruments.
- As an integral part of the DREI analyses, an institutional stakeholder mapping will be carried out to map out the public derisking instruments that are being supported by different institutions that may be used by the FGN as a road map for guiding targeted and coordinated interventions by different stakeholders in the renewable electricity sector (see Section 1.5 and Annex 7.2).
- A GIS based tool will be developed to identify practicable RE (PV, wind and biomass) sites in Nigeria. This will further guide private investors to sites that offer the least risks combined with sufficient renewable energy resources.
- An MRV system will be designed to provide quality assurance on GHG emission reductions accruing from the RE NAMA.
- A set of guidelines and design criteria is developed for the power sector NAMA that can be used as a template for all other NAMAs in Nigeria.
- A set of social and environmental safeguard guidelines is developed for all utility-scale RE projects.
- A study on domestic financial sector reform to unlock low-cost local capital for green infrastructure investment will be performed.
- The Lagos Energy Academy is capacitated to deliver RE trainings to IPPs, undergraduate students, and public institutions on a cost-recovery basis.

- The baseline projects will demonstrate improved performance in terms of clean electricity output that is compatible with grid stability and the utilisation of technologies that can be adopted by future renewable energy generation projects.

The enabling conditions created by the project will have the long-term impact of catalysing private investment to implement the RE NAMA that promises to generate cumulative direct emission reductions of around 0.57 $MtCO_2$ and indirect GHG emission reductions between 6.61 and 9.72 $MtCO_2$ from utility-scale solar PV plants alone.

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:

The main identified risks to the successful implementation of the project include:

Risk Description	***Risk Rating***	***Mitigation Strategy***
Political instability risks Although there is currently a strong political will and commitment to tackle the electricity access challenges in Nigeria, political instability or a change of government could lead to potential policy reversals that may impact the energy policy and discourage private investment.	Medium	Adoption of appropriate policy and regulatory changes will be assured through involvement of the stakeholders concerned at the highest possible political level, such as the Presidential Task Force on Power. The Task Force has played an instrumental role in leading the process of power sector reform since 2005 and its efforts have been highly praised by the Government, international partners and the private sector. The Task Force and its key members have been closely involved in project design and it will play an important role during implementation to secure political commitment, buy-in and integration of the RE policies in the national power market reform agenda, which is under direct supervision of the President. It is also pointed out that Nigeria has proved capable to manage risks related to political instability through peaceful elections in March 2015 that has brought about a change in government.
Economic risks The baseline technology used for generating electricity in Nigeria is natural gas turbines. The international price of natural gas is at a historically low level that is expected to persist. In this context, and as demonstrated by the LCOE analysis shown in Annex E (and also Section 1.5 and Annex 7.2 of the Project Document for solar PV compared to gas-fired electricity generation), many of the renewable energy solutions proposed in this project are therefore not expected to become economically competitive compared to baseline energy sources.	High	Unless appropriate policies and regulations, supported by financial derisking mechanisms and incentives are introduced and enforced, RE will not be able to compete with fossil fuel based power generation in Nigeria. Component 1 of this project therefore aims precisely at achieving these goals and leveling the playing field for RE.
Technical risks Technical risks exist that the	Medium	Voltage and frequency fluctuations will affect the integration of the baseline project into the national grid. This deficiency will be

Risk Description	*Risk Rating*	*Mitigation Strategy*
introduced renewable energy solutions fail to be viable for electricity generation in Nigeria, especially in the situation of poor grid stability and reliability of transmission.		mitigated under Component 3 of the project which will introduce adequate voltage electronics that will allow the output of the solar PV farm to match that of the grid. Such an interface will allow the PV installation to inject power into the grid more frequently than otherwise. Further, the UNDP-GEF project will team up with the Lagos Energy Academy to provide training to technicians and private developers to better understand the nature of technical risks and adequacy of domestic supply chain and O&M capacities for RE-plants construction and operation. These measures, in conjunction with the involvement of experienced international IPPs and RE developers throughout the project, will help mitigate technical risks.
Environmental Risks In order to leverage international financing, private promoters must be able to carry out environmental impact assessments of their project according to international benchmarks, such as the WB Environmental and Social safeguards. Since an EIA permit is also needed according to the Environmental Impact Assessment (EIA) Act No. 86 of 1992, there is the risk that compliance with national regulations is not sufficient in order to meet international benchmarks. In this case, additional screening has to be carried out at the risk of project delays and additional costs.	Low	Although the baseline project has complied with the Environmental Impact Assessment (EIA) Act No. 86 of 1992, it has also carried out an independent EIA using World Bank standards. Environmental screening has also been carried against the requirements of the AfDB. Further, the baseline project has been subject to a screening according to UNDP's Social and Environmental Safeguard Policy. Based on the lessons-learned from the EIAs and screening, a set of guidelines will be developed for future utility-scale RE projects in the Nigerian power sector that will align the national and international safeguards. This output of the project will capitalize on the work already accomplished by the WB under its Environmental and Social Management Framework (ESMF) (Section 1.3.2.2).
Climate Change risk Climate change is expected to change Nigeria's biomass production, accelerate land degradation, and modify the hydrological systems. Also, the temperature increase will lead to higher power demand. In a drier climate, and with more episodes of extreme weather events such as droughts, especially in the North / North East, the impact of dust on solar PV performance is expected to be	Medium	Among all available RE sources in Nigeria, hydropower will likely be most negatively affected by changing climate. The project will therefore put more emphasis on promoting other RE sources, solar and wind, which are less likely to be affected by climate change and therefore represent a viable climate adaptation alternative for the Nigerian power sector (which currently depends by 20-25% on hydro power generation). In the specific case of dust-induced loss of solar PV yield, Component 3 of the project will support the testing and validation of equipment to clean solar PV arrays in the Nigerian context. The GEF-supported incremental intervention will be useful for replication in the future.

Risk Description	*Risk Rating*	*Mitigation Strategy*
impacted detrimentally.		
Financial Risks Implementation of on-grid solar PV will require substantial investments that are well beyond the capacity of the FGN to invest. This is the reason why the FGN is seeking to attract private investment and international funding.	Medium	The prevailing conditions pose significant barriers, and hence risks, to catalysing private investment and international funding. For instance, the DREI interview with Ecobank[22] revealed that the cost of debt denominated in Nigeria (denominated in Naira) is around 24%, which makes project financing unviable. The UNDP-GEF project will actively address these risks by removing key barriers, thereby mitigating financial risks. The design of the project has been informed by detailed quantitative analysis of financial risks (among other risks) – and their impacts on the cost of capital (debt and equity) – facing renewable energy investments in Nigeria. DREI analysis will be used to demonstrate the significant leverage ratio of the proposed derisking instruments to catalyse investments to implement the power sector RE NAMA. In particular, the project will carry out a review of the financial sector in order to propose and capitalise financial instruments that will unlock low-cost capital.
Security risk Political tensions in the Niger Delta between the foreign oil corporations and a number of ethnic minorities seeking a share of the oil profit have led to numerous violent attacks towards the oil infrastructure and staff in the last 20 years. Risk exists that a similar situation happens to renewable energy installations developed within or following this project. Also, there are security risks associated with terrorism in the North East of Nigeria, especially in the States of Borno and Yobe.	High	While it is not feasible to fully mitigate security risk within the framework of the proposed project, appropriate arrangements and precautionary measures will be taken during project design and implementation. First of all, full participation of local communities in pilot sites will be ensured to raise their awareness and secure buy-in for the proposed RE projects. Local NGOs and CSOs will be mobilized to lead this process. The UNDP has carried out the Social and Environmental Screening of the baseline project to certify that such community-level interactions and communications have taken place (see Annex 7.3). Further, the UNDP-GEF project will support the FGN to develop guidelines for carrying out environmental and social impact assessments of RE projects that will also cover the security dimension. It is pointed out that a similar exercise is being planned by the private promoters for the 100 MW solar PV in Bauchi State. This process of security risk assessment will inform the development of guidelines mentioned above.
• Resettlement of Project Affected Persons risk • According to the Resettlement Action Plan (RAP), an estimated total of 217 individuals (Project Affected Persons) on the proposed solar farm site and transmission line corridor will be affected by the project. There are about 30 households comprising	High	Environquest prepared an initial RAP as part of their Environmental and Social Impact Assessment (ESIA). The RAP was prepared in accordance with the World Bank's Operating Procedure 4.12. The plan included screening, identification of key issues, and data collection through site survey and asset valuation conducted in August 2013. The survey determined land demarcations, clarified land access issues, and documented ownership patterns and existing use. Project-affected persons (PAPs) consulted and participated in development of mitigation measures, such as compensation and alternative livelihoods.

[22] Interview carried out with Mr Sunkanmi Olowo, Head, SME/Value Chain Banking on Wednesday 8 April 2015.

Risk Description	*Risk Rating*	*Mitigation Strategy*
approximately 150 residents on the proposed solar farm site who will be displaced. Includes loss of farmland (200 ha) and sources of income as result of land acquisition.		

A.7. Coordination with other relevant GEF financed initiatives

***The GEF-financed, UNIDO-supported Project entitled* "Mini-grid based renewable energy (biomass) sources to augment rural electrification**" is expected to reach completion in 2015. It will provide lessons learned on several issues pertaining to the outputs and outcomes of the UNDP-GEF NAMA project. Of relevance here are the following:

- The identification of potential sites endowed with renewable biomass for replication of power generation projects: This output will be useful for the development a GIS-based tool that will provide the practicable locations of renewable biomass power across Nigeria;
- Feed-in-tariff (FiT) for biomass power in place: Based on the DREI analyses that have been carried out for solar PV during the project design, and that will be detailed during project implementation, the application of the methodology can be scaled up to cover biomass-derived renewable electricity using a risk-adjusted approach;
- Appropriate financing facility developed for RE related projects: This output will be used to inform the technical assistance that the UNDP-GEF project will provide regarding the identification and proposition of nationally-appropriate low-cost financial instruments to facilitate the development of RE projects in Nigeria.

The Nigeria Erosion and Watershed Management Project (NEWMAP) is a GEF-financed and WB-supported initiative aimed at rehabilitating degraded lands and reducing erosion and climate vulnerability in targeted areas (Abia, Anambra, Cross Rivers, Ebonyi, Edo, Enugu and Imo). The project has four primary components: (i) investment in erosion and watershed management; (ii) institutional and information systems for erosion and watershed management; (iii) climate change adaptation and mitigation; and (iv) project management. In particular, the activities in component one involve sub-projects each of which may include construction and/or rehabilitation of various identified erosion or flooding sites. These activities may lead to environmental and social impacts, which must be mitigated in accordance with the tenets of sustainable development. An Environmental and Social Management Framework (ESMF) seeks to provide a clear process including action plans to integrate environmental and social considerations into the NEWMAP. The ESMF will ensure that implementation of NEWMAP meets with the existing EIA law in Nigeria and the WB Environmental and Social Safeguards policies. Based on the ESMF the, UNDP-GEF project will support the Environmental Protection Agency (EPA) to develop social and environmental screening and safeguard guidelines for renewable energy projects. This will allow the FME to align the *Environmental Impact Assessment (EIA) Act No. 86 of 1992* with international benchmarks that will facilitate private developers of renewable power to raise international financing.

B. ADDITIONAL INFORMATION NOT ADDRESSED AT PIF STAGE:

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

The design and conceptualisation of the project have been carried out using multi-stakeholder processes. This was a key consideration in project development for two principal reasons: (1) the 'meta-technology' characteristics of the power sector imply that a diverse set of stakeholders from the public sector, the private sector and civil society are directly involved across the value chain spanning electricity generation to end-use; and (2) to ensure national institutional ownership that will aid the successful implementation of the project. The stakeholders listed in the table below were actively engaged in preparation of the UNDP-GEF project. Their roles and responsibilities during project implementation are also captured.

Table: Roles and responsibilities of stakeholders in the project.

Stakeholder	Roles and responsibilities (project preparation & implementation)
Energy Commission of Nigeria (ECN)	The ECN has the statutory mandate for strategic planning and coordination of national policies in the field of energy. ECN has coordinated stakeholder consultations during preparation of the project. During the implementation phase, ECN will be the co-chair of the Technical Working Group (TWG) for Component 1 of the project. The ECN will also house the Project Management Unit (PMU).
Federal Ministry of Power (FMP)	The key function of the Ministry is to develop and facilitate the implementation of policies for the provision of adequate and reliable power supply in the country. In this capacity, the FMP was consulted during the formulation of the project. The FMP will chair the TWG for Component 2 of the project. The FMP will also be a direct beneficiary of the project through the development of geospatially referenced practicable locations for siting various types of on-grid renewable energy projects.
Nigerian Electricity Regulatory Commission (NERC)	NERC is an independent regulatory agency mandated to regulate and monitor the Nigerian power sector. Of direct relevance to NERC is the DREI analysis that can be used to guide the revision of MYTO II (equivalent of feed-in-tariffs in Nigeria) using a risk-adjusted approach. The DREI analyses can complement the technical assistance that the NERC is getting from GIZ under the NESP. This provides an opportunity for the UNDP-GEF project to collaborate with the GIZ and NERC. NERC will be invited to join the TWG for Component 2 and the Project Board (PB).
Federal Ministry of Environment (FME)	The GEF Operational Focal Point and the DNA are hosted within the Ministry of Environment. The former was involved during the PIF and project preparation phases and will continue his involvement during project implementation. As the coordinator for developing the Nigeria NAMA strategy and action plan, the FME was closely involved in the formulation of the UNDP-GEF project. The FME will have a central role as chair of the Project Board (PB), and hence have the responsibility to seek high level political support for the project during implementation. The FME will also be a beneficiary of the project through the output related to the development of guidelines for social and environmental screening of RE projects so that the national EIA is aligned with international benchmarks.
Private sector – Nigeria Solar Capital Partners (NSCP)	Because of the prevailing barriers and risks, there is currently limited private sector investment in renewable energies in Nigeria. The most prominent solar PV private developer to date – i.e. NSCP - has been heavily involved in preparation of the UNDP-GEF project. Since NSCP is also the project owner of the 100 MW baseline solar PV project in Bauchi State, it will continue to be a key stakeholder throughout project implementation. Further, NSCP will be a member of the Project Board. The DREI methodology, which has been used in the preparation of the project, and will be used in Component 1 to assist the NAMA preparation, involves active outreach to the private sector to solicit its quantitative feedback on the barriers and investment risks to renewable energy in Nigeria. The DREI analysis performed for this Project Document involved structured interviews with 8 private sector investors, both domestic and international.
Federal Ministry of Finance (FMF)	The FMF was consulted during project formulation. It will chair the TWG for Component 1 and it will be a member of the PB. The FMF will be a direct beneficiary of the project under Component 1 that seeks to identify and propose financial derisking instruments to attract private sector investments in renewable energies, and in particular solar energy. The FMF will be closely

	consulted during the project implementation to identify the appropriate financial sector reforms that may be required in Nigeria in order to unlock low-cost public finance.
Presidential Task Force on Power (PTFP)	The PTFP was established in 2010 to drive the implementation of the reform of Nigeria's power sector. The role of the PTFP is to co-ordinate the activities of the various agencies charged with ensuring the removal of legal and regulatory obstacles to private sector investment in the power industry. It also has the mandate to monitor the planning and execution of various short-term projects in generation, transmission, distribution and fuel-to-power that are critical to meeting the stated service delivery targets of the power sector roadmap. In these capacities, the PTFP will co-chair the TWG for Component 2 of the project. Given its mandate, the PTFP will also provide political support for the UNDP-GEF project. The chairperson (or delegate) of the PTFP will be a member of the PB.
GIZ	GIZ has been consulted throughout all the stages of project design and conceptualisation, specifically – but not exclusively – in regard to the projects discussed in Section 1.3.2. Since GIZ is working in close collaboration with several national partners, including FMP, NERC and local training institutions, seamless coordination with projects implemented by GIZ will be ensured. Further, lessons-learned from the GIZ projects will be drawn upon when implementing the UNDP-GEF project. GIZ will be invited to be a member of the PB.
Lagos Energy Academy (LEA)	The LEA was consulted during the project formulation, and it was identified as a reliable partner for providing applied trainings for technicians from the private sector across the entire solar PV value chain. Through seed funding from the Lagos State Government and DFID, the LEA has put in place state-of-the-art training facilities, including testing laboratories and field operation of a solar PV array. The UNDP-GEF project will capitalize on these initial investments to develop new training courses and to complement existing equipment. The LEA will be invited to form part of the PB and as a member of the TWG for Component 2.

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):

The opportunities and need for the development of renewable energies in Nigeria are better understood when looking at the broader sustainable development goals. The FGN has put forward an ambitious vision for the country's economic development by 2020: Nigeria Vision 20: 2020.[23] It is a platform for socioeconomic transformation intended to position Nigeria among the 20 largest economies in the world by the year 2020. To achieve sustainable growth, Vision 20: 2020 projects a significant transformation of the economy, with rapid expansion of non-oil sectors such as manufacturing, wholesale and retail trade, telecommunications, construction, and real estate. It calls for large investment in infrastructure and the strengthening of reforms to shift investment toward supporting private-sector activities and increasing the productivity of human capital. Much of the progress to be achieved under Vision 20: 2020 will require significant investment in physical infrastructure, including power, transport, oil and gas infrastructure, housing, and water resources. Power has been a particularly serious bottleneck to growth due to inadequate generation capacity and poor maintenance of the installed capacity. As a result, the FGN attaches particular emphasis (both in Vision 20: 2020 and in "Roadmap for Power Sector Reform") to aggressive rehabilitation of power installations, coupled with an accelerated expansion of electricity generation, transformation, and distribution networks.[24]

[23] FGN (Federal Government of Nigeria) (2010) *Nigeria Vision 20:2020: The First NV20:2020 Medium-Term Implementation Plan (2010–2013)*; *Volume 1: The Vision and Development Priorities*. Lagos, Nigeria.

[24] Cervigni, Raffaello, John Allen Rogers, and Max Henrion, eds. (2013) *Low-Carbon Development: Opportunities for Nigeria*. Directions in Development. Washington, DC: World Bank. pg. 17.

There are many ways that Nigeria can achieve the Vision 20: 2020 development objectives for 2020 and beyond, but with up to 32 % lower carbon emissions. A lower carbon path offers not only the global benefits of reducing contributions to climate change, but also net economic benefits to Nigeria, estimated at about 2 percent of GDP. These national benefits include cheaper and more diversified electricity sources, with savings of the order of 7 % or US$12 billion, among others.[25] Furthermore, the project forms part of Nigeria's ongoing process of defining a low-carbon development strategy (please see Section 1.3.2 of the Project Document, and the discussion at A.1. above), which forms part of a broader process to develop a low-carbon, climate-resilient development pathway for the country.

The specific dimensions of the socio-economic benefits to be derived from this project will be clearly spelled out as mitigation option analyses are carried out and NAMA designs are developed. The project will fully incorporate the socio-economic dimension in the RE NAMA design and implementation process. This includes contributing to:

- Increasing security and sovereignty of energy supply at the national level by reducing dependence on gas;
- Having high-quality access to energy at competitive prices[26] and reducing the impact on natural resources and environment;
- Increasing social equality and reducing energy poverty, through increased access to quality and affordable energy services, especially in the northern states;
- Potentially expanding electricity grid coverage to capitalise on indigenous renewable energy sources that will facilitate rural electricity programmes using appropriate and cost-effective technologies;
- Facilitating the creation of conditions for sustainable socio-economic development in rural, isolated villages and country borders by improving the quality of life of the rural population and encouraging the promotion of productive uses of energy (this is assumed under conditions of larger penetration of solar PV (all renewables) of around 10% (20%) of total installed capacities (see Table 8 in the Project Document);
- Developing a vibrant renewable energy supply chain in Nigeria that will generate green jobs;
- Promoting the coordination of financing instruments with public and private entities in order to allow better access to economic resources and financing for projects.
- Gender issues will be addressed in the Regions through poverty alleviation and job creation.

Global Environmental Benefits

Direct GHG emission reductions

Using a combined margin grid emission factor of 0.4306 tCO_2/MWh (see calculations in Annex 7.5) for the Nigerian electricity system, the direct emission reductions from the 100 MW solar PV plant are expected to be approximately 113,158 tCO_2/year. During the lifetime of the UNDP-GEF project, the baseline project will deliver 452,633 tCO_2 in cumulative emission reductions for the period 2017-2020.[27] Assuming a useful investment lifetime of 20 years, the combined cumulative direct emission reductions will amount to 2.263 $MtCO_2$, at an abatement cost of 1.94 US$GEF/$tCO_2$. This is similar to the values given in the PIF after updating the grid emission factor and solar electricity generated by the 100 MW PV plant.

As justified in Annex 7.5 of the Project Document (and in line with the approach proposed in the PIF), a causality factor of 25% has been applied to the cumulative direct emission reductions to give adjusted direct project emission reductions of 0.565 $MtCO_2$. This approach gives a more conservative estimate of direct emission reductions since the baseline project would have been implemented in the absence of the UNDP-GEF project. The causality factor provides a measure of the enhancements that the GEF interventions will bring to the baseline project, which then allows a more

[25] Ibid, pg. 1.

[26] In the case of the 100 MW solar PV project in Bauchi State, a case can be made that the effective baseline against which on-grid solar PV can be compared is off-grid diesel generation. This is because of the unreliability and unpredictability of grid electricity. As quoted in Section 1.3.1, local cost of diesel-generated electricity is $0.55-0.60/kWh, well over twice the cost of solar PV generated electricity. Further, assuming an emission factor of 0.8 tCO_2/MWh for stand-alone diesel generated electricity, the emission reduction potential for on-grid PV would be 1.8 time larger than when compared with gas-generated on-grid electricity.

[27] The baseline project is expected to be fully commissioned at the end of 2016 or beginning of 2017.

realistic calculation of the cost-effectiveness of GEF interventions. In this scenario, the abatement cost is 7.78 US$GEF/tCO$_2$.

Indirect GHG emission reductions

Indirect emission reductions are expected to be substantial, arising from the policy and financial derisking, capacity development and institutional strengthening aspects of the project – specifically:

- Output 1.1: At least 3 policy and financial derisking instruments have been assessed using DREI analysis based on work initiated in the development of the project document.
- Output 1.3: A basket of the most appropriate financial derisking instruments is identified and their capitalization is demonstrated.
- Output 2.1: A GIS based tool is developed to identify practicable RE (PV, wind and biomass) sites in Nigeria.
- Output 2.2: A set of social and environmental safeguard guidelines is developed for all utility-scale RE based on international standards.
- Output 2.4: The Lagos Energy Academy is capacitated to deliver RE trainings to IPPs, undergraduate students, and public institutions on a cost-recovery basis.
- Output 2.5: Dissemination of best practices.

At this stage, it is extremely difficult to predict which tools will actually be adopted by the Government, what form the power sector RE NAMA will assume and what basket of financial instruments will be identified and capitalised, making estimation of GEF-driven emission reductions challenging. As a conservative approach, indirect emission reductions have been calculated using both the top-down and bottom-up approaches. The detailed calculations are given in Annex 7.5 of the Project Document.

Top-down approach

The top-down approach uses the post-project 10-year market potential as the starting point. Hence, the 10 year market potential coincides with the emission reductions expected between 2021 and 2030, which are the long-term targets shown in Table 8 of the Project Document. In order to be conservative, a weak causality factor of 25% has been applied to give indirect emission reductions. The top-down indirect emission reductions are found to be 6.61 MtCO$_2$ (Reference scenario), 8.17 MtCO$_2$ (High Growth scenario) and 9.72 MtCO$_2$ (Optimistic II scenario). This equates to an abatement cost in the range of approximately 0.45 – 0.67 US$GEF/tCO$_2$.

Bottom-up approach

A replication factor of 3 has been applied to the direct project emission reductions of 2.263 MtCO$_2$. The choice of replication factor is given in Annex 7.5 of the Project Document, and following the guidance of the GEF for calculating indirect GHG emission reductions. The bottom-up approach gives indirect emission reductions equal to 6.79 MtCO$_2$, and an abatement cost of ~0.65 US$GEF/tCO$_2$.

The project results framework includes indicators to measure the project's contribution in these areas. These emission reductions will be clearly recorded and reported to the GEF Secretariat via the established monitoring and evaluation channels. The strong focus of the project on MRV will facilitate this task. The assumptions used to calculate the direct and indirect emission reductions will be reviewed at the mid-term review and terminal evaluation of the project.

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

The proposed project is very cost-effective as it will utilise US$ 4,400,000 of GEF funds to leverage US$ 213,550,000 of co-financing (a co-financing ratio of over 48). In the absence of the UNDP-GEF project, the 100 MW solar PV baseline project would be built but not according to best practices and with greatly reduced potential for replicability and efficient performance. The cost-effectiveness of the project is reflected in its very low direct GEF GHG abatement cost of ~7.8 US$GEF/tCO$_2$.

The DREI analyses discussed in Section 1.5 and Annex 7.2 of the Project Document and Annex E of this document have shown through the use of quantifiable and objective metrics that the derisking approach to developing a power sector NAMA is a more cost-effective means of achieving the long term RE targets in Nigeria as otherwise would

happen. Given the fact that renewable electricity (e.g. solar PV) is still more expensive that conventional, fossil-uel generated electricity, the conventional approach to incentivizing renewable energy is to provide a premium tariff to renewable electricity as a compensation mechanism. This usually overlooks the fact that the cost of renewable electricity is higher in developing countries because of the high cost of capital arising from prevailing barriers and risks in the baseline or business-as-usual (BAU) situation. As discussed earlier, the project design has been guided by applying the DREI methodology. In this case, the main focus of the project is to put in place public desriskign instruments prior to applying any compensation for residual risks. This approach is demonstrably more cost effective as discussed now.

The DREI methodology uses four performance metrics to analyse the impacts of the selected public instrument package to promote investment, each metric taking a different perspective: the ability to catalyse investment (*leverage ratio*); the economic savings generated for society (*savings ratio*); the resulting electricity price for end-users (*affordability*); and the efficiency in mitigating greenhouse gas emissions (*carbon abatement*).

For the *leverage ratio*, achieving the 2020 target of 1,238 MW in installed solar PV capacity equates to USD 1.89 billion in private sector investment.

- In the *business-as-usual scenario*, the model estimates that achieving this target will require a direct financial incentive in the form of a price premium over 20 years, valued at USD 2.26 billion. This results in a leverage ratio (the ratio of the cost of public instruments to investment catalysed) of 0.8x.
- In the *post-derisking scenario*, the model estimates that this same investment target can be achieved with a package of derisking instruments estimated at USD 300.7 million, and a lower direct financial incentive (price premium) over 20 years valued at USD 1.30 billion. This raises the leverage ratio by 50% to 1.2x, indicating a higher efficiency in terms of the costs of public instruments.

Taking the two scenarios together, the USD 300.7 million package of derisking instruments is estimated to create net savings to the economy of USD 960.2 million in lower direct financial incentives.

For *carbon abatement*, achieving the 2020 target of 1,238 MW in solar PV is estimated to result in a total reduction of 26.2 million tonnes of CO_2 over the lifetime of the solar PV plants. In the *business-as-usual scenario*, the abatement cost of the investment in solar PV is USD 86.69 per tonne of CO_2e. Or, in other words, the cost of public instruments – in this case a direct financial incentive – equates to USD 86.69 for every tonne of CO_2e reduced by the investment in solar PV. In the *post-derisking scenario*, this cost falls by 29% to USD 61.34 per tonne of CO_2e. This performance metric is helpful in terms of understanding a carbon price that is necessary to promote investment, and in comparing the relative costs of different low-carbon options.

In comparing the *business-as-usual* and *post-derisking* scenarios, the results clearly demonstrate how investing in public derisking measures is cost-effective by creating significant direct economic savings in achieving Nigeria's utility-scale solar PV investment targets. Instead of paying for investment in solar PV at higher generation costs, public derisking measures should be prioritised, thereby resulting in investment at lower generation costs and more affordable electricity for Nigerian citizens.

In addition to the above, the cost effectiveness of the project stems from its innovation, sustainability, replicability, and the support it lends to the development prerogatives of Nigeria. These are discussed in Sections 1.3.2 and 2.7 of the Project Document.

Innovation

As discussed in Section 1.1.5 in the Project Document, Nigeria is yet to develop and submit any NAMA to the UNFCCC. Consequently, Nigeria has not capitalised on using NAMAs as a means to attract international climate finance, and also as a potential means to implement its post-2020 INDC. The project is innovative, since it is the first national initiative that will allow Nigeria to develop a sector-wide NAMA based on UNDP's derisking approach (see Section 1.5 in the Project Document and Annex E below). The UNDP-GEF project will therefore pave the way for Nigeria to develop NAMAs in other sectors, and also for off-grid RE applications. Other elements of innovativeness stem from migrating from a conventional, project-based approach to a sector-wide transformational approach that will also include the testing and implementation of novel policy and financial

derisking instruments to scale-up the diffusion of renewable energy technologies. The innovativeness aspect of the derisking approach is that funding for on-grid renewables comes at a lower social cost compared to providing a feed-in tariff to promote the same technologies in the presence of underlying risks. The derisking approach will contribute to the financial sustainability of promoting private investments in on-grid renewable energies as discussed below.

Sustainability

The main barrier to sustainability of achieving the integration of 1,248 MW of solar PV in the national grid is the availability of sufficient private-sector and international funding. The methodological and evidence-based approach promoted by the UNDP-GEF project, complemented by the establishment of necessary policy and enabling conditions, will be instrumental in leveraging private and international funding to support the implementation of the RE NAMA. For instance, the preliminary DREI analyses have shown that the putting in place of a package of public derisking instruments can lower the costs of financing that prevail in the business-as-usual (BAU) situation – e.g. from 18% cost of equity in the BAU situation to 14.8%; and from 8% cost of debt in the BAU situation to 6.6%. The impact of the reduced risks, and hence lowered cost of capital, is a reduction of the LCOE for solar PV from USD 10.5 cts per kWh (BAU) to USD 7.7 cts per kWh (post-derisking), thereby making it more cost competitive with the baseline power generation technology.

Also, a USD 300.7 million package of derisking instruments is estimated to create net savings to the economy of USD 960.2 million in lower direct financial incentives. Hence, the sustainability of the proposed NAMA project for the Nigerian power sector based on a derisking approach emanates from the fact that it lowers the cost of capital in a financially sustainable way – i.e. at lower social costs compared to the case when renewables are incentivised without reducing or eliminating underlying risks and barriers.

The sustainability of the project also rests on the collaboration with existing initiatives (see Section 1.3.2 in Project Document), and developing partnerships with national institutions and also developing institutional capacities. For instance, as discussed in Section 2.2 of the Project Document, the NERC is being assisted by the GIZ (through the NESP – see Section 1.3.2.2 in Project Document) to review the feed-in-tariffs under MYTO II. Since the GIZ is already supporting the NERC with MYTO II, one of the proposed changes to the project design (see Above) is that the UNDP-GEF project will not specifically work on FiT review or its design. Based on the experience with collaboration with the GIZ in Tunisia where a similar UNDP-GEF derisking RE NAMA project is being implemented (Section 2.2 in Project Document), the results of the derisking analyses (which will be carried out periodically by the ECN – see below) will be shared with the GIZ and NERC to support the FiT review process that will be carried out periodically as the underlying risks and barriers change. Further, there will be capacity building of local institutions, such as transferring the technical capacity to the ECN for the periodic application of the DREI analyses to track the risk profile regarding renewable energy investments in Nigeria. Also, the UNDP-GEF project will build a partnership with the LEA to provide technical backstopping for private project developers, and this will complement the ongoing initiatives under the NESP. The collaborations and institutional capacity development are discussed in Sections 2.2. The table below summarises the interactions of the UNDP-GEF project with other institutions (international development partners and domestic institutions) across the different risk categories and proposed public derisking instruments.

RISK CATEGORY	POLICY DERISKING INSTRUMENTS	UNDP-GEF PROJECT SUPPORT	OTHER INTERN. SUPPORT	DOMESTIC SUPPORT
Power Market Risk	[Well designed PPA-bidding process]		[GIZ]	
	[Differentiated tariff approach]		[GIZ/NIAF]	
	Project development facility	✓	[GIZ]	[LEA]
Permits Risk	[Streamlining permits process]		[GIZ]	
	Project development facility	✓	[GIZ]	[LEA]
Social Acceptance Risk	Guidelines to benchmark EIA against international standards	✓		[FME]
Resource & Technology Risk	GIS-based tool for identifying suitable on-grid RE sites	✓		[ECN/FMP]
	Project development facility	✓	[GIZ]	[LEA]
Grid/Transmission Risk	[Technical codes, grid absorption study]		[GIZ/NIAF]	
	Project development facility	✓	[GIZ]	[LEA]
Counterparty Risk	Support to DISCOs on cost-recovery, operational performance		[WB]	
Financial Sector Risk	Study on domestic financial sector reform for green infrastructure	✓		[FMF]
	Project development facility	✓	[GIZ]	[LEA]

Scaling up

The successful implementation of the project, including its sustainability, will provide a template for scaling up on-grid RE projects given the size of RE potential in Nigeria. As discussed in Section 1.2.5.3 of the Project Document, the target for on-grid solar PV is 1,238 MW by 2020, and increasing to 9,900 MW by 2030 (Table 9 in Project Document). Given the fact that there are no on-grid solar PV applications in Nigeria to date, and that the 100 MW solar PV baseline project in Bauchi State represents the most advanced project in its design and conception, the UNDP-GEF has the capacity to unlock large-scale solar PV projects in Nigeria through a sectoral NAMA by proposing a derisking approach combined with collaboration with international and national institutions. Further, the UNDP-GEF project will provide the foundations (practical resources assessments and DREI analyses) for on-grid wind and biomass projects.

In addition, the project is designed to establish a sustainable framework for the energy sector NAMA design and implementation. This is intended to trigger the process of implementing NAMA activities in the country and to foster the replication of such activities. The project can expect replication at the following three levels: (1) *Baseline project implementation* – The project will facilitate the successful implementation of one baseline project that forms part of the solar PV action plan under the broader umbrella of the power sector RE NAMA. The baseline project will have a lifespan that extends beyond the duration of the UNDP-GEF project, and will have catalytic effects as first-of-its-kind in Nigeria (see Section 1.3.1 and Section 1.3.2.2 of the Project Document, and above discussions); (2) *additional power sector NAMA projects* – By extending the solar PV action plan to cover other grid-connected renewable technologies such as wind and biomass, and by developing an optimal combination of cost-effective policy and financial derisking instruments using UNDP's DREI methodology, it is expected that the private investments will be catalysed effectively to implement the technology-specific renewable electricity initiative forming the power sector RE NAMA beyond the lifetime of the project; and (iii) *definition of new NAMAs in the*

energy sector – As described in the sustainability section above, the project aims to develop a NAMA planning framework that allows for the development of new NAMA activities in the energy sector. The voluntary targets established by the Federal Government of Nigeria (see Section 1.2.5.3) for the power sector are ambitious and require significant changes within the sector to be achieved. There are a number of voluntary mitigation actions that go beyond the power sector RE NAMA, like demand side management, off-grid and mini-grid renewable electricity generation. Further, there is the potential for GHG emission reductions in the oil and gas sector.[28] Likewise, the project's support for the establishment of MRV mechanisms will be replicable across NAMAs and will allow for quality reporting of the country's mitigation efforts. This collective effort will ultimately result in the mainstreaming of NAMAs in Nigeria's national development process, which will be vital for steering Nigeria towards a low-carbon development pathway.

Impact of transformational change on RE development

A high cost of capital is a significant deterrent for investments in renewable energies such as solar PV. In turn, a high cost of capital would imply the need for higher returns, and hence a higher tariff for the production of on-grid renewable electricity. As discussed in Section 1.5 of the Project Document (and Section A.5 and Annex E in this document), the cost of capital (i.e. cost of equity and debt) is influenced by underlying risks and barriers. In the presence of these underlying risks and barriers, the promotion of on-grid solar PV would require a significant compensation (say in the form of a conventional FiT) to make it financially competitive with the baseline technology (gas-generated power in this case). These comparisons are quantified under the 'sustainability' section above. The transformational change of the UNDP-GEF project is supported by a robust theory of change whereby the cost of capital (and hence the need for any renewable electricity compensation) is reduced by either eliminating or reducing the underlying risks and barriers. By providing an innovative and financially sounder lens to promote on-grid solar PV (also applicable to other on-grid renewables), the impact of the transformational change can be summarised as follows:

- Achieving the 2020 target of 1,238 MW in installed solar PV capacity equates to USD 1.89 billion in private sector investment;
- In the *business-as-usual scenario*, the model estimates that achieving this target will require a direct financial incentive in the form of a price premium over 20 years, valued at USD 2.26 billion. This results in a leverage ratio (the ratio of the cost of public instruments to investment catalysed) of 0.8x;
- In the *post-derisking scenario*, the model estimates that this same investment target can be achieved with a package of derisking instruments estimated at USD 300.7 million, and a lower direct financial incentive (price premium) over 20 years valued at USD 1.30 billion. This raises the leverage ratio by 50% to 1.2x, indicating a higher efficiency in terms of the costs of public instruments; and
- Taking the two scenarios together, the USD 300.7 million package of derisking instruments is estimated to create net savings to the economy of USD 960.2 million in lower direct financial incentives.

C. DESCRIBE THE BUDGETED M &E PLAN:

The project will be monitored through the following M&E activities.

Project Start: A Project Inception Workshop will be held within the first 2 months of project start with those who were assigned roles in the project organisation structure, the UNDP Country Office, as well as the coordinator of the UNDP and relevant stakeholders of the project including public, private and civil society organisations. The Inception Workshop is crucial to building ownership for the project results, to generate agreements related to the objectives of the project and to plan the first year annual work plan.

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

1. Assisting all partners to fully understand their roles and responsibilities in the project context and take ownership of the process. Discuss the roles, support services and complementary responsibilities of UNDP and the Project Board (PB) vis-à-vis the PMU. Discuss the roles, functions and responsibilities within the project's

[28] Cervigni et al. (2013).

decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for the PB and project staff will be validated.

2. Based on the validated project results logical framework, the detailed first year work plan will be finalised. This process will help review and agree on the indicators, targets and their means of verification, and re-check assumptions and risks.
3. Providing a detailed overview of the reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed on and scheduled.
4. Explaining and elaborating on the financial reporting procedures and obligations, as well as arrangements for an annual audit, if required.
5. Planning and scheduling PB meetings. Roles and responsibilities of all project organisation structures should be clarified and the meetings planned according to the milestones defined in the work plan during the first quarter of the project. The first PB meeting should be held within the first 6 months following the inception workshop.

An Inception Workshop report will be drafted and shared with the participants. This document will serve as a key reference document and as a way to formalise various agreements and plans agreed on during the meeting.

Quarterly: The Project Manager will report progress made using the reporting format provided by UNDP. Based on the initial risk analysis submitted, the risk log will be regularly updated. Risks become critical when the impact and probability are high. Note that for UNDP-GEF projects, all financial risks associated with the financial instruments proposed as part of the project 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).

The UNDP Implementation Officer will hold quarterly meetings with the PMU, or more frequently if necessary. This will allow the parties to conduct periodic assessments and solve problems related to the project in a timely manner to ensure smooth implementation of project activities.

Annually: The Annual Progress Report/Project Implementation Review (APR/PIR) will be the responsibility of the UNDP Implementation Officer with support from the PMU. This report is prepared to monitor progress made since project start, especially for the previous reporting period. The APR/PIR combines both UNDP and 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
- Annual Work Plan and other expenditure reports
- Risk and adaptive management

The PMU will develop a detailed programme of monitoring and will review meetings, consultations with partners who will implement the project and relevant stakeholders that have been incorporated into the inception workshop report. The schedule will include: (i) a tentative agenda for meetings of the Project Board and other relevant advisory and/or coordination mechanisms if appropriate, and (ii) activities related to M & E of the project.

Day-to-day monitoring of the progress of project implementation will be the responsibility of both the Project Manager and UNDP Implementation Officer, based on the annual work plan and its indicators. The Project Manager will report to the UNDP Implementation Officer any delays or difficulties that take place in the project development, for the adoption of corrective measures in time and support or appropriate remedial actions.

Mid-Term of Project Cycle: The project will undergo a Mid-Term Review by an independent consultant at the mid-point of project implementation (July 2018). The Mid-Term Review will determine progress being made toward the achievement of outcomes, and will identify course corrections if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; it will highlight issues requiring decisions and actions; and will present initial

lessons learned about project design, implementation and management. The findings from this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organisation and timing of the Mid-Term Review will be decided after consultation between the parties regarding the project document.

A GEF Climate Change Mitigation Tracking Tool will be completed at the mid-term of the project.

End of Project: A Terminal Evaluation Report will be prepared by an independent evaluator during a three-month period prior to the final PB meeting. The terminal 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 takes place). The terminal evaluation will look at the impacts and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals.

A GEF Climate Change Mitigation Tracking Tool will be completed at the end of the project.

Audit Clause: The audit will be conducted in accordance with UNDP financial rules and regulations and applicable audit policies on UNDP projects.

The M&E work plan and budget are summarised in the table below.

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	Project Manager, PSC, UNDP Nigeria, UNDP-GEF	Indicative cost: $5,000	Within first two months of project start up
Measurement of Means of Verification of project results.	UNDP Nigeria / Project Manager & M&E Expert	None	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 Project Manager Project team	To be determined as part of the Annual Work Plan's preparation.	Annually, prior to ARR/PIR and the definition of annual work plans
ARR/PIR	Project Manager and team UNDP Nigeria, UNDP-GEF	None	Annually
Periodic status/ progress reports	Project Manager and team (PB)	None	Quarterly
Mid-Term Review	Project Manager and team (PB) UNDP Nigeria, UNDP-GEF External Consultants (i.e. review team)	Indicative cost: $23,900	At the mid-point of project implementation
Terminal Evaluation	Project Manager and team (PB) UNDP Nigeria, UNDP-GEF External Consultants (i.e. evaluation team)	Indicative cost: $34,400	At least three months before the end of project implementation
Audit	UNDP Nigeria Project Manager and team (PB)	Indicative cost per year: $3,500 for a total of $17,500 (for 5 years)	Yearly
Visits to field sites	UNDP Nigeria Government representatives (PSC)	For UNDP-GEF project, paid from IA fees and operational budget	Yearly
TOTAL indicative COST Excluding project team staff time and UNDP staff and travel expenses		**$US 80,800**	

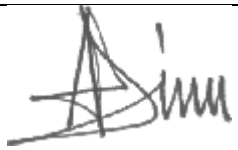
PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)

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)*
Momoh Tahor ABU	Director and GEF OFP	**FEDERAL MINISTRY OF ENVIRONMENT**	13 FEBRUARY 2013

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		January 18, 2016	Faris Khader Regional Technical Advisor EITT	+251 91 250 3307	faris.khader@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 CPD: Promote initiatives for access to renewable and rural energy; and Build capacity to develop, coordinate and monitor energy diversification policy and strategy for equitable energy access.
Country Programme Outcome Indicators: Renewable energy policy and strategy available and implemented; Number of people accessing renewable energy.
Primary applicable Key Environment and Sustainable Development Key Result Area: Catalyzing environmental finance.
Applicable GEF Focal Area Objective: GEF-5 FA Objective: #3 (CCM-3): "Promote Investment in Renewable Energy Technologies"

Objective/ Outcomes	**Indicators**	**Baseline**	**Targets End of Project**	**Source of verification**	**Risks and Assumptions**
Objective: The objective of the project is to support the Federal Government of Nigeria (FGN) in the development and implementation of a NAMA in the energy	- A NAMA developed for the Nigerian power sector (NPS) - Quantity of renewable electricity generated by on-grid baseline projects (MWh/year) - Quantity of direct GHG emissions	- No NAMA for the energy sector - No MRV system for monitoring GHG emission reductions in the energy sector - Proposed 100 MW PV plant in Bauchi State becomes operational but with deficiencies (e.g. significant	- A NAMA developed for the NPS and submitted for registration with the UNFCCC NAMA Registry - 262 GWh/yr is generated by 100 MW PV plant in Bauchi State - Emissions reductions: • Total direct emission	- Project reports (Quarterly, Annual, PIR, MTE, TE) - Minutes of PSC - UNFCCC NAMA Registry - Power sector GHG inventory report (National Inventory Reports) - MRV mechanism or technology-specific MRV mechanisms	- The Government of Nigeria maintains its commitment to its voluntary GHG abatement initiatives through NAMAs, especially in the energy sector - Detailed sectoral inventory is established and operational - MRV mechanism(s) developed

sector, namely a RE NAMA for the Nigerian Power Sector (NPS).	resulting from the baseline projects and power sector NAMA (tCO_2/year)	policy and financial risks))	reductions of 452,000 tCO_2 between 2017 and 2020		- Implementation barriers (regulatory, financial, technical, technological) have been reduced or overcome
Outcome 1: A coherent derisking approach is established for catalysing private sector investment to implement renewable energy power sector NAMA.	- Number of policy and financial derisking instruments designed using DREI analysis and implemented - Number of national guidelines - Standardised baseline for calculating GHG emission reduction for on-grid RE	- No methodology is used to quantify risks that hinder investments in RE, and to develop policy and financial derisking instruments to promote large-scale private investments. - Social and environmental safeguards for RE projects do not meet international standards - No baseline exists to calculate emission reductions for grid connected RE - No technology action plans RE projects	- At least 3 policy and financial derisking instruments have been assessed using DREI analysis based on work initiated in the development of the project document. - 3 TAPs developed by the end of Year 3 - An MRV mechanism is developed for the power sector, including a standardized baseline for national grid developed in Year 1 and updated on a yearly basis	- Project reports (Quarterly, Annual, PIR, MTE, TE) - Minutes of PSC - DREI reports - Report on the design and operationalisation of the environmental and social safeguard guidelines - Standardized baseline for national electricity system - Report on the MRV mechanism - 3 NAMA technology action plans	- GoN supports the facilitation of private-sector investment in the energy sector

Outcome 2: Public instruments are developed and implemented for derisking the national policy environment.	- Number of public instruments developed and implemented (e.g. trainings delivered to IPPs, RE resources assessments, environmental and social safeguard guidelines, RE IPPs benefiting from trainings) - Investments in on-grid utility scale RE projects	- Limited availability of local capital because of the risk perception of the financial sector - No GIS-based tool to provide the practicable RE potential is available - Limited capacity in public and private institutions to plan, implement, monitor and evaluate RE projects - Lack of internationally-benchmarked social and environmental safeguards	- A study on domestic financial sector reform to unlock low-cost local capital for green investment is carried out - A GIS based tool is developed to identify practicable RE (PV, wind and biomass) sites in Nigeria - A set of social and environmental safeguard guidelines is developed for all utility-scale RE by the end of Year 1 based on international standards - The Lagos Energy Academy are capacitated to deliver RE trainings to IPPs, undergraduate students, and public institutions on a cost-recovery basis - A lessons learned report is developed to captured best practices for dissemination (Year 5)	- Project reports (Quarterly, Annual, PIR, MTE, TE) - Report on financial sector reform - GIS-based resource assessment tool - Lessons-learned report	- GoN maintains its commitment to monitor, report and verify its voluntary NAMA initiatives - Beneficiary institutions have the human and institutional capacity and willingness to collaborate
Outcome 3: The NPS RE NAMA is operationalised by demonstrating a proof-of-concept grid connected solar	- Emission reductions from grid-connected PV power - Number of households benefiting from electricity generated by PV	- Baseline project implemented with identified deficiencies - No MRV system for NPS NAMA	- 113,150 tCO_{2e}/year from 100 MW PV plant in Bauchi State (452,000 tCO_{2e} between 2017 and 2020) - 295,000 households benefiting from PV by the end of the project	Project reports (Annual, PIR, MTE, TE) and minutes of PSC	- Baseline projects do not suffer major alterations in scope or financing - Grid-connected, utility-scale private sector projects are supported through power sector liberalization - Standardised baseline

PV plant with quantified GHG emission reductions.	plants (households/year)[29]				for national grid has been developed - National MRV system is in place

[29] The targets are based on average electricity consumption of approximately 879 kWh/household in 2011 calculated using the following data: (1) population = 164,728,579 persons (Annual Abstract of Statistics, 2012); (2) average number of persons per household = 5.9 - http://www.kwarastate.gov.ng/statistics/population/householdsizeandcharacteristics.php; and (3) per capita electricity consumption = 149 kWh/person (World Development Indicators, 2014).

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).

Response to GEFSec Comments dated January 11, 2016

Secretariat Comment	UNDP Response	Reference
13. Comment on the project's innovative aspects, sustainability, and potential for scaling up. • **Assess whether the project is innovative and if so, how, and if not, why not.** • **Assess the project's strategy for sustainability, and the likelihood of achieving this based on GEF and Agency experience.** • **Assess the potential for scaling up the project's intervention.** Not completed at this time. There is some confusion in paragraphs on innovation, sustainability and scaling up (pages 21 and 22). For example, De-risking Renewable Energy as one of the Nationally Appropriate Mitigation Actions (NAMA) might be a new government initiate. If so, it should be described in the paragraph of "Innovation". Please re-write a short paragraph for each of the following topics: 1. Innovation; 2. Sustainability; 3. Scaling up; and 4. Impact of transformational change of the project on the RE development in the country.	The comments and suggestions of the GEF Secretariat have been duly considered and the following paragraphs have been added: <u>Innovation</u> As discussed in Section 1.1.5 in the Project Document, Nigeria is yet to develop and submit any NAMA to the UNFCCC. Consequently, Nigeria has not capitalised on using NAMAs as a means to attract international climate finance, and also as a potential means to implement its post-2020 INDC. The project is innovative, since it is the first national initiative that will allow Nigeria to develop a sector-wide NAMA based on UNDP's derisking approach (see Section 1.5 in the Project Document and Annex E below). The UNDP-GEF project will therefore pave the way for Nigeria to develop NAMAs in other sectors, and also for off-grid RE applications. Other elements of innovativeness stem from migrating from a conventional, project-based approach to a sector-wide transformational approach that will also include the testing and implementation of novel policy and financial derisking instruments to scale-up the diffusion of renewable energy technologies. The innovativeness aspect of the derisking approach is that funding for on-grid renewables comes at a lower social cost compared to providing a feed-in tariff to promote the same technologies in the presence of underlying risks. The derisking approach will contribute to the financial sustainability of promoting private investments in on-grid renewable energies as discussed below. <u>Sustainability</u> The following paragraph has been added to the existing text. 'The sustainability of the project also rests on the collaboration with existing initiatives (see Section 1.3.2 in Project Document), and developing partnerships with national institutions and also developing institutional capacities. For instance, as discussed in Section 2.2 of the Project Document, the NERC is being assisted by the GIZ (through the	CER: pp. 21-22 CER: pp. 22-23; Prodoc: pp. 65-66

Secretariat Comment	UNDP Response	Reference
	NESP – see Section 1.3.2.2 in Project Document) to review the feed-in-tariffs under MYTO II. Since the GIZ is already supporting the NERC with MYTO II, one of the proposed changes to the project design (see Above) is that the UNDP-GEF project will not specifically work on FiT review or its design. Based on the experience with collaboration with the GIZ in Tunisia where a similar UNDP-GEF derisking RE NAMA project is being implemented (Section 2.2 in Project Document), the results of the derisking analyses (which will be carried out periodically by the ECN – see below) will be shared with the GIZ and NERC to support the FiT review process that will be carried out periodically as the underlying risks and barriers change. Further, there will be capacity building of local institutions, such as transferring the technical capacity to the ECN for the periodic application of the DREI analyses to track the risk profile regarding renewable energy investments in Nigeria. Also, the UNDP-GEF project will build a partnership with the LEA to provide technical backstopping for private project developers, and this will complement the ongoing initiatives under the NESP. The collaborations and institutional capacity development are discussed in Sections 2.2. The table below (not shown here) summarises the interactions of the UNDP-GEF project with other institutions (international development partners and domestic institutions) across the different risk categories and proposed public derisking instruments.' <u>Scaling up</u> The title of the section has been changed from 'replicability' to 'scaling up', and the following paragraph has been added before the existing text that are deemed to be relevant to the scaling up efforts afforded by the UNDP-GEF project. 'The successful implementation of the project, including its sustainability, will provide a template for scaling up on-grid RE projects given the size of RE potential in Nigeria. As discussed in Section 1.2.5.3 of the Project Document, the target for on-grid solar PV is 1, 238 MW by 2020, and increasing to 9,900 MW by 2030 (Table 9 in Project Document). Given the fact that there are no on-grid solar PV applications in Nigeria to date, and that the 100 MW solar PV baseline project in Bauchi State represents the most advanced project in its design and conception, the UNDP-GEF has the capacity to unlock large-scale solar PV projects in Nigeria	CER: p. 23; Prodoc: p. 67

Secretariat Comment	UNDP Response	Reference
	through a sectoral NAMA by proposing a derisking approach combined with collaboration with international and national institutions. Further, the UNDP-GEF project will provide the foundations (practical resources assessments and DREI analyses) for on-grid wind and biomass projects.' <u>Impact of transformational change on RE development</u> The following text has been added: 'A high cost of capital is a significant deterrent for investments in renewable energies such as solar PV. In turn, a high cost of capital would imply the need for higher returns, and hence a higher tariff for the production of on-grid renewable electricity. As discussed in Section 1.5 of the Project Document (and Section A.5 and Annex E in this document), the cost of capital (i.e. cost of equity and debt) is influenced by underlying risks and barriers. In the presence of these underlying risks and barriers, the promotion of on-grid solar PV would require a significant compensation (say in the form of a conventional FiT) to make it financially competitive with the baseline technology (gas-generated power in this case). These comparisons are quantified under the 'sustainability' section above. The transformational change of the UNDP-GEF project is supported by a robust theory of change whereby the cost of capital (and hence the need for any renewable electricity compensation) is reduced by either eliminating or reducing the underlying risks and barriers. By providing an innovative and financially sounder lens to promote on-grid solar PV (also applicable to other on-grid renewables), the impact of the transformational change can be summarised as follows: • Achieving the 2020 target of 1,238 MW in installed solar PV capacity equates to USD 1.89 billion in private sector investment; • In the *business-as-usual scenario*, the model estimates that achieving this target will require a direct financial incentive in the form of a price premium over 20 years, valued at USD 2.26 billion. This results in a leverage ratio (the ratio of the cost of public instruments to investment catalysed) of 0.8x; • In the *post-derisking scenario*, the model estimates that this same investment target can be achieved with a package of derisking instruments estimated at USD 300.7 million, and a lower direct financial incentive (price	CER: p. 24; Prodoc: pp. 68-69

Secretariat Comment	UNDP Response	Reference
	premium) over 20 years valued at USD 1.30 billion. This raises the leverage ratio by 50% to 1.2x, indicating a higher efficiency in terms of the costs of public instruments; and • Taking the two scenarios together, the USD 300.7 million package of derisking instruments is estimated to create net savings to the economy of USD 960.2 million in lower direct financial incentives.'	
26. Is CEO endorsement/approval being recommended? Not at this time. Please address the comment in box 13.	All technical comments have now been addressed. We look forward to receiving the CEO endorsement.	

GEFSEC Review Comments	Response
Please address the following items by the CEO Endorsement stage:	
(a) It is expected that the CEO endorsement request will detail how component 4 will validate through real case implementation each of the activities proposed in components 1 to 3.	In the redesigned project, Component 4 in the PIF is now Component 3, and it consists of the 100 MW baseline solar PV project. The baseline project will be linked with the outputs of Components 1 and 2 (noting that Component 3 in the PIF has been eliminated) in the following ways: • The private developers (NSCP) of the baseline project have participated in the DREI interviews that were carried out during the project design, and being the first of its kind in Nigeria, the project design has benefited significantly from their unique experience. For instance, the NSCP played an instrumental role in validating the underlying barriers and risks shown in Table 13, the public instruments shown in Table 14 of the Project Document, and to test the assumptions made in the DREI analyses (Section 1.5 and Annex 7.2 of the Project Document, and Annex E in this document); • Since the baseline project is currently in the process of negotiating a PPA, the results of the derisking analysis shown in Section 1.5 of the Project Document may be used to guide the negotiation process. Further, as discussed above, the DREI analysis provides an opportunity for developing incentives in the form of 'proxy FiT' that has better public financing leverage ratios. In collaboration with the NESP initiative of the GIZ, a derisking approach can be used for the review of MYTO-II concerning FiTs for renewable electricity. Section B.3 above and Annex E give more details about the use of the risk-adjusted approach to designing incentives for renewable electricity. The baseline project will not receive any financial incentives. The

	incrementality of GEF investment support to the baseline project is justified on the basis of the specific design flaws that were described in Section 1.3 and that are further discussed below; • The MRV system that will be developed under Output 1.3 will be applied to the baseline project in order to monitor its performance in terms of GHG emission reductions; • Since the baseline project has completed the social and environmental screening of the WB, its experience will be used to achieve the targets of Output 2.3; and • Based on its experience in interacting with the WB and AfDB (and other financial institutions), the developers of the baseline project will be closely consulted during the identification of the optimum set of public derisking instruments that will be most effective for solar PV in Nigeria, as well as designing the financial derisking instruments that will be capitalized under Component 1.
(b) Please note that the CEO endorsement request is not expected to include activities to design the details of a policy-financing mix. The PPG requested is expected to clarify all elements of the project design.	The elements of the project design are: (1) consideration given to ongoing initiatives to promote renewable energy in the power sector that have been elaborated at A.3 and A.7 above, and that are discussed in Section 1.3.2 of the Project Document; and (2) using DREI analyses as discussed in Section 1.5 and Annex 7.2 of the Project Document, and as summarised in Annex E in this document. The DREI methodology is being adopted in several ways that are informed by the prior application of the methodology in the design and implementation of a UNDP-GEF project in Tunisia that is entitled 'NAMA Support for the Tunisian Solar Plan'. The DREI methodology has been carried out during the PPG stage to inform the design of the project outputs – i.e. Component 1 and Component 2. Secondly, the DREI methodology will be used on an on-going basis as part of the policy cycle to support government in tracking the risk profile of the Nigerian investment environment regarding renewables. This is discussed at (e) below.
(c) The complementarity of the project's activities with the activities of the EC/GIZ project is expected to be detailed at CEO endorsement stage.	As discussed in Section A.3, and following the response to comment (a) of the GEF Council Member for Germany in the next table, the UNDP-GEF project has been redesigned taking into account the NESP (and the initiatives of other development partners). This has ensured that the UNDP-GEF project does not duplicate ongoing initiatives, and rather brings complementarity with these initiatives.
d) At CEO endorsement, detailed explanations are expected as to how the proposed de-risking instrument will enable renewable energy project to have be competitive vis-à-vis fossil fuel-based power generation projects considering the WB-	The DREI analysis considers nine different risk categories as discussed in Annex E. The partial guarantee scheme is a financial derisking instrument that can be used to mitigate counter party risk. In the DREI analysis, the LCOE of solar PV (or any other on-

supported partial guarantee scheme.	grid renewable) is compared with the LCOE of the baseline fossil fuel technology, which in the case of Nigeria is gas-fired thermal generation. The analysis given in Section 1.5 and Annex 7.2 of the Project Document, and Annex E of this document clearly show that the LCOE of solar PV is reduced from USD 10.5 cts / kWh in the business-as-usual (BAU) situation to USD 7.7 cts / kWh when derisking instruments are put in place making it more competitive with gas-generated electricity. This is the result of the decreasing cost of equity (18% in BAU to 14.8% with derisking) and debt (8% in BAU to 6.6% with derisking) when public derisking instruments are put in place. Further, the key conclusion from the modelling is that investing in derisking measures, bringing down the financing costs of solar PV in Nigeria, appears to be highly cost-effective when measured against paying direct financial incentives to compensate investors for higher risks. As shown in Annex E, investing in a USD 300.7 million package of derisking instruments is estimated to create net savings to the economy of USD 960.2 million in lower direct financial incentives. The derisking instruments also reduce the GHG abatement cost by 29% compared to the BAU situation. Instead of using scarce public funds to pay higher electricity tariffs (for instance, in the form of a premium feed-in tariff), it is advantageous to first target specific investment risks (for example, those associated with grid/transmission, counterparty risk, financial sector risk), thereby changing the fundamental risk/reward profile that energy investors face in Nigeria.
e) It is expected that, at CEO endorsement stage, details will be provided on the expected duration and evolution over time of the de-risking instruments and on the rationale behind these elements.	As discussed in the Project Document, and as an integral part of Component 1 of the project, the DREI analyses will be carried out at the beginning of project implementation based on the preliminary analyses that have been carried out during the PPG Phase. Since the risk profile of the country will evolve over time, and also to better understand the impacts of the GEF-funded project (as well as the impacts of other ongoing initiatives), the DREI analyses will be repeated towards the end of the project. This will form part of the M&E of the project and can be included as part of the final evaluation of the project. The approach that will be adopted by the project is to capacitate the government institutions that will participate in the DREI analyses during the implementation phase to be able to carry similar analyses on an ongoing basis after then project lifetime. In this way, the DREI methodology will become a tool within the toolbox of policy decision makers that can be used to frame policies and do design public derisking instruments.

f) It is expected that, at CEO endorsement stage, details will be provided on the business model proposed to sustain the activities of the entity taking over the responsibility for provision of technical assistance, training and advice for IPPs beyond the project duration.	Project development facilitation will be supported by the project under the new Component 2. Project development facilitation, including technical assistance, training and advice for IPPs, is a measure that can be used to address underlying barriers for several risk categories that cut across the entire technology chain. Specifically for solar PV, the project will collaborate with the Lagos Energy Academy (a co-financer in the UNDP-GEF project) for the provision of project development facilitation through specialised trainings to private stakeholders that have an interest in renewable energy development in the power sector. The services will be offered using a cost-recovery approach that is already in place at LEA. Project development facilitation could take the form of training on the steps to follow to acquire permits and licenses to financial modeling of a RE project to maintenance of hardware to carrying out resources assessments to integration of renewable electricity into the grid. Discussions with the LEA have shown that while it has state-of-the-art training and laboratory facilities (see Section 1.3.2.3 of the Project Document), it will require incremental support: • To develop a medium-to-large-scale solar PV safety and commissioning standard training that will focus on the prevention of unnecessary damage to equipment and persons during large-scale PV installations and operation; • To set up a solar PV Troubleshooting and Maintenance Center that will be established in partnership with major PV equipment manufacturer (to be confirmed during project implementation) to support local PV industry, improve local O&M skills and mitigate resource & technology risk. The LEA has already constructed the building for a solar park and set-up a solar testing laboratory; • To develop solar PV financial modeling and risk analysis training for banks in partnership with Siemens. Hopefully with more knowledge, financial sector reform (see Component 1) for renewable energy projects can be encouraged. A similar training has been conducted by LEA/Siemens for Stanbic IBTC bank but needs to be improved and developed further; and • To develop guidelines and standards for solar PV that could be adapted to National Policies. These guidelines and standards will be accompanied by short how-to guides and videos. This will help raise awareness as well as increase social acceptance and demystify solar PV.

The comments from the GEF Council Member from Germany are addressed below. Please note that there are several overlaps between these comments and those made by the STAP and the GEF Secretariat.

GEF Council Review Comments	Response
Germany has major concerns about approving this project proposal as there are large overlaps in the components 1-3 with the existing Nigerian Energy Support Programme (NESP) and also with other activities supported by different donors like DFID's Nigerian Infrastructure Advisory Facility. It is only the activities foreseen under component 4 that are complementary and could represent a value added to existing activities. Further, there has not been any coordination with NESP or GIZ during project preparation and the mentioned co-financing by GIZ is not agreed upon. The GEF proposal states that implementation was not a scope of NESP. However, actually the focus of NESP is on implementation.	During the project preparation phase, based on (i) discussions with the FGN and development partners such as GIZ, NIAF/DFID, the WB and the AfDB (please see previous discussions) during an in-country mission carried out in March 2015, (ii) the GEF Secretariat review of the PIF and recommended changes at PPG, (iii) the comments from the GEF Council Member from Germany on the PIF in the November 2013 work programme; and (iv) the STAP advisory response and guidance, the project has been redesigned. The redesigned project, including the reformulated strategic results framework and institutional arrangement, was presented to all the stakeholders, including development partners such as GIZ, at a validation workshop on Friday 20 March 2015. The main changes that have been carried out are: 1. Component 3 (Grid management to absorb intermittent but predictable renewable energy) in the PIF has been eliminated because all the formerly proposed outputs are already being implemented by GIZ, DFID/NIAF and the WB through the initiatives discussed above. Hence, the reformulated project has only three components as will be discussed below (please also see Section 3 of the Project Document); 2. UNDP's DREI methodology has been given a more central role in the design of the reformulated project in order to address underlying barriers and resulting risks that lead to the increasing cost of capital for renewable energies. As discussed in Section 1.5 of the Project Document, the DREI approach is supported by the theory of change that the occurrence of negative events due to underlying barriers, and the financial impacts of these negative events result in a higher level of risk that translates to higher costs of capital (equity and debt). In this respect, Components 1 and 2 that were proposed in the PIF have been retained, but interchanged in their respective sequencing in order to reflect the use of DREI as a cornerstone tool in the project redesign. The outputs/activities related to the interchanged Components 1 and 2 have been updated based on a review of the current baselines that have changed since April 2013 when the PIF was cleared; taking into account the ongoing initiatives related to grid-connected electricity generation that are discussed above and in Section A.7. (please see Sections 1.3.2.2 and 1.3.2.3 of the Project Document); and taking into account the needs of national stakeholders, including the review comments discussed in Annex B. Hence, the new outputs will complement the existing policy and financial measures that are already in place in the

	baseline; and 3. Component 3 (i.e. Component 4 in PIF) of the project has been retained and designed to explain how the outputs from Components 1 and 2 of the redesigned project will either be validated or benefit from the experience of the 100 MW solar PV baseline project. It is argued using incremental reasoning (see Section A.5 below) that the current design of the 100 MW solar PV project in Bauchi State has deficiencies that will reduce its performance. Through an investment component, these deficiencies will be overcome. It is also pointed out that the changes were validated at a multi-stakeholder meeting that included the GIZ that took place in Abuja on Friday 20 March 2015.
b) Component 1: The implementing entity of the NESP, GIZ, is currently advising on the finalization of a renewable energy policy. The development of a standard Power Purchase Agreement for on-grid renewable energy RE has already been developed under an USAID-funded programme. Hence, by the beginning of the GEF-funded project, the outputs of component 1 will probably have already been achieved.	This comment has been fully integrated in redesigning the project. Based on this fact, the output related to developing a standardised PPA has been dropped in favour of alternative outputs that address outstanding gaps/barriers that have been identified by stakeholders and/or suggested by reviews from the GEF Secretairat and the STAP. Please note that Component 1 in the PIF is now Component 2 in the Project Document. The outputs proposed under Component 2 are: Output 2.1: A study on domestic financial sector reform to unlock low-cost local capital for green investment is carried out Output 2.2: A GIS based tool is developed to identify practicable RE (PV, wind and biomass) sites in Nigeria Output 2.3: A set of social and environmental safeguard guidelines is developed for all utility-scale RE based on international standards (e.g. World Bank) Output 2.4: The Lagos Energy Academy is capacitated to deliver RE trainings to IPPs, undergraduate students, and public institutions on a cost-recovery basis Output 2.5: A lessons learned report is developed to capture best practices for dissemination (website, publications, manuals, participation in national, regional and international conferences and fora etc.) and to demonstrate an architecture for leveraging private investments and climate finance using a risk-adjusted approach
c) Component 2: Under NESP, GIZ is in discussions with the Federal Ministry of Power of analyzing de-risking mechanisms and developing respective instruments.	Please note that discussions with the GIZ during in-country mission carried out in March 2015 revealed that the GIZ did not have a quantifiable methodology for analysing risks and for developing the impacts of public derisking instruments on different risks. All the results

	of the preliminary DREI analysis have been shared with the GIZ team in Abuja. Please also note that other development partners such as the World Bank and AfDB have assessed the derisking methodology that is being implemented by the UNDP as being a novel contribution for assessing the usefulness of interventions in on-grid renewable energy projects. It is further pointed out that the DREI methodology is currently being implemented under a UNDP-GEF project in Tunisia, and the design and implementation of the DREI analysis has been carried out in close collaboration with the GIZ. Finally, as discussed at (g) below, the DREI methodology can provide useful input to develop feed-in-tariffs through the technical assistance of the GIZ under the NESP.
d) Component 3: Under NESP, GIZ has commented on the grid codes and offered support in aligning them with the requirements of on-grid RE as well as further advising on grid and system integration of RE. Furthermore, a number of other donors are engaged particularly in the energy transmission and distribution sector.	As mentioned at (a), Component 3 proposed in the PIF has been eliminated because all the originally proposed outputs were already being implemented by various development partners such as the GIZ (The NESP), DFID (NIAF) or the WB.
e) The project's aim of increasing the RE share up to 10% by 2020 (excluding hydro power) seems very ambitious against the background that only small capacities of solar and wind systems are used to date. The rationale for focus on wind and solar energy is not clear and shall be explained.	As discussed in Section 1.2.5.3 of the Project Document, Nigeria has set itself challenging targets for renewable energies. For instance, please see Tables 7, 8 and 9 in the Project Document. The technologies covered include hydro power, solar power, wind energy, and biomass. Out of these, the most developed technology is hydropower. There are to date none of the other forms of power generation in Nigeria. Given the ambition of the Federal Government of Nigeria to promote indigenous forms of renewables, then the baseline situation shows that there are prevailing barriers and risks that hamper the implementation of these renewable forms of energy. Given that the GEF seeks to provide funding for removal of barriers and the elimination/reduction of risks, this project focuses on risks that prevent private sector investments in solar, wind and biomass energy. Immediate attention is given to solar energy since it has the largest share among the three sources of energy (please see Table 8 of the Project Document). In addition, and as discussed at (h) below, there has been no attempt today to look at private sector investments in renewable energies from the perspective of risks and opportunities (through derisking instruments). UNDP's DREI methodology is well suited to assessing on-grid renewables such as solar PV and wind energy. Also stakeholders, including the GIZ and the Presidential Task Force on Power, have suggested that the project should also cover wind and biomass energy since these renewable energy sources have generally received least attention. This is the

	reason why Outputs 1.1, 1.4 and 2.2 cover solar PV, as well as wind and biomass energy.
f) What is the national vision target of 20:2020? Which measures have been foreseen to achieve this target?	The national vision target of 20:2020 is to achieve socioeconomic transformation intended to position Nigeria among the 20 largest economies in the world by the year 2020. The NV20:2020 does not have a target for renewable energy. These are laid out in several other documents that have been developed to assist Nigeria achieve NV20:2020. For example, these are the National Energy Policy 2013 and the National Energy Master Plan 2014 that are discussed in Section 1.2.5.3 of the Project Document. The main strategies that have been enumerated to support the NV20:2020 through the promotion of renewable energy sources are listed in Table 4 of the Project Document.
g) Relating to component 2 it remains unclear what the new tariff regime put in place in mid 2012 consists of.	In the PIF, this was referring to the Multi-Year Tariff Order (MYTO) II. However, this is not relevant to the redesigned project since the output on developing feed-in-tariff for renewables has been removed because of the support that the GIZ is providing NERC under the NESP. As is discussed under Component 2, the results of the detailed DREI analyses, when used in conjunction with the GIS-based resource assessment and RE project siting, provide an opportunity to support ongoing initiatives under the NESP (supported by the GIZ) that is providing technical support to NERC to review FiTs for renewable electricity. As shown in Section 1.5 of the Project Document, when FiTs are developed as a direct compensation mechanism for renewable electricity while risks and underlying barriers persist in the baseline, the social cost of the FiT is higher when compared to the case when public derisking instruments are implemented before any residual risks are compensated for in the form of what is here called a 'proxy FiT'. More details about the cost effectiveness of derisking RE investments as opposed to direct compensation without derisking are given in Annex E.
h) Germany recommends explaining the rationale for considering only on-grid renewable energy systems. Given that 80 per cent of the poor population in rural Nigeria have no access to electricity and that feeding power grids from small scale RE systems could result in additional costs, it is not clear why off-grid systems are not taken into consideration, especially for rural areas.	To date, such a holistic approach to derisk on-grid renewable energy investments has not been attempted in the Nigerian power sector. As is discussed in Section B.3, derisking instruments offer a more cost effective approach to catalyzing private investments than for instance a pure tariff compensation in the form of a FiT. Hence, the derisking approach offers the opportunity to design incentives for promoting renewable electricity in a more rational way. Further, it is pointed out that the UNDP is currently designing an off-grid project under GEF-6 for which a Letter of Endorsement has been secured from the Nigerian GEF Operational Focal Point. Also, the fact there are still no on-grid renewables in Nigeria shows that there are prevailing barriers and risks

	to private sector investments. By building on past initiatives (e.g. the GEF-UNIDO biomass project – Section A.7), and collaborating with ongoing initiatives (e.g. GIZ-implemented NESP and the AfDB and WB support to on-grid solar PV, including the baseline 100 MW solar PV project discussed above), the UNDP-GEF project aims to develop a single and coherent Nigerian Power Sector RE NAMA. Solar PV is the chosen technology for demonstrating the development of the NAMA. This approach will serve to market the NAMA as an integrated package to attract financial (international, bilateral, public and private sector) support. The core components of the RE NAMA will cover: clear long-term targets (such as those discussed in Section 1.2.5.3 of the Project Document), a public instrument package to create an enabled investment environment, assessment of costs and incremental costs, assessment of global environmental benefits, and MRV/indicators. The application of these elements of using the example of grid-tied solar PV can be replicated to other on-grid renewables. In fact, the preliminary DREI analyses that have been carried out to design the project will be further detailed during project implementation, as well as an extension of similar analyses to wind and biomass energy. Finally, the project idea was endorsed by the GoN as on-grid RE generation is seen to be a national priority.

STAP Review Comments	Response
1. What is the rationale for considering only on-grid renewable energy systems? Why not off-grid renewable energy applications, particularly for rural areas. Feeding power grids from small scale renewable energy systems could lead to additional costs and technological requirements.	Please see response to the same comment – i.e. (h) in the previous table – that was raised by the GEF Council Member from Germany.
2. The PIF mentions only solar and wind energy based renewable energy systems. Why not small hydro and biomass heat and power systems (assuming there is no geothermal resource and ocean energy is still immature)? The STAP recommends the consideration of different renewable energy technologies for each given region based on techno-economic assessments.	Please see responses to comments (e) and (h) from the GEF Council Member for Germany in the previous table.
3. Selection of pilot investments to finance projects should be based on techno-economic analysis of different renewable energy options.	The UNDP-GEF project does not seek to invest in pilot projects for which the requested techno-economic analysis would have been required. Instead, the UNDP-GEF project is investing in a baseline project that has carried out detailed techno-economic, social and

	environmental feasibility studies. It is pointed out that the 100 MW solar PV project by Nigeria Solar Capital Partners is receiving the support of the WB and AfDB (please see Section 1.3.1 of the Project Document) through the Clean Technology Fund showing that the baseline project is technologically and financially sound. However, the baseline project has been found to have design deficiencies that the UNDP-GEF project will seek to address in order to successfully generate global environmental benefits. The incremental reasoning is discussed in Section A.3 above.
4. Setting up of targets for renewable energy should also be based on techno-economic assessment of different renewable energy options and the available resources.	While this may be desirable, techno-economic assessments were not possible in the absence of detailed renewable energy resources availability. Instead, the UNDP-GEF project has utilised a top-down approach using targets that appear in official government sources such as the National Energy Master Plan 2014. In order to address the barrier and risk arising from the lack of detailed renewable energy resources, and taking into account comment 14 below, the redesigned project has included an output under Component 2 to carry out resources assessment for solar PV, wind and biomass energy. The response to comment 14 below provides more details.
5. For any on-grid renewable energy systems, there is a need for assuring a stable, year-round supply of power if expensive back-up systems are to be avoided. The proposed project should also consider the variability and seasonality of certain renewable energy systems and make provisions for addressing these.	It is pointed out that the DREI analyses have taken into account the need for firm power back up when considering on-grid renewable energy systems that are intermittent. Please see Annex 7.2 of the Project Document for details of the assumptions used in DREI analyses.
6. What is the scale of renewable energy systems proposed in the project? Will it be kilowatt scale or megawatt scale or large multi-megawatt scale plants?	The scale of renewable energy systems considered in the UNDP-GEF project is grid-connected renewable energy projects of the order of 10 – 100 MW. For instance, the baseline project is a 100 MW solar PV project. The scale of projects considered here is commensurate with the multi-megawatt installed capacity targets for solar PV, wind energy and biomass energy envisaged in the NEMP 2014. Please see Table 7 and Table 8 of the Project Document.
7. The PIF states that the tariff for electricity is very low. In such a scenario how can the government best make investment in renewable energy systems attractive for private investors, unless exceptional resources (solar radiation levels, mean annual wind speeds) are available. Feed-in-tariffs are an option being pursued, and it is good that an analytical approach is being pursued. Lessons can be learned from several European countries (Spain, Italy, UK, Germany) where FIT policies have been revised recently for various reasons.	In the PIF, consideration was given for the design of FiTs for on-grid renewables. However, this is no longer relevant in the redesigned project since the output on developing feed-in-tariff for renewables has been removed because of the support that the GIZ is providing NERC under the NESP. However, it is argued that the derisking approach should be considered before any incentive scheme such as a FiT is designed to incentivize renewable electricity. For more details, please see the response to comment (h) from the GEF Council Member for Germany.
8. Renewable energy systems usually need higher	As discussed in Section 1.5 and Annex 7.2 of the

up-front investments and O&M costs can also be relatively high, although fuel costs are zero (except for bioenergy plants). How will this incremental capital cost and the implications for the price of electricity be addressed in the project to make it attractive for private investors?	Project Document, and Annex E of this document, the LCOE for solar PV (or any other renewable energy sources) takes into account the up-front capital investments and O&M costs. Further, sensitivity analyses are carried out to investigate the effect of cost of technology on LCOE. With these in mind, the theory of change that underpins the DREI methodology is that higher risks translate into a higher cost of capital, regardless of the cost of the infrastructure and O&M costs. The LCOE of the renewable energy source is reduced, and made more competitive with the prevailing baseline technology which is gas-generated thermal electricity, by putting in place public derisking instruments. More details are given in Annex E below.
9. The project should also address rationalization of power tariffs and possible removal of any subsidies for fossil fuels.	The rationalization of power tariffs is being covered by the initiatives of other development partners, such as the GIZ-supported NESP (please see Section A.3 above). To avoid duplication, this is not covered by the UNDP-GEF project. As discussed in Annex 7.2 of the Project Document, the price of gas for power generation was aligned with the international market price as from 1 January 2015. At this juncture, there should be no subsidies for fossil fuels used in power generation. Should this situation change, analysis of any fossil fuel subsidies will be integrated in the detailed DREI analyses that are planned to be carried out during project implementation.
10. Technology transfer issues have to be addressed if a large-scale shift to renewable energy systems is envisaged.	Discussions with private investors, such as Nigeria Solar Capital Partners, during DREI interviews have shown that technology transfer will take place once the various risks that have been identified in the DREI analyses are either reduced or eliminated. As discussed in the response to comment (f) of the GEF Secretariat, the UNDP-GEF project will support renewable energy project development facilitation that will cover issues of technology and skills transfer.
11. The project should develop a good baseline scenario and make projections for the next 10 years at least on the share of fossil fuels, large hydro and renewable systems under the baseline scenario.	As discussed at 4 above, the project has adopted the baseline scenarios that have been developed to 2030 by the National Energy Master Plan 2014 that are summarised in Tables 7, 8 and 9 of the Project Document.
12. Two baseline projects are already in place. This GEF project will build on them, but exactly how, will need careful management and difficulties for MRV. The main problem with integrating variable renewable energy generation into an existing power supply system is to make the system more flexible. It is not clear how this will be achieved using demand-side management, better forecasting, energy storage, inter-boundary connections etc. This is complex and will require more than the	The national grid in Nigeria suffers from both voltage and frequency fluctuations that constitute significant threats to the proper integration of intermittent RE sources such as solar PV.[30] In the baseline project, these fluctuations in the national grid are not taken into account at sub-stations where renewable electricity is injected into the network. The mismatch between the voltage/frequency of electricity generated by the baseline project and the grid voltage/frequency will lead to losses and sub-optimal performance of the PV plant.

[30] Transmission Company of Nigeria (2014) Grid Operations 2013 – Annual Technical Report.

training of grid system operators, though this is an important component. It depends on the anticipated share of variables to total generation. (Chapter 8 of the IPCC Special Report on Renewable Energy, 2011, and various IEA reports on flexible grids could be useful.)	As part of the investment component, the UNDP-GEF project will support the installation of interface electronics to match the voltage of renewable electricity with that of the national grid. This will be applied to the baseline project and, once demonstrated for its effectiveness, interface electronics will be applicable to future RE projects that will form part of the Nigerian power sector RE NAMA.
13. It seems that upgrading of the network to accommodate higher shares of renewable energy is underway, and that GEF funding will build on that. However, the MRV will be difficult. Therefore, STAP recommends for the project developers to elaborate further on this aspect.	The MRV mechanism for on-grid renewables will build on proven CDM elements, such as the CDM grid emission factor tool, the tool to demonstrate additionality, baseline development and the MRV approaches adopted by CDM renewable energy methodologies. Where necessary, the UNDP-GEF project will adapt these carbon finance building blocks to serve as a 'next-generation' scaled-up NAMA approach. The detailed calculation of the combined margin grid emission factor for the electricity system in Nigeria is given in Annex 7.5 of the Project Document, and is an example of how an existing CDM methodological tool can be used to design and implement the MRV system.
14. It appears that a major gap in the project is the details of the assessments of wind and solar resources. Without these, it is difficult to undertake economic analyses or locate optimum sites (with best wind speeds). Producing a renewable energy resource assessment for the whole country should be a high priority. It takes time to obtain detailed assessments of useful accuracy with seasonal and diurnal variations. It is not clear who will do that, or even the assessments for the specific pilot projects as proposed, including the methodology and models used. (and at what resolution).	This observation by the STAP has been validated by in-depth stakeholder consultations during the PPG stage. The re-designed project has fully incorporated an output for the development of a GIS-based resource assessment tool. The UNDP-GEF project will support the development of a GIS-based tool that will provide private developers with geospatial information regarding favourable sites for developing solar PV, wind and biomass energy projects. In the first instance, the GIS-based tool will be developed using existing geospatial data and information. This output will be coordinated with the GIS-based work that is being carried out by the WB, NIAF and GIZ concerning grid extension in Nigeria. Wherever possible the GIS-based tool will use existing geospatial layers for resources assessment, grid coverage, human settlements, public infrastructure, environmentally sensitive areas (e.g. wetlands, protected areas, corridor for migrating soaring birds), and strategic infrastructure (e.g. military facilities, airports etc.), among others. Besides providing private developers with a tool to identify practical sites for RE projects, this tool will also be used to: (1) identify gaps in RE resources assessment data that may be used to redirect investments in ground measurements and surveys to assess RE resources potential; (2) coordinate and rationalise land use planning activities that have a bearing on the siting of RE projects; (3) assist policy makers to better set practicable targets for RES in the

	power sector that may provide multiple socio-economic and environmental benefits by considering electricity access, diversification of energy supply in the power sector, and job creation while at the same time taking risks to investments into consideration, and (4) provide a platform for developing risk-adjusted incentives in the form of a 'proxy FiT' as discussed under Component 1.

ANNEX C: STATUS OF IMPLEMENTATION OF PROJECT PREPARATION ACTIVITIES AND THE USE OF FUNDS[31]

A. DESCRIBE FINDINGS THAT MIGHT AFFECT THE PROJECT DESIGN OR ANY CONCERNS ON PROJECT IMPLEMENTATION, IF ANY:

There are no specific issues that might affect project implementation. The proposed project has been developed following an in-country stakeholder mission and a large number of interviews and meetings, and its design was concluded with a validation workshop that was held on Friday 20 March 2015. The GIZ participated in the validation workshop, and provided positive feedback on the redesigned project.

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

As part of the PPG process, extensive multi-stakeholder consultations were held in Abuja and Lagos, and meetings were held with the GIZ personnel working on the NESP that is covered in Section 1.3.2 of the Project Document. Extensive interviews were also held with private developers, including the proponent of the 100 MW solar PV baseline project. An important innovative element of the project development involved the application of UNDP's DREI analysis to identify public derisking instruments to catalyse private investments to implement the RE NAMA. One of the key stakeholders that was interviewed in the process was the AfDB, which is providing financial and technical support to the baseline project under the Clean Technology Fund.

PPG GRANT APPROVED AT PIF: $130,000			
PROJECT PREPARATION ACTIVITIES IMPLEMENTED	***GEF/LDCF/SCCF/NPIF AMOUNT ($)***		
	BUDGETED AMOUNT	***AMOUNT SPENT TO DATE***	***AMOUNT COMMITTED***
LOCAL CONSULTANTS	30,000	17,438	12,562
INTERNATIONAL CONSULTANT	50,000	0	54,934
TRAVEL	10,000	5,066	0
SUPPLIES	3,000	3,000	0
COMMUNICATIONS	5,000	5,000	0
TRAINING, WORKSHOPS &	30,000	2,500	27,500

[31] 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.

CONFERENCE			
MISCELLANEOUS (E.G. WORKSHOP ORGANISATION, OFFICE FACILITIES, PUBLICATION)	2,000	2,000	0
TOTAL	**130,000**	**35,004**	**94,996**

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

ANNEX E: ABBREVIATED SUMMARY OF KEY FINDINGS FROM THE DERISKING (DREI) ANALYSIS

The Derisking Renewable Energy Investment Methodology

E.1. Introducing the DREI methodology

In 2013, UNDP issued the Derisking Renewable Energy Investment report (the "DREI report") (UNDP, 2013). The DREI report introduced an innovative methodology (the "DREI methodology"), with an accompanying financial tool in Microsoft Excel, to quantitatively compare the cost-effectiveness of different public instruments in promoting renewable energy investment. The preliminary analysis of Nigeria set out in this report is based on the DREI methodology.

A key focus of the DREI methodology is on financing costs for renewable energy. While technology costs for renewable energy have fallen dramatically in recent years , private sector investors in renewable energy in developing countries still face high financing costs (both for equity and debt). These high financing costs reflect a range of technical, regulatory, financial and informational barriers and their associated investment risks. Investors in early-stage renewable energy markets, such as those of many developing countries, require a high rate of return to compensate for these risks.

In seeking to create an enabled environment for private sector renewable energy investment, policy-makers typically implement a package of public instruments. From a financial perspective, the public instrument package aims to achieve a risk-return profile for renewable energy that can cost-effectively attract private sector capital. Figure 1 below, from the DREI report, identifies the four key components of a public instrument package that can address this risk-return profile.

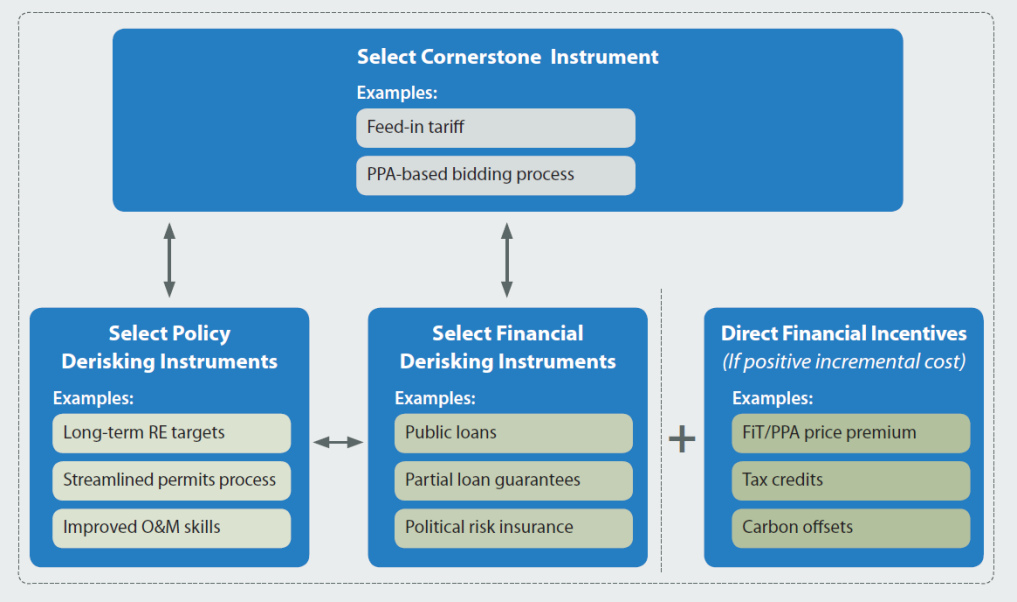


Figure 1. Typical components of a public instrument package for large-scale renewable energy. (Source: Waissbein *et al*. (2013), pg. 47)

The cornerstone instrument is the centrepiece of any public instrument package. For large-scale renewable energy, the cornerstone instrument is typically a Feed-in Tariff (FiT) or a tendering process, either of which allows independent power producers (IPPs) to enter into long-term (e.g. 15-20 year) power purchase agreements (PPAs) for the sale of their electricity. The cornerstone instrument can then be complemented by three core types of public instruments:

- **Instruments that reduce risk**, by addressing the underlying barriers that are the root causes of investment risks. These instruments utilise policy and programmatic interventions. An example might involve a lack of transparency or uncertainty regarding the technical requirements for renewable energy project developers to connect to the grid. The implementation of a transparent and well-formulated grid code can address this barrier, reducing risk. The DREI methodology terms this type of instrument "policy derisking".

- **Instruments that transfer risk,** shifting risk from the private sector to the public sector. These instruments do not seek to directly address the underlying barrier but, instead, function by transferring investment risks to public actors, such as development banks. These instruments can include public loans and guarantees, political risk insurance and public equity co-investments. For example, the credit-worthiness of a PPA may often be a concern to lenders. In order to address this, a development bank can guarantee the PPA, taking on this risk. The DREI methodology terms this type of instrument "financial derisking".
- **Instruments that compensate for risk,** providing a financial incentive to investors in the renewable energy project. When risks cannot be reduced or transferred, residual risks and costs can be compensated for. These instruments can take many forms, including price premiums as part of the electricity tariff (either as part of a PPA or FiT), tax breaks and proceeds from the sale of carbon credits. The DREI methodology calls these types of instruments "direct financial incentives".

E.2. Modeling Results

An initial DREI analysis was performed during the project design. This analysis models the selection of public instruments to attract private sector investment in utility-scale on-grid solar PV. The main results are provided in this section, and supplementary information is given in Annex 7.2 of the Project Document.

E.2.1 Risk Environment (Stage 1)

In order to assess the risk environment, an initial taxonomy of nine investment risk categories was developed for the Nigerian context. Definitions of these risk categories, together with their underlying barriers, are set out in Table 1 below.

Data on the scale of each investment risk category was obtained from structured interviews held with 5 domestic and international project developers who are considering, or actively involved, in utility-scale solar PV opportunities in Nigeria.

The results estimate that financing costs for solar PV in Nigeria today are 18.0% for the cost of equity (USD), and 8.0% for the cost of debt (USD). These are substantially higher than in the best-in-class country, Germany, which is estimated at 8.0% for the cost of equity (USD), and 4.0% for the cost of debt (USD). As is shown in later results, over the long life-time of energy investments, the impact of Nigeria's higher financing costs on the competitiveness of renewable energy is significant.

Table 1. Description of the generic risk categories and underlying barriers that were considered for the DREI analysis in Nigeria.

Risk Category	Generic Description	Underlying Barriers
Power Market Risk	Risk arising from limitations and uncertainties in the power market, and/or sub-optimal regulations to address these limitations and promote renewable energy markets	• *Market outlook*: Lack of or uncertainties regarding Government renewable energy strategy and targets • *Market access/price*: Sub-optimal energy market liberalisation; uncertainties regarding competitive and price outlook; limitations in PPA and/or PPA process • *Market distortions*: high fossil fuel subsidies
Permits Risk	Risk arising from the public sector's inability to efficiently and transparently administer renewable energy-related licensing and permits	• Labour-intensive, complex processes and long time-frames for obtaining licences and permits (generation, EIAs, land title) for renewable energy projects • High levels of corruption. No clear recourse mechanisms
Social Acceptance Risk	Risks arising from lack of awareness and resistance to wind energy in communities, end-users, and other stakeholders such as unions	• Lack of awareness of renewable energy amongst consumers, end-users, and local residents
Resource & Technology Risk	Risks arising from use of the renewable energy resource and technology (resource assessment; construction and operational use; hardware purchase and manufacturing)	• *For resource assessment and supply:* inaccuracies in early-stage assessment of renewable energy resource • *For planning, construction, operations and maintenance:* uncertainties related to securing land; sub-optimal plant design; lack of local firms and skills. limitations in civil infrastructure (roads etc.) • *For the purchase and, if applicable, local manufacture of hardware:* purchasers' lack of information on quality, reliability and cost of hardware; lack of local industrial presence and experience with hardware
Grid/Transmission Risk	Risks arising from limitations in grid management and transmission infrastructure in Nigeria	• *Grid code and management*: limited experience or sub-optimal operational track-record of grid operator with variable sources (e.g. grid management and stability). Lack of standards for the integration of variable renewable energy sources into the grid • *Transmission infrastructure:* inadequate or antiquated grid infrastructure, including lack of transmission lines from the renewable energy source to load centres; uncertainties for construction of new transmission infrastructure
Counterparty Risk	Risks arising from the utility's poor credit quality and an IPP's reliance on payments	• Limitations in the utility's (electricity purchaser) credit quality, corporate governance, management and operational track-record or outlook; unfavourable policies regarding utility's cost-recovery arrangements
Financial Sector Risk	Risks arising from the lack of information and track record on financial aspects of solar PV, and general scarcity of investor capital (debt and equity), in Nigeria	• C*apital scarcity*: Limited availability of local or international capital (equity/and or debt) for green infrastructure due to, for example: under-developed local financial sector; policy bias against investors in green energy • *Limited experience with renewable energy:* Lack of information, assessment skills and track-record for

Risk Category	Generic Description	Underlying Barriers
		renewable energy projects amongst investor community; lack of network effects (investors, investment opportunities) found in established markets; lack of familiarity with project finance structures
Political Risk	Risks arising from country-specific governance, social and legal characteristics	• Uncertainty or impediments due to war, terrorism, and/or civil disturbance • Uncertainty due to high political instability; poor governance; poor rule of law and institutions • Uncertainty or impediments due to government policy (currency restrictions, corporate taxes)
Currency/Macro-economic Risk	Risks arising from the broader macroeconomic environment and market dynamics	• Uncertainty due to volatile local currency; unfavourable currency exchange rate movements • Uncertainty around inflation, interest rate outlook due to an unstable macroeconomic environment

Figure 2 shows how a range of investment risks currently contribute to these higher financing costs for solar PV in Nigeria. The risk category with the largest impact on elevated financing costs is power market risk, which relates to accessing power markets and the price paid for renewable energy. Other risk categories with large impacts include grid/transmission risk, counterparty risk, financial sector risk, political risk and macroeconomic/currency risk.

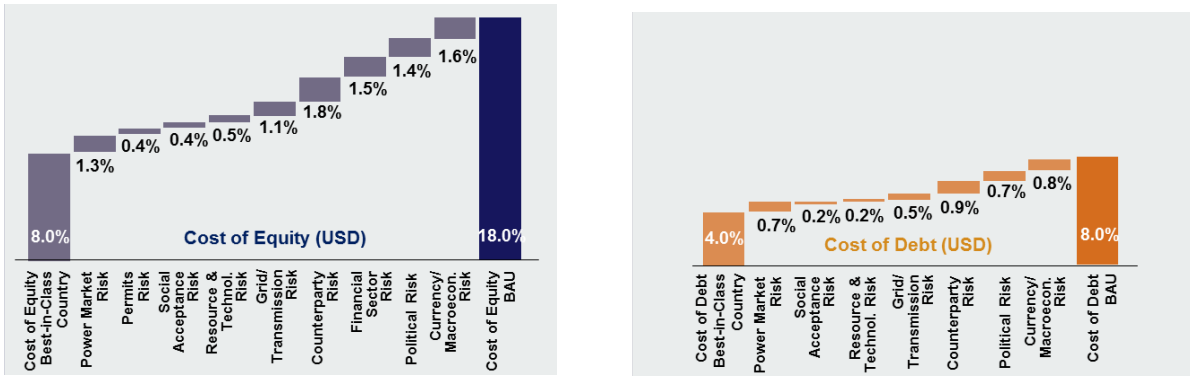


Figure 2. Impact of risk categories on financing costs for solar PV investments in Nigeria, business-as-usual scenario (Source: interviews with solar PV investors and developers; modelling; best-in-class country is assumed to be Germany; see Annex 7.2 of Project Document for details of assumptions and methodology).

E.2.2. Public Instruments (Stage 2)

Public Instrument Selection

The modelling uses a 2020 target of 1,238 MW of private sector investment in utility-scale solar PV, based on the National Energy Master Plan (NEMP). It then models the implementation of a package of public instruments, containing both policy and financial derisking instruments, to promote investment to achieve these targets. The instruments are selected in order to specifically target the risk categories identified in the financing cost waterfalls. A list of these public derisking instruments is shown in **Table 2**. The policy derisking instruments are estimated as costing USD 11.8 million (net present value), and the financial derisking instruments USD 288.8 million.

Table 2. Public instrument selection to promote solar PV in Nigeria.

Risk Category	Policy Derisking Instruments	Financial Derisking Instruments
Power Market Risk	• Long term renewable energy	NA

Risk Category	Policy Derisking Instruments	Financial Derisking Instruments
	targets • Regulatory framework • FIT/PPA tender (standardised PPA) • Independent regulator	
Permits Risk	• Streamlined permitting; one-stop shop; recourse mechanism	NA
Social Acceptance Risk	• Awareness-raising campaigns • Promote/pilot community-based approaches	NA
Resource & Technology Risk	• Resource assessment • Technology support (solar PV)	NA
Grid/Transmission Risk	• Transparent, up-to-date grid code • Grid management/planning	• Take or pay clause in PPA[32]
Counterparty Risk	• Strengthen utility's management	• Government guarantee of PPA
Financial Sector Risk	• Domestic financial sector reform	• Concessional public loans to IPPs
Political Risk	NA	NA
Currency/ Macroeconomic Risk	NA	• Partial indexing of PPA tariffs to foreign currencies[33]

Note: NA indicates Not Applicable.

Impact of public instruments on financing costs

The impact of the public instrument package on reducing financing costs for solar PV in Nigeria is shows in **Figure 3**. Based on the modelling analysis, the selected package of derisking instruments is anticipated to reduce the average cost of equity to 2020 by 3.2%, to 14.8%, and the cost of debt by 1.4%, to 6.6%.

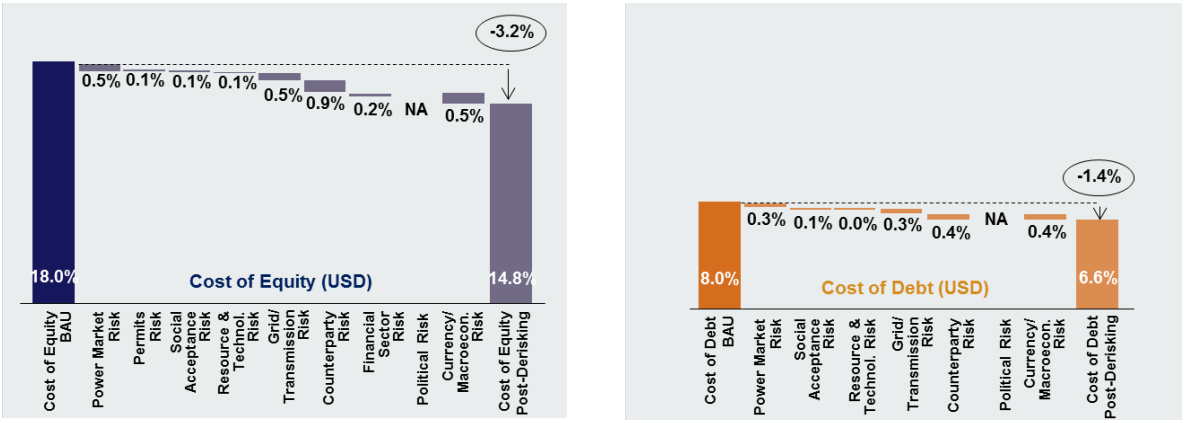


Figure 3. Impact of public derisking instruments on reducing financing costs for solar PV in Nigeria, post-derisking scenario (Source: interviews with solar PV investors and developers; modelling; see Annex 7.2 of the project Document for details of assumptions and methodology. Note: the impacts shown are average impacts over the 2016-2020 modelling period, assuming linear timing effects)**.**

[32] A "take-or-pay" clause is a clause found in a Power Purchase Agreement (PPA) that essentially allocates risk between parties in the scenario where transmission line failures or curtailment (required by the grid operator) result in the IPP being unable to deliver electricity generated by its renewable energy plant.

[33] Partial indexing involves tariffs in a local-currency denominated PPA being partially indexed to foreign hard currencies, such as EUR or USD. In this way, IPPs are partially protected against currency fluctuation. If a PPA tender process is used, IPPs can be asked to specify the maximum degree of partial indexing they require, thereby minimising the cost to the public sector.

E.2.3. Levelised Costs (Stage 3)

The modelling is performed for two risk environment scenarios; first, a *business-as-usual* scenario, representing the current risk environment (with today's financing costs); and second, a *post-derisking* scenario, after implementing the public instrument packages (resulting in lower financing costs).

The results for generation costs (the Levelised Cost of Electricity, LCOE) are shown in **Figure 4** below:

- In the *business-as-usual* (BAU) scenario, solar PV is more expensive than the baseline technology of single cycle gas turbines that Nigeria currently relies on to increase its electricity generation capacity[34]. The baseline generation cost (gas) is calculated as being USD 4.0 cents per kWh. In comparison, solar PV today in Nigeria is estimated at USD 10.7 cents per kWh. This means that, today, solar PV require a price premium (USD 4.7 cents per kWh) over the baseline energy technology.
- In the *post-derisking* scenario, the cost of solar PV falls to USD 7.7 cents per kWh. As such, following government interventions to derisk the investment environment, and with resulting lower financing costs, solar PV energy becomes more competitive with the baseline energy technology. That said, solar PV remains more expensive than the baseline and will still require a price premium (USD 3.7 cents per kWh) over the baseline.

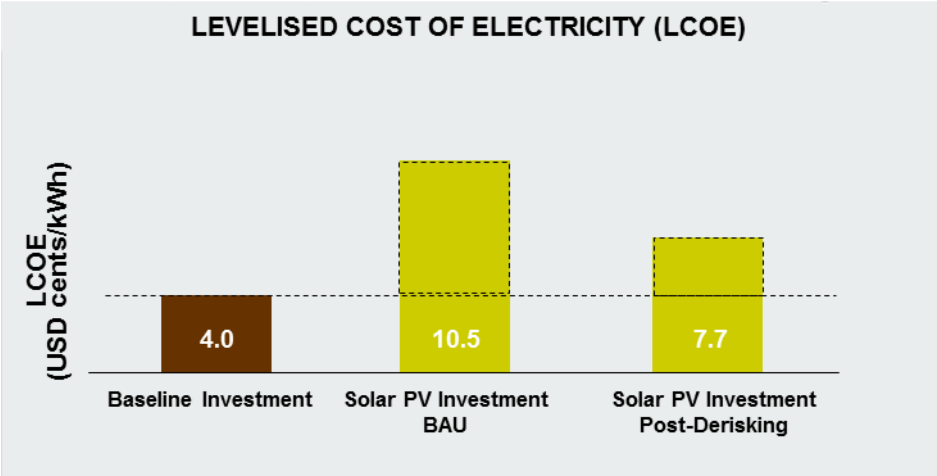


Figure 4. LCOEs for the baseline and solar PV investment in Nigeria (Source: Modelling; see Annex 7.2 of the Project Document for details of assumptions and methodology).

E.2.4 Evaluation (Stage 4)

The DREI methodology uses four performance metrics to analyse the impacts of the selected public instrument package to promote investment, each metric taking a different perspective: the ability to catalyse investment (*leverage ratio*); the economic savings generated for society (*savings ratio*); the resulting electricity price for end-users (*affordability*); and the efficiency in mitigating greenhouse gas emissions (*carbon abatement*).

Figure 5 and **Figure 6** show the results for the leverage ratio and carbon abatement metrics respectively.
For the *leverage ratio*, achieving the 2020 target of 1,238 MW in installed solar PV capacity equates to USD 1.89 billion in private sector investment.

- In the *business-as-usual scenario*, the model estimates that achieving this target will require a direct financial incentive in the form of a price premium over 20 years, valued at USD 2.26 billion. This results in a leverage ratio (the ratio of the cost of public instruments to investment catalysed) of 0.8x.
- In the *post-derisking scenario*, the model estimates that this same investment target can be achieved with a package of derisking instruments estimated at USD 300.7 million, and a lower direct financial incentive (price

[34] Single cycle gas turbines have been selected as the marginal baseline technology for this analysis. This is a simplified assumption and the reality is that a variety of baseline technologies are in existence in Nigeria, which often differ by region. For example, in off-grid regions, or regions experiencing unreliable on-grid service, diesel generation is arguably a more realistic baseline. Future modelling will further examine these questions.

premium) over 20 years valued at USD 1.30 billion. This raises the leverage ratio by 50% to 1.2x, indicating a higher efficiency in terms of the costs of public instruments.

Taking the two scenarios together, the USD 300.7 million package of derisking instruments is estimated to create net savings to the economy of USD 960.2 million in lower direct financial incentives.

For *carbon abatement*, achieving the 2020 target of 1,238 MW in solar PV is estimated to result in a total reduction of 26.2 million tonnes of CO_2 over the lifetime of the solar PV plants. In the *business-as-usual scenario*, the abatement cost of the investment in solar PV is USD 86.69 per tonne of CO_2e. Or, in other words, the cost of public instruments – in this case a direct financial incentive – equates to USD 86.69 for every tonne of CO_2e reduced by the investment in solar PV. In the *post-derisking scenario*, this cost falls by 29% to USD 61.34 per tonne of CO_2e. This performance metric is helpful in terms of understanding a carbon price that is necessary to promote investment, and in comparing the relative costs of different low-carbon options.

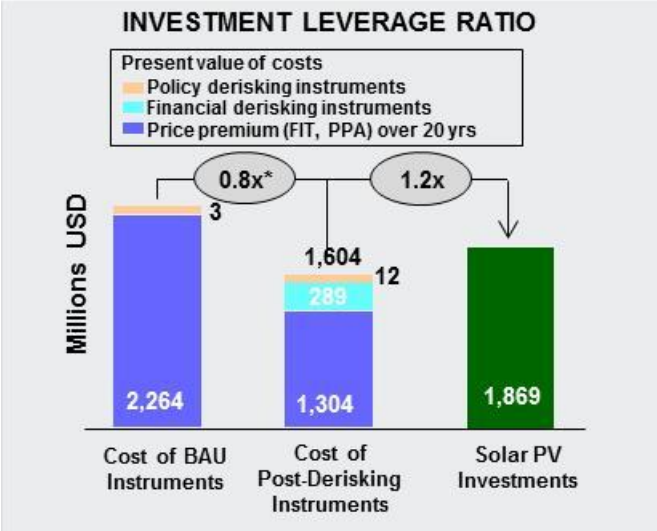


Figure 5. The *leverage ratio* performance metric for the selected package of derisking instruments in promoting 1,238 MW of solar PV investment in Nigeria (Source: modelling; see Annex 7.2 of the Project Document for details of assumptions and methodology).

*In the BAU scenario, the full 2030 investment target may not be met.

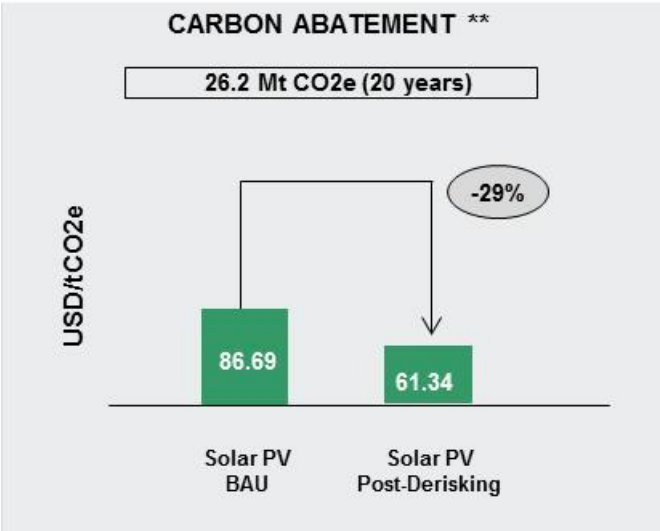


Figure 6. The *carbon abatement* performance metric for the selected package of derisking instruments in promoting 1,238 MW of solar PV investment in Nigeria (Source: modelling; see Annex 7.2 of the Project Document for details of assumptions and methodology).

** The Carbon Abatement metric can be broken down into the costs of policy derisking instruments, financial derisking

instruments and the price premium. In the *business-as-usual* scenario, this breakdown is USD 0.13, USD 0.00 and USD 86.56 respectively, for a total of USD 86.69 per tCO2e. In the *post-derisking* scenario, this breakdown is USD 0.45, USD 11.04 and USD 49.85 respectively, for a total of USD 61.34 per tCO2e.

In comparing the *business-as-usual* and *post-derisking* scenarios, the results clearly demonstrate how investing in public derisking measures creates significant direct economic savings in achieving Nigeria's utility-scale solar PV investment targets. Instead of paying for investment in solar PV at higher generation costs, public derisking measures should be prioritised, thereby resulting in investment at lower generation costs and more affordable electricity for Nigerian citizens.

E.5.3. Next Steps

As set out in **Box 1**, a typical power sector NAMA will typically contain a number of different components.

Box 1. Typical components of a power sector NAMA

A typical NAMA in the power sector will likely include some or all of the following components:

- A **voluntary long-term, time-bound investment** target for low-carbon activities in the power sector. A breakdown of the target will be provided by technology (installed capacity, target years).
- The identification and implementation of **a package of public instruments** to create an enabled environment to attract this targeted investment. The investment will come from a mix of public and private sources, with the majority of investment typically coming from the private sector.
- A breakdown of the **anticipated costs and incremental costs** to achieve the NAMA's investment target, differentiated between financing sources: public and private, domestic and international, as well as market mechanisms (e.g. carbon markets).
- An assessment of the anticipated **socio-economic and environmental co-benefits** that will arise from the targeted investment, including economic growth, job creation and sustainable development benefits.
- An **MRV framework**, with appropriate indicators, to measure, report and verify the emission reductions that will be generated by the investment in low-carbon activities under the NAMA.

This initial analysis performed for project design indicates that the DREI methodology is well suited to NAMA design. It provides a structured framework to quantify and itemise the various components of a NAMA, including the costs of investments, the selection and cost of public instruments, and the anticipated greenhouse gas emission reductions.

Conclusions

Implications for promoting renewable energy in Nigeria

A central conclusion from the modelling is the importance of systematically addressing investment risks. The results clearly identify a range of risks that currently impair the investment environment in Nigeria. The DREI methodology then takes a comprehensive approach to addressing these risks: if a risk is identified in the financing cost waterfall, a matching instrument targeting the risk is selected; both risk reduction (policy derisking) and risk transfer (financial derisking) instruments are used, benefiting from their complementary roles; and, lastly, the instruments are implemented in a sustained way, across the entire modelling period from 2016 to 2020.

The key conclusion from the modelling is that investing in derisking measures, bringing down the financing costs of solar PV in Nigeria, appears to be highly cost-effective when measured against paying direct financial incentives to compensate investors for higher risks. Instead of using scarce public funds to pay higher electricity tariffs (for instance, in the form of a premium feed-in tariff), it is advantageous to first target specific investment risks (for example, those associated with grid/transmission, counterparty risk, financial sector risk), thereby changing the fundamental risk/reward profile that energy investors face in Nigeria.

Premium prices for solar PV (which we call here 'proxy FiT') in Nigeria may still be required to supplement derisking efforts depending on the choice of baseline on-grid power generation technology (e.g. on-grid gas generation *versus* off-grid diesel generation). The results indicate that all derisking instruments that can be immediately implemented should be prioritised before resorting to direct financial incentives to buy down any residual risks.

Further studies

A number of areas of further work have been identified for the application of DREI analysis in Nigeria:

- *Further analyses of baseline technologies*. There is considerable uncertainty around baseline technologies, which also vary greatly by region within Nigeria. For instance, in certain northern parts of Nigeria where the supply of grid electricity is constrained by a combination of lack of power capacity, constrained supply of natural gas for power generation, or inadequate power transmission and distribution infrastructure, a more appropriate baseline technology could be standalone diesel generation. A more granular level of analyses can be performed.
- *Role of fossil-fuel subsidies*. It was not possible to examine the role of fossil fuel subsidies in the modelling. Once there is better data and visibility, the modelling can be strengthened by including them. These subsidies can have a large impact on the attractiveness of solar PV.
- *Sensitivity analyses*. Sensitivity analyses should be performed. This can include, but is not limited to: future hardware (investment) cost, capacity factors (which vary significantly between north and south Nigeria), baseline technologies and fuel costs, grid integration costs, and balancing costs.
- *Cost analyses*. The costing of instruments for this modelling was preliminary in nature. There is a need for further data gathering and methodology development for the costing of both policy derisking and financial derisking instruments.

Empowered lives.
Resilient nations.

United Nations Development Programme
Country: Nigeria
PROJECT DOCUMENT[1]

Project Title:	Derisking Renewable Energy NAMA for the Nigerian Power Sector
UNDAF/CPD Outcome(s):	Outcome 3.2: Energy – The UN will collaborate with government to strengthen the capacities of relevant institutions and support efforts to address the problem of sub-optimal energy supply through the diversification of renewable energy sources for equitable and affordable access in line with the recently launched government policy on Sustainable Energy for All (SE4All).
UNDP Strategic Plan Primary Outcome:	Outcome 1: Growth and development are inclusive and sustainable, incorporating productive capacities that create employment and livelihoods for the poor and excluded.
UNDP Strategic Plan Related Outputs:	Output 1.4: Scaled up action on climate change adaptation and mitigation across sectors which is funded and implemented. Output 1.5: Inclusive and sustainable solutions adopted to achieve increased energy efficiency and universal modern energy access (especially off-grid sources of renewable energy).
Expected CPD Output:	• Promote initiatives for access to renewable and rural energy; • Build capacity to develop, coordinate and monitor energy diversification policy and strategy for equitable energy access;
Expected CPAP Output(s):	There is no CPAP.
Executing Entity/Implementing Partner:	Federal Ministry of Environment
Implementing Entity/Responsible Partners:	Federal Ministry of Environment, Federal Ministry of Power, Energy Commission of Nigeria, United Nations Development Programme – Nigeria.

[1] For UNDP supported GEF-funded projects, as this includes GEF-specific requirements

Brief Description

The UNDP-GEF project will support the Government of Nigeria to develop a Nationally Appropriate Mitigation Action (NAMA) for the Nigerian Power Sector. The NAMA will target solar PV primarily in order to achieve a transformation in the electricity mix such that at least 20GW of Nigeria's electricity is generated from solar PV by 2030. The NAMA design will use a rigorous quantitative methodology based on UNDP's Derisking ("DREI") methodology. The project will build upon existing national development policies and initiatives that seek to put in place public derisking instruments to support the more efficient and effective participation of the private sector in the power sector. The project will develop the NAMA architecture and enabling conditions through a combination of complementary policy and financial derisking instruments, which will be validated through the implementation of a 100 MW PV project. The project will contribute to the country's attainment of its voluntary mitigation targets in the energy sector, with expected direct emission reductions of 205,700 tonnes of CO_{2e} during the project's lifetime and additional indirect emission reductions of between 6.79 and 9.72 million tCO_2e. Being the first of its kind, the baseline project will also pave the way for catalysing more private investments so that the NAMA will generate national benefits related to green growth, energy security and job creation at scale.

Programme Period:	2015-2021
Atlas Award ID:	00086990
Project ID:	00094142
PIMS #	5243
Start date:	May 1, 2015
End Date:	May 1, 2021
Management Arrangements:	NIM
PAC Meeting Date	_____

Total resources required	**$US 218,150,000**
Total allocated resources:	
o **GEF**	**$US 4,400,000**
Other parallel funding (cash/in-kind):	
o ECN (in-kind)	$US 1,500,000
o FMP (in-kind)	$US 350,000
o FME (in-kind)	$US 200,000
o UNDP (cash)	$US 1,500,,000
o NSCP (cash)	$US 210,000,000
o LEA (in-kind)	$US 200,000
Total Co-Financing:	**$US 213,750,000**

Agreed by (Government):

Date/Month/Year

Agreed by (Executing Entity/Implementing Partner):

Date/Month/Year

Agreed by (UNDP):

Date/Month/Year

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AfDB	African Development Bank
BUR	Biennial Update Report
CAGR	Compound Annual Growth Rate
CCGT	Combined Cycle Gas Turbine
CDM	Clean Development Mechanism
CO_2	Carbon dioxide
CoP	Conference of Parties (of the UNFCCC)
CSO	Civil Society Organisation
DREI	Derisking Renewable Energy Investment (UNDP methodology)
ECN	Energy Commission of Nigeria
EE	Energy Efficiency
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
FEPA	Federal environmental Protection Agency
FGN	Federal Government of Nigeria
FiT	Feed-in tariff
FME	Federal Ministry of Environment
FMF	Federal Ministry of Finance
FMP	Federal Ministry of Power
GCF	Green Climate Fund
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ICF	International Climate Fund
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
kWh	Kilowatt-hour
LCOE	Levelised Cost of Electricity
LEA	Lagos Energy Academy
LEDS	Low-Emission Development Strategy
M&E	Monitoring and Evaluation
MRV	Monitoring, Reporting and Verification
$MtCO_2$	Million tonnes of carbon dioxide
MTM	Medium Term Market
MWh	Megawatt-hour
MYTO	Multi Year Tariff Order
NAMA	Nationally Appropriate Mitigation Action
NCCPRS	National Climate Change Policy and Response Strategy
NERC	Nigerian Electricity Regulatory Commission
NESP	Nigerian Energy Support Programme
NEWMAP	Nigerian Erosion and Watershed Management Project
NGO	Non-Governmental Organisation
NIAF	Nigerian Infrastructure Advisory Facility
NPS	Nigerian Power Sector
PAP	Project Affected Persons
PB	Project Board
PIR	Project Implementation Review
PoA	Programme of Activities (CDM)
PPA	Power Purchase Agreement
PV	Photovoltaic
RAP	Resettlement Action Plan
RE	Renewable Energy

RES	Renewable Energy Source
SD	Sustainable Development
SNC	Second National Communication to the UNFCCC
STAP	Scientific and Technical Advisory Panel
TAP	Technology Action Plan
tCO_2	tonnes of carbon dioxide
TEM	Transitional Electricity Market
TNA	Technology Needs Assessment
TWG	Technical Working Group
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WB	World Bank

1. SITUATION ANALYSIS

1.1. NAMA Context, Global and National Significance

1.1.1. Climate change mitigation

'Mitigation', in the context of climate change, is a human intervention to reduce the sources or enhance the sinks of greenhouse gases (GHGs). Mitigation, together with adaptation to climate change, contributes to the objective expressed in Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC) to stabilise "greenhouse gas concentrations in the atmosphere at a level to prevent dangerous anthropogenic interference with the climate system…within a time frame sufficient to allow ecosystems to adapt…to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner".

The stabilisation of the climate system will require large-scale reductions in atmospheric GHGs through a combination of mitigation and removal by sinks. **Figure 1** shows that the current emission pathway is not sustainable in the context of limiting global temperature rise to within 2°C. Even the best scenarios of emission reduction pledges in the Copenhagen Accord and Cancun Agreements will leave an emissions gap that will prevent stabilisation of atmospheric GHGs for the 2°C target.[2] Ad hoc or project-based approaches to reducing GHG emissions are no longer sufficient to achieve the scale of reductions required to stabilise emissions by 2050. Nationally Appropriate Mitigation Actions (NAMAs), embodying systemic or sector-wide approaches to emission reductions, are considered an effective means of achieving the scale of mitigation required.

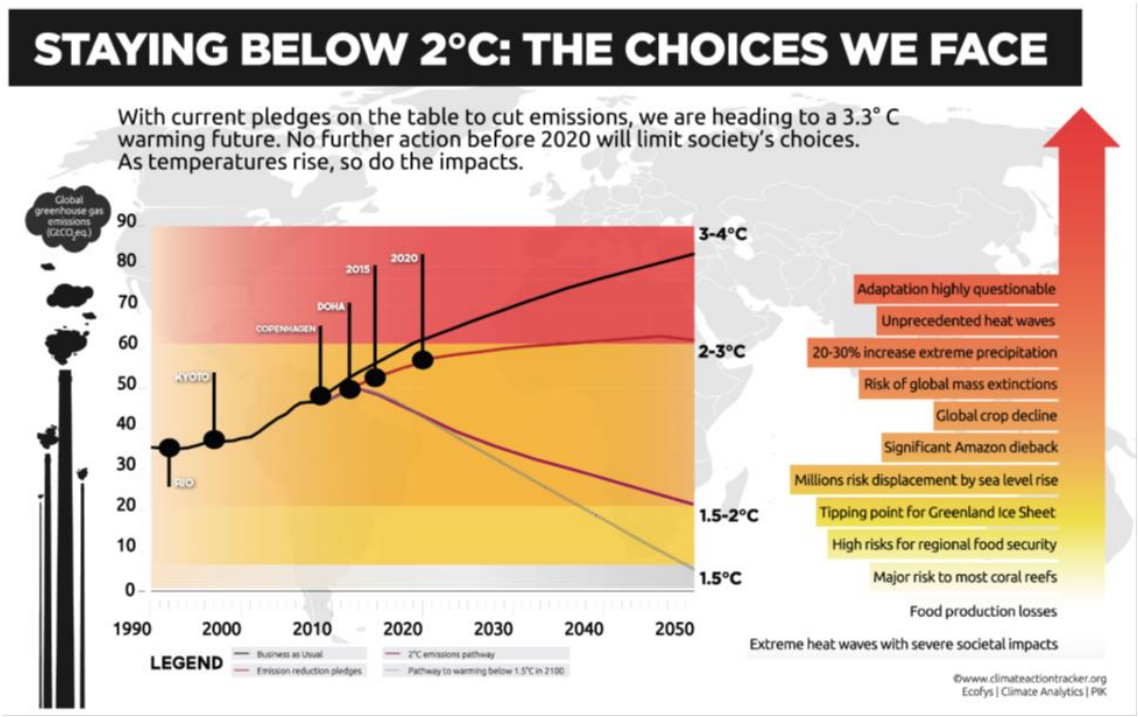


Figure 1. Emission pathways for different increases in average global temperatures (Source: Höhne, N. *et al*. (2012). *Warnings of Climate Science – Again – Written in Doha Sand.* Ecofys, Climate Analytics & PIK).

However, the financial sums involved in a rapid shift to low-emission energy pathways are significant, and leveraging such financing in a timely manner is a challenge. For example, in the

[2] Höhne, N. *et al*. (2012), 'National GHG emissions reduction pledges and 2°C: comparison of studies'*, Climate Policy, 12:3,* 356-377.

energy sector, UNDESA has estimated that it would cost up to $US 250-270 billion per year to shift developing countries to 20 percent renewable energy by 2025. Similarly, according to the Global Energy Assessment, global investment in energy efficiency and low-carbon energy generation will need to increase to between $US 1.7-2.2 trillion per year – compared to present levels of about $US 1.3 trillion per year – over the coming decades to meet the combined challenges of energy access, energy security and climate change.[3]

The promising outlook is that the private sector and the global capital markets, representing some $US 212 trillion in financial assets, including $US 71 trillion managed by institutional investors, in principle have the size and depth to step up to this investment challenge. If countries are going to successfully scale-up low-emission energy systems, including the use of renewable energy, it is clear that private sector investment must be at the forefront. A direct link is established in the design of the UNDP-GEF project between investments in low-carbon energy systems (driver) and GHG emission reductions (outcome). A further link that will be made in Section 1.5 is that the cost of capital (debt and equity) to implement low-emission energy systems, such as renewable energies, depends on the level of risk that is generated by barriers. More and higher barriers to the implementation of low-carbon energy systems increase the cost of capital by increasing the risks to investments. All else being equal, the higher risks reduce the financial attractiveness of investments in low-emission systems, thereby preventing or slowing down the required transformation in energy systems.

1.1.2. Nationally Appropriate Mitigation Actions (NAMAs) under the UNFCCC

The concept of Nationally Appropriate Mitigation Actions (NAMAs) was introduced in the Bali Action Plan in 2007 (Decision 1/CP.13). The parties to the United Nations Framework Convention on Climate Change (UNFCCC) called for "Enhanced national/international action on mitigation of climate change" including "Nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner" (paragraph 1(b) (ii)).

Decision 2 CP/15 on the Copenhagen Accord noted that "nationally appropriate mitigation actions seeking international support will be recorded in a registry along with relevant technology, finance and capacity building support. Those actions supported will be added to the list in appendix II. These supported nationally appropriate mitigation actions will be subject to international measurement, reporting and verification in accordance with guidelines adopted by the Conference of the Parties" (paragraph 5). NAMAs were seen as a means to achieve the "deep cuts in global emissions required according to science" to hold the increase in global temperature below 2 degrees Celsius" (Decision 2/CP.15, paragraph 2).

As part of the Cancun Agreements (CoP 16), the Parties further agreed that "developing country Parties will take nationally appropriate mitigation actions in the context of sustainable development, supported and enabled by technology, financing and capacity-building, aimed at achieving a deviation in emissions relative to 'business as usual' emissions in 2020" (Paragraph 48). Likewise, the agreements took note of the first NAMAs formally communicated by the Parties (paragraph 49). The Cancun Agreements also differentiated between NAMAs that were domestically supported and those that were internationally supported, specifying that both were subject to being monitored, reported and verified domestically, but that the latter would be subject to international monitoring, reporting and verification (MRV).

Decision 2/CP.17 (paragraph 46) provides guidance to non-Annex 1 countries on what information should be contained in the submission of Parties to the NAMA Registry. NAMAs seeking international support should cover the following:

[3] Waissbein, O., Glemarec, Y., Bayraktar, H., & Schmidt, T.S., (2013). *Derisking Renewable Energy Investment: A Framework to Support Policymakers in Selecting Public Instruments to Promote Renewable Energy Investment in Developing Countries.* New York, NY: United Nations Development Programme, pg. 28 (and references therein). Can be accessed at www.undp.org/DREI.

(a) A description of the mitigation action and the national implementing entity, including contact information;
(b) The expected time frame for the implementation of the mitigation action;
(c) The estimated full cost of preparation;
(d) The estimated full cost and/or incremental cost of implementation of the mitigation action;
(e) The amount and type of support (financial, technology and capacity-building) required to prepare and/or implement the mitigation action;
(f) The estimated emission reductions;
(g) Other indicators of implementation;
(h) Other relevant information, including the co-benefits for local sustainable development, if information exists.

Unilateral (or domestically-funded) NAMAs should also be submitted for recording in a separate section of the registry (Decision 2/CP.17, paragraph 47). At CoP 17, the Ad Hoc Working Group on Long-term Cooperative Action made way for sectoral approaches as a means of up-scaling GHG emission reductions (Decision 2/CP.17, paragraph 74).

CoP 18 in Doha (November-December 2012) culminated in the adoption of the Doha Climate Gateway and confirmed a new climate regime to be adopted in 2015 and to be implemented as of 2020, pending completion of decisions relating to NAMA implementation by SBI (UNFCCC Implementation body) between 2013 and 2014.

Finally, although NAMAs represent a central means of reducing GHG emissions in developing countries, international negotiations have neither provided a formal definition of the information that should be included in a NAMA document nor clarified some key aspects, including the international MRV mechanisms and guidelines required. It is expected that these aspects will be progressively clarified in a bottom-up manner based on the experience of the countries that draft and implement NAMAs.

The integrated or systemic approach for delivering a higher level of emission reductions (the transformational role of NAMAs) is more clearly formulated in the decisions made at CoP 19 (November 2013). Paragraph 5 of Decision 1/CP.19 calls for "intensifying, as from 2014, the technical examination of opportunities for actions with high mitigation potential, including those with adaptation and sustainable development co-benefits, with a focus on the implementation of policies, practices and technologies that are substantial, scalable and replicable, with a view to promoting voluntary cooperation on concrete actions in relation to identified mitigation opportunities in accordance with nationally defined development priorities".

CoP20 in Lima (December 2014) culminated with the Lima Call for Climate Action (Decision 1/CP.20) that focused mainly on intended nationally determined contributions (INDCs). The linkages between NAMAs and INDCs are discussed in Section 1.1.4.

1.1.3. NAMAs in application

From the above decisions, a NAMA can be considered to be a mitigation action tailored to the national context and capabilities (according to the 'common but differentiated' approach), which is in accordance with national sustainable development priorities. NAMAs are typically implemented to incentivise mitigation on a long-term basis at a sector-policy level to reduce emissions permanently. In order to operationalise NAMAs at the national level, it is important to distinguish two dimensions of NAMAs.[4]

(1) The first differentiation of NAMAs, also in the NAMA Registry, is made according to the source of financing:

[4] UNEP. (2013), *Guidebook for the Development of Nationally Appropriate Mitigation Actions on Efficient Lighting*, UNEP DTIE: Paris.

- Unilateral NAMA (for recognition): entirely financed by the host country;
- Supported NAMA: enabled in part by international technology, financing and/or capacity building.

Although there exists a possibility of linking emission reductions resulting from NAMAs to carbon markets through credited NAMAs, no international agreement to date recognises credited NAMAs.

(2) The second differentiation is made between policy or programme NAMAs, and project NAMAs.

- Policy or programme NAMAs are interventions implemented by a government in order to promote or discourage technology options at the country or sector level, impact economic activity or change consumer behaviour to achieve sustainable low-carbon development. An example would be establishing feed-in-tariffs to promote different types of renewable energy (RE);

- Project NAMAs are specific activities undertaken by private or public organisations that are clearly limited in duration, scope and geography. Project NAMAs encompass defined activities, which typically require technology investments such as the installation of a solar PV farm.

The increasing emphasis on NAMAs to be 'transformational' implies a clear preference for a programmatic approach (e.g. decisions of CoP 18 and CoP 19). Further, supported NAMAs offer a new avenue to channel international financial, technological and capacity building support.

As such, a practical understanding is now emerging of the core components of a supported NAMA addressing the power sector in a developing country. Such a NAMA will likely include:

- A **voluntary long-term, time-bound investment target** for low-carbon activities in the power sector. A breakdown of the target will be provided by technology (installed capacity, target years).

- The identification and implementation of **a package of public instruments** to create an enabled environment to attract this targeted investment. The investment will come from a mix of public and private sources, with the majority of investment coming from the private sector.

- A breakdown of the **anticipated costs and incremental costs** to achieve the NAMA's investment target, differentiated between financing sources: public and private, domestic and international, as well as market mechanisms (e.g. carbon markets). Limited public finance will be used to catalyse far larger quantities of private investment.

- An assessment of the anticipated **socio-economic and environmental co-benefits** that will arise from the targeted investment, including economic growth, job creation and sustainable development benefits.

- An **MRV framework,** with appropriate indicators, to measure, report and verify the emission reductions that will be generated by the investment in low-carbon activities under the NAMA.

These components inform the design of the supported NAMA to transform the power sector in Nigeria that forms the core of the UNDP-GEF project. In summary, NAMAs could be seen as

nationally voluntary determined and potentially internationally supported mitigation actions of a developing country in a pre-2020 climate negotiation context.[5]

1.1.4. NAMAs and INDCs

Parties at CoP19 agreed to "initiate or intensify preparation of their intended nationally determined contributions (INDCs)" so that they can be submitted in advance of the Meeting of Parties (MOP) to the UNFCCC in Paris (Decision 1/CP.19, Para. 2b). Whilst NAMAs are not INDCs, there are several connections between the two, namely:[6]

- NAMAs can be the actions to implement the INDCs, which are the emission reduction targets for achieving the longer-term low emission development strategies (LEDS). In this context, NAMAs that go beyond 2020 could be continued to be implemented as part of INDCs post-2020;
- NAMAs can be used as a bottom-up approach to identify mitigation priorities at the sectoral and national levels and then translating them into national-level emission pledges to define INDCs; and
- NAMAs themselves may be put forward as contributions (at the expense of losing their voluntary character if INDCs turn into commitments). For instance, countries that have previously submitted targets as NAMAs under the Copenhagen Accord may convert these into INDCs.

Based on these considerations, the UNDP-GEF project will support the Federal Government of Nigeria (F)to implement the component of its INDC related to the power sector. As discussed below, the reduction of emissions through the implementation of renewable energies such as solar PV, wind and biomass in the power sector has been identified as an opportunity for the low-carbon development of Nigeria.

1.1.5. Nigeria's voluntary mitigation actions

Nigeria is one of the 141 countries to either agree to the Copenhagen Accord (Decision 2/CP.15) or to be associated with it.[7]. The Federal Government of Nigeria (FGN) communicated its intention to be associated with the Accord on 21 May 2010 (see Annex 7.1) without submitting a list of NAMAs to the UNFCCC Secretariat. It is also noted that Nigeria has not yet submitted any NAMAs to the NAMA Registry for financial support.[8] By associating with the Accord, the country has positioned itself for opportunities arising from the deal. One such key opportunity is the possibility of attracting new funding for critical power sector-related emission reduction projects, especially in gas flaring reduction, renewable energy development and energy efficiency.[9] The UNDP-GEF project will therefore support Nigeria in developing a robust NAMA for the power sector that will have all the attributes (see outcomes of CoP17 discussed above) for submission to the NAMA Registry.

---

[5] Daniela Boos, Hauke Broecker, Tobias Dorr and Sudhir Sharma (2014) How are INDCs and NAMAs linked? (http://www.igep.in/live/hrdpmp/hrdpmaster/igep/content/e54413/e54441/e61720/NAMAINDCPublication.pdf - accessed 22 April 2015).

[6] Frauke Röser and Xander van Tilburg (2014) Side event brief – The future of NAMAs (http://www.mitigationmomentum.org/downloads/MitigationMomentum-Side_Event_brief_Future_of_NAMAs.pdf - accessed 22 April 2015); UNDP (2014) Report on Sources of Support for the Preparation of Intended Nationally Determined Contributions (INDCs) – Revised Technical Note (http://unfccc.int/files/focus/mitigation/application/pdf/support_for_indcs.pdf - accessed 22 April 2015); Daniela Boos, Hauke Broecker, Tobias Dorr and Sudhir Sharma (2014) How are INDCs and NAMAs linked?

[7] http://unfccc.int/meetings/copenhagen_dec_2009/items/5262.php - accessed 23 April 2015.

[8] Please see http://www4.unfccc.int/sites/nama/SitePages/Country.aspx?CountryId=127 – accessed 23 April 2015.

[9] Please see http://forestindustries.eu/de/content/nigeria-signs-copenhagen-climate-accord - accessed 22 April 2015.

1.2. The Energy Sector in Nigeria

1.2.1. Vision 2020 and low carbon development

The opportunities and need for the development of renewable energies in Nigeria are better understood when looking at the broader sustainable development goals. The FGN has put forward an ambitious vision for the country's economic development by 2020: Nigeria Vision 20: 2020.[10] It is a platform for socioeconomic transformation intended to position Nigeria among the 20 largest economies in the world by the year 2020. To achieve sustainable growth, Vision 20: 2020 projects a significant transformation of the economy, with rapid expansion of non-oil sectors such as manufacturing, wholesale and retail trade, telecommunications, construction, and real estate. It calls for large investment in infrastructure and the strengthening of reforms to shift investment toward supporting private-sector activities and increasing the productivity of human capital. Much of the progress to be achieved under Vision 20: 2020 will require significant investment in physical infrastructure, including power, transport, oil and gas infrastructure, housing, and water resources. Power has been a particularly serious bottleneck to growth due to inadequate generation capacity and poor maintenance of the installed capacity. As a result, the FGN attaches particular emphasis (both in Vision 20: 2020 and in "Roadmap for Power Sector Reform" to aggressive rehabilitation of power installations, coupled with an accelerated expansion of electricity generation, transformation, and distribution networks.[11]

There are many ways that Nigeria can achieve the Vision 20: 2020 development objectives for 2020 and beyond, but with up to 32 % lower carbon emissions. A lower carbon path offers not only the global benefits of reducing contributions to climate change, but also net economic benefits to Nigeria, estimated at about 2 percent of GDP. These national benefits include cheaper and more diversified electricity sources, with savings of the order of 7 % or US$12 billion, among others.[12]

1.2.2. Emissions from the energy sector

The energy sector is by far the largest source of GHG emissions in Nigeria, accounting for over 70% of the country's total GHG emissions (155.34 $MtCO_2e$ in 2000).[13] Over 85% of energy sector emissions emanated from fuel combustion activities, and the remaining from fugitive fuel emissions. The sectoral contributions to GHG emissions are shown in **Figure 2**. In 1994, GHG emissions from the energy sector were 119.83 $MtCO_2e$, implying an increase of ~30% (or ~2.6% compound annual growth rate, CAGR) between 1994 and 2000.

[10] FGN (Federal Government of Nigeria) (2010) *Nigeria Vision 20:2020: The First NV20:2020 Medium-Term Implementation Plan (2010–2013)*; *Volume 1: The Vision and Development Priorities*. Lagos, Nigeria.

[11] Cervigni, Raffaello, John Allen Rogers, and Max Henrion, eds. (2013) *Low-Carbon Development: Opportunities for Nigeria*. Directions in Development. Washington, DC: World Bank. pg. 17.

[12] Ibid, pg. 1.

[13] Federal Republic of Nigeria (2014) *Nigeria's Second National Communication under the United Nations Framework Convention on Climate Change*, Federal Ministry of Environment: Abuja (http://unfccc.int/resource/docs/natc/nganc2.pdf - accessed 12 January 2015).

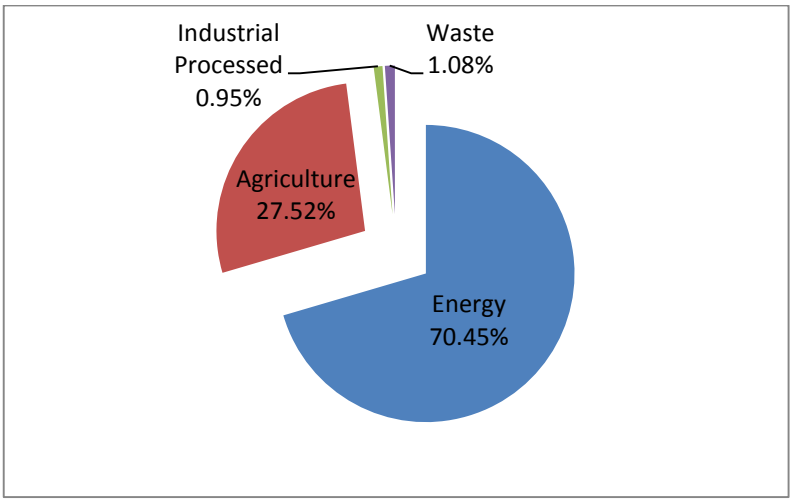


Figure 2. Emission of GHG by Sector, 2000 (Source: Second National Communication (SNC), 2014, Table 2.1, pg. 35).

The sub-sector breakdown of GHG emissions from the energy sector for 2000 is shown in **Table 1**. The emissions from the energy industries (i.e. power generation) represent only 8.5% of all energy sector emissions, a reflection of Nigeria's poor investment in this sub-sector.

Table 1. Breakdown of the energy sector GHG emissions, 2000 (Source: SNC, Table 2.4, pg. 37)

Energy sub-sector	Emissions ($MtCO_2e$)	(% of energy sector)	(% of national)
Energy industries	11.970	8.5	5.4
Manufacturing & construction	17.579	12.5	8.0
Transport	25.752	18.4	11.7
CRAFF activities	19.120	13.6	8.7
Gas flaring	56.570	40.4	25.7
Petroleum refining	2.962	2.1	1.3
Fugitive process	6.162	4.4	2.8

According to the SNC, annual growth rates of about 1.3% were found for all GHGs and precursor gases considered. These results imply that at a minimum Nigeria may double its current annual emissions in time frames of 30 years if the population growth rates as well as the consumption patterns increase.[14]

The GHG emissions emanating from the power sector to 2035 has been modelled using a reference scenario that projects the rapid addition of new grid-connected generation capacity to meet the existing known suppressed demand and the anticipated rapid growth in demand over the coming years in order to achieve Vision20:2020. The projections cover both on-grid and off-grid generation. It adds to the current capacity and planned expansion a fuel mix that does not change substantially from Nigeria's existing use of natural gas, hydropower, and diesel, except for the addition of 10 GW coal and 1 GW of nuclear power by 2035. Both of these are in existing plans but not currently used in Nigeria.[15] The results are shown in **Figure 3**. There is an approximately 15 fold increase in emissions between 2035 and 2010, with on-grid generation representing about 64% of this increase (or ~220 $MtCO_{2e}$). Hence, there are significant opportunities for low-carbon development in the power sector through the adoption of environmentally-sound technologies.

[14] SNC (2014), pg. 41.

[15] Cervigni et al. (2013), pg 85.

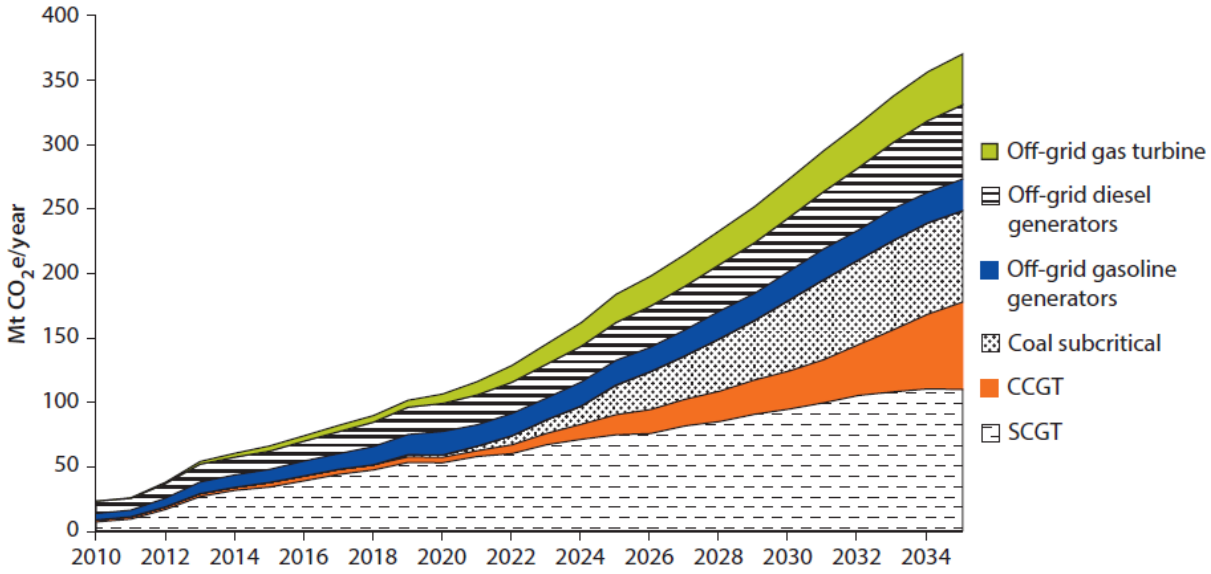


Figure 3. Emissions by generation technology under Reference Scenario, 2010-2035 (Source: Cervigni et al., 2013, Figure 6.7, pg.87).

1.2.2. Primary energy production and consumption

Nigeria is the largest oil producer in Africa, holds the largest natural gas reserves on the continent, and is among the world's top five exporters of liquefied natural gas (LNG). **Figure 4** shows the change in primary energy production and consumption.

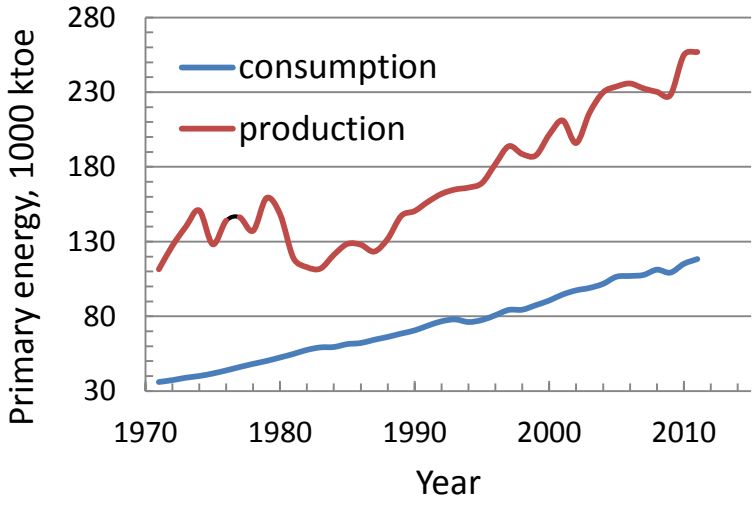


Figure 4. Primary energy production and consumption in Nigeria, 1971-2011 (Source: World Development Indicators, 2014).

Primary energy consumption has increased linearly between 1971 and 2011 at a CAGR of ~3.01%. Traditional biomass and waste (typically consisting of wood, charcoal, manure, and crop residues) accounted for 80%; oil for 13%, natural gas for 6% and hydro for 1%. This high share represents the use of biomass to meet off-grid heating and cooking needs, mainly in rural areas.[16] Over the same period of time, the primary energy production has exceeded consumption by a factor varying between 1.92 and 3.29. While Nigeria is a net exporter of oil and gas, the epileptic character of its power sector is partly attributed to the supply deficiency of natural gas for electricity generation.

[16] http://www.eia.gov/countries/cab.cfm?fips=ni – accessed 23 April 2015.

1.2.4. Electricity production and demand

Nigeria's electricity grid faces many challenges, including insufficient grid-connected capacity to meet demand, inadequate infrastructure to make the country's abundant gas available for power generation, and an inefficient transmission and distribution system with limited coverage. In part for these reasons, an estimated 50% of the electrical energy consumed in the country is currently produced off-grid by diesel and gasoline generators of all shapes and sizes. Unmet demand is also high, particularly amongst the many citizens who have no access to the grid and cannot afford off-grid power. According to the WDI, electricity access stood at 48% in 2010 (34.9% and 79.8% in rural and urban areas, respectively). Nigeria is also characterized by a very low per capita electricity consumption that was ~149 kWh/person in 2011.

The generation and consumption of on-grid electricity are shown in **Figure 5**. In 2013, total on-grid generation was 29,629 GWh, of which thermal generation from gas was 79.4% and the remaining 20.6% from hydro. In 2013, only 46% of the total installed on-grid generation capacity of 10,915 MW was available. The available power park (i.e. 5,051 MW) consisted of gas-fired power plants (4,037 MW) and hydroelectric plants (1,014 MW).[17] The thermal power plants consisted of IPPs (1,192 MW), NIPP plants (994 MW), and privatized PHCN plants (1,851 MW).

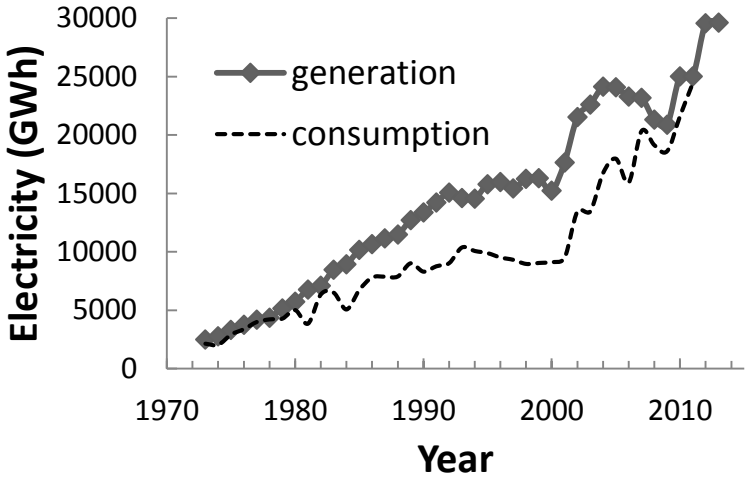


Figure 5. Electricity generation and consumption in Nigeria, 1973 – 2013 (Source: TCN, 2013; WDI, 2014).

Besides suppressed demand, electricity consumption has been largely constrained by transmission and distribution losses reaching over 40% in the late 1990s. The epileptic state of the Nigerian power sector is due to a cocktail of causes, including antiquated grid infrastructure and grid management constraints, and other system generation constraints as summarized in **Table 2**.[18]

Table 2. Constraints characterizing the epileptic state of the Nigerian power sector.

Grid management	System generation	Consequences of inadequacy of gas supply
• System control constraints • Transmission constraints due to lack of adequate capacity 330 kV and 132 kV lines, inadequate shunt	• Inadequacy of gas supply • Unreliable black start facility • Poor generator spread and fuel mix	• Inability of the PHCN, IPPs and NIPPs to utilize available thermal plants capacity for power generation • Incessant forced outages of

[17] Transmission Company of Nigeria (TCN) (2014) Grid Operations 2013 – Annual Technical Report.

[18] TCN (2014).

reactors, and overloaded transformer and capacitor banks	• Impact of seasons on hydro power generation • Difficulty in maintenance due to dearth of spares • Low machine availability due to impact of ageing • Inadequacy of units with free governor mode of operation	plants due to ingress of condensate in the Combustion Chamber • Frequent system disturbances from demand/generation imbalance • Embarrassment to PHCN corporate image in particular and the country at large • Loss of revenue to PHCN and impaired economic activities throughout the country. • Environmental pollution as some customers used their personal generators whenever power supply from PHCN failed • Insecurity; crimes thrived in locations without electricity • Higher than needed demand on hydro turbines, making compliance with operational and maintenance plans rather difficult

As disposable income increases to meet NV20:2020, power demand is also expected to grow. **Figure 6** suggests a constant elasticity of electricity demand to income, which can be used to project the trajectory of Nigeria's per capita electricity consumption and income 2008–35 (orange diamonds).[19] It also highlights how Nigeria's recent grid electricity supply has lagged far below that of similar countries. The reference scenario (see Section 1.2.2) projects a rapid expansion in electricity supply through 2015 that reflects the NV20:2020. The reference case scenario also projects that post-2015, Nigeria will follow the trend line, which is an average of other developing countries. This would result in a per capita consumption of 1,875 kWh/capita in 2035, at a per capita income of $8,226 (2009 USD at PPP). The result is that total demand (grid and off-grid) for electricity grows by a factor of 5.0 by 2020 and 16.8 by 2035 relative to 2009.

[19] Cervigni et al. (2013), pg.78.

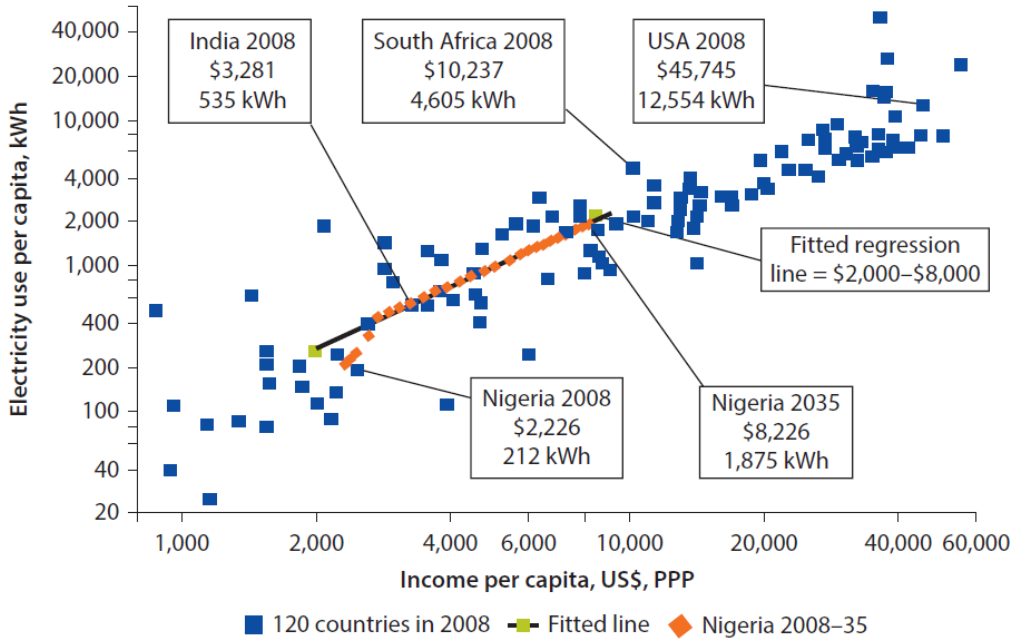


Figure 6. Annual per capita electricity use versus income for 120 countries, 2008; Nigeria projections, 2008-2035 (Source: Cervigni et al., 2013, Figure 6.1, pg.78).

1.2.5. The Future of the Nigerian Power Sector

The NV20:2020 strategic objective is to ensure that the power sector is able to efficiently deliver sustainable, adequate, qualitative, reliable and affordable power in a deregulated market. The Vision estimates that Nigeria will need to generate electricity in the range of about 35,000MW by 2020.[20] The target is to grow installed power generation capacity to 20,000MW by 2015 and 35,000MW by 2020. In the medium-term, existing IPPs will be encouraged to increase capacity and ongoing NIPP projects will be speeded up to achieve the target of 20,000MW by 2015. Incentives will also be granted to new entrants, especially for renewable power generation, in order to achieve additional generation capacity. Between 2011 and 2020, it is estimated that IPPs will generate an incremental 2,000MW on an annual basis. In the long-term, additional large hydro plants, coal-fired plants, IPPs and renewable power generating plants (hydro, solar and biomass) will be installed to further increase power generation capacity to 35,000 MW.

The vision relies heavily on the private sector to take the lead in the power market (generation, transmission and distribution). Whilst power sector reforms are being implemented to favour private sector participation in the power market, there are significant risks (and underlying barriers) that hinder private investments in the Nigerian power sector, especially concerning renewable energy sources. As discussed in Section 1.5, these risks (and underlying barriers) have to be reduced for implementing NV20:2020 using a low-carbon development partway. The challenge is evident when noticing the short fall of ~9,000 MW in installed capacity that existed at the end of 2013 in order to achieve the 2015 target of 20,000 MW. The challenge is even bigger when considering the fact that only 46% of the plants were available for power generation at the end of 2013 (see Section 1.2.4).

It is worthwhile to note that Nigeria's overall performance in the ranking of the World Bank report *Doing Business 2014* has deteriorated from 131 out of 185 in 2013 to 147 out of 189 in 2014. This was due to Nigeria's worsened performance in six of the ten indicators for the ranking (Starting a Business, Dealing with Construction Permits, Getting Electricity, Getting Credit Protecting Investors and Paying Taxes). The country has also slipped in ranking to 120th

[20] FGN (2010) Nigeria Vision 20:2020 – Abridged version, pp. 19-20.

out of 148 countries in the 2013-14 Global Competitiveness Index (GCI) from 115th out of 144 countries in the 2012-13 GCI.[21]

1.2.5.1. Power sector reforms[22]

The Nigerian Electricity Supply Company (established in 1929), was the State-owned utility that operated as a monopoly to manage the generation, transmission and distribution of electricity. It became clear by the late 1990s that the Nigerian electricity system was failing to meet Nigeria's power needs. Hence, the National Electric Power Policy of 2001 kicked off the power sector reform in Nigeria. The Electric Power Sector Reform (EPSR) Act 2005 can be described as the foundation of the restructured power sector in Nigeria. The Act established the basis under which private companies can now participate in the generation, transmission and distribution of electricity. The Act amongst others: (i) provides for the creation of a holding company for the assets and liabilities of the then National Electricity Power Authority (NEPA); (ii) provides for the unbundling of the Power Holding Company of Nigeria (PHCN) through the formation of several companies to take over the assets, liabilities, functions and staff of the PHCN, (iii) establishes the Nigeria Electricity Regulatory Commission, (iv) provides for the development of a competitive electricity market, and (v) provides the basis for determination of tariffs, customer rights and obligations and other related matters.

The three segments of the Nigerian power sector are:

Generation

- *Successor Generation Companies (Gencos)*: There are 6 successor Gencos in Nigeria.
- *Independent Power Producers (IPPs)*: IPPs are power plants owned and managed by the private sector. Although there were Independent Power Producers (IPPs) existing in Nigeria prior to the privatisation process, the Nigerian Electricity Regulatory Commission (NERC) has recently issued about 70 licenses to Independent Power Producers in order to improve the power situation in the country.
- *National Integrated Power Projects (NIPPs)*: The NIPP was conceived in 2004 as a fast-track public sector funded initiative to add significant new generation capacity to Nigeria's electricity supply system along with the electricity transmission and distribution and natural gas supply infrastructure required to deliver the additional capacity to consumers throughout the country. There are 10 NIPPs.

Transmission

- The Transmission Company of Nigeria (TCN) is a successor company of PHCN, following the unbundling of the sector, and is currently being managed by a Management Contractor, Manitoba Hydro International (Canada). The TCN is made up of two major departments: System Operator and Market Operator. The Market Operator is a department under TCN charged with the responsibility of administering the wholesale electricity market, promoting efficiency and where possible, competition. The System Operator is focused on system planning, administration and grid discipline. TCN will be reorganized so that the Market Operator and the System Operator become autonomous.

Distribution

- There are 11 electricity distribution companies (discos) in Nigeria having the coverage areas indicated in **Figure 7**. The figure also shows two selected tariffs practiced by each disco (C1 – single and 3-phase commercial customer; R2 – single and 3-phase residential customer).

[21] AfDB, OECD & UNDP (2014) African Economic Outlook – Nigeria 2014, pg. 9.

[22] KPMG International (2013) A guide to the Nigerian Power Sector.

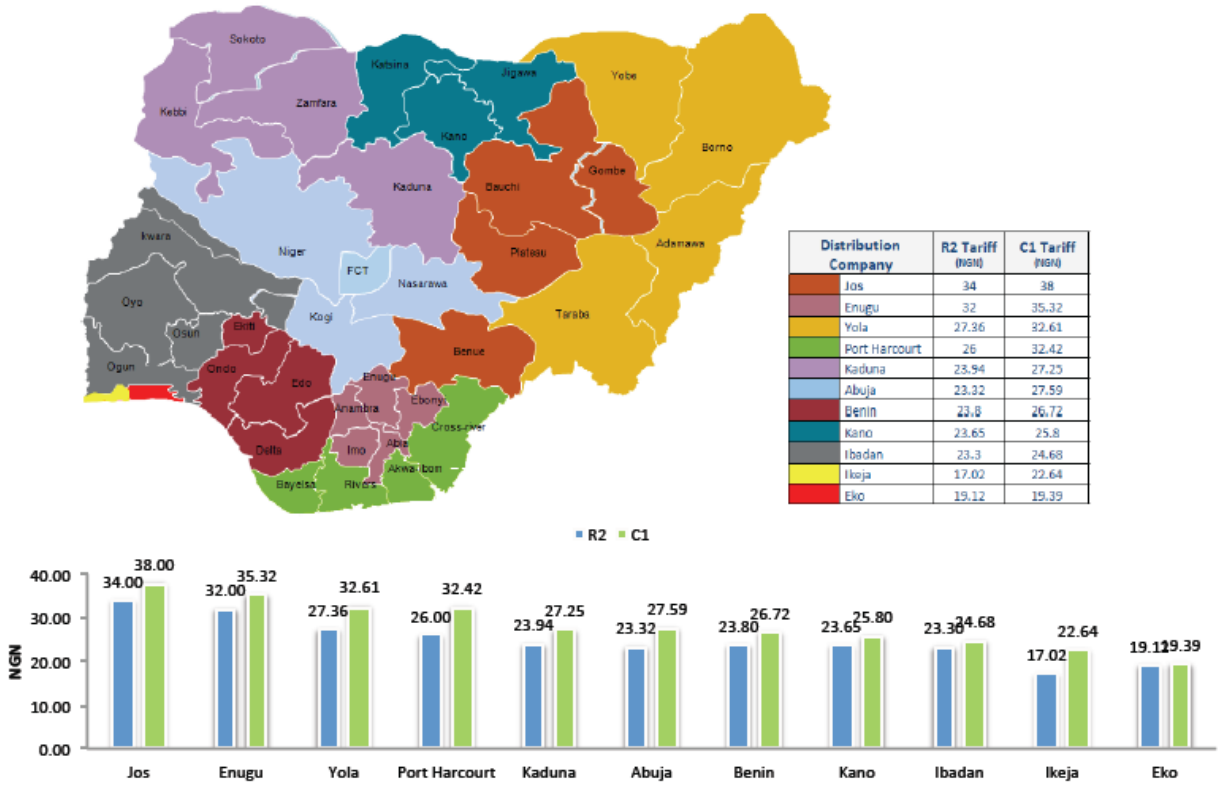


Figure 7. Geographical areas served by discos and selected tariffs in Nigeria (Courtesy of Joel Abrams).

1.2.5.2. Institutional framework of the power sector[23]

This section reviews the principal institutional players in the power sector. The stakeholders that have been directly involved in the design and conceptualisation of this project, and which will be involved in its implementation, are discussed in Section 1.4. The main regulatory institutions consist of the Federal Ministry of Power, NERC, ECN and the Presidential Task Force on Power. Another key institution is the Nigerian Bulk Electricity Trading Plc (NBET).

Federal Ministry of Power (FMP)

The key function of the Ministry is to develop and facilitate the implementation of policies for the provision of adequate and reliable power supply in the country. In carrying out its functions, it is guided by the provisions of the National Electric Power Policy, 2001, the Electric Power Sector Reforms (EPSR) Act, 2005, the Roadmap for Power Sector Reform, 2010 as well as the Transformation Agenda on Power of the Federal Government.

Nigerian Electricity Regulatory Commission (NERC)

NERC was established by the EPSR Act 2005. It is an independent regulatory agency mandated to regulate and monitor the Nigerian power sector. The functions of the NERC include, but are not limited to, the following:

i. Promote competition and private sector participation, when and where feasible,
ii. Establish or approve appropriate operating codes and safety, security, reliability and quality standards,
iii. License and regulate persons engaged in the generation, transmission, system operation, distribution and trading of electricity, and
iv. Approve amendments to the market rules and monitor the operation of the electricity market.

[23] Benedetti *et al*. (2013), *Nigeria Energy Country Report: Focus on Electricity Sector and Renewable Energy Policies*, GSE: Rome, pp 9-10.

Energy Commission of Nigeria (ECN)

The ECN was established in 1988 with the statutory mandate for strategic planning and coordination of national policies in the field of energy. It was established in line with the declaration of the Heads of The Economic Community of West African States (ECOWAS) in 1982 for the establishment of an Agency in each member state charged with the responsibility of coordinating and supervising all energy functions and activities. The functions of the ECN include, but are not limited to, the following:

i. Serve as a centre for gathering and disseminating information relating to national policy in the field of energy,
ii. Inquire into and advise the Government of the Federation or the State on adequate funding of the energy sector including research and development, production and distribution,
iii. Monitor the performance of the Energy sector in the execution of government policies on energy, and
iv. Serve as a centre for providing solutions to inter-related technical problems that may arise in the implementation of any policy relating to the field of energy.

Presidential Task Force on Power (PTFP)

The PTFP was established in 2010 to drive the implementation of the reform of Nigeria's power sector. The role of the PTFP is to co-ordinate the activities of the various agencies charged with ensuring the removal of legal and regulatory obstacles to private sector investment in the power industry. It also has the mandate to monitor the planning and execution of various short-term projects in generation, transmission, distribution and fuel-to-power that are critical to meeting the stated service delivery targets of the power sector roadmap.

Nigerian Bulk Electricity Trading Plc (NBET)

The NBET is a government-owned public liability company encouraging investment in the energy sector that was established under the EPSR Act 2005. It is an electricity trading licensee that engages in the purchase of electrical power and ancillary services (from IPPs and gencos), and subsequent resale to distribution companies and eligible consumers. It is not envisaged to be the sole authorized or designated electricity buyer, as other entities, such as distribution companies that have attained commercial viability, will also be able to procure power directly from the generation companies.

The role of the NBET is, however, a key success factor during the transitional stage of the Nigerian power sector reforms. Its role in the reform process is to use its legal backing to drive private sector investment in generation activities by executing bankable Power Purchase Agreements (PPAs) with them. These PPAs may subsequently be novated to the distribution companies when it becomes economically viable for all parties.

1.2.5.3. Low carbon development of the Nigerian power sector

The introduction of low emission technologies in the Nigerian power sector is supported by several policies, strategies and action plans.

National Energy Policy

The Renewable Electricity Policy Guidelines 2006 set the FGN's vision of renewable energy in the power sector for the achievement of accelerated sustainable development through increased share of renewable electric power to the national electricity supply.[24] It built on the National Energy Policy 2003 that promoted the "optimal utilization of the nation's energy resources for sustainable development".[25] The Policy Guidelines identified specific policy, regulatory, financing and investment, technological, public awareness, quality and standards, poor resource assessment database and intermittency of resource availability as barriers to the

[24] Federal Ministry of Power and Steel (2006) Renewable Electricity Policy Guidelines.

[25] Energy Commission of Nigeria (2003) National Energy Policy.

market development of renewable electricity. The policy guidelines sought to achieve the following specific objectives:

- Expand electricity generating capacity to meet national economic and social development goals; Encourage the diversification of sources of electricity supply through renewable energy, and as such improve the energy security of the country;
- Increase access to electricity services nationwide, especially in rural areas;
- Stimulate growth in employment generation through an expanded renewable electricity industry;
- Enhance technological development through increased domestic manufacturing of renewable electricity components;
- Stimulate competition in the delivery of renewable electricity;
- Promote rapid expansion of the renewable-based electricity market through cost-reducing supply side and demand side incentives.
- Develop regulatory procedures that are sensitive to the peculiarities of renewable energy based power supply;
- Create a stable and predictable investment climate in the renewable electricity market;
- Provide effective protection of electricity consumers through effective regulation; and
- Reduce household and outdoor air pollution as well as contribute to the abatement of greenhouse gas emissions, and thus contribute to improved health and overall social development.

In order to achieve these outcomes, the on-grid related policies and strategies listed in **Table 3** were identified.

Table 3. Policies and strategies for promoting renewable electricity.

Policy	Strategies
Market expansion - *The Federal Government of Nigeria shall expand the market for renewable electricity to at least five percent of total electricity generating capacity and a minimum of 5TWh of electric power production, excluding large hydropower by 2016.*	- Applicable licensing and fees schedule shall be revised and where necessary, simplified - Tax exemptions for a period not less than five years shall apply to new investments in the manufacture and assembly of renewable electricity components - Reduce the upfront costs for consumers of renewable energy technologies through subsidies - NERC shall ensure the development of technical standards and certification procedures for technical personnel participating in renewable electricity projects - The Federal Government shall raise public awareness of the benefits and opportunities of renewable electricity
Grid-connected operations - *The Federal Government shall establish stable and long-term favorable pricing mechanisms and ensure unhindered access to the grid. Grid operators must guarantee the purchase and transmission of all available electricity from renewable electricity producers. While renewable electricity plant owners bear the cost of connection, grid operators must ensure the necessary system upgrade. All upgrade costs must be declared to ensure the necessary transparency.*	- Feed-in tariffs for small hydro schemes not exceeding 30MW, all biomass cogeneration power plants, solar and wind-based power plants, irrespective of their sizes - NERC shall promote the generation of electricity through renewable sources by providing suitable commercial and technical measures for connectivity to the grid and sale of electricity to any persons - NERC shall develop an appropriate standard or model for PPAs - NERC shall specify the terms and conditions for the determination of tariff, and in so doing shall be guided by the promotion of renewable sources in electricity production
Financing - *There shall be a Renewable Electricity Trust Fund which shall be set up under the Rural Electrification Fund*	- The Federal Government shall continuously improve the climate for enhanced funding of renewable electricity through equity, debt financing, grants and micro finance

The updated National Energy Policy 2013 has reaffirmed the policies and strategies for promoting renewable energy. It has proposed policies, objectives and strategies for various renewable energy sources, electricity generation and financing, among others. Some of the key attributes of the NEP 2013 are listed in **Table 4**.

Table 4. Selected policies, objectives and strategies of the NEP 2013.

Policies	Objectives	Strategies
Electricity		
- The nation shall promote private sector participation in the electricity sub-sector - The nation shall pursue measure to diversity energy sources for electricity generation	- To ensure electric power security - To make reliable electricity available to 75% of the population by the year 2020 and 100% by 2030	- Establishing a viable cost reflective tariff that will encourage the private sector's investment in the power sector - Developing bankable feasibility studies for the development of renewable sources of power generation - Creating the enabling environment such as FiT and model PPP that will encourage renewable sources of power generation - Providing the enabling environment and encouraging financial institutions to support indigenous investments in the electricity industry - Ensuring a balanced electricity supply mix - Establishing commercially bankable agreements within the chain
Solar (applicable also to wind and biomass)		
- The nation shall aggressively pursue the integration of solar energy into the nation's energy mix	- To develop the nation's capacity and capability in the utilization of solar energy - To develop the market for solar energy technologies and services	- Intensifying human and institutional capacity building in solar energy technologies and applications - Developing and enforcing standards for solar energy technologies, products, services and processes - Setting up and maintaining a comprehensive information system on available solar energy resources and technologies - Putting in place measures to leverage funding from international agencies and countries that promote the use of solar energy
Financing		
- Investments in the nation's energy sector shall be accorded high priority within the economic sector - The nation shall explore and adopt all viable financing options from local and	- To ensure the availability of adequate funding for the energy sector - To attract foreign investments from a highly competitive international finance market	- Establish a clear legal and regulatory framework for energy financing in Nigeria - Encouraging energy firms to source development funds from the Nigerian capital market

Policies	Objectives	Strategies
international sources for cost effective exploitation of its energy resources - The nation shall encourage an increase in private investments, both domestic and foreign, in the energy sector		- Ensuring periodic review of energy pricing to guarantee a reasonable return on investments - Employ the use of PPP models to finance viable energy projects - Expanding the scope of venture capital financing to embrace investments in the energy sector - Establish mechanisms for developing corporate bonds to unlock pension funds for energy finance and/or government resource fund as an independent source of support for energy projects

Both the ECN and FMP have perused the existing energy policies and strategies to draft the National Renewable Energy and Energy Efficiency Policy (NREEEP), with that of the FMP focusing on the electricity sector.[26] The two documents are aligned, with that of the FMP providing additional targets regarding the share of renewable electricity to 2030. For example, the objective of the NREEEP for the electricity sector has the objective to ensure a minimum (i.e. a lower limit) electricity contribution from solar energy of 3% by 2020 and 6% by 2030. The absolute targets are not known since the NREEEPs do not provide future electricity demand projections, similar to what has been carried out in the Renewable Energy Master Plan (REMP). Also, it is not clear whether the solar electricity targets are relative to installed capacity (e.g. MW installed) or electricity generation (e.g. MWh).

National Energy Master Plan (NEMP)

The ECN, with the support of the UNDP, produced the first Renewable Energy Master Plan (REMP) in 2005. Supported by the UNDP, the REMP was revised in 2012. Based on REMP 2012, the NEP 2013 and Draft NREEEP 2014, the 2007 draft National Energy Master Plan (NEMP) was updated in the last quarter of 2014 to produce the NEMP 2014.[27] The backdrop of the NEMP 2014 was the need for energy demand forecasting and energy supply diversification in order to meet the goals and objectives of NV20:2020, and the SE4ALL targets.[28] The diversification of the energy mix is based on Nigeria's broad energy reserves (see **Table 5**).

Table 5. Nigeria's energy reserves at December 2013 (Source: NEMP 2014).

Energy source	Reserves	Energy source	Reserves
Crude oil	36.2 billion barrels	Fuelwood	13,071,464 hectares
Natural gas	187.44 trillion scf	Animal waste	61 million tonnes/yr
Tar sands	30 billion barrels of oil equivalent	crop residue	83 million tonnes/yr
Coal & lignite	>4 billion tonnes	Solar radiation	3.5 – 7.0 kWh/m^2-day
Large hydropower (LHP)	11,250 MW	Wind	2 – 4 m/s at 10 m
Small hydropower (SHP)	3,500 MW		

[26] ECN (2014) Draft National Renewable Energy and Energy Efficiency Policy (NREEEP); FMP (2014) Draft National Renewable Energy and Energy Efficiency Policy (NREEEP) for the Electricity Sector.

[27] ECN (2014) National Energy Master Plan – draft revised edition.

[28] Ibid., pg. 1.

Using 2009 as the base year, short, medium and long term energy demand and supply studies were carried out to 2030 using MAED and MESSAGE for several GDP growth scenarios, including:

- Reference Scenario – real GDP grows at an average of 7% per annum which is consistent with the MDG objective to reduce poverty by half by 2015;
- High Growth Scenario – real GDP grows at an average of 10% per annum in line with the government objective of growing the economy to accelerate Nigeria's economic development; and
- Optimistic Growth Scenario – real GDP grows at an average of 11.5% per annum (Optimistic I) or 13% per annum (Optimistic II), which is intended to further accelerate the pace of economic development

Since the focus of the UNDP-GEF project is on on-grid electricity, the remaining discussion will be restricted to the power sector. The electricity demand projections are shown in **Table 6** for three scenarios.

Table 6. Electricity demand projections per scenario, MW (Source: NEMP 2014).

Scenario	2009	2010	2015	2020	2025	2030
Reference (7%)	4,052	7,440	24,380	45,490	79,798	115,674
High (10%)	4,052	8,420	30,236	63,363	103,859	196,875
Optimistic II (13%)	4,052	10,230	41,133	88,282	170,901	315,113

The projections for electricity supply are shown in **Table 7** for the three economic growth scenarios. The NEMP 2014 also provides further breakdowns of renewable electricity supply projections over the short term (to 2015), medium term (2016 - 2020) and long term (2021 – 2030). These are summarized in **Table 8** for the Reference, High Growth and Optimistic II scenarios. Considering the different scenarios and time scales, the share of RE in the total electricity mix is expected to vary between 20% and 29%. The figures given in **Table 8** show that the percentage penetration of solar PV in the total electricity mix (in terms of installed capacity) is expected to vary between 5.2% and 6.3% in the short term; between 5.5% and 5.8% in the medium term; and between 9.5% and 12.5% in the long term when all scenarios are considered. These solar PV penetration figures are consistent with those stated in the NREEEP for the electricity sector.[29]

The projected installed capacities for solar PV can be further disaggregated according to end application. Although the breakdown of solar PV according to end application is not provided in the NEMP 2014, the REMP 2012 provides a basis for doing this.[30] Although the projected power demand and supply are different in NEMP 2014 and REMP 2012, the solar PV supply target is the same in the two documents – i.e. 30,000 MW – only for the long term timeline and Optimistic II growth scenario. In this specific case, the breakdown of solar PV installed capacity according to end application is shown in **Table 9**. It is seen that large scale solar PV plants (i.e. utility scale on-grid solar PV) account for only 9,990 MW. Using a pro-rated index derived from REMP 2014 for large-scale PV plants in the short term and medium term timelines for the Optimistic II scenario, the equivalent utility-scale PV targets in the updated NEMP 2014 have been calculated as 667 MW (short term) and 1,238 MW (medium term). Since the medium term timeline (i.e. 2016 to 2020) coincides with the project lifetime, a target of 1,238 MW has been used in the DREI analyses that are discussed in Section 1.5. The targets of the Optimistic II scenario are relevant here since Vision 20: 2020 assumes a 13% annual GDP growth through 2020.[31]

[29] MFP (2014), pg. 15.

[30] ECN (2012) Renewable Energy Master Plan, pg. 9.

[31] Quoted in Cervigni et al. (2013), pg. 28.

Table 7. Electricity supply projections (MW) by energy source for the Reference, High Growth and Optimistic II scenarios (Source: NEMP 2014).

	2009	2010			2015			2020			2025			2030		
		7%	10%	13%	7%	10%	13%	7%	10%	13%	7%	10%	13%	7%	10%	13%
Coal	0	609	870	3353	1850	2579	3353	6527	9324	12122	7545	10778	14011	10984	15691	20399
Electricity Import	0			0			0			0			0	31948	45640	59333
Gas	3803	4572	6957	13110	18679	21328	26426	33711	44763	49996	61891	82702	120512	80560	115086	164307
LHP+SHP	1930	1930	2174	4157	3043	4348	11207	6533	9332	12132	6533	9332	12132	6533	9332	12132
Nuclear	0	0	0	0	1000	1500	3600	1500	2500	7200	2500	3500	7200	3500	3500	7200
SHP	20	60	81	105	172	246	320	409	585	760	894	1277	1660	1886	2694	3502
Solar	0	260	377	490	1369	1956	2543	3455	4936	6417	7000	10000	15970	25917	37024	48132
Wind	0	10	18	23	19	28	36	22	32	41	25	36	47	29	42	54
Biomass	0	0	0	0	3	4	5	16	23	30	35	50	65	54	77	100
Supply	5733	7440	10476	21238	26092	31989	47490	52174	71495	88698	8642	117675	171598	164411	229086	315158

Table 8. Renewable electricity supply projections (MW) for the Reference, High Growth and Optimistic II scenarios (Source: NEMP 2014).

System	Short term (to 2015)			Medium term (2016 – 2020)			Long term (2021 – 2030)		
	7%	10%	13%	7%	10%	13%	7%	10%	13%
LHP	3,000	4,000	11,207	6000	8,000	12,132	6,000	8,000	12,132
SHP	43	350	320	533	1,332	760	533	1,332	2,600
Solar PV	1,400	2,000	2,500	3000	4,000	5,000	20,000	25,000	30,000
Solar thermal	-	-	-	45	936	1,400	6,000	12,000	18,132
Biomass	5	5	5	16	23	30	50	77	100
Wind	20	28	36	22	32	41	30	42	54
Total RE	4,468	6,383	14,068	10,026	14,323	19,363	32,613	46,451	63,018
Total Energy	26,000	32,000	48,000	52,000	72,000	90,000	160,000	230,000	315,000
% RE	17%	20%	29%	19%	20%	22%	20%	20%	20%
% solar PV	5.4%	6.3%	5.2%	5.8%	5.5%	5.5%	12.5%	10.9%	9.5%

Table 9. Long term targets for Solar PV end applications - Optimistic II scenario (Source, REMP 2012).

Index	End application	Long term target (MW)
1	Solar PV home systems	15
2	Solar PV water pumping	5,000
3	Solar PV community services	3,000
4	Solar PV refrigerators	2,000
5	Solar PV street and traffic lighting	10,000
6	Solar PV large-scale PV plants	9,990
	Total	**30,005**

Low carbon strategy to achieve NV20:2020

The World Bank has carried out a study to assess the costs and benefits of different avenues to pursue green growth in Nigeria. The main insight of the study is that Nigeria can stabilize carbon emissions while at the same time moving it closer to the objectives of NV20:2020.[32] Based on its low carbon development results in four sectors (power,[33] agriculture, transport and oil & gas), the study has recommended that the Federal Ministry of Environment (FME) should expeditiously finalise Nigeria's NAMAs. Several observations have been made concerning the power sector, including: [34]

- one recommendation is for up to 20% of grid-based power to be generated by renewable energy sources (including hydro-power) between 2020 and 2022,
- 80 % of total carbon emission reductions have a negative marginal abatement cost, negative cost (that is, a benefit);
- Nigeria should develop large scale grid-connected demonstration projects totaling about 100 MW each for PV, CSP, and wind before 2020; and
- Feasibility studies for large-scale renewable energy projects could be supported by seed resources already earmarked for this purpose under the World Bank NEWMAP project (Nigeria Erosion and Watershed Management Project) as well as through mobilization of additional resources;

The emissions related to the Reference Scenario in the WB study are shown in **Figure 3**. A low-carbon pathway has been developed that takes into account measures such as demand-side energy efficiency (EE) measures, T&D loss reduction, power generation from renewables (wind, solar PV, concentrated solar, waste-to-power, biomass, large and small hydro), more efficient fossil fuel combustion, and hybrid off-grid solutions.[35] In the low-carbon scenario, the installed capacity of solar PV is 100 MW in 2015, 1.7 GW in 2025, and 10 GW in 2035. The installed solar PV capacities in the WB study are consistent with the baseline project considered in the UNDP-GEF project (see 100 MW PV project in Bauchi State discussed in Section 1.3.1), and the medium-term target under Optimistic II scenario derived from NEMP 2014. **Table 10** compares the results between the Reference and Low Carbon development scenarios. The results show that the low-carbon development pathway allows Nigeria to achieve the objectives of the NV20:2020 at a lower cost than the Reference scenario. The alternative model would also generate significant reduction of GHG emissions, estimated to be in the range of 2–2.5 billion tCO_{2e} between 2010 and 2035.

The study also observed that the solar radiation in the range 1,500–2,000 kWh/m^2 per year was adequate for PV even in the South of Nigeria. The average solar irradiation in Nigeria is 2,011

[32] Cervigni et al. (2013), pg.xi.

[33] In the case of the power sector analysis, several working sessions were convened by the Energy Commission of Nigeria (ECN) where the study team and Nigerian experts conducted hands-on interaction on the modeling tools to come up with a shared understanding of the model's inputs and a consensus on plausible results (Cervigni et al, 2013, pg. 31).

[34] Cervigni et al. (2013), pp. 104-106.

[35] Ibid. pg. 88.

kWh/m^2 per year. Covering 1% of the land area of Nigeria would produce about 1,833 TWh/year of energy with an installed capacity of 1,046 GW.[36] This simple calculation makes clear that PV in Nigeria is not limited by the resource potential. The actual capacity installed will be constrained by capital costs (see DREI analyses in Section 1.5) and energy needs.

Table 10. Two scenarios for power sector development to 2035 (Source: Cervigni et al. (2013), Table 6.5, pg. 88).

	Annual generation in 2035	*NPV of generation costs (US$billions)*			*Cumulative emissions*	*Diversity of generation*
Scenarios	*TWh*	*Capital and O&M*	*Fuel*	*Total*	*Mt CO_2e*	*Complement of Gini index (%)*
Reference case	620	52	127	178	4,335	17
Low-carbon	525	71	94	166	2,475	34

1.3. Baseline Projects and Baseline Supporting Activities

1.3.1 Baseline project

For the purposes of the UNDP-GEF project, a baseline project has been identified as a 100 MW PV plant that will be implemented by Nigerian Solar Capital Partners (NSCP) in the North-East State of Bauchi. The project lends support to Nigeria's economic agenda for North East *Special Initiative for the Nigerian North East*. Also, due to a significant lack of investment in power generation and a lack of gas transmission in Northern Nigeria, local populations and industry rely on expensive diesel generators. The local cost of diesel-generated electricity is $0.55-0.60/kWh, well over twice the cost of solar PV generated electricity. Solar power is a natural option for Northern Nigeria due to prolific irradiation levels.[37] With a capacity factor of 30%, the project is expected to deliver 262,800 MWh/yr to the grid.

The NSCP project is the most advanced on-grid solar PV project being developed in Nigeria, and it has reached the stage of PPA negotiations. The project has also completed social and environmental impact assessments using the due diligence processes of multilateral institutions like the WB and the AfDB. The project is also benefiting from the technical and financial assistance of the WB and AfDB under the Clean Technology Fund (CTF).[38]

The CTF has been instrumental in limiting upfront costs in establishing project feasibility, knowledge and experience for the developer and financiers. By presenting an 'investment bid ready' document that consists of the CTF investment plan and feasibility studies, it is expected to contribute to reducing risk perceptions and significantly reducing transaction costs due to resource assessment, siting, permitting, planning, developing project proposals, pre-assembling financing packages, negotiating power-purchase contracts with utilities/entities and hedging cash-flows/payments, thereby attracting investors. Bundling the CTF investment plan with feasibility studies assures a greater degree of public acceptance for environmental and social impact studies, getting clearances and increases investor confidence. The proposed NSCP Solar PV power plant with 'investment bid ready' Investment Plan approach (combined pre-cooked Investment Plan and site-specific Feasibility studies) will be able to not only attract international investors, and fast disbursement, but also enable construction and operational implementation as per timelines. Also the proposed 'competitive bidding' adopting a reverse auction method for awarding projects to qualified bidders would help leverage the continuous falling price landscape in solar PV. The CTF solar PV power plant project is proposed to be a

[36] This calculation assumes a total land area of 911,521 km2, an average PV conversion efficiency of 10%, and a 20% capacity factor.

[37] WB & AfDB (2014) Clean Technology Fund Investment Plan for Nigeria – update note, July 2014, pg. 33.

[38] WB & AfDB (2014) Clean Technology Fund Investment Plan for Nigeria – update note, July 2014.

component within the World Bank Nigeria Electricity Transmission and Access Project, hence leveraging synergies with that project including monitoring and evaluation.[39]

The solar irradiance at the project site has been measured as 2,122 kWh/m^2/yr at the horizontal plate, providing an optimum location for the generation of solar PV power. The project site is located at around 18km from the interconnection point at the 132KV Gombe – Bauchi 132KV single circuit distribution line (see **Figure 8**).

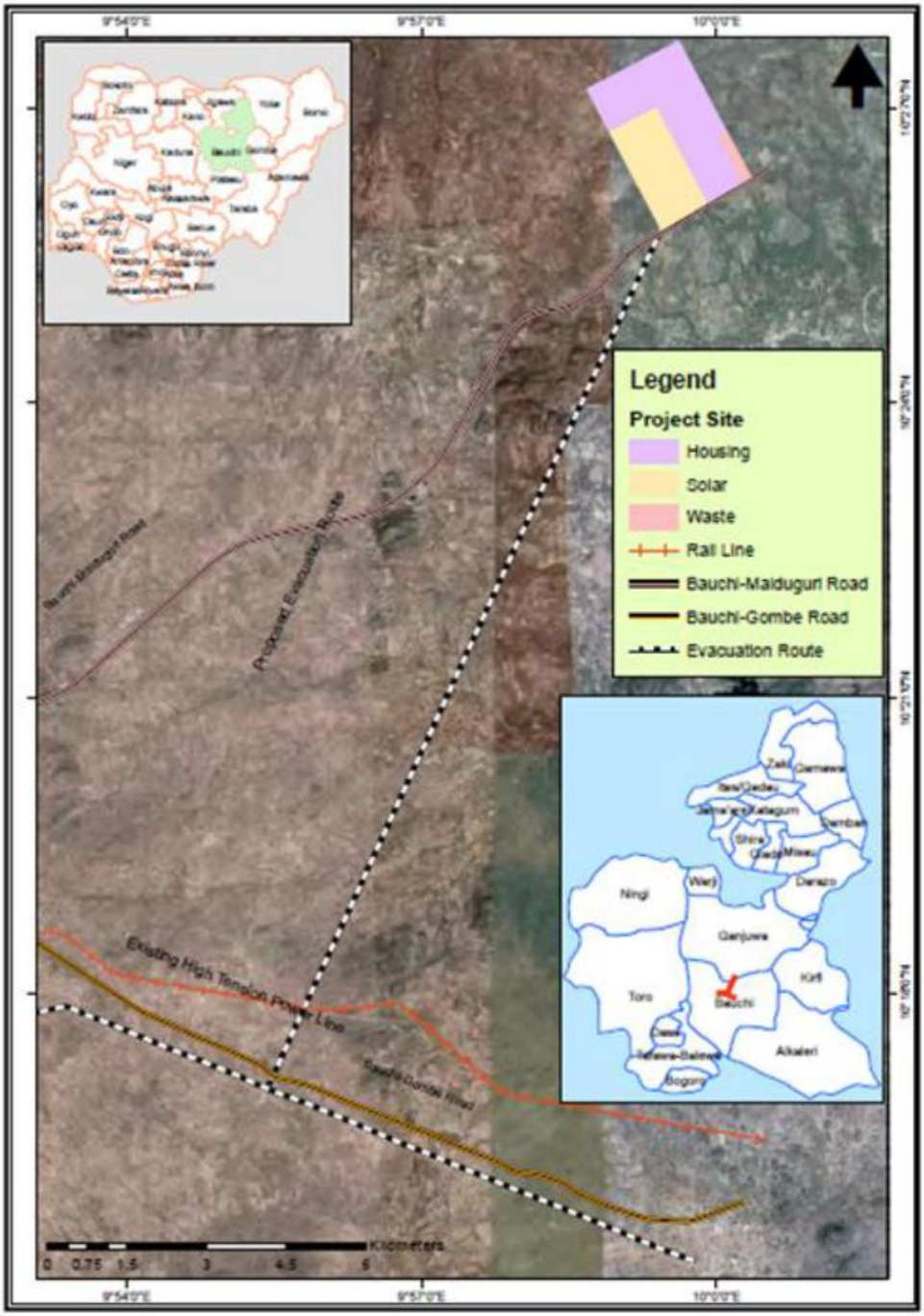


Figure 8. Baseline project location site (Source: WB&AfDB, 2014, pg. 34).

[39] Ibid, pg. 29.

The contractual structure of the project is illustrated in Figure 10. The AfDB is finalizing its due diligence on the following contracts: (i) PPA, (ii) tariff, (iii) EPC contract, (iv) generation license, (v) O&M, (vi) land lease agreement, (vii) power transmission. Project implementation and commissioning is expected to take 18 months after the due diligence has been completed. CTF funding is expected to be US$25 million, and the AfDB is looking to provide a senior loan of US$80 million. The CTF funding is expected to catalyse a total of US$243 million in private investments for the project.[40]

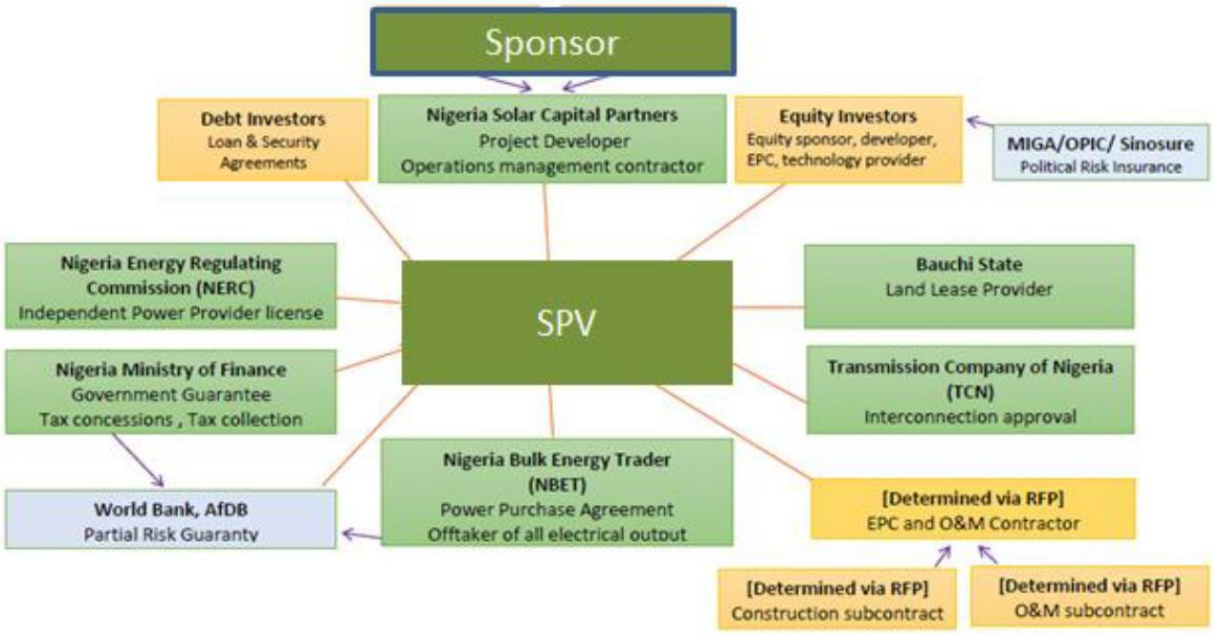


Figure 9. Project contractual structure (WB&AfDB, 2014, pg. 35).

As discussed in Section 2, all of the technical assistance components of the UNDP-GEF project have been designed to enhance the successful implementation of the baseline project. The incremental reasoning relating to the baseline projects is detailed in Section 2.2. In brief, the baseline projects are expected to be implemented in the absence of the UNDP- GEF project but with known deficiencies. The principal deficiency has been identified as being: no planned use of PV technologies that are designed to operate in semi-arid / desert climatic condition where dust arising from the Harmattan can severely degrade PV yield. The investments under Component 3 of the project will address this issue to enhance the performance of the baseline project and thereby ensure delivery of the expected global environmental benefits (see Section 2.4). The incremental reasoning is also related to scaled-up mitigation action in the power sector through the reduction of risks for catalysing investments required to implement renewable energy technologies in Nigeria. As is discussed in Sections 1.5 and 2, the technical assistance components of the project propose to overcome the overall barrier related to the high cost of capital through the implementation of policy and financial derisking instruments. Therefore, the baseline projects form the foundation on which these derisking instruments will be designed and implemented with a view to scaling-up mitigation actions in the form of a NAMA for the power sector. As the first IPP solar PV project in Nigeria connected to the national grid, its success will serve as a demonstration project to evaluate technical, institutional and economic viability in Nigeria and to build local expertise to foster rapid adoption and replication for similar grid-connected projects. This project will help the FGN to find solutions to barriers and common set of issues that a solar PV power plant provider may experience.[41]

[40] Ibid., pg. 36.

[41] Ibid., pg. 36.

1.3.2 Baseline Supporting Activities

Several activities are taking place in the baseline that will support the development of renewable energy sources in the power sector. The review and interactions with these initiatives during project design and conceptualisation have enabled very close coordination and complementarity of efforts with other development partners and other national institutions to be achieved.

1.3.2.1. NAMA-related initiatives

As discussed in Section 1.2.5.3, the WB study on low carbon development in four sectors (power, agriculture, transport and oil & gas), has recommended that the FME should expeditiously finalise Nigeria's NAMAs based on the results of the WB's low-emission pathways to achieve the objectives of the NV20:2020.

1.3.2.2. Initiatives of development partners

African Development Bank (AfDB)

As discussed in Section 1.3.1, the AfDB is actively supporting the 100 MW baseline solar PV project in Bauchi State through the CTF and potentially through debt financing. The AfDB is also providing capacity development assistance to the NBET in terms of managing contractual agreements under PPAs with IPPs,[42] and through the provision of Partial Risk Guarantees (PRGs) on PPAs. These linkages are shown in **Figure 9**.

World Bank (WB)

Support to NSCP's baseline project and other renewable projects[43]

As shown in **Figure 9**, the WB is also supporting NSCP's 100 MW solar PV project in Bauchi State through the provision of PRGs. Further, the CTF-component of the WB will be used to propose an additional 100 MW solar PV generation capacity that will be configured as solar PV projects in three or four sites, with grid generation near load centers in key regions, showcasing different PPP/PPA IPP configurations. The location of the solar power plants is likely to be in the Northern and Eastern parts of the country (locations contingent on feasibility study recommendations). Three different plant configurations (20-100 MW) are being considered: (1) at single-site, allowing for modular scale-up, phased development in the State of Bauchi; (2) co-generation feeder plants adjacent to the Hydro Power Plant (Shiroro, Jebba, Kainji including exploring upcoming proposed Hydro Power Plants) (grid-connected, centralized &/or distributed); and (3) embedded generation plants within privatized DISCOs (grid-connected, distributed). Due to high supply-demand gap in Nigeria, at the margin, generation using diesel fuel or similar are utilized at a cost higher than that of solar-hydro. The intention is to develop plants within existing transmission infrastructure set-up, using current policies (e.g. embedded generation, incentives, etc.) and market-based mechanisms. The feasibility studies will be funded by other WB projects such as the NEWMAP and the NETAP (see below).

Nigeria Erosion and Watershed Management Project (NEWMAP)[44]

NEWMAP is a GEF-financed and WB-supported initiative aimed at rehabilitating degraded lands and reducing erosion and climate vulnerability in targeted areas (Abia, Anambra, Cross Rivers, Ebonyi, Edo, Enugu and Imo). The project has four primary components: (i) investment in erosion and watershed management; (ii) institutional and information systems for erosion and watershed management; (iii) climate change adaptation and mitigation; and (iv) project management. In particular, the activities in component one involve sub-projects each of which

[42] DREI interview carried out with Mr Bokar Ture, Senior Energy Analyst, AfDB on Friday 10 April 2015.

[43] WB & AfDB (2014), pp. 26-29.

[44] WB (2012) Nigeria Erosion and Watershed Management Project (NEWMAP) : environmental and social management framework - executive summary. (http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2012/05/09/000333037_20120509005138/Rendered/PDF/685560BR0P12490Official0Use0Only090.pdf - accessed 24 April 2015)

may include construction and/or rehabilitation of various identified erosion or flooding sites. These activities may lead to environmental and social impacts, which must be mitigated in accordance with the tenets of sustainable development. An Environmental and Social Management Framework (ESMF) that seeks to provide a clear process including action plans to integrate environmental and social considerations into the NEWMAP. The ESMF will ensure that implementation of NEWMAP meets with the existing EIA law in Nigeria and the WB Environmental and Social Safeguards policies. Based on the ESMF the, UNDP-GEF project will support the Environmental Protection Agency (EPA) to develop social and environmental screening and safeguard guidelines for renewable energy projects. This will allow the FME to align the *Environmental Impact Assessment (EIA) Act No. 86 of 1992* with international benchmarks that will facilitate private developers of renewable power to raise international financing.

Nigeria Electricity Transmission and Access Project (NETAP)[45]

The transmission network in Nigeria is not equipped to transmit the volume of power needed to supply the demand. The TCN, which has remained as a public utility during the reforms, has been placed under a management contract (Manitoba Hydro International) to support its capacity building and to improve the efficiency of the national grid operator, whose technical losses are estimated to be in the range of 12 %. FGN intends to combine TCN's reform with a major investment program which will increase the wheeling capacity of the network from the current 4,800 MW to about 13,000 MW by the year 2020, as well as to increase the network's reliability, stability, and efficiency. The NETAP development objective is to improve the capacity and efficiency of the transmission network and increase electricity services. More specifically, the project seeks to (i) increase the transmission network's wheeling capacity; (ii) reduce transmission network losses; and (iii) increase the number of people connected to the grid in a gender-differentiated manner. The NETAP also supports the goals set under the Sustainable Energy for All (SE4All) initiative by assisting in increased power supply and improving access to energy. In achieving these goals, the WB project will also indirectly serve to support the integration of renewable electricity in the strengthened national grid, and support the geospatial development of practicable renewable energy projects in Nigeria. Through technical assistance, the NETAP plans the preparation of a least-cost geospatial implementation plan for grid and off-grid rollout.[46] The UNDP-GEF project will collaborate with the NETAP initiative for developing a geospatially-based map of practical locations for implementing grid-connected renewable energy projects (solar, wind and biomass). NETAP will be implemented between 2015 and 2030.

Power Sector Guarantee Project (PSGP)

Under this initiative, the WB is providing PRGs to support increased private sector participation in the power sector (IPPs, privatized generation, and distribution companies) by supporting improved credit worthiness of the FGN agencies (e.g. NBET). The first two greenfield IPP transactions being supported under the PSGP (Azura Edo IPP and the Exxon Qua Iboe IPP) will increase the installed power capacity of Nigeria by 1,000 MW and mobilize over US$1.7 billion in private capital. The institutional strengthening that will be achieved under the PSGP will also benefit IPPs that will develop renewable electricity generation projects.

Rural Electrification and Renewable Energy Development

The project will build upon the results and lessons learnt from the earlier GEF-financed, World Bank-supported project "Rural Electrification and Renewable Energy Development" (completed in 2011), which supported implementation of pilot off-grid RE projects in rural locations. The project final report states that in the absence of comprehensive public policies to promote RE,

[45] World Bank (2014) NG-Electricity Transmission Project - Report No.: PIDC7335 - http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/AFR/2014/07/16/090224b08259512e/1_0/Rendered/INDEX/Project0Inform0on0Project000P146330.txt - accessed 27 April 2015.

[46] Terms of reference for technical assistance provided by Mr Muhammad Wakil, Energy Specialist, World Bank, Nigeria.

scaling-up is not possible. In this context, the focus of the proposed UNDP-GEF project on policy and financial derisking is fully justified and consistent with WB recommendations.

Financial Intermediary Loan for Discos

Discussions with the NIAF and the WB revealed that the ability of the electricity off-taker – i.e. NBET – to honour its financial contractual agreements with IPPs was heavily dependent on the ability of discos to recover revenues downstream. Currently, discos have an electricity sales revenue recovery of between 40% and 70%[47] with the discos in southern Nigeria having higher recovery rates. As far as IPPs are concerned, this situation translates into a counterparty risk (see Section 1.5) that eventually increases the cost of capital. Using a value chain approach, the WB is designing a financial intermediary loan scheme of about US$500 million[48] that will be used to enhance the technical, managerial and governance capabilities of discos to increase their revenue collection rates, and hence, their financial wellbeing.

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Nigerian Energy Support Programme (NESP)[49]

The NESP supports the Nigerian government, in particular the Federal Ministry of Power (FMP), the Federal Ministry of Finance (FMF), the Nigerian Electricity Regulatory Commission (NERC), the Nigerian Bulk Electricity Trading Plc. (NBET) as well as the Transmission Company of Nigeria (TCN) in designing, structuring and implementing a renewable energy support scheme based on tender processes (in particular for large grid-connected PV solar, wind and hydro power projects).

Regarding the RE support scheme, the NESP scope of activities includes the following tasks:

1. Conceptual preparation and structuring of a RE tender process (for large scale PV, wind and small hydro power plants) in line with the Regulation for the Procurement of the Generation Capacity 2014. This comprises among other tasks the following key activities:
   a. Support NERC in conducting economic impact assessment calculations and analysis (in line with activities listed under 2. and 3.)
   b. Assist stakeholders in establishing financial security and support instruments in cooperation with their partners (in line with activities listed under 2.)
   c. Design and structure competitive procurement concept (technical, commercial and financial design parameters)
   d. Support preparation of technology-specific competitive procurement documentation packages, i.e.
      i. Preparation of a Request for Information (RfI)
      ii. Preparation of an Expression of Interest (EoI)
      iii. Preparation of NDAs for the parties involved in the process
      iv. Conceptual preparation of a Request for Proposal (RfP) for indicative and binding bids (general requirements, qualification criteria, evaluation) and preparation of RfP documentation, e.g. Implementation Agreement, Grid Connection Agreement (backstopping consultancy), Bid forms (indicative and binding), and Power Purchase Agreement (backstopping consultancy)
   e. Assist in implementation of first competitive procurement window
      i. Organization and moderation of public consultations, bidders' conferences, and questions and answers sessions
      ii. Provision of expert staff for the auditors' committee for bid evaluation

[47] Discussions with NIAF staff in Abuja on Monday 16 March 2015.

[48] Information provided by WB staff (Muhammad Wakil) in Abuja on Thursday 19 March 2015.

[49] Information provided by GIZ staff (Sibylle Hasse and Daniel Werner) on 20 March 2015.

f. Monitoring and assessment of first RE competitive procurement window in Nigeria once first round is completed

2. Support NERC in review of RE feed-in tariffs under Multi Year Tariff Order (MYTO) II for small scale (PV, wind and biomass) projects and review of ceiling tariffs for large scale (PV and wind) projects
   a. Revision of existing tariff calculations and tools (with regard to adequate risk-/cost-reflectivity)
   b. Review of "least to consumer" approach (regulatory impact analysis)
   c. Review of System and Market Operator's data structure to enhance power industry performance data by financial and economic data
   d. Support promotion campaign of RE support mechanism
3. Support to TCN regarding grid and system integration of renewable energy
   a. Review of transmission and distribution grid codes
   b. Conduct Grid availability and capacity studies to define capacity thresholds and regional allocation for on-grid renewable energy projects and estimation of technical and economic impact
   c. Preparation of concept note regarding necessary infrastructure data collection requirements for Market Operator's report to NERC
   d. Support establishment of Market Operator's Annual Report Power to NERC to create basis for information-based decision making at regulatory level
   e. Support capacity development and training of TCN staff regarding RE grid integration and application of respective planning and analysis tools
   f. Establish GIS based data encoding and analysis system to support grid integration planning of RE generation capacity and development of an institutionalized IRP

Furthermore, NESP provides the following support to on-grid RE:

- Design of a feed-in tariff for small RE (< 5 MW)
- Organizational development support to the FMP (Renewable Energy and Rural Power Access Department, all RE technologies)
- Support in drafting the National Policy on Renewable Energy and Energy Efficiency, National Action Plans for renewable energy and energy efficiency and further policy documents

<u>NESP Training Programme</u>

In Nigeria, the skills acquisition landscape for renewable energy and energy efficiency is fragmented and inconsistent with market needs. Current offers are either academic, or irregular or focused on poverty alleviation, and ignoring relevant professional groups. With an eye on market needs, NESP seeks to establish nationally recognised training courses that enhance employability and accelerate the deployment of renewable energy and energy efficiency interventions.

NESP will achieve this by developing six curricula and empowering 7 or more Nigerian training academies and research institutions to deliver the curricula (**Table 11**). Training partners are supported with training syllabi, handbooks and other training material and a training of faculty. Selected partners will also receive hands-on assistance in training delivery and advisory services on commercialisation. NESP is further seeking certification through a national body so as to link current courses to competency standards that are revalidated periodically. The NESP Training Programme will be implemented until 2017.

Table 11. Proposed curricula and training partners for the NESP Training Programme.

Curricula under development	*Training partners*
1. Add-on qualification as *Off-Grid RE Designer* 2. Add-on qualification as *Solar PV Installer* 3. Add-on qualification for *Small Hydropower Civil Works* 4. Add-on qualification as *Energy Manager* 5. Add-on qualification as *Energy Auditor* 6. Add-on qualification for *Energy Efficient Building Design*	1. Centre for Renewable Energy Technology, Federal University of Technology Akure 2. Sokoto Energy Research Centre (SERC), University of Sokoto 3. National Centre for Energy Efficiency & Conservation (NCEEC), University of Lagos 4. National Power Training Institute of Nigeria (NAPTIN), Kainji 5. Centre for Renewable Energy Research, Umaru Musa Yar'adua University, Katsina 6. National Centre for Energy Research & Development (NCERD), University of Nigeria, Nsukka 7. BAS Consulting, Lagos 8. Green Technology Development Institute, University of Ibadan (*proposed*) 9. International Energy Academy (IEA), Ibadan (*proposed*)

Department for International Development (DFID)

Nigeria Infrastructure Advisory Facility (NIAF)

The DFID-financed NIAF was designed to provide access to rapid and flexible consulting expertise to help Nigeria improve its infrastructure through policy and strategy formulation, planning, project implementation and private sector investment. NIAF is designed to implement projects in power, transport, major infrastructure, climate change and cities (urban planning and development) aimed at reducing infrastructure constraints to growth in non-oil gross domestic product and employment, and reduced poverty due to the relaxation of binding infrastructure constraints'.[50]

NIAF has been working in the Nigerian electricity sector since 2007 with the objective of reducing the degree to which power shortages impede economic growth across the country. The NIAF Power workstream is divided into three Activity Areas as follows:[51]

- Privatisation – targeting the increasing of private sector participation in the sector.
- Market Reform – assisting with the preparation for the commencement of the Transitional Electricity Market (TEM) and then the Medium Term Market (MTM).
- Service Delivery – focusing on the more immediate maintenance and expansion of power generation, transmission and distribution capacity.

Among other projects and initiatives, Adam Smith International, through NIAF, has designed a programme aimed at developing both public and private markets for solar in Lagos and northern Nigeria. Funded by the International Climate Fund (ICF) and DFID, the SolarNigeria Programme will facilitate the sustainable delivery of public services through solar (health clinics and school electrification) and a private sector component to expand the commercial market for solar. For instance, using ICF funding of £37m, SolarNigeria has negotiated Lagos State co-funding of £15m, and expects private sector funding of £90m. The expected outcomes are more than 40MW of installed PV capacity, 3m tonnes of CO_2 abatement, 2.8 million people using solar in the home, 11 flagship rural health centres benefitting from improved services, and more than 3,000 jobs established in the supply chain.[52] NIAF is also collaborating with the WB and the GIZ for developing grid extension investment plans in various Nigerian states.

[50] http://niafng.org/about-2/ - accessed 25 April 2015.

[51] http://niafng.org/sectors-2/power/ - accessed 25 April 2015.

[52] http://niafng.org/green-growth-powering-nigerias-future/ - accessed 25 April 2015.

GEF-financed, UNIDO-supported Project

Mini-grid based renewable energy (biomass) sources to augment rural electrification

The UNIDO-GEF project is expected to reach completion in 2015. It will provide lessons learned on several issues pertaining to the outputs and outcomes of the UNDP-GEF NAMA project. Of relevance here are the following:

- The identification of potential sites endowed with renewable biomass for replication of power generation projects: This output will be useful for the development a GIS-based tool that will provide the practicable locations of renewable biomass power across Nigeria;
- Feed-in-tariff (FiT) for biomass power in place: Based on the DREI analyses that have been carried out for solar PV during the project design, and that will be detailed during project implementation, the application of the methodology can be scaled up to cover biomass-derived renewable electricity using a risk-adjusted approach;
- Appropriate financing facility developed for RE related projects: This output will be used to inform the technical assistance that the UNDP-GEF project will provide regarding the identification and proposition of nationally-appropriate low-cost financial instruments to facilitate the development of RE projects in Nigeria.

1.3.2.3. National complementary initiatives

National Climate Change Policy and Response Strategy (NCCPRS)

Nigeria has put in place a NCCPRS that seeks to address the issues of mitigation measures and financial requirements and mobilization. The draft policy document has been approved by the federal executive council and is currently with the legislators for passage into law.[53] The strategic goal of Nigeria's response to climate change is to foster a low-carbon, high growth economic development path and to build a climate resilient society.[54] This will be achieved through the attainment of the following objectives:

i. Implement mitigation measures that promote low carbon options and increase carbon sinks while also creating sustainable and high economic growth;
ii. Implement climate-resilient adaptation measures, particularly in vulnerable sectors and vulnerable communities, within a gender-sensitive, national development context;
iii. Strengthen national capacity to address mitigation and adaptation issues of climate change, at the technical, institutional, financial and system levels;
iv. Raise national climate change-related science, technology, and R&D efforts to a new level that will enable the country to better participate in international scientific and technological cooperation on climate change;
v. Significantly increase public awareness and involve private sector participation in addressing the challenges of climate change;
vi. Strengthen national institutions and mechanisms (policy, legislative and economic) to establish a suitable and functional framework for climate change governance.

Concerning the energy sector, the NCCPRS proposes the following actions:

- Promote diverse energy mix with increasing proportion from renewable and other sources using clean technologies;
- Enhance energy efficiency in all sectors;
- Strengthen private sector participation in the production and use of clean energy;

[53] Federal Ministry of Environment (FME) (2014) Nigeria's Second National Communication Under the United Nations Framework Convention on Climate Change, pg. 48.

[54] FME (2012) National Climate Change Policy and Strategy Response.

- Support on-going initiatives to gradually eliminate gas flaring.

The NCCPRS has recommended a target for generating energy from renewable sources to account for a minimum of 20% by 2030.

National Environmental, Economic and Development Study (NEEDS) for Climate Change

The NEEDS initiative was carried out in 2010 through technical assistance from the UNFCCC. A key lesson was: "Integrated and sustainable approach is grounded in the fact that mitigation is essential to avoid the unmanageable, while adaptation is no less essential to manage the unavoidable. This should constitute the basis for the country's efforts at mainstreaming climate change into national sustainable development."[55] The NEEDS project also mentioned the government's goal of providing half of the country's total energy demand in the form of sustainable and affordable renewable energy, thereby contributing to the country's efforts to keep GHG at barest minimum.[56]

The relative vulnerability of the six geopolitical zones of Nigeria is shown in **Figure 10**. The indicators used to measure vulnerability were a combination of many variables ranging from physical (e.g. rainfall, temperature, changes in sea level, relief, soil conditions etc.) to socio-economic (e.g. education, assets, income, access to information, services and technology, poverty, etc.), and they were sufficiently broad in relevance to allow a meaningful assessment of vulnerability of different parts of the country to climate change. There is a general south-north divide, but the south west is relatively the least vulnerable of the zones. The three zones in the north show higher vulnerability when compared with those in the south, a reflection of the higher rainfall and certain better socio-economic development in the south. The North East zone exhibits the highest relative vulnerability because of its highest exposure to adverse climatic impacts and lowest adaptive capacity. Vulnerability to climate impacts should therefore be a key design feature in the baseline PV project that is discussed in Section 1.3.1. This is further discussed in Section 2.2.

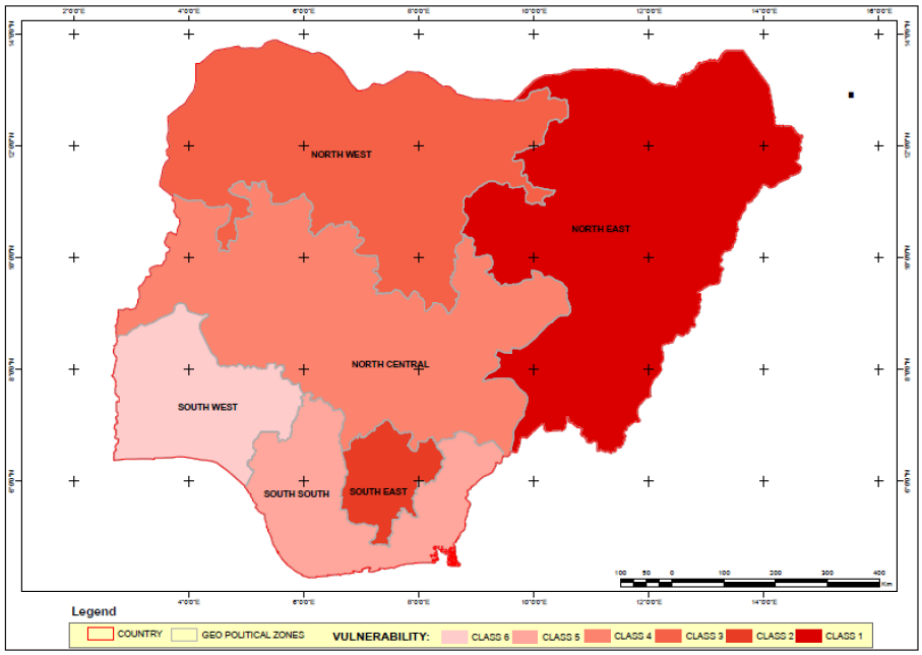


Figure 10. Spatial variation in relative vulnerability to climate change over Nigeria (Source: NEEDS, 2010).

[55] Federal Ministry of Environment (FME) (2010) National Environmental, Economic and Development Study (NEEDS) for Climate Change in Nigeria, pp. 6-7.

[56] Ibid., pg. 12.

Low Carbon Development Opportunities to Achieve the NV20:2020

As discussed in Section 1.2.5.3, the WB has carried out a study to investigate the low-carbon achievement of the NV20:2020. It has shown that the objectives of NV20:2020 could be achieved using a low-carbon development trajectory at a lower cost while at the same time delivering significant global environmental benefits.

National Capacity Self-Assessment (NCSA)

Nigeria conducted an NCSA for the three Conventions through a WB-supported, GEF-financed project.[57] The NCSA covered the status of regulatory and institutional frameworks; national communications; a study on vulnerability and adaptation to climate change; and potential sectoral GHG emission reduction projects. The NCSA highlights the critical role that renewable energy can play in improving Nigeria's energy security and reducing its GHG emissions, and the importance of institutional strengthening and coordination for maximising the impacts of mitigation actions.

National Communications

Nigeria submitted its Initial National Communication to the UNFCCC in November 2003[58] and its Second National Communication in February 2014.[59] The UNDP-GEF project is fully aligned with the SNC, notably with regard to its support to solar energy, and its emphasis on capacity development and institutional strengthening. Nigeria is launching its Third National Communication[60] and is receiving GEF support to submit its first Biennial Update Report (BUR)[61]. Both GEF-financed enabling activities will be supported by the UNDP. The NCs and BUR are effective means of detailing planned NAMAs, and enhancing their visibility to attract financial support.

Lagos Energy Academy (LEA)[62]

The LEA was commissioned on 14 October 2014 to train the next generation of Energy sector workers, ready to take the Energy sector in Nigeria to where it should be in the 21st Century. An Atkins study called 'Future Proofing Cities' conducted for Lagos State has revealed that the Energy Sector needs 200,000 engineers to meet the Power sector needs over the next 15 years. The objectives of the LEA are as follows:

- Provide international-standard training in all areas of the power value chain ranging from generation, transmission, distribution and production of power sector components such as transformers, meters and control panels;
- To provide industry standard training for young citizens and produce employable graduates;
- To deliver medium and long-term social and economic benefits to citizens and society in the state by improving local content inputs, building local capacity, improving energy efficiency and creating new jobs;
- Improve the standard of electricity technicians and professionals in Lagos State and Nigeria;
- Establish a Certification Scheme - to ensure that professionals have received and continue to receive a high level of training and experience; and

[57] http://www.worldbank.org/projects/P082884/nigeria-national-capacity-needs-self-assessment?lang=en – accessed 27 April 2015.

[58] Ministry of Environment (2003) Nigeria's First National Communication Under the United Nations Framework Convention on Climate Change.

[59] Federal Ministry of Environment (2014) Nigeria's Second National Communication Under the United Nations Framework Convention on Climate Change.

[60] https://www.thegef.org/gef/project_detail?projID=5777 – accessed 27 April 2015.

[61] https://www.thegef.org/gef/project_detail?projID=6976 – accessed 27 April 2015.

[62] Information provided by Ms Y Olagbende, Director, Lagos Energy Academy on 10 April 2015.

- To establish a Research and Development (R&D) centre where new technology in Power generation, distribution and management can be developed.

The Academy is made up of a number of training rooms, workshops, a Power simulation room and the Lagos Solar Park which contains a solar PV research facility and a RE training hub. The LEA business model is a combination of self-sufficiency and also sponsorship. The UNDP-GEF project will support the LEA to enhance its delivery of applied trainings across the solar PV value chain on a cost-recovery basis.

1.4. Stakeholder Analysis

The design and conceptualisation of the project have been carried out using multi-stakeholder processes. This was a key consideration in project development for two principal reasons: (1) the 'meta-technology' characteristics of the power sector imply that a diverse set of stakeholders from the public sector, the private sector and civil society are directly involved across the value chain spanning electricity generation to end-use; and (2) to ensure national institutional ownership that will aid the successful implementation of the project. The stakeholders listed in **Table 12** were actively engaged in preparation of the UNDP-GEF project. Their roles and responsibilities during project implementation are also captured.

Table 12. Roles and responsibilities of stakeholders in the project.

Stakeholder	Roles and responsibilities (project preparation & implementation)
Energy Commission of Nigeria (ECN)	The ECN has the statutory mandate for strategic planning and coordination of national policies in the field of energy. ECN has coordinated stakeholder consultations during preparation of the project. During the implementation phase, ECN will be the co-chair of the Technical Working Group (TWG) for Component 1 of the project. The ECN will also house the Project Management Unit (PMU).
Federal Ministry of Power (FMP)	The key function of the Ministry is to develop and facilitate the implementation of policies for the provision of adequate and reliable power supply in the country. In this capacity, the FMP was consulted during the formulation of the project. The FMP will chair the TWG for Component 2 of the project. The FMP will also be a direct beneficiary of the project through the development of geospatially referenced practicable locations for siting various types of on-grid renewable energy projects.
Nigerian Electricity Regulatory Commission (NERC)	NERC is an independent regulatory agency mandated to regulate and monitor the Nigerian power sector. Of direct relevance to NERC is the DREI analysis that can be used to guide the revision of MYTO II (equivalent of feed-in-tariffs in Nigeria) using a risk-adjusted approach. The DREI analyses can complement the technical assistance that the NERC is getting from GIZ under the NESP. This provides an opportunity for the UNDP-GEF project to collaborate with the GIZ and NERC. NERC will be invited to join the TWG for Component 2 and the Project Board.
Federal Ministry of Environment (FME)	The GEF Operational Focal Point and the DNA are hosted within the Ministry of Environment. The former was involved during the PIF and project preparation phases and will continue his involvement during project implementation. As the coordinator for developing the Nigeria NAMA strategy and action plan, the FME was closely involved in the formulation of the UNDP-GEF project. The FME will have a central role as chair of the Project Board (PB), and hence have the responsibility to seek high level political support for the project during implementation. The FME will also be a beneficiary of the project through the output related to the development of guidelines for social and environmental screening of RE projects so that the national EIA is aligned with international benchmarks.
Private sector – Nigerian	Because of the prevailing barriers and risks, there is currently limited

Solar Capital Partners (NSCP)	private sector investment in renewable energies in Nigeria. The most prominent solar PV private developer to date – i.e. NSCP - has been heavily involved in preparation of the UNDP-GEF project. Since NSCP is also the project owner of the 100 MW baseline solar PV project in Bauchi State, it will continue to be a key stakeholder throughout project implementation. Further, NSCP will be a member of the Project Board. The DREI methodology, which has been used in the preparation of the project, and will be used in Component 1 to assist the NAMA preparation, involves active outreach to the private sector to solicit its quantitative feedback on the barriers and investment risks to renewable energy in Nigeria. The DREI analysis performed for this Project Document involved structured interviews with 8 private sector investors, both domestic and international.
Federal Ministry of Finance (FMF)	The FMF was consulted during project formulation. It will chair the TWG for Component 1 and it will be a member of the PB. The FMF will be a direct beneficiary of the project under Component 1 that seeks to identify and propose financial derisking instruments to attract private sector investments in renewable energies, and in particular solar energy. The FMF will be closely consulted during the project implementation to identify the appropriate financial sector reforms that may be required in Nigeria in order to unlock low-cost public finance.
Presidential Task Force on Power (PTFP)	The PTFP was established in 2010 to drive the implementation of the reform of Nigeria's power sector. The role of the PTFP is to co-ordinate the activities of the various agencies charged with ensuring the removal of legal and regulatory obstacles to private sector investment in the power industry. It also has the mandate to monitor the planning and execution of various short-term projects in generation, transmission, distribution and fuel-to-power that are critical to meeting the stated service delivery targets of the power sector roadmap. In these capacities, the PTFP will co-chair the TWG for Component 2 of the project. Given its mandate, the PTFP will also provide political support for the UNDP-GEF project. The chairperson (or delegate) of the PTFP will be a member of the PB.
GIZ	GIZ has been consulted throughout all the stages of project design and conceptualisation, specifically – but not exclusively – in regard to the projects discussed in Section 1.3.2. Since GIZ is working in close collaboration with several national partners, including FMP, NERC and local training institutions, seamless coordination with projects implemented by GIZ will be ensured. Further, lessons-learned from the GIZ projects will be drawn upon when implementing the UNDP-GEF project. GIZ will be invited to be a member of the PB.
Lagos Energy Academy (LEA)	The LEA was consulted during the project formulation, and it was identified as a reliable partner for providing applied trainings for technicians from the private sector across the entire solar PV value chain. Through seed funding from the Lagos State Government and DFID, the LEA has put in place state-of-the-art training facilities, including testing laboratories and field operation of a solar PV array. The UNDP-GEF project will capitalize on these initial investments to develop new training courses and to complement existing equipment. The LEA will be invited to form part of the PB and as a member of the WG for Component 2.

1.5 Derisking Renewable Energy Investment (DREI) Analysis

1.5.1 Introducing the DREI methodology

In 2013, UNDP issued the Derisking Renewable Energy Investment report (the "DREI report") (UNDP, 2013). The DREI report introduced an innovative methodology (the "DREI methodology"), with an accompanying financial tool in Microsoft Excel, to quantitatively compare the cost-effectiveness of different public instruments in promoting renewable energy investment. The preliminary analysis of Nigeria set out in this report is based on the DREI methodology.

A key focus of the DREI methodology is on financing costs for renewable energy. While technology costs for renewable energy have fallen dramatically in recent years , private sector investors in renewable energy in developing countries still face high financing costs (both for equity and debt). These high financing costs reflect a range of technical, regulatory, financial and informational barriers and their associated investment risks. Investors in early-stage renewable energy markets, such as those of many developing countries, require a high rate of return to compensate for these risks.

In seeking to create an enabled environment for private sector renewable energy investment, policy-makers typically implement a package of public instruments. From a financial perspective, the public instrument package aims to achieve a risk-return profile for renewable energy that can cost-effectively attract private sector capital. **Figure 11** below, from the DREI report, identifies the four key components of a public instrument package that can address this risk-return profile.

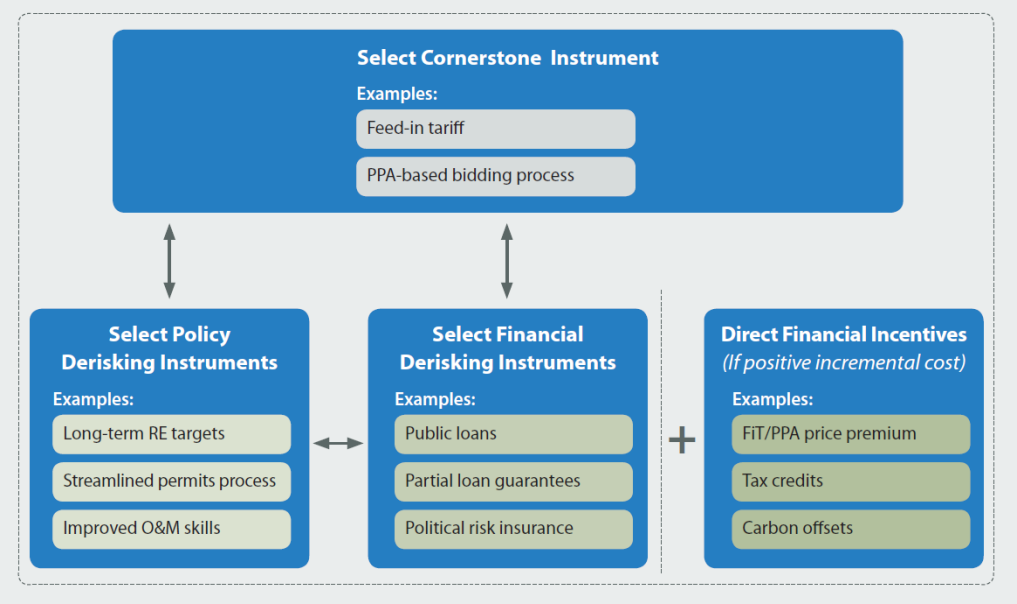


Figure 11. Typical components of a public instrument package for large-scale renewable energy.
(Source: Waissbein *et al*. (2013), pg. 47)

The cornerstone instrument is the centrepiece of any public instrument package. For large-scale renewable energy, the cornerstone instrument is typically a Feed-in Tariff (FiT) or a tendering process, either of which allows independent power producers (IPPs) to enter into long-term (e.g. 15-20 year) power purchase agreements (PPAs) for the sale of their electricity. The cornerstone instrument can then be complemented by three core types of public instruments:

- **Instruments that reduce risk**, by addressing the underlying barriers that are the root causes of investment risks. These instruments utilise policy and programmatic interventions. An example might involve a lack of transparency or uncertainty regarding the technical requirements for renewable energy project developers to connect to the grid. The implementation of a transparent and well-formulated grid code can address this barrier, reducing risk. The DREI methodology terms this type of instrument "policy derisking".

- **Instruments that transfer risk,** shifting risk from the private sector to the public sector. These instruments do not seek to directly address the underlying barrier but, instead, function by transferring investment risks to public actors, such as development banks. These instruments can include public loans and guarantees, political risk insurance and public equity co-investments. For example, the credit-worthiness of a PPA may often be a concern to lenders. In order to address this, a development bank can guarantee the PPA, taking on this risk. The DREI methodology terms this type of instrument "financial derisking".

- **Instruments that compensate for risk,** providing a financial incentive to investors in the renewable energy project. When risks cannot be reduced or transferred, residual risks and costs can be compensated for. These instruments can take many forms, including price premiums as part of the electricity tariff (either as part of a PPA or FiT), tax breaks and proceeds from the sale of carbon credits. The DREI methodology calls these types of instruments "direct financial incentives".

1.5.2. Modeling Results

An initial DREI analysis was performed during the project design. This analysis models the selection of public instruments to attract private sector investment in utility-scale on-grid solar PV. The main results are provided in this section, and supplementary information is given in Annex 7.2.

1.5.2.1 Risk Environment (Stage 1)

In order to assess the risk environment, an initial taxonomy of nine investment risk categories was developed for the Nigerian context. Definitions of these risk categories, together with their underlying barriers, are set out in **Table 13** below.

Data on the scale of each investment risk category was obtained from structured interviews held with 5 domestic and international project developers who are considering, or actively involved, in utility-scale solar PV opportunities in Nigeria.

The results estimate that financing costs for solar PV in Nigeria today are 18.0% for the cost of equity (USD), and 8.0% for the cost of debt (USD). These are substantially higher than in the best-in-class country, Germany, which is estimated at 8.0% for the cost of equity (USD), and 4.0% for the cost of debt (USD). As is shown in later results, over the long life-time of energy investments, the impact of Nigeria's higher financing costs on the competitiveness of renewable energy is significant.

Table 13. Description of the generic risk categories and underlying barriers that were considered for the DREI analysis in Nigeria.

Risk Category	Generic Description	Underlying Barriers
Power Market Risk	Risk arising from limitations and uncertainties in the power market, and/or sub-optimal regulations to address these limitations and promote renewable energy markets	• *Market outlook*: Lack of or uncertainties regarding Government renewable energy strategy and targets • *Market access/price*: Sub-optimal energy market liberalisation; uncertainties regarding competitive and price outlook; limitations in PPA and/or PPA process • *Market distortions*: high fossil fuel subsidies
Permits Risk	Risk arising from the public sector's inability to efficiently and transparently administer renewable energy-related licensing and permits	• Labour-intensive, complex processes and long time-frames for obtaining licences and permits (generation, EIAs, land title) for renewable energy projects • High levels of corruption. No clear recourse mechanisms
Social Acceptance Risk	Risks arising from lack of awareness and resistance to wind energy in communities, end-users, and other stakeholders such as unions	• Lack of awareness of renewable energy amongst consumers, end-users, and local residents
Resource & Technology Risk	Risks arising from use of the renewable energy resource and technology (resource assessment; construction and operational use; hardware purchase and manufacturing)	• *For resource assessment and supply:* inaccuracies in early-stage assessment of renewable energy resource • *For planning, construction, operations and maintenance:* uncertainties related to securing land; sub-optimal plant design; lack of local firms and skills. limitations in civil infrastructure (roads etc.) • *For the purchase and, if applicable, local manufacture of hardware:* purchasers' lack of information on quality, reliability and cost of hardware; lack of local industrial presence and experience with hardware
Grid/Transmission Risk	Risks arising from limitations in grid management and transmission infrastructure in Nigeria	• *Grid code and management*: limited experience or sub-optimal operational track-record of grid operator with variable sources (e.g. grid management and stability). Lack of standards for the integration of variable renewable energy sources into the grid • *Transmission infrastructure:* inadequate or antiquated grid infrastructure, including lack of transmission lines from the renewable energy source to load centres; uncertainties for construction of new transmission infrastructure
Counterparty Risk	Risks arising from the utility's poor credit quality and an IPP's reliance on payments	• Limitations in the utility's (electricity purchaser) credit quality, corporate governance, management and operational track-record or outlook; unfavourable policies regarding utility's cost-recovery arrangements
Financial Sector Risk	Risks arising from the lack of information and track record on financial aspects of solar PV, and general scarcity of investor capital (debt and equity), in Nigeria	• C*apital scarcity*: Limited availability of local or international capital (equity/and or debt) for green infrastructure due to, for example: under-developed local financial sector; policy bias against investors in green energy • *Limited experience with renewable energy:* Lack of information, assessment skills and track-record for renewable energy projects amongst investor community; lack of network effects (investors, investment opportunities) found in established markets; lack of familiarity with project finance structures
Political Risk	Risks arising from country-specific governance, social and legal characteristics	• Uncertainty or impediments due to war, terrorism, and/or civil disturbance • Uncertainty due to high political instability; poor governance; poor rule of law and institutions • Uncertainty or impediments due to government policy (currency restrictions, corporate taxes)
Currency/Macro-economic Risk	Risks arising from the broader macroeconomic environment and market dynamics	• Uncertainty due to volatile local currency; unfavourable currency exchange rate movements • Uncertainty around inflation, interest rate outlook due to an unstable macroeconomic environment

Figure 12 shows how a range of investment risks currently contribute to these higher financing costs for solar PV in Nigeria. The risk category with the largest impact on elevated financing costs is power market risk, which relates to accessing power markets and the price paid for renewable energy. Other risk categories with large impacts include grid/transmission risk, counterparty risk, financial sector risk, political risk and macroeconomic/currency risk.

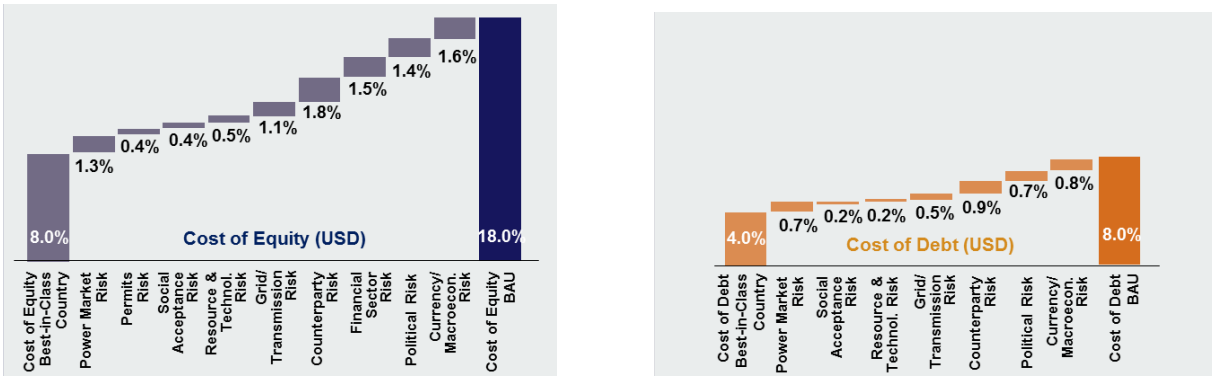


Figure 12. Impact of risk categories on financing costs for solar PV investments in Nigeria, business-as-usual scenario (Source: interviews with solar PV investors and developers; modelling; best-in-class country is assumed to be Germany; see Annex 7.2 for details of assumptions and methodology).

1.5.2.2. Public Instruments (Stage 2)

Public Instrument Selection

The modelling uses a 2020 target of 1,238 MW of private sector investment in utility-scale solar PV, based on the National Energy Master Plan (NEMP). It then models the implementation of a package of public instruments, containing both policy and financial derisking instruments, to promote investment to achieve these targets. The instruments are selected in order to specifically target the risk categories identified in the financing cost waterfalls. A list of these public derisking instruments is shown in **Table 14**. The policy derisking instruments are estimated as costing USD 11.8 million (net present value), and the financial derisking instruments USD 288.8 million.

Table 14. Public instrument selection to promote solar PV in Nigeria.

Risk Category	Policy Derisking Instruments	Financial Derisking Instruments
Power Market Risk	• Long term renewable energy targets • Regulatory framework • FIT/PPA tender (standardised PPA) • Independent regulator	NA
Permits Risk	• Streamlined permitting; one-stop shop; recourse mechanism	NA
Social Acceptance Risk	• Awareness-raising campaigns • Promote/pilot community-based approaches	NA
Resource & Technology Risk	• Resource assessment • Technology support (solar PV)	NA
Grid/Transmission Risk	• Transparent, up-to-date grid code • Grid management/planning	• Take or pay clause in PPA[63]
Counterparty Risk	• Strengthen utility's management	• Government guarantee of PPA
Financial Sector Risk	• Domestic financial sector reform	• Concessional public loans to IPPs
Political Risk	NA	NA

[63] A "take-or-pay" clause is a clause found in a Power Purchase Agreement (PPA) that essentially allocates risk between parties in the scenario where transmission line failures or curtailment (required by the grid operator) result in the IPP being unable to deliver electricity generated by its renewable energy plant.

Currency/ Macroeconomic Risk	NA	• Partial indexing of PPA tariffs to foreign currencies[64]

Note: NA indicates Not Applicable.

Impact of public instruments on financing costs

The impact of the public instrument package on reducing financing costs for solar PV in Nigeria is shows in **Figure 13**. Based on the modelling analysis, the selected package of derisking instruments is anticipated to reduce the average cost of equity to 2020 by 3.2%, to 14.8%, and the cost of debt by 1.4%, to 6.6%.

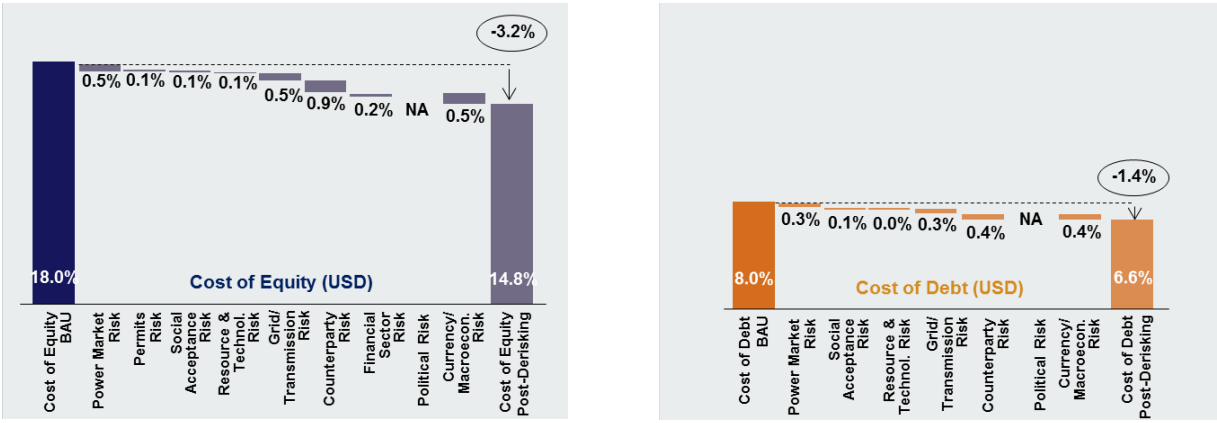


Figure 13. Impact of public derisking instruments on reducing financing costs for solar PV in Nigeria, post-derisking scenario (Source: interviews with solar PV investors and developers; modelling; see Annex 7.2 for details of assumptions and methodology. Note: the impacts shown are average impacts over the 2016-2020 modelling period, assuming linear timing effects)**.**

1.5.2.3. Levelised Costs (Stage 3)

The modelling is performed for two risk environment scenarios; first, a *business-as-usual* scenario, representing the current risk environment (with today's financing costs); and second, a *post-derisking* scenario, after implementing the public instrument packages (resulting in lower financing costs).

The results for generation costs (the Levelised Cost of Electricity, LCOE) are shown in **Figure 14** below:

- In the *business-as-usual* (BAU) scenario, solar PV is more expensive than the baseline technology of single cycle gas turbines that Nigeria currently relies on to increase its electricity generation capacity[65]. The baseline generation cost (gas) is calculated as being USD 4.0 cents per kWh. In comparison, solar PV today in Nigeria is estimated at USD 10.7 cents per kWh. This means that, today, solar PV require a price premium (USD 4.7 cents per kWh) over the baseline energy technology.

- In the *post-derisking* scenario, the cost of solar PV falls to USD 7.7 cents per kWh. As such, following government interventions to derisk the investment environment, and with resulting lower financing costs, solar PV energy becomes more competitive with the baseline energy technology. That said, solar PV remains more expensive than the

[64] Partial indexing involves tariffs in a local-currency denominated PPA being partially indexed to foreign hard currencies, such as EUR or USD. In this way, IPPs are partially protected against currency fluctuation. If a PPA tender process is used, IPPs can be asked to specify the maximum degree of partial indexing they require, thereby minimising the cost to the public sector.

[65] Single cycle gas turbines have been selected as the marginal baseline technology for this analysis. This is a simplified assumption and the reality is that a variety of baseline technologies are in existence in Nigeria, which often differ by region. For example, in off-grid regions, or regions experiencing unreliable on-grid service, diesel generation is arguably a more realistic baseline. Future modelling will further examine these questions.

baseline and will still require a price premium (USD 3.7 cents per kWh) over the baseline.

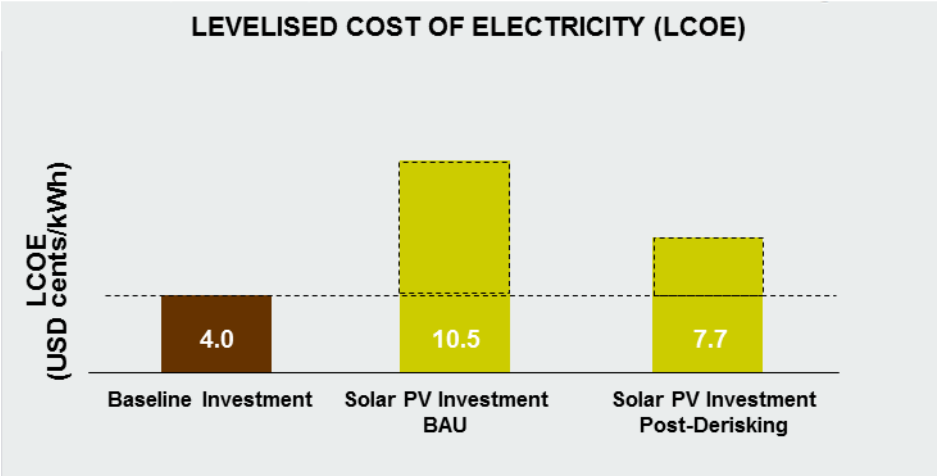


Figure 14. LCOEs for the baseline and solar PV investment in Nigeria (Source: Modelling; see Annex 7.2 for details of assumptions and methodology).

1.5.2.4 Evaluation (Stage 4)

The DREI methodology uses four performance metrics to analyse the impacts of the selected public instrument package to promote investment, each metric taking a different perspective: the ability to catalyse investment (*leverage ratio*); the economic savings generated for society (*savings ratio*); the resulting electricity price for end-users (*affordability*); and the efficiency in mitigating greenhouse gas emissions (*carbon abatement*).

Figure 15 and **Figure 16** show the results for the leverage ratio and carbon abatement metrics respectively.

For the *leverage ratio*, achieving the 2020 target of 1,238 MW in installed solar PV capacity equates to USD 1.89 billion in private sector investment.

- In the *business-as-usual scenario*, the model estimates that achieving this target will require a direct financial incentive in the form of a price premium over 20 years, valued at USD 2.26 billion. This results in a leverage ratio (the ratio of the cost of public instruments to investment catalysed) of 0.8x.

- In the *post-derisking scenario*, the model estimates that this same investment target can be achieved with a package of derisking instruments estimated at USD 300.7 million, and a lower direct financial incentive (price premium) over 20 years valued at USD 1.30 billion. This raises the leverage ratio by 50% to 1.2x, indicating a higher efficiency in terms of the costs of public instruments.

Taking the two scenarios together, the USD 300.7 million package of derisking instruments is estimated to create net savings to the economy of USD 960.2 million in lower direct financial incentives.

For *carbon abatement*, achieving the 2020 target of 1,238 MW in solar PV is estimated to result in a total reduction of 26.2 million tonnes of CO_2 over the lifetime of the solar PV plants. In the *business-as-usual scenario*, the abatement cost of the investment in solar PV is USD 86.69 per tonne of CO_2e. Or, in other words, the cost of public instruments – in this case a direct financial incentive – equates to USD 86.69 for every tonne of CO_2e reduced by the investment in solar PV. In the *post-derisking scenario*, this cost falls by 29% to USD 61.34 per tonne of CO_2e. This performance metric is helpful in terms of understanding a carbon price that is necessary to promote investment, and in comparing the relative costs of different low-carbon options.

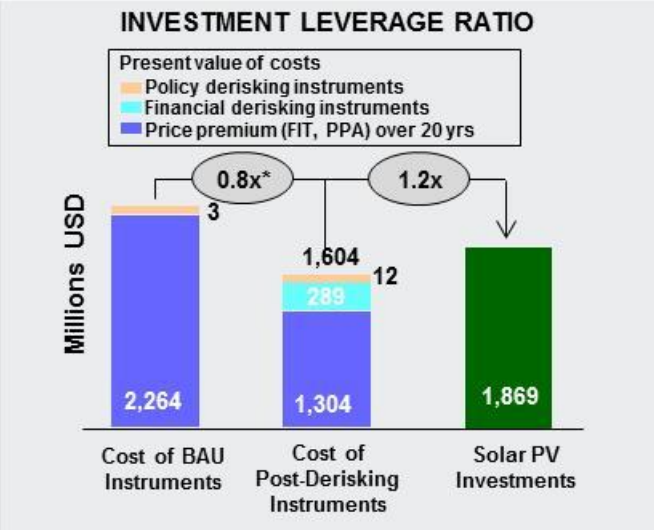


Figure 15. The *leverage ratio* performance metric for the selected package of derisking instruments in promoting 1,238 MW of solar PV investment in Nigeria (Source: modelling; see Annex 7.2 for details of assumptions and methodology).
*In the BAU scenario, the full 2030 investment target may not be met.

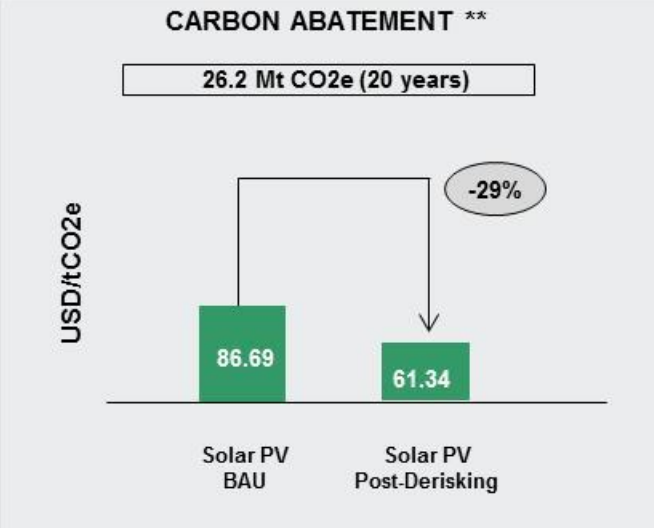


Figure 16. The *carbon abatement* performance metric for the selected package of derisking instruments in promoting 1,238 MW of solar PV investment in Nigeria (Source: modelling; see Annex 7.2 for details of assumptions and methodology).
** The Carbon Abatement metric can be broken down into the costs of policy derisking instruments, financial derisking instruments and the price premium. In the *business-as-usual* scenario, this breakdown is USD 0.13, USD 0.00 and USD 86.56 respectively, for a total of USD 86.69 per tCO2e. In the *post-derisking* scenario, this breakdown is USD 0.45, USD 11.04 and USD 49.85 respectively, for a total of USD 61.34 per tCO2e.

In comparing the *business-as-usual* and *post-derisking* scenarios, the results clearly demonstrate how investing in public derisking measures creates significant direct economic savings in achieving Nigeria's utility-scale solar PV investment targets. Instead of paying for investment in solar PV at higher generation costs, public derisking measures should be prioritised, thereby resulting in investment at lower generation costs and more affordable electricity for Nigerian citizens.

1.5.3. Next Steps

As set out in **Box 1**, a typical power sector NAMA will typically contain a number of different components.

Box 1. Typical components of a power sector NAMA

A typical NAMA in the power sector will likely include some or all of the following components:

- A **voluntary long-term, time-bound investment** target for low-carbon activities in the power sector. A breakdown of the target will be provided by technology (installed capacity, target years).
- The identification and implementation of **a package of public instruments** to create an enabled environment to attract this targeted investment. The investment will come from a mix of public and private sources, with the majority of investment typically coming from the private sector.
- A breakdown of the **anticipated costs and incremental costs** to achieve the NAMA's investment target, differentiated between financing sources: public and private, domestic and international, as well as market mechanisms (e.g. carbon markets).
- An assessment of the anticipated **socio-economic and environmental co-benefits** that will arise from the targeted investment, including economic growth, job creation and sustainable development benefits.
- An **MRV framework**, with appropriate indicators, to measure, report and verify the emission reductions that will be generated by the investment in low-carbon activities under the NAMA.

This initial analysis performed for project design indicates that the DREI methodology is well suited to NAMA design. It provides a structured framework to quantify and itemise the various components of a NAMA, including the costs of investments, the selection and cost of public instruments, and the anticipated greenhouse gas emission reductions.

A number of areas of further work have been identified for the application of DREI analysis in Nigeria:

- *Further analyses of baseline technologies*. There is considerable uncertainty around baseline technologies, which also vary greatly by region within Nigeria. For instance, in certain northern parts of Nigeria where the supply of grid electricity is constrained by a combination of lack of power capacity, constrained supply of natural gas for power generation, or inadequate power transmission and distribution infrastructure, a more appropriate baseline technology could be standalone diesel generation. A more granular level of analyses can be performed.
- *Role of fossil-fuel subsidies*. It was not possible to examine the role of fossil fuel subsidies in the modelling. Once there is better data and visibility, the modelling can be strengthened by including them. These subsidies can have a large impact on the attractiveness of solar PV.
- *Sensitivity analyses*. Sensitivity analyses should be performed. This can include, but is not limited to: future hardware (investment) cost, capacity factors (which vary significantly between north and south Nigeria), baseline technologies and fuel costs, grid integration costs, and balancing costs.

- *Cost analyses*. The costing of instruments for this modelling was preliminary in nature. There is a need for further data gathering and methodology development for the costing of both policy derisking and financial derisking instruments.

2. PROJECT STRATEGY

2.1. Rationale and Scope

Nigeria's willingness to promote and implement a low-emission development course is clearly expressed in its voluntary association with the Copenhagen Accord (Annex 7.1), as well as the host of low-carbon development initiatives described in Sections 1.2.5 and 1.3. These initiatives clearly demonstrate that the country intends to implement a low-carbon development strategy within the larger context of sustainable development – i.e. mitigation actions that deliver economic, social and environmental co-benefits. The rationale for selecting the power sector as the focus of the UNDP-GEF project is straightforward. First, the energy sector is the largest emitter of GHGs in Nigeria (**Figure 2**). Second, the epileptic state of the power sector has been identified as a main constraint for achieving the objectives of the NV20:2020. Renewable energy development in the power sector is seen as a means for energy mix diversification and increasing energy security, improving the reliability of grid power, and delivering job creation and global environmental benefits simultaneously.

During the project preparation phase, based on (i) discussions with the FGN and development partners such as GIZ, NIAF/DFID, the WB and the AfDB during an in-country mission carried out in March 2015, (ii) the GEF Secretariat review of the PIF and recommended changes at PPG, (iii) the comments from the GEF Council Member from Germany on the PIF in the November 2013 work programme; and (iv) the STAP advisory response and guidance, the project has been redesigned. The redesigned project, including the reformulated strategic results framework and institutional arrangement, was presented to all the stakeholders, including development partners such as GIZ, at a validation workshop on Friday 20 March 2015. All stakeholders, including the GIZ supported the reformulated project. The main changes are:

1. Component 3 (Grid management to absorb intermittent but predictable renewable energy) in the PIF has been eliminated because all the formerly proposed outputs are already being implemented by GIZ, DFID/NIAF and the WB through the initiatives discussed in section 1.3.2.2. Hence, the reformulated project has only three components as will be discussed below (also see Section 3);
2. UNDP's DREI methodology has been given a more central role in the design of the reformulated project in order to address underlying barriers and resulting risks that lead to the increasing cost of capital for renewable energies. As discussed in Section 1.5, the DREI approach is supported by the theory of change that the occurrence of negative events due to underlying barriers, and the financial impacts of these negative events result in higher level of risk that translate to higher costs of capital (equity and debt). In this respect, Components 1 and 2 that were proposed in the PIF have been retained, but interchanged in their respective sequencing in order to reflect the use of DREI as a cornerstone tool in the project redesign. The outputs/activities related to the interchanged Components 1 and 2 have been updated based on a review of the current baselines that have changed since April 2013 when the PIF was cleared; taking into account the ongoing initiatives related to grid-connected electricity generation that are discussed in Sections 1.3.2.2 and 1.3.2.3; and taking into account the needs of national stakeholders. Hence, the new outputs will complement the existing policy and financing derisking instruments that are already in place in the baseline. Based on changes in the baseline and ongoing parallel initiatives by other development partners, the new Component 1 has been reformulated to focus primarily on the design and development of a NAMA for the power sector; and
3. Component 3 (formerly Component 4) of the project has been retained and designed to explain how the outputs from Components 1 and 2 of the redesigned project will either be validated or benefit from the experience of the 100 MW solar PV baseline project. It

will be argued using incremental reasoning below that the current design of the 100 MW solar PV project in Bauchi State has deficiencies that will reduce its performance. Through an investment component, these deficiencies will be overcome. The rationale for maintaining an on-grid approach as opposed to an off-grid approach will be discussed below.

The changes proposed in the Project Document address a gap in the baseline, which is the lack of a practical NAMA as a pre-2020 instrument that will allow Nigeria to be better prepared to leverage international climate finance. The focus on a NAMA for the power sector is also complementary with the ongoing initiatives discussed in Section 1.3.2.

By building on past initiatives (e.g. the GEF-UNIDO biomass project – Section 1.3.2.2), and collaborating with ongoing initiatives (e.g. GIZ-implemented NESP and the AfDB and WB support to on-grid solar PV, including the baseline 100 MW solar PV project), the UNDP-GEF project aims to develop a single and coherent Nigerian Power Sector RE NAMA. Solar PV is the chosen technology for demonstrating the development of the NAMA. This approach will serve to market the NAMA as an integrated package to attract financial (international, bilateral, public and private sector) support. The core components of the RE NAMA will cover: clear long-term targets (such as those discussed in Section 1.2.5.3, a public instrument package to create an enabled investment environment, assessment of costs and incremental costs, assessment of global environmental benefits, and MRV/indicators. The application of these elements of using the example of grid-tied solar PV can be replicated to other on-grid renewables. In fact, the preliminary DREI analyses that have been carried out to design the project will be further detailed during project implementation, as well as an extension of similar analyses to wind and biomass energy.

The project is designed in two broad elements: (1) technical assistance – to establish the enabling conditions for a Nigerian power sector RE NAMA. This element of the project will also implement targeted public (policy and financial) derisking instruments to remove barriers that exist in the baseline. The reduction of risks and the creation of an enabling environment will reduce the cost of financing for RE technologies, hence making electricity generation from RE sources more competitive, and ultimately creating a positive feedback loop that will further increase investments in RE sources in the power sector; and (2) investment – the elements of the RE NAMA will be tested by supporting one baseline project that has been identified as having several deficiencies. The technical assistance and investment components of the UNDP-GEF project are further detailed in Section 2.2.

Incremental Reasoning

The project's primary added-value is to build upon the country's existing NAMA design activities and programmes (Section 1.3). While there have been a number of prior activities to enhance the NAMA-preparedness of Nigeria, Section 1.5 has shown that significant barriers still prevail.

GEF funds will be used to support activities – i.e. incremental investment and removal of the barriers and risks discussed in Section 1.5 – that will not take place in the baseline and yet which will substantially enhance the prospects of both the baseline projects and future projects that all fall under the Nigerian power sector RE NAMA. From this perspective, the incremental contribution of the GEF will be significant for scaling-up mitigation actions through the RE NAMA. By the end of the project, it is expected that:

- The Government will develop and adopt policy and financial derisking instruments that will be conducive for private sector investment in grid-connected renewable electricity. The DREI will provide an evidence-based approach for identifying and implementing these public derisking instruments.

- As an integral part of the DREI analyses, an institutional stakeholder mapping will be carried out to map out the public derisking instruments that are being supported by

different institutions that may be used by the FGN as a road map for guiding targeted and coordinated interventions by different stakeholders in the renewable electricity sector (see Section 1.5 and Annex 7.2).

- A GIS based tool will be developed to identify practicable RE (PV, wind and biomass) sites in Nigeria. This will further guide private investors to sites that offer the least risks combined with sufficient renewable energy resources.
- An MRV system will be designed to provide quality assurance on GHG emission reductions accruing from the RE NAMA.
- A set of guidelines and design criteria is developed for the power sector NAMA that can be used as a template for all other NAMAs in Nigeria.
- A set of social and environmental safeguard guidelines is developed for all utility-scale RE projects.
- A study on domestic financial sector reform to unlock low-cost local capital for green infrastructure investment will be performed.
- The Lagos Energy Academy is capacitated to deliver RE trainings to IPPs, undergraduate students, and public institutions on a cost-recovery basis.
- The baseline projects will demonstrate improved performance in terms of clean electricity output that is compatible with grid stability and the utilisation of technologies that can be adopted by future renewable energy generation projects.

The enabling conditions created by the project will have the long-term impact of catalysing private investment to implement the RE NAMA that promises to generate cumulative direct emission reductions of around 0.57 $MtCO_2$ and indirect GHG emission reductions between 6.61 and 9.72 $MtCO_2$ from utility-scale solar PV plants alone.

2.2. Project Objective, Outcomes and Outputs

The objective of the project is to support the FGN in the development and implementation of a NAMA in the energy sector, namely a RE NAMA for the Nigerian Power Sector (NPS). The project will contribute to the reduction of GHGs related to the renewable electricity targets established voluntarily by the FGN, which aim to achieve a contribution of 10% installed capacity of various sources of renewables by 2030 (see **Table 8**).

The project is designed to support both the design and implementation of a RE NAMA in the NPS, applying relevant NAMA methodologies and guidance for identifying and designing technology-specific (in this case solar PV) NAMA components, and piloting the implementation of the NAMA activities around a 100 MW private sector solar PV plant in Bauchi State. The project will develop a standardised baseline for the electricity sector as part of the development of an MRV system for quantifying GHG emission reductions. A GIS-based tool will be developed to guide private developers in siting geographical locations for PV, wind and biomass projects across Nigeria based on several criteria, including renewable energy resource potential, grid coverage and stability, environmentally sensitive areas, and physical infrastructure, among others. The GIS-based tool will be accompanied by a geographically-differentiated risk approach using UNDP's DREI methodology that is discussed in Section 1.5. In order to catalyse the necessary levels of private financing to implement the RE NAMA, the financial instruments will be identified and capitalised, and these instruments will be linked to the MRV system to catalyse climate financing.

The project is structured in three components, as described below.

The key focus of the UNDP-GEF project is to capacitate Nigeria to implement its long-term RE targets to its full potential – i.e. 10% renewable electricity generation capacity installed by 2030 using a combination of solar PV, wind, biomass, solar thermal and hydroelectricity.

A project-based, stand-alone approach, though useful, is not sufficient to achieve this ambitious target. The UNDP-GEF project will, instead, support the implementation of RE in the NPS through a coherent NAMA that will contain a detailed investment plan for on-grid solar PV and solar PV-specific derisking instruments. Although the GEF-UNDP project will not provide any technical assistance concerning the design of incentives for renewable electricity, the DREI analyses will generate technology-specific risk profiles that may be used by GIZ's NESP that is supporting NERC with the review of feed-in-tariffs for renewables. It will also identify an optimum basket of public derisking instruments for promoting private investments in on-grid solar PV. The DREI analyses will be extended to other forms of renewable sources of power generation such as wind energy and biomass energy. An important element in designing the RE NAMA for the NPS is to be able to identify the most appropriate and practicable geographical locations for installing RE plants. For this, the project will develop a GIS-based tool that will be compatible with ongoing WB, DFID/NIAF and GIZ initiatives to develop GIS-based grid extension plans. In order to be able to quantify emission reductions that will accrue from the implementation of the RE NAMA in the NPS, the project will also provide technical assistance to put in place an MRV system for the power sector, including a standardized baseline for the emission factor of the national grid.

Besides two technical assistance components, the project also encompasses an investment component to support a baseline investment project in the State of Bauchi to enhance its mitigation potential and for inclusion in the RE NAMA. GEF financing will be used incrementally to create the appropriate policy and capacity environment in which the identified (and enhanced) baseline project can be embedded, thereby enhancing its probability of successful implementation; establishing the framework for a programmatic approach to the RE NAMA in the NPS; and supporting the pre-conditions for replication in Nigeria and in the broader West African region.

The derisking instruments designed and implemented under Components 1 and 2 will serve to reduce the financing costs of renewable energy in Nigeria, thereby reducing the unit cost (cost per tonne of CO_2) of GHG abatement (see **Figure 16**). This will provide more incentive for bilateral donors to support the RE NAMA (designed with robust MRV systems and a sound derisking framework for designing incentives). Such buyers may choose to purchase emission reductions directly or through capitalisation of financial derisking instruments that will be established under Output 1.3.[66] When it is operational, the Green Climate Fund (GCF) may also support the capitalization of these financial instruments.

Component 1: ***Design and development of a power sector renewable energy NAMA supported by DREI analysis.***

Expected outcomes: A coherent derisking approach is established for catalysing private sector investment to implement renewable energy power sector NAMA.

GEF funding: US$1,163,518

Co-financing: US$700,000 (ECN: US$500,000; UNDP: US$200,000)

This technical assistance component seeks to establish the necessary conditions to leverage financing to support a RE NAMA in the Nigerian Power Sector. As discussed in Section 1.5, leveraging low-cost capital is constrained by the presence of risks and underlying barriers. The ability to unlock low-cost capital for private investments in alternative energies in the power sector rests on the detailed quantification of the different types of risks and their impacts on the cost of capital. The DREI analyses that are presented in Section 1.5 and Annex 7.2 will be

[66] See, for example, UNDP (2011), *Blending Climate Finance Through National Climate Funds*, New York.

further developed to propose the most comprehensive and optimal (from cost-benefit and cost-effectiveness perspectives) combination of policy and financial derisking instruments to minimise the risks to private investments. First, the DREI analyses will be further detailed for solar PV in order to better capture the potential impacts of geographically-differentiated risks, such as political risks, that have emerged during DREI interviews. Since grid infrastructure is more reliable and robust in the south than in the north, this could also translate into geographically-differentiated grid/transmission risks. Further, as discussed above, discos operating in the southern parts of Nigeria have a relatively higher revenue collection rate than those in the north. In turn, this may lead to geographically-differentiated counterparty risks. Second, the DREI analyses will be applied to on-grid wind and biomass power projects. As is discussed under Component 2, the results of the detailed DREI analyses, when used in conjunction with the GIS-based resource assessment and RE project siting, will provide an opportunity to support ongoing initiatives under the NESP that is providing technical support to NERC to review FiTs for renewable electricity. As shown in Section 1.5, when FiTs are developed as a direct compensation mechanism for renewable electricity while risks and underlying barriers persist in the baseline, the social cost of the FiT is higher when compared to the case when public derisking instruments are implemented before any residual risks are compensated for in the form of what is here called a 'proxy FiT'. Since risks are not geographically uniform, any residual compensation – i.e. 'proxy FiT' – will necessarily exhibit geographical variations. The UNDP has carried out a detailed DREI analysis of on-grid wind energy and solar PV in Tunisia during the development of a UNDP-GEF project on developing a NAMA for the Tunisian Solar Plan, which has informed the development of a territorial approach to developing any compensation or incentives for renewable electricity.[67] Since the GEF-UNDP project in Tunisia is being implemented, the current project stands to benefit from lessons learned in the application of DREI analysis. The coordination between the two projects will be facilitated by the UNDP. The DREI analyses will be used:

- To develop the investment components of the technology-specific targets established by 2030, including quantifiable GHG emission reductions (in combination with the MRV system that will be developed under Component 1); and

- To carry out an institutional stakeholder mapping in the power sector of Nigeria that may be used as a road map for the coordination of stakeholder interventions in supporting the implementation of the RE NAMA in the Nigerian Power Sector.

Arising from the detailed DREI analyses will be an optimum mix of public (policy and financial) derisking instruments to promote private sector investments in renewable energy in the NPS. The optimum mix of derisking instruments may be different for different technologies, and any technological specificity will be informed by the detailed analyses for the three technologies (solar PV, wind and biomass).

This technical assistance component also seeks to establish the necessary conditions to leverage financing to support a NAMA in the power sector. Where possible, NAMA design elements of the project will be 'front-loaded' in the first months of the project so as to facilitate rapid implementation of the NAMA. Prior to being able to attract funding to support the implementation of NAMAs, the country must first demonstrate that a thorough and robust methodological approach has been used to develop NAMAs. Minimum standards for NAMA design (e.g. relating to robust MRV systems and greenhouse gas emission reduction estimation methodologies) will be developed and enforced by the DNA. Institutional support will be provided to the FME/DNA and other national institutions. The project will build on proven CDM elements, such as the CDM grid emission factor tool, the tool to demonstrate additionality, baseline development and the MRV approaches adopted by CDM renewable energy methodologies to develop a coherent, internationally-benchmarked MRV system for on-grid

[67] UNDP (2014) Tunisia: *Tunisia: Derisking Renewable Energy Investment.* New York, NY: United Nations Development Programme.

renewables. The application of the CDM methodological tool to calculate the emission factor of the Nigerian electricity system is shown in **Annex 7.5**.

A technology action plan (TAP) will be developed for each of the three technologies proposed by national stakeholders and development partners (i.e. solar PV, wind and biomass). Each TAP will detail the means and measures for barrier removal, institutional and capacity development requirements, GHG inventory and MRV structures and processes, and a full description of the geographical location of proposed projects pertaining to that technology. Each TAP will carry out a detailed investment analysis based on the tools and methodologies developed under Components 1 and 2. Technology-specific barrier and enabling framework analyses using methodologies and tools (e.g. market mapping techniques and Logical Problem Analysis coupled with incremental cost-benefit analysis) developed under the GEF-financed TNA will be carried out. Each TAP will be at the sectoral level, and will, therefore, cover the ensemble of projects that have been identified in the NV20:2020 for each technology (see **Table 7** and **Table 8**). This approach also favours the leverage of financing for ensembles of projects, thereby allowing the scaling-up of mitigation actions. Formulation of the TAPs will be informed by the results of Output 1.1 that will provide the most appropriate mix of public instruments for derisking investments in each technology.

Under Component 1, a basket of the most appropriate financial derisking instruments will be identified. The Federal Ministry of Finance will be a key stakeholder in this Component of the project as revealed by the role of the FMF as chair of the Technical Working Group (TWG) for Component 1 (see **Figure 17**).

The following outputs will be used to achieve the outcomes of Component 1:

Output 1.1: At least 3 policy and financial derisking instruments have been assessed using DREI analysis based on work initiated for solar PV in the development of the project document, and implemented. The DREI analyses will be replicated for on-grid wind energy and renewable biomass power generation.

Output 1.2: Development of a set of guidelines to establish national NAMA eligibility and design criteria

Output 1.3: An MRV mechanism is developed for the power sector, including a standardized baseline for national grid is developed and updated on a yearly basis

Output 1.4: Development of three comprehensive sectoral NAMA action plans for solar PV, wind and biomass (or Technology Action Plans)

Component 2: *Policy and institutional framework for private investment in on-grid renewable power generation.*

Expected outcomes: Public instruments are developed and implemented for derisking the national policy environment.

GEF funding: US$894,828

Co-financing: US$ 2,300,000 (ECN: US$500,000; FME: US$ 200,000; LEA: US$ 300,000; UNDP: US$1,300,000)

Component 2 of the project will be implemented in close collaboration with the baseline initiatives that are ongoing in Nigeria, and which are discussed in Section 1.3.2. Cornerstone policy derisking instruments such as the GIS-based renewable energy resources assessment, project development support facility through training for the private sector on renewable energies, and guidelines to align the national environmental and social safeguards with internal

benchmarks are supported by the UNDP-GEF project. The support will cover solar PV, wind and biomass energy projects.

The UNDP-GEF project will support the development of a GIS-based tool that will provide private developers with geospatial information regarding favourable sites for developing solar PV, wind and biomass energy projects. In the first instance, the GIS-based tool will be developed using existing geospatial data and information. This output will be coordinated with the GIS-based work that is being carried out by the WB, NIAF and GIZ concerning grid extension in Nigeria. Wherever possible the GIS-based tool will use existing geospatial layers for resources assessment, grid coverage, human settlements, public infrastructure, environmentally sensitive areas (e.g. wetlands, protected areas, corridor for migrating soaring birds), and strategic infrastructure (e.g. military facilities, airports etc…), among others. Besides providing private developers with a tool to identify practical sites for RE projects, this tool will also be used to: (1) identify gaps in RE resources assessment data that may be used to redirect investments in ground measurements and surveys to assess RE resources potential; (2) coordinate and rationalise land use planning activities that have a bearing on the siting of RE projects; (3) assist policy makers to better set practicable targets for RES in the power sector that may provide multiple socio-economic and environmental benefits by considering electricity access, diversification of energy supply in the power sector, and job creation while at the same time taking risks to investments into consideration, and (4) provide a platform for developing risk-adjusted incentives in the form of a 'proxy FiT' as discussed under Component 1.

As shown in Section 1.5, financial sector and currency/macroeconomic risks are quite dominant in Nigeria. These two categories of risks are interlinked. For instance, the lack of low-cost capital denominated in Naira on the Nigerian financial market leads to private investors (or IPPs) raising capital on international markets in foreign currency. However, the tariff in the PPA between the IPP and NBET, if denominated in Naira (which is usually the case), exposes the IPP to currency exchange risks when debtors have to be repaid in foreign currency. One way to address this risk is to put in place tariffs that are partially-indexed to currency exchange rates, which effectively transfer the risk from the IPP to the public sector. The risk which this poses to the public sector will increase proportionally with the scaling up of renewable energies in the NPS, and potentially to a point where the risks become too onerous for the continued use of partial indexation to promote RE sources. An effective way to circumvent this potential problem is to eliminate the risks that require partial indexation of tariffs in the first place. This can be achieved by unlocking low-cost capital denominated in Naira (e.g. sovereign and public equity funds, domestic bank lending, intermediary loan facilities guaranteed by the FGN) on the Nigerian financial markets. In this respect, the project will include a study of domestic financial sector reform for green infrastructure investment that could be carried out in Nigeria in order to unlock low-cost financing.

Further, the GEF-UNDP project will establish social and environmental guidelines that will allow the Nigerian EIA to be benchmarked to international safeguards, such as those of the World Bank. This will allow private investors in RE to reduce transaction costs by preparing only one environmental and social impact assessment, and to reduce potential delays in project development. Further, the internationally-benchmarked guidelines will be useful in providing a higher level of confidence to financial institutions. Since political risk has also been identified as a key risk that increases the cost of capital, the guidelines will also cover risks arising from security of person and infrastructure.

Project development facilitation is another intervention that will be supported by the project. Project development facilitation is a measure that can be used to address underlying barriers for several risk categories that cut across the entire technology chain. Specifically for solar PV, the project will collaborate with the LEA for the provision of project development facilitation through specialised trainings to private stakeholders that have an interest in renewable energy development in the power sector. The services will be offered using a cost-recovery approach that is already in place at LEA. Project development facilitation could take the form of training on

the steps to follow to acquire permits and licenses to financial modeling of a RE project to maintenance of hardware to carrying out resources assessments to integration of renewable electricity into the grid. Discussions with the LEA have shown that while it has state-of-the-art training and laboratory facilities (see Section 1.3.2.3), it will require incremental support:

- To develop a medium-to-large-scale solar PV safety and commissioning standard training that will focus on the prevention of unnecessary damage to equipment and persons during large-scale PV installations and operation;
- To set up a solar PV Troubleshooting and Maintenance Center that will be established in partnership with major PV equipment manufacturer (to be confirmed during project implementation) to support local PV industry, improve local O&M skills and mitigate resource & technology risk. The LEA has already constructed the building for a solar park and set-up a solar testing laboratory;
- To develop solar PV financial modeling and risk analysis training for banks in partnership with Siemens. Hopefully with more knowledge, financial sector reform (see Component 1) for renewable energy projects can be encouraged. A similar training has been conducted by LEA/Siemens for Stanbic IBTC bank but needs to be improved and developed further; and
- To develop guidelines and standards for solar PV that could be adapted to National Policies. These guidelines and standards will be accompanied by short how-to guides and videos. This will help raise awareness as well as increase social acceptance and demystify solar PV.

Building on proven CDM elements, such as the CDM grid emission factor tool, the tool to demonstrate additionality, baseline development and the MRV approaches adopted by CDM renewable energy methodologies, the UNDP-GEF project will adapt these carbon finance building blocks to serve as a 'next-generation' scaled-up NAMA approach.

The outcomes of Component 2 will be achieved through the following outputs:

Output 2.1: A study on domestic financial sector reform to unlock low-cost local capital for green investment is carried out.

Output 2.2: A GIS based tool is developed to identify practicable RE (PV, wind and biomass) sites in Nigeria

Output 2.3: A set of social and environmental safeguard guidelines is developed for all utility-scale RE based on international standards (e.g. World Bank)

Output 2.4: The Lagos Energy Academy is capacitated to deliver RE trainings to IPPs, undergraduate students, and public institutions on a cost-recovery basis

Output 2.5: A lessons learned report is developed to capture best practices for dissemination (website, publications, manuals, participation in national, regional and international conferences and fora etc.) and to demonstrate an architecture for leveraging private investments and climate finance using a risk-adjusted approach

Component 3: ***First commercial on-grid RE project*.**

Expected outcome - The Nigeria Power Sector RE NAMA is operationalised by demonstrating a proof-of-concept grid-connected solar PV plant with quantified GHG emission reductions.

GEF funding: US$2,341,454

Co-financing: US$210,550,000 (NCSP: US$210,000,000; ECN: US$ 500,000; LEA: US$ 50,000)

This investment component of the project will achieve three principal impacts: (1) the reliability of renewable electricity generation from the baseline project - 100 MW solar PV plant in Bauchi State will be enhanced as discussed below, thereby ensuring enhanced GHG emission reduction capabilities; (2) the baseline project will be implemented as part of the Nigerian power sector RE NAMA, with appropriate MRV of emission reductions; and (3) supporting the development of public derisking instruments under Components 1 and 2 as explained below.

A significant proportion (~53%) of the GEF funding (Output 3.1) will be allocated as incremental investment in the baseline project in order to enhance its performance in terms of clean electricity output that is compatible with grid stability. In the absence of the GEF-UNDP interventions, the project would be implemented with two significant deficiencies. First, the national grid in Nigeria suffers from both voltage and frequency fluctuations that constitute significant threats to the proper integration of intermittent RE sources such as solar PV.[68] In the baseline project, these fluctuations in the national grid are not taken into account at sub-stations where renewable electricity is injected into the network. The mismatch between the voltage/frequency of electricity generated by the baseline project and the grid voltage/frequency will lead to losses and sub-optimal performance of the PV plant. Secondly, the deposition of dust on solar modules can reduce the yield of PV plants. In the case of Nigeria, the maximum amount of dust accumulation has been reported in the December to March period when the dry and dusty wind, called the Harmattan, blows. The northern part of the country that has a Sahel-like climate is most affected. Studies have shown that the loss of yield can vary between 6% for an exposure to dust of 2 weeks to 60% for an exposure to dust of 4 months.[69] Further, conventional PV technologies that are considered in the baseline project are not designed specifically for desert-like environments, and this constitutes a weakness of the baseline project. These constraints have not been taken into account in the design of the baseline project.

The incremental contributions of the GEF in the baseline project will be a combination of investments and technical assistance targeted at the following:

- As part of the investment component, the UNDP-GEF project will support the installation of interface electronics to match the voltage of renewable electricity with that of the national grid. This will be applied to the baseline project and, once demonstrated for its effectiveness, interface electronics will be applicable to future RE projects that will form part of the Nigerian power sector RE NAMA;

- Since solar PV modules are mounted at relatively low angles of elevation (10-12°) in the northern parts of Nigeria (and even lower inclinations in the south), natural cleaning by rainfall is inadequate. The conventional way to clean dust is through a combination of mechanical brushing that is very water intensive.[70] Since climate variability and climate change is a threat to water availability, especially in the northern parts of Nigeria,[71] it would be preferable to adopt water efficient cleaning technologies. Cost-effective and water efficient robotic dust cleaning technology now exists for removing dust from utility-scale PV plants with efficiencies reaching up to 99%. Further, such equipment are self-powered using solar energy.[72] While noting that the GEF funding will not be sufficient to fit the entire plant with such cleaning technology, the GEF investment will be used to test the dust cleaning technology on part of the installations as proof of concept and for

[68] TCN (2014) Grid Operations 2013 – Annual Technical Report.

[69] Sanusi (2012) The Performance of a-Si PV system under Harmattan dust conditions in a tropical area, Pac. J. Sci. Technology 13(1), 168-175; Yahya and Sambo (1991(The effect of dust on the performance of PV modules in Sokoto, Nigerian J Renew Energy 2(1), 36-42; Ohunakin et al. (2013) Generation of a typical meteorological year for north-east Nigeria, Applied Energy 112, 152-159.

[70] Sami Al-Ghannam (2012) Comparison of Different Cleaning Technologies for Photovoltaic Panels of Utility Scale Application.

[71] Second National Communication (2014), pp. 54-58, pg. 66.

[72] For example, see www.ecoppia.com or http://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=232711493 – accessed 13 April 2015.

further replication. The robotic technology is also cloud-based with a system controller that is able to pull meteorological data in order to identify optimal PV plant operating conditions and to deploy robotic cleaning hardware as needed; and

- Also, GEF investment support will be deployed to test the application of anti-sand-blasting (anti-abrasive) coatings on the PV facility in Bauchi State. For control purposes, some PV modules/arrays will not be coated so as to enable comparative analysis. These technical tests will be invaluable for the wider Sahel region, and hence will be published and disseminated for informing technology choices within Nigeria and in the region. Following this line of incremental thinking, it augurs well for the UNDP-GEF project that there is a new PV manufacturing facility in North Africa (Tunisia) claiming to produce "100% desert proof" modules.[73] During implementation, the characteristics of these "desert proof" PV modules will be investigated for potential application in the 100 MW solar PV baseline project;

Besides these incremental interventions, the baseline project will be linked with the outputs of Components 1 and 2 in the following ways:

- The private developers (NSCP) of the baseline project have participated in the DREI interviews that were carried out during the project design, and being the first of its kind in Nigeria, the project design has benefited significantly from their unique experience. For instance, the NCSP played an instrumental role in validating the underlying barriers and risks shown in **Error! Reference source not found.**, the public instruments shown in Error! Reference source not found., and to test the assumptions made in the DREI analyses (Section 1.5 and Annex 7.2);

- Since the baseline project is currently in the process of negotiating a PPA, the results of the derisking analysis shown in Section 1.5 may be used to guide the negotiation process. Further, as discussed above, the DREI analysis provides an opportunity for developing incentives in the form of 'proxy FiT' that has better public financing leverage ratios. In collaboration with the NESP initiative of the GIZ, a derisking approach can be used for the review of MYTO-II concerning FiTs for renewable electricity. The baseline project will not receive any financial incentives. The incrementality of GEF investment support to the baseline projects is justified on the basis of the specific design flaws that were described in Section 1.3 and that are further discussed below;

- As discussed above, the MRV system that will be developed under Output 2.3 will be applied to the baseline project in order to monitor its performance in terms of GHG emission reductions;

- Since the baseline project has completed the social and environmental screening of the WB, its experience will be used to achieve the targets of Output 2.2; and

- Based on its experience in interacting with the WB and AfDB (and other financial institutions), the developers of the baseline project will be closely consulted during the identification of the optimum set of public derisking instruments that will be most effective for solar PV in Nigeria, as well as designing the financial derisking instruments that will be capitalized under Component 1.

[73] Please see : http://www.pv-magazine.com/news/details/beitrag/jvg-thoma-establishes-30-mw-pv-module-fab-in-Nigeria_100015094/?utm_source=RCREEE+Newsletter+Subscribers&utm_campaign=4c106893f2-EN_395_21_2014&utm_medium=email&utm_term=0_c4fdb77805-4c106893f2-73390305#ixzz32L0UOX5C1.%09http:/www.pv-magazine.com/news/details/beitrag/jvg-thoma-establishes-30-mw-pv-module-fab-in-Nigeria_100015094/ - accessed 26 May 2014.

The Outputs through which the outcome will be achieved are:

Output 3.1: One private-sector supported solar PV energy project (100 MW in Bauchi State) is implemented to validate the adopted framework and methodologies;

Output 3.2: Interface electronics installed to match the voltage of renewable electricity with that of the national grid;

Output 3.3: Robotic dust cleaning technology tested on part of the installations as proof of concept and for further replication; and

Output 3.4: Application of anti-sand-blasting (anti-abrasive) coatings tested on the PV facility.

2.3 Project indicators, Risks and Assumptions

2.3.1. Project indicators

In accordance with the GEF-5 Focal Area Objectives, the key success indicators of the project are:

Objective 3 - Promote Investment in Renewable Energy Technologies:

- Favourable policy and regulatory environment created for renewable energy investments
- Investment in RE technologies increased
- GHG emissions avoided

For further details about the related targets, see the project's results framework in Section 3.

2.3.2. Risks and assumptions

The main identified risks to the successful implementation of the project include:

Risk Description	*Risk Rating*	*Mitigation Strategy*
Political instability risks Although there is currently a strong political will and commitment to tackle the electricity access challenges in Nigeria, political instability or a change of government could lead to potential policy reversals that may impact the energy policy and discourage private investment.	Medium	Adoption of appropriate policy and regulatory changes will be assured through involvement of the stakeholders concerned at the highest possible political level, such as the Presidential Task Force on Power. The Task Force has played an instrumental role in leading the process of power sector reform since 2005 and its efforts have been highly praised by the Government, international partners and the private sector. The Task Force and its key members have been closely involved in project design and it will play an important role during implementation to secure political commitment, buy-in and integration of the RE policies in the national power market reform agenda, which is under direct supervision of the President. It is also pointed out that Nigeria has proved capable to manage risks related to political instability through peaceful elections in March 2015 that has brought about a change in government.
Economic risks The baseline technology used for generating electricity in Nigeria is natural gas turbines.	High	Unless appropriate policies and regulations, supported by financial derisking mechanisms and incentives are introduced and enforced, RE will not be able to

The international price of natural gas is at a historically low level that is expected to persist. In this context, and as demonstrated by the LCOE analysis shown in Section 1.5 and Annex 7.2 for solar PV compared to gas-fired electricity generation, many of the renewable energy solutions proposed in this project are therefore not expected to become economically competitive compared to baseline energy sources.		compete with fossil fuel based power generation in Nigeria. Component 1 of this project therefore aims precisely at achieving these goals and leveling the playing field for RE.
Technical risks Technical risks exist that the introduced renewable energy solutions fail to be viable for electricity generation in Nigeria, especially in the situation of poor grid stability and reliability of transmission	Medium	Voltage and frequency fluctuations will affect the integration of the baseline project into the national grid. This deficiency will be mitigated under Component 3 of the project which will introduce adequate voltage electronics that will allow the output of solar PV farm to match that of the grid. Such an interface will allow the PV installation to inject power into the grid more frequently than otherwise. Further, the UNDP-GEF project will team up with the Lagos Energy Academy to provide training to technicians and private developers to better understand the nature of technical risks and adequacy of domestic supply chain and O&M capacities for RE-plants construction and operation. These measures, in conjunction with the involvement of experienced international IPPs and RE developers throughout the project, will help mitigate technical risks.
Environmental Risks In order to leverage international financing, private promoters must be able to carry out environmental impact assessments of their project according to international benchmarks, such as the WB Environmental and Social safeguards. Since an EIA permit is also needed according to the Environmental Impact Assessment (EIA) Act No. 86 of 1992, there is the risk that compliance with national regulations is not sufficient in order to meet international benchmarks. In this case, additional screening has to be carried out at the risk of project delays and additional costs.	Low	Although the baseline project has complied with the Environmental Impact Assessment (EIA) Act No. 86 of 1992, it has also carried out independent EIA using World Bank standards. Environmental screening has also been carried against the requirements of the AfDB. Further, the baseline project has been subject to a screening according to UNDP's Social and Environmental Safeguard Policy. Based on the lessons-learned from the EIAs and screening, a set of guidelines will be developed for future utility-scale RE projects in the Nigerian power sector that will align the national and international safeguards. This output of the project will capitalize on the work already accomplished by the WB under the MSMF (Section 1.3.2.2).

Climate Change risk Climate change is expected to change Nigeria's biomass production, accelerate land degradation, and modify the hydrological systems. Also, the temperature increase will lead to higher power demand. In a drier climate, and with more episodes of extreme weather events such as droughts, especially in the North / North East, the impact of dust on solar PV performance is expected to be impacted detrimentally.	Medium	Among all available RE sources in Nigeria, hydropower will likely be most negatively affected by changing climate. The project will therefore put more emphasis on promoting other RE sources, solar and wind, which are less likely to be affected by climate change and therefore represent a viable climate adaptation alternative for the Nigerian power sector (which currently depends by 20-25% on hydro power generation). In the specific case of dust-induced loss of solar PV yield, Component 3 of the project will support the testing and validation of equipment to clean solar PV arrays in the Nigerian context. The GEF-supported incremental intervention will be useful for replication in the future.
Financial Risks Implementation of on-grid solar PV will require substantial investments that are well beyond the capacity of the FGN to invest. This is the reason why the FGN is seeking to attract private investment and international funding.	Medium	The prevailing conditions pose significant barriers, and hence risks, to catalysing private investment and international funding. For instance, DREI interview with Ecobank[74] revealed that the cost of debt denominated in Nigeria (denominated in Naira) is around 24%, whichmakes project financing unviable. The UNDP-GEF project will actively address these risks by removing key barriers, thereby mitigating financial risks. The design of the project has been informed by detailed quantitative analysis of financial risks (among other risks) – and their impacts on the cost of capital (debt and equity) – facing renewable energy investments in Nigeria. DREI analysis will be used to demonstrate the significant leverage ratio of the proposed derisking instruments to catalyse investments to implement the power sector RE NAMA. In particular, the project will carry out a review of the financial sector in order to propose and capitalise financial instruments that will unlock low-cost capital.
Security risk Political tensions in the Niger Delta between the foreign oil corporations and a number of ethnic minorities seeking a share of the oil profit have led to numerous violent attacks towards the oil infrastructure and staff in the last 20 years. Risk exists that a similar situation happens to renewable energy installations developed within or following this project. Also, there are security risks associated with terrorism in the North East of Nigeria, especially in the States of Borno and Yobe.	High	While it is not feasible to fully mitigate security risk within the framework of the proposed project, appropriate arrangements and precautionary measures will be taken during project design and implementation. First of all, full participation of local communities in pilot sites will be ensured to raise their awareness and secure buy-in for the proposed RE projects. Local NGOs and CSOs will be mobilized to lead this process. The UNDP has carried out the Social and Environmental Screening of the baseline project to certify that such community-level interactions and communications have taken place (see Annex 7.3). Further, the UNDP-GEF project will support the FGN to develop guidelines for carrying out environmental and social impact assessments of RE projects that will also cover the security dimension. It is pointed out that a similar exercise is being planned by the private promoters for the 100 MW solar PV in Bauchi State. This process of security risk assessment will inform the

[74] Interview carried out with Mr Sunkanmi Olowo, Head, SME/Value Chain Banking on Wednesday 8 April 2015.

		development of guidelines mentioned above.
Resettlement of Project Affected Persons risk According to the Resettlement Action Plan (RAP), an estimated total of 217 individuals (Project Affected Persons) on the proposed solar farm site and transmission line corridor will be affected by the project. There are about 30 households comprising approximately 150 residents on the proposed solar farm site who will be displaced. Includes loss of farmland (200 ha) and sources of income as result of land acquisition.	High	Environquest prepared an initial RAP as part of their Environmental and Social Impact Assessment (ESIA). The RAP was prepared in accordance with the World Bank's Operating Procedure 4.12. The plan included screening, identification of key issues, and data collection through site survey and asset valuation conducted in August 2013. The survey determined land demarcations, clarified land access issues, and documented ownership patterns and existing use. Project-affected persons (PAPs) consulted and participated in development of mitigation measures, such as compensation and alternative livelihoods.

2.4. Expected Global, National and Local Benefits

The development of a RE NAMA in the power sector in Nigeria should be contextualised within the priority of achieving sustainable development. As such, the project is embedded in a context in which the delivery of national socio-economic benefits is equally important to the country's contribution to GHG emission reductions. The identification of cost-effective mitigation measures in the power sector, and their implementation as a RE NAMA, will provide a clear demonstration of effective mechanisms to integrate national sustainable development and greenhouse gas mitigation goals. Furthermore, the project forms part of Nigeria's ongoing process of defining a low-carbon development strategy (Section 1.3.2), which forms part of a broader process to develop a low-carbon, climate-resilient development pathway for the country.

National benefits

The project will fully incorporate the socio-economic dimension in the RE NAMA design and implementation process. This includes contributing to:

- Increasing security and sovereignty of energy supply at the national level by reducing dependence on gas;
- Having high-quality access to energy at competitive prices[75] and reducing the impact on natural resources and environment;
- Increasing social equality and reducing energy poverty, through increased access to quality and affordable energy services, especially in the northern states;
- Potentially expanding electricity grid coverage to capitalise on indigenous renewable energy sources that will facilitate rural electricity programmes using appropriate and cost-effective technologies;
- Facilitating the creation of conditions for sustainable socio-economic development in rural, isolated villages and country borders by improving the quality of life of the rural

[75] In the case of the 100 MW solar PV project in Bauchi State, a case can be made that the effective baseline against which on-grid solar PV can be compared is off-grid diesel generation. This is because of the unreliability and unpredictability of grid electricity. As quoted in Section 1.3.1, local cost of diesel-generated electricity is $0.55-0.60/kWh, well over twice the cost of solar PV generated electricity. Further, assuming an emission factor of 0.8 tCO_2/MWh for stand-alone diesel generated electricity, the emission reduction potential for on-grid PV would be 1.8 time larger than when compared with gas-generated on-grid electricity.

population and encouraging the promotion of productive uses of energy (this is assumed under conditions of larger penetration of solar PV (all renewables) of around 10% (20%) of total installed capacities – see **Table 8** in the long-term and for any growth scenario);

- Developing a vibrant renewable energy supply chain in Nigeria that will generate green jobs;
- Promoting the coordination of financing instruments with public and private entities in order to allow better access to economic resources and financing for projects.

Global Environmental Benefits

Direct GHG emission reductions

Using a combined margin grid emission factor of 0.4306 tCO_2/MWh (see calculations in Annex 7.5) for the Nigerian electricity system, the direct emission reductions from the 100 MW solar PV plant is expected to be approximately 113,158 tCO_2/year. During the lifetime of the UNDP-GEF project, the baseline projects will deliver 452,633 tCO_2 in cumulative emission reductions for the period 2017-2020. Assuming a useful investment lifetime of 20 years, the combined cumulative direct emission reductions will amount to 2.263 $MtCO_2$, at an abatement cost of 1.94 US$GEF/$tCO_2$. This is similar to the values given in the PIF after updating the grid emission factor and solar electricity generated by 100 MW PV plant.

As justified in Annex 7.5, a causality factor of 25% has been applied to the cumulative direct emissions reductions to give adjusted direct project emissions reductions of 0.565 $MtCO_2$. This approach gives a more conservative estimate of direct emissions reductions since the baseline projects would have been implemented in the absence of the UNDP-GEF project. The causality factor provides a measure of the enhancements that the GEF interventions will bring to the baseline projects, which then allows a more realistic calculation of the cost-effectiveness of GEF interventions. In this scenario, the abatement cost is 7.78 US$GEF/$tCO_2$.

Indirect GHG emission reductions

Indirect emission reductions are expected to be substantial, arising from the policy and financial derisking, capacity development and institutional strengthening aspects of the project – specifically:

- Output 1.1: At least 3 policy and financial derisking instruments have been assessed using DREI analysis based on work initiated in the development of the project document.
- Output 1.2: A set of social and environmental safeguard guidelines is developed for all utility-scale RE based on international standards.
- Output 1.4: Technology Action Plans have been developed in conjunction with Output 1.1 to promote investment in soalr PV, wind and biomass energy.
- Output 2.1: A study on domestic financial sector reform to unlock low-cost local capital for green investment is carried out.
- Output 2.2: A GIS based tool is developed to identify practicable RE (PV, wind and biomass) sites in Nigeria.
- Output 2.4: The Lagos Energy Academy is capacitated to deliver RE trainings to IPPs, undergraduate students, and public institutions on a cost-recovery basis.
- Output 2.5: Dissemination of best practices.

At this stage, it is extremely difficult to predict which tools will actually be adopted by the Government, what form the power sector RE NAMA will assume and what basket of financial instruments will be identified and capitalised, making estimation of GEF-driven emission

reductions challenging. As a conservative approach, indirect emission reductions have been calculated using both the top-down and bottom-up approaches. The detailed calculations are given in Annex 7.5.

Bottom-up approach

A replication factor of 3 has been applied to the direct project emissions reductions of 2.263 $MtCO_2$. The choice of replication factor is given in Annex 7.5. The top-down approach gives indirect emissions reductions equal to 6.79 $MtCO_2$, and an abatement cost of ~0.65 US$GEF/$tCO_2$.

Top-down approach

The top-bottom approach uses the post-project 10-year market potential as the starting point. Hence, the 10 year market potential coincides with the emissions reductions expected between 2021 and 2030, which are the long-term targets shown in **Table 8**. In order to be conservative, a weak causality factor of 25% has been applied to give indirect emissions reductions. The top-down indirect emission reductions are found to be 6.61 $MtCO_2$ (Reference scenario), 8.17 $MtCO_2$ (High Growth scenario) and 9.72 $MtCO_2$ (Optimistic II scenario). This equates to an abatement cost in the range of approximately 0.45 – 0.67 US$GEF/$tCO_2$.

The project results framework includes indicators to measure the project's contribution in these areas. These emission reductions will be clearly recorded and reported to the GEF Secretariat via the established monitoring and evaluation channels. The strong focus of the project on MRV will facilitate this task. The assumptions used to calculate the direct and indirect emission reductions will be reviewed at the mid-term and final evaluation of the project.

2.5. Project Rationale and GEF Policy Conformity

The project contributes to GEF Climate Change Focal Area Objective 3, "Promote Investment in Renewable Energy Technologies", by recognising that renewable energy plays a key role not only in reducing GHG emissions, but also in addressing national development priorities such as broader energy access, energy security, environmental pollution and job creation. In accordance with the adopted strategy, the GEF support under this objective will expand beyond the creation of enabling policy, regulatory tools and public derisking instruments to promote the implementation of a power sector RE NAMA using solar PV as entry point. Through a combination of policy and financial derisking, the UNDP-GEF project will enhance private-sector participation and reduce the delivery risk of GHG emission reductions in the electricity sector.

2.6. Country Ownership: Country Eligibility and Country Drivenness

According to the Instrument for the Establishment of the Restructured Global Environment Facility, Nigeria qualifies for GEF financing on the following grounds:

- It has ratified the UN Framework Convention on Climate Change; and
- It receives development assistance from UNDP's core resources.

The objective of the project is consistent with the voluntary agreement of the FGN as shown in Annex 7.1. Furthermore, it is clearly aligned with the mitigation objectives outlined in the Second National Communication to the UNFCCC, submitted to the UNFCCC in February 2014.

As discussed in Section 1, the project is fully consistent with the country's long-term energy strategy as expressed in the NEMP 2014. Nigeria is clearly committed to an energy diversification strategy, which calls for the efficient use of energy and the use of indigenous resources. The country has commenced deep reforms in the power sector that will be deepened over the time scale of the UNDP-GEF project; is implementing a number of favourable policies under the power sector reform roadmap; and is developing financial incentives through MYTO-II (and supported by technical assistance from GIZ's NESP). As discussed in Section 1.3.2.2,

several initiatives are being implemented in the power sector that will directly benefit the integration of renewable electricity in the national grid. This context allows the project to develop a coherent NAMA for renewable electricity based on solar PV targets, and eventually for other types of technologies, to support the sustainable development of Nigeria, including the reduction of GHGs.

2.7 Sustainability and Replicability

Sustainability

As discussed in Section 1.1.5 in the Project Document, Nigeria is yet to develop and submit any NAMA to the UNFCCC. Consequently, Nigeria has not capitalised on using NAMAs as a means to attract international climate finance, and also as a potential means to implement its post-2020 INDC. The project is innovative, since it is the first national initiative that will allow Nigeria to develop a sector-wide NAMA based on UNDP's derisking approach (see Section 1.5 in the Project Document). The UNDP-GEF project will therefore pave the way for Nigeria to develop NAMAs in other sectors, and also for off-grid RE applications. Other elements of innovativeness stem from migrating from a conventional, project-based approach to a sector-wide transformational approach that will also include the testing and implementation of novel policy and financial derisking instruments to scale-up the diffusion of renewable energy technologies. The innovativeness aspect of the derisking approach is that funding for on-grid renewables comes at a lower social cost compared to providing a feed-in tariff to promote the same technologies in the presence of underlying risks. The derisking approach will contribute to the financial sustainability of promoting private investments in on-grid renewable energies as discussed below.

The main barrier to sustainability of private sector investments in on-grid renewable electricity generation is the risk-induced high cost of capital in Nigeria. The methodological and evidence-based approach promoted by the UNDP-GEF project, complemented by the establishment of necessary institutional and enabling conditions, will be instrumental in leveraging private and international funding to support the scaling up of on-grid renewable electricity. For instance, the preliminary DREI analyses have shown that the putting in place of a package of public derisking instruments can lower the costs of financing that prevail in the business-as-usual (BAU) situation – e.g. from 18% cost of equity in the BAU situation to 14.8%; and from 8% cost of debt in the BAU situation to 6.6%. The impact of the reduced risks, and hence lowered cost of capital, is a reduction of the LCOE for solar PV from USD 10.5 cts per kWh (BAU) to USD 7.7 cts per kWh (post-derisking), thereby making it more cost competitive with the baesline power generation technology.

Also, a USD 300.7 million package of derisking instruments is estimated to create net savings to the economy of USD 960.2 million in lower direct financial incentives. Hence, the sustainability of the proposed NAMA project for the Nigerian power sector based on a derisking approach emanates from the fact that it lowers the cost of capital in a financially sustainable way – i.e. at lower social costs compared to the case when renewables are incentivised without reducing or eliminating underlying risks and barriers.

The sustainability of the project also rests on the collaboration with existing initiatives (see Section 1.3.2), and developing partnerships with national institutions and also developing institutional capacities. For instance, as discussed in Section 2.2, the NERC is being assisted by the GIZ (through the NESP – see Section 1.3.2.2 above) to review the feed-in-tariffs under MYTO II. Since the GIZ is already supporting the NERC with MYTO II, one of the proposed changes to the project design is that the UNDP-GEF project will not specifically work on FiT review or its design. Based on the experience with collaboration with the GIZ in Tunisia where a similar UNDP-GEF derisking RE NAMA project is being implemented (Section 2.2), the results of the derisking analyses (which will be carried out periodically by the ECN – see below) will be shared with the GIZ and NERC to support the FiT review process that will be carried out periodically as the underlying risks and barriers change. Further, there will be capacity building

of local institutions, such as transferring the technical capacity to the ECN for the periodic application of the DREI analyses to track the risk profile regarding renewable energy investments in Nigeria. Also, the UNDP-GEF project will build a partnership with the LEA to provide technical backstopping for private project developers, and this will complement the ongoing initiatives under the NESP. The collaborations and institutional capacity development are discussed in Section 2.2. The table below summarises the interactions of the UNDP-GEF project with other institutions (international development partners and domestic institutions) across the different risk categories and proposed public derisking instruments.

RISK CATEGORY	POLICY DERISKING INSTRUMENTS	UNDP-GEF PROJECT SUPPORT	OTHER INTERN. SUPPORT	DOMESTIC SUPPORT
Power Market Risk	[Well designed PPA-bidding process]		[GIZ]	
	[Differentiated tariff approach]		[GIZ/NIAF]	
	Project development facility	✓	[GIZ]	[LEA]
Permits Risk	[Streamlining permits process]		[GIZ]	
	Project development facility	✓	[GIZ]	[LEA]
Social Acceptance Risk	Guidelines to benchmark EIA against international standards	✓		[FME]
Resource & Technology Risk	GIS-based tool for identifying suitable on-grid RE sites	✓		[ECN/FMP]
	Project development facility	✓	[GIZ]	[LEA]
Grid/Transmission Risk	[Technical codes, grid absorption study]		[GIZ/NIAF]	
	Project development facility	✓	[GIZ]	[LEA]
Counterparty Risk	Support to DISCOs on cost-recovery, operational performance		[WB]	
Financial Sector Risk	Study on domestic financial sector reform for green infrastructure	✓		[FMF]
	Project development facility	✓	[GIZ]	[LEA]

It is pointed out that the DREI approach can be extended to off-grid and mini-grid renewable energy applications as well. In this case, the baseline power generation technology (or its LCOE) against which the renewable energy alternative will be compared will be different (most probably stand-alone diesel generation that has a higher cost of generation – see Section 1.3.1).

Further, the project originates from the FGN's willingness to establish long-term climate change mitigation targets, placing it in a stable policy context that strongly favours its sustainable development. Furthermore, the concept of NAMAs as a means to engage non-Annex 1 countries in mitigation efforts is embedded in the UNFCCC discussions and negotiations, providing further stability to the project context. As discussed in Section 1.1.4, NAMAs can be used to support the development and implementation of INDCs in the context of a post-2020 climate regime. Therefore, the conceptual framework of the project is highly likely to be sustainable, as NAMAs will continue to form a part of UNFCCC discussions and Nigeria seeks to finalise its NAMAs (see discussions in Section 1.3.2.1). By linking GHG reduction

opportunities and national development priorities captured in NV20:2020, the NAMA can serve as a template for other NAMA activities in the energy sector.

Other features of the project design that will ensure its sustainability are:

- By adopting a strategy, which focuses first and foremost on reducing investment risks, the project is destined to make a long-lasting impact;
- RE-supportive policy derisking instruments formulated under the technical assistance of Component 2 will form an integral part of the broader Power Sector Reform package and roadmap which are being pursued by the Government under the auspices of the high-level Presidential Task Force on Power;
- No capital subsidies will be provided which could adversely impact on RE project investment profile and replication potential;
- The project will support the national agencies listed in **Table 12** in full compliance with their existing mandate and power of authority thus making sure that lasting institutional and human capacities are created for implementation of project-supported policy changes;
- Capacity building does not feature as a distinct activity of the project. Instead, the learning-by-doing approach is favoured. This implies that all technical assistance will comprise a capacity building component for national stakeholders and institutions. As far as practicable, national consultants will be used to support the delivery of international technical assistance in a way that will enhance local capacities;
- Also, the LEA (complementing the NESP Training Partners shown in **Table 11**) has been identified to gradually take over the responsibility for provision of technical assistance, training and advice for IPPs and ensure continuation of project results after its completion. The LEA is already endowed with state-of-the-art training facilities on solar PV, and it has put in place a cost-recovery model for delivering training to national stakeholders;
- Sustainability and lasting impact of financial derisking instruments will hinge upon their ability to lower the cost of financing for RE projects. Financial derisking instruments will be identified and proposed in such a way as to achieve a sector-wide impact and lower RE financing costs for ALL perspective RE projects and therefore eliminate or at least significantly reduce the need for additional financial derisking after project completion.

Scaling up

The successful implementation of the project, including its sustainability, will provide a template for scaling up on-grid RE projects given the size of RE potential in Nigeria. As discussed in Section 1.2.5.3 of the Project Document, the target for on-grid solar PV is 1,238 MW by 2020, and increasing to 9,900 MW by 2030 (**Table 9** above). Given the fact that there are no on-grid solar PV applications in Nigeria to date, and that the 100 MW solar PV baseline project in Bauchi State represents the most advanced project in its design and conception, the UNDP-GEF has the capacity to unlock large-scale solar PV projects in Nigeria through a sectoral NAMA by proposing a derisking approach combined with collaboration with international and national institutions. Further, the UNDP-GEF project will provide the foundations (practical resources assessments and DREI analyses) for on-grid wind and biomass projects.

The project is designed to establish a sustainable framework for the energy sector NAMA design and implementation. This is intended to trigger the process of implementing NAMA activities in the country and to foster the replication of such activities. The project can expect replication at the following three levels:

Baseline project implementation – The project will facilitate the successful implementation of one baseline project that forms part of the solar PV action plan under the broader umbrella of the power sector RE NAMA. The baseline project will have a lifespan that extends beyond the duration of the UNDP-GEF project, and will have catalytic effects as first-of-its-kind in Nigeria

(see Section 1.3.1 and Section 1.3.2.2). A significant proportion (~50%) of the GEF funding (Output 3.1) will be allocated as incremental investment in the baseline project in order to enhance its performance in terms of clean electricity output that is compatible with grid stability. For example, in the baseline project, the voltage fluctuations in the national grid are not taken into account at sub-stations where renewable electricity is injected into the network. The mismatch between voltage generated by the baseline projects and the grid voltage will lead to losses and sub-optimal performance of the PV plant. As part of the investment component, the UNDP-GEF project will support the installation of interface electronics to match the voltage of renewable electricity with that of the national grid. Once demonstrated for its effectiveness, interface electronics will be applicable to future grid-connected RE projects covered in the power sector RE NAMA. Similarly, the incremental investments in reducing the impact of dust due to the Harmattan on solar PV yield will pave the way for the enhanced performance of PV plants that will be installed in Sahel-type climate in the future.

Additional power sector NAMA projects – By extending the solar PV action plan to cover other grid-connected renewable technologies such as wind and biomass, and by developing an optimal combination of cost-effective policy and financial derisking instruments using UNDP's DREI methodology, it is expected that the private investments will be catalysed effectively to implement the technology-specific renewable electricity initiative forming the power sector RE NAMA beyond the lifetime of the project. Further, the project will work to identify potential sources of financing to capitalise the basket of most appropriate financial derisking instruments for Nigeria to ensure sustainable financing for solar PV and future renewable electricity projects constituting the power sector RE NAMA. A key indicator of the project's replication success, included in the results framework, is an assessment of the number of financial instruments capitalised by the end of the project lifetime.

Definition of new NAMAs in the energy sector – As described in the sustainability section above, the project aims to develop a NAMA planning framework that allows for the development of new NAMA activities in the energy sector. The voluntary targets established by the Government of Nigeria (see Section 1.2.5.3) for the power sector are ambitious and require significant changes within the sector to be achieved. There are a number of voluntary mitigation actions that go beyond the power sector RE NAMA, like demand side management, off-grid and mini-grid renewable electricity generation. Further, there is the potential for GHG emission reductions in the oil and gas sector.[76] Likewise, the project's support for the establishment of MRV mechanisms will be replicable across NAMAs and will allow for quality reporting of the country's mitigation efforts. This collective effort will ultimately result in the mainstreaming of NAMAs in Nigeria's national development process, which will be vital for steering Nigeria towards a low-carbon development pathway.

Impact of transformational change on RE development

A high cost of capital is a significant deterrent for investments in renewable energies such as solar PV. In turn, a high cost of capital would imply the need for higher returns, and hence a higher tariff for the production of on-grid renewable electricity. As discussed in Section 1.5 of the Project Document, the cost of capital (i.e. cost of equity and debt) is influenced by underlying risks and barriers. In the presence of these underlying risks and barriers, the promotion of on-grid solar PV would require a significant compensation (say in the form of a conventional FiT) to make it financially competitive with the baseline technology (gas-generated power in this case). These comparisons are quantified under the 'sustainability' section above. The transformational change of the UNDP-GEF project is supported by a robust theory of change whereby the cost of capital (and hence the need for any renewable electricity compensation) is reduced by either eliminating or reducing the underlying risks and barriers. By providing an innovative and financially sounder lens to promote on-grid solar PV (also applicable to other on-grid renewables), the impact of the transformational change can be summarised as follows:

[76] Cervigni et al. (2013).

- Achieving the 2020 target of 1,238 MW in installed solar PV capacity equates to USD 1.89 billion in private sector investment;

- In the *business-as-usual scenario*, the model estimates that achieving this target will require a direct financial incentive in the form of a price premium over 20 years, valued at USD 2.26 billion. This results in a leverage ratio (the ratio of the cost of public instruments to investment catalysed) of 0.8x;

- In the *post-derisking scenario*, the model estimates that this same investment target can be achieved with a package of derisking instruments estimated at USD 300.7 million, and a lower direct financial incentive (price premium) over 20 years valued at USD 1.30 billion. This raises the leverage ratio by 50% to 1.2x, indicating a higher efficiency in terms of the costs of public instruments; and

- Taking the two scenarios together, the USD 300.7 million package of derisking instruments is estimated to create net savings to the economy of USD 960.2 million in lower direct financial incentives.

3. Project Results Framework

This project will contribute to achieving the following Country Programme Outcome as defined in CPD: Promote initiatives for access to renewable and rural energy; and Build capacity to develop, coordinate and monitor energy diversification policy and strategy for equitable energy access.
Country Programme Outcome Indicators: Renewable energy policy and strategy available and implemented; Number of people accessing renewable energy.
Primary applicable Key Environment and Sustainable Development Key Result Area: Catalyzing environmental finance.
Applicable GEF Focal Area Objective: GEF-5 FA Objective: #3 (CCM-3): "Promote Investment in Renewable Energy Technologies"

Objective/ Outcomes	**Indicators**	**Baseline**	**Targets End of Project**	**Source of verification**	**Risks and Assumptions**
Objective: The objective of the project is to support the Federal Government of Nigeria (FGN) in the development and implementation of a NAMA in the energy	- A NAMA developed for the Nigerian power sector (NPS) - Quantity of renewable electricity generated by on-grid baseline projects (MWh/year) - Quantity of direct GHG emissions resulting from the	- No NAMA for the energy sector - No MRV system for monitoring GHG emission reductions in the energy sector - Proposed 100 MW PV plant in Bauchi State becomes operational but with deficiencies (e.g.	- A NAMA developed for the NPS and submitted for registration with the UNFCCC NAMA Registry - 262 GWh/yr is generated by 100 MW PV plant in Bauchi State - Emissions reductions: • Total direct emission reductions of 452,000	- Project reports (Quarterly, Annual, PIR, MTE, TE) - Minutes of PSC - UNFCCC NAMA Registry - Power sector GHG inventory report (National Inventory Reports) - MRV mechanism or technology-specific MRV mechanisms	- The Government of Nigeria maintains its commitment to its voluntary GHG abatement initiatives through NAMAs, especially in the energy sector - Detailed sectoral inventory is established and operational - MRV mechanism(s) developed

sector, namely a RE NAMA for the Nigerian Power Sector (NPS).	baseline projects and power sector NAMA (tCO_2/year)	significant policy and financial risks))	tCO_2 between 2017 and 2020		- Implementation barriers (regulatory, financial, technical, technological) have been reduced or overcome

Outcome 1: A coherent derisking approach is established for catalysing private sector investment to implement renewable energy power sector NAMA.	- Number of policy and financial derisking instruments designed using DREI analysis and implemented - Number of national guidelines - Standardised baseline for calculating GHG emission reduction for on-grid RE	- No methodology is used to quantify risks that hinder investments in RE, and to develop policy and financial derisking instruments to promote large-scale private investments. - Social and environmental safeguards for RE projects do not meet international standards - No baseline exists to calculate emission reductions for grid connected RE - No technology action plans for promoting RE projects	- At least 3 policy and financial derisking instruments have been assessed using DREI analysis based on work initiated in the development of the project document. - 3 TAPs developed by the end of Year 3 - An MRV mechanism is developed for the power sector, including a standardized baseline for national grid developed in Year 1 and updated on a yearly basis	- Project reports (Quarterly, Annual, PIR, MTE, TE) - Minutes of PSC - DREI reports - Report on the design and operationalisation of the environmental and social safeguard guidelines - Standardized baseline for national electricity system - Report on the MRV mechanism - 3 NAMA technology action plans	- GoN supports the facilitation of private-sector investment in the energy sector

Outcome 2: Public instruments are developed and implemented for derisking the national policy environment.	- Number of public instruments developed and implemented (e.g. trainings delivered to IPPs, RE resources assessments, environmental and social safeguard guidelines, RE IPPs benefiting from trainings) - Investments in on-grid utility scale RE projects	- Limited availability of local capital because of the risk perception of the financial sector - No GIS-based tool to provide the practicable RE potential is available - Limited capacity in public and private institutions to plan, implement, monitor and evaluate RE projects - Lack of internationally-benchmarked social and environmental safeguards	- A study on domestic financial sector reform to unlock low-cost local capital for green investment is carried out - A GIS based tool is developed to identify practicable RE (PV, wind and biomass) sites in Nigeria - A set of social and environmental safeguard guidelines is developed for all utility-scale RE by the end of Year 1 based on international standards - The Lagos Energy Academy are capacitated to deliver RE trainings to IPPs, undergraduate students, and public institutions on a cost-recovery basis - A lessons learned report is developed to captured best practices for dissemination (Year 5)	- Project reports (Quarterly, Annual, PIR, MTE, TE) - Report on financial sector reform - GIS-based resource assessment tool - Lessons-learned report	- GoN maintains its commitment to monitor, report and verify its voluntary NAMA initiatives - Beneficiary institutions have the human and institutional capacity and willingness to collaborate
Outcome 3: The NPS RE NAMA is operationalised	- Emission reductions from grid-connected PV power	- Baseline project implemented with identified	- 113,150 tCO_{2e}/year from 100 MW PV plant in Bauchi	Project reports (Annual, PIR, MTE, TE) and minutes of PSC	- Baseline projects do not suffer major alterations in scope or financing

by demonstrating a proof-of-concept grid connected solar PV plant with quantified GHG emission reductions.	- Number of households benefiting from electricity generated by PV plants (households/year)[77]	deficiencies - No MRV system for NPS NAMA	State (452,000 tCO_{2e} between 2017 and 2020) - 295,000 households benefiting from PV by the end of the project		- Grid-connected, utility-scale private sector projects are supported through power sector liberalization - Standardised baseline for national grid has been developed - National MRV system is in place

[77] The targets are based on average electricity consumption of approximately 879 kWh/household in 2011 calculated using the following data: (1) population = 164,728,579 persons (Annual Abstract of Statistics, 2012); (2) average number of persons per household = 5.9 - http://www.kwarastate.gov.ng/statistics/population/householdsizeandcharacteristics.php; and (3) per capita electricity consumption = 149 kWh/person (World Development Indicators, 2014).

3.1. Total Budget and Work Plan

Table 15. Allocation of GEF budget and work plan.

Award ID:	00086990	Project ID(s):	00094142
Award Title:	NAMA Support for TSP		
Business Unit:	NGA 10		
Project Title:	Derisking Renewable Energy NAMA for the Nigerian Power Sector		
PIMS no:	5243		
Implementing Partner (Executing Agency)	Energy Commission of Nigeria, Federal Ministry of Environment, Federal Ministry of Power		

GEF Outcome/Atlas Activity	Responsible Party/ Implementing Agent	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Budget Note	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Amount Year 5 (USD)	Total (USD)
OUTCOME 1: A coherent derisking approach is established for catalysing private sector investment in renewables.	ECN & FMP	**62000**	**GEF**	71200	International Consultants	1	20,000	20,000	20,000	20,000	20,000	100,000
				71300	Local Consultants	1	60,000	60,000	50,000	50,000	50,000	270,000
				71400	Contractual Services - Individ	1	8,600	0	0	8,600	0	17,200
				72200	Equipment and Furniture	5	15,000	5,500	5,500	2,500	2,500	31,000
				72100	Contractual Services - Company	1	150,000	150,000	125,000	100,000	100,000	625,000
				71600	Travel	2	3,000	5,000	5,000	5,000	5,000	23,000
				74200	Audio Visual&Print Prod Costs	3	5,000	0	5,000	5,000	5,000	20,000
				75700	Training, Workshops and Confer	4	2,000	6,000	6,000	5,000	3,000	22,000
					sub-total GEF		**263,600**	**246,500**	**216,500**	**196,100**	**185,500**	**1,108,200**
		4000	**UNDP**	71200	International Consultants	1	20,000	20,000	20,000	0	20,000	80,000
				71300	Local Consultants	1	20,000	20,000	20,000	0	20,000	80,000
				71600	Travel	2	2,000	5,000	5,000	5,000	5,000	22,000

				75700	Training, Workshops and Confer	4	2,000	4,000	4,000	4,000	4,000	18,000
					sub-total UNDP		**44,000**	**49,000**	**49,000**	**9,000**	**49,000**	**200,000**
					sub-total Outcome 1		**307,600**	**295,500**	**265,500**	**205,100**	**234,500**	**1,308,200**
OUTCOME 2: Public instruments are developed and implemented for derisking the national policy environment.	FMP & FME & ECN	**62000**	**GEF**	71200	International Consultants	1	110,000	110,000	110,000	120,000	70,000	520,000
				71300	Local Consultants	1	20,000	70,000	80,000	80,000	40,000	290,000
				71400	Contractual Services - Individ	1	0	8,600	0	0	8,600	17,200
				71600	Travel	2	5,000	5,000	5,000	5,000	5,100	25,100
					sub-total GEF		**135,000**	**193,600**	**195,000**	**205,000**	**123,700**	**852,300**
		4000	**UNDP**	71200	International Consultants	1	20,000	78,000	78,000	76,000	30,000	282,000
				71300	Local Consultants	1	20,000	70,000	90,000	90,000	50,000	320,000
				71600	Travel	2	10,000	25,000	25,000	25,000	18,000	103,000
				72200	Equipment and Furniture	5	50,000	90,000	80,000	80,000	50,000	350,000
				74200	Audio Visual&Print Prod Costs	3	10,000	20,000	20,000	20,000	35,000	105,000
				75700	Training, Workshops and Confer	4	15,000	30,000	30,000	30,000	35,000	140,000
					sub-total UNDP		**125,000**	**313,000**	**323,000**	**321,000**	**218,000**	**1,300,000**
					sub-total Outcome 2		**260,000**	**506,600**	**518,000**	**526,000**	**341,700**	**2,152,300**
OUTCOME 3: The NPS NAMA is operationalised by demonstrating a proof-of-concept grid connected solar PV plant with quantified GHG emission reductions.	FMP & ECN	**62000**	**GEF**	71200	International Consultants	1	25,000	40,000	10,000			75,000
				71300	Local Consultants	1	10,000	10,000				20,000
				71400	Contractual Services - Individ	1	0	0	8,600	0	0	8,600
				71600	Travel	2	3,000	3,000	2,000	1,000	1,000	10,000
				72200	Equipment and Furniture	5	707,900	1,408,500				2,116,400
					sub-total GEF		**745,900**	**1,461,500**	**20,600**	**1,000**	**1,000**	**2,230,000**
					sub-total Outcome 3		**745,900**	**1,461,500**	**20,600**	**1,000**	**1,000**	**2,230,000**
PROJECT MANAGEMENT	ECN	**62000**		71400	Contractual	1	32,400	32,400	32,400	32,400	32,400	162,000

			GEF		Services - Individ							
				75700	Training, Workshops and Confer	4	5,000					5,000
				74599	UNDP cost recovery charges	6	5,000	5,000	5,000	5,000	5,000	25,000
				74100	Professional Services	7	3,500	3,500	3,500	3,500	3,500	17,500
					Total Management GEF		**45,900**	**40,900**	**40,900**	**40,900**	**40,900**	**209,500**
					PROJECT TOTAL (GEF)		**1,190,400**	**1,942,500**	**473,000**	**443,000**	**351,100**	**4,400,000**
					PROJECT TOTAL (UNDP)		**169,000**	**362,000**	**372,000**	**330,000**	**267,000**	**1,500,000**
					PROJECT TOTAL (GEF + UNDP)		**1,359,400**	**2,304,500**	**845,000**	**773,000**	**618,100**	**5,900,000**

Category	Budget notes
International consultancy	1,320,000
National consultancy and project staff	785,000
Travel	58,100
Print/Publications	20,000
Equipment	2,147,400
Workshops	27,000
Direct Project Costs (Annex 7.9)	25,000
Audit	17,500

Budget Notes

1- Summary terms of reference for project staff, local consultancies, and international consultancies can be found in Annex 7.6.
2- Estimated travel costs are for internal travel within Nigeria, taking into consideration the fact that many project implementation activities will be conducted at the regional and local level. Significant levels of co-financing will be used to support the total project travel costs. Travel of international consultants is included within the international consultancy budget as the procurement process will require international consultancies to include their travel costs within their offers.
3- Project printing and publication costs are kept to a minimum and co-financing resources will primarily be used for this purpose.
4- The workshop and consultation budget is designed to support a thorough and continuous stakeholder consultation process throughout the project. Nevertheless, co-financing will be used for this purpose and joint workshops with other programmes will be planned to foster collaboration and avoid duplication.
5- Equipment costs are primarily allocated to the implementation support provided for baseline project enhancements. These costs will include the procurement of interface electronics to interconnect renewable electricity to the national grid; enhancing the performance of PV modules through a combination of water and energy efficient cleaning and/or ‘desert proof’ module technologies.

6- Direct project costs – these costs, based on the Universal Price List, are agreed between the Government of Nigeria and UNDP for project execution services above and beyond those covered by the implementing agency fee: please refer to Annex 7.7 for a budget breakdown. An LoA will be signed with the Government of Nigeria – see Annex 7.7 for the draft LoA.
7- Audit – These are mandatory audit costs. Audit should be undertaken annually as indicated in the UNDP financial rules and regulations.

Summary of funds

Source of funding	Amount (USD) Year 1	Amount (USD) Year 2	Amount (USD) Year 3	Amount (USD) Year 4	Amount (USD) Year 5	Amount (USD) Total
GEF	1,190,400	1,942,500	473,000	443,000	351,100	**4,400,000**
UNDP (cash)	169,000	362,000	372,000	330,000	267,000	**1,500,000**
National Government (in-kind)	420,000	420,000	410,000	400,000	400,000	**2,050,000**
Private Sector (cash)	157,500,000	52,500,000				**210,000,000**
TOTAL	**159,279,400**	**55,224,500**	**1,255,000**	**1,173,000**	**1,018,100**	**217,950,000**

3.2 Summary of project co-financing (in US$)

Table 16. Allocation of project co-financing.

		ECN	FME	LEA	NSCP	UNDP	Total
Outcome 1	Cash					200,000	**200,000**
	In-kind	475,000					**475,000**
Outcome 2	Cash					1,300,000	**1,300,000**
	In-kind	475,000	190,000	285,500			**950,000**
Outcome 3	Cash				199,500,000		**199,500,000**
	In-kind	475,000		47,500			**522,500**
Project management	Cash				10,500,000		**10,500,000**
	In-kind	75,000	10,000	17,500			**102,500**
Total		***1,500,000***	***200,000***	***350,000***	***210,000,000***	***1,500,000***	**213,550,000**

The letters of co-financing are found in Annex 7.4.

4. PROJECT MANAGEMENT ARRANGEMENTS

This Project Document shall be the instrument referred to as such in Article I of the Standard Basic Assistance Agreement between the FGN and the UNDP, signed by the parties on 12 April 1988. The project will be nationally implemented (NIM) by the Federal Ministry of Environment (FME) for the Government of Nigeria. UNDP will be accountable for the disbursement of funds and the achievement of the project goals, in accordance with the approved work plan. The ting agency, FME, will assign a senior officer as a Project Director to: i) coordinate the project activities with the activities of other Government entities; and ii) certify that the expenditures are in line with the approved budgets and work-plans. The organisational structure of the project is shown in **Figure 17**.

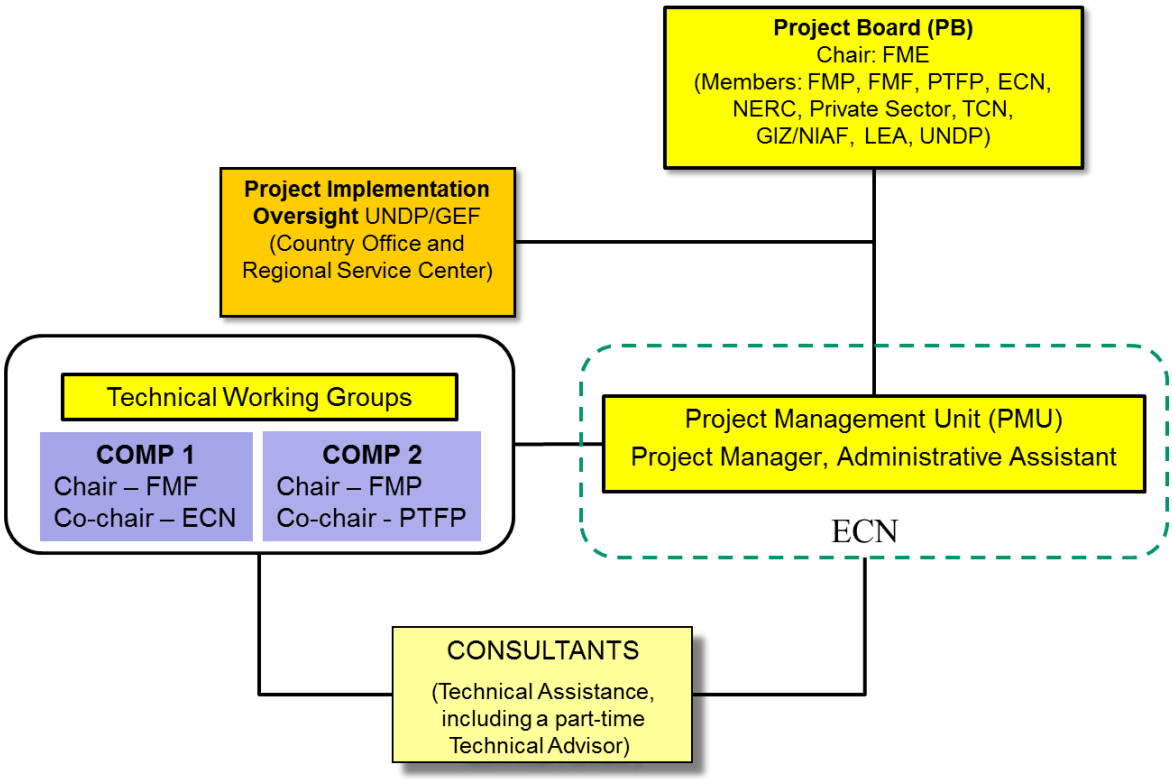


Figure 17. Project management structure.

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. The PB will be chaired by the FME. The PB will comprise the federal Ministry of Power, the Federal Ministry of Finance, the Nigerian Electricity Regulatory Commission, the Energy Commission of Nigeria, the Presidential Task Force on Power, the Lagos Energy Academy, and a representative of the private sector (Nigeria Solar Capital Partners), representative of CSO/NGO (e.g. involved in the development of the 100 MW solar PV project in Bauchi State), as well as the Project Manager. If required, representatives of the project stakeholders or other co-financing partners such as GIZ, DFID/NIAF, AfDB and WB, can be invited to the PB meetings at the discretion of the PB. UNDP will participate as the GEF Implementing Agency. 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 Project Manager will participate as a non-voting member in the PB meetings and

will also be responsible for compiling a summary report of the discussions and conclusions of each meeting.

A Project Management Unit (PMU) under the overall guidance of the Project Boardwill carry out the day-to-day management of the project. The PMU will be established within ECN and will coordinate its work with the PB. The Project Manager will report to UNDP, the implementing partner (ENC, FMP and FME depending on relevant project outcomes) and the PB. The Terms of Reference of the key project personnel are presented in Annex 7.6. The project personnel will be selected on a competitive basis in accordance with the relevant UNDP rules and procedures and in consultation with the UNDP-GEF Regional Technical Advisor.

The 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 Support Centre in Addis Ababa, Ethiopia and the GEF, as well as organising mandatory and possible complementary reviews, financial audits and evaluations on an as-needed basis. It will also support the implementing partner 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. A Letter of Agreement (Annex 7.7) describes all additional services required of UNDP beyond its role in oversight between the IP and UNDP. The direct project costs requested of UNDP are also detailed in the Total Budget Work Plan.

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

5. MONITORING FRAMEWORK AND EVALUATION

The project will be monitored through the following M&E activities.

5.1. Project Start

A Project Inception Workshop will be held within the first 2 months of project start with those who were assigned roles in the project organisation structure, the UNDP Country Office, as well as the coordinator of the UNDP and relevant stakeholders of the project including public, private and civil society organisations. The Inception Workshop is crucial to building ownership for the project results, to generate agreements related to the objectives of the project and to plan the first year annual work plan.

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

1. Assisting all partners to fully understand their roles and responsibilities in the project context and take ownership of the process. Discuss the roles, support services and complementary responsibilities of UNDP and the PB vis-à-vis the PMU. 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 the PB and project staff will be validated.

2. Based on the validated project results logical framework, the detailed first year work plan will be finalised. This process will help review and agree on the indicators, targets and their means of verification, and re-check assumptions and risks.

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

4. Explaining and elaborating on the financial reporting procedures and obligations, as well as arrangements for an annual audit, if required.

5. Planning and scheduling Project Board meetings. Roles and responsibilities of all project organisation structures should be clarified and the meetings planned according to the milestones defined in the work plan during the first quarter of the project. The first Project Board meeting should be held within the first 6 months following the inception workshop.

An Inception Workshop report will be drafted and shared with the participants. This document will serve as a key reference document and as a way to formalise various agreements and plans agreed on during the meeting.

5.2 Quarterly

The Project Manager shall report progress made using the reporting format provided by UNDP. Based on the initial risk analysis submitted, the risk log shall be regularly updated. Risks become critical when the impact and probability are high. Note that for UNDP-GEF projects, all financial risks associated with the financial instruments proposed as part of the project 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).

The UNDP Implementation Officer will hold quarterly meetings with the PMU, or more frequently if necessary. This will allow the parties to conduct periodic assessments and solve problems related to the project in a timely manner to ensure smooth implementation of project activities.

5.3 Annually

The annual Project Review/Project Implementation Reports (APR/PIRs) will be the responsibility of the UNDP Implementation Officer with support from the PMU. This report is prepared to monitor progress made since project start, especially for the previous reporting period. The APR/PIR combines both UNDP and 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
- Annual Work Plan and other expenditure reports
- Risk and adaptive management

The PMU will develop a detailed programme of monitoring and will review meetings, consultations with partners who will implement the project and relevant stakeholders that have

been incorporated into the inception workshop report. The schedule will include: (i) a tentative agenda for meetings of the Project Boardand other relevant advisory and/or coordination mechanisms if appropriate, and (ii) activities related to M & E of the project.

Day-to-day monitoring of the progress of project implementation will be the responsibility of both the Project Manager and UNDP Implementation Officer, based on the annual work plan and its indicators. The Project Manager will report to the UNDP Implementation Officer any delays or difficulties that take place in the project development, for the adoption of corrective measures in time and support or appropriate remedial actions.

5.4. Mid-Term of Project Cycle

The project will undergo a Mid-Term Review by an independent consultant at the mid-point of project implementation (July 2018). The Mid-Term Review will determine progress being made toward the achievement of outcomes, and will identify course corrections if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; it will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. The findings from this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organisation and timing of the Mid-Term Review will be decided after consultation between the parties regarding the project document.

A GEF Climate Change Mitigation Tracking Tool will be completed at the mid-term of the project.

5.5. End of Project

A Final Evaluation Report will be prepared by an independent evaluator during a three-month period prior to the final Project Board meeting. 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 takes place). The final evaluation will look at the impacts and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. In order to institutionalise the use of the DREI methodology to continuously assess the evolution of the risk profile of Nigeria regarding investments in renewable energies, it is proposed that a DREI analyses be carried out at the end of the project. These analyses can then be compared to those that will be carried out under Component 1 in year 1 of project implementation. This comparison will provide feedback on the effectiveness of the UNDP-GEF project (and also other ongoing derisking initiatives in Nigeria), and it will provide information to frame and design future public derisking initiatives in the renewable energy sector in Nigeria. This Final Evaluation will therefore provide yet another opportunity for public institutions that are beneficiaries of the UNDP-GEF project to increase their respective capacities to carry out DREI analyses, and to institutionalise the DREI methodology as a tool to support public decision-making.

During the last three months, the PMU will prepare the Project Terminal Report. This comprehensive report will summarise 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.

A GEF Climate Change Mitigation Tracking Tool will be completed at the end of the project.

5.6. Audit Clause

The audit will be conducted in accordance with UNDP financial rules and regulations and applicable audit policies on UNDP projects.

5.7. Learning and Knowledge Sharing

Results from the project will be shared within and beyond the project intervention zone through existing information-sharing networks and forums at the national, sub-national, regional and global levels.

The project will identify and participate, if considered relevant and appropriate, in scientific, policy-based and/or any other networks which may be considered beneficial to project implementation, providing access to lessons-learned and contributing to its replicability.

5.8. Communications and Visibility Requirements

Full compliance is required with the 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 need to be used. To avoid 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 and on 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.

5.9. 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	Project Manager, PB, UNDP Nigeria, UNDP-GEF	Indicative cost: $5,000	Within first two months of project start up
Measurement of Means of Verification of project results.	UNDP Nigeria / Project Manager & M&E Expert	None	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 Project Manager Project team	To be determined as part of the Annual Work Plan's preparation.	Annually, prior to ARR/PIR and the definition of annual work plans
ARR/PIR	Project Manager and team UNDP Nigeria, UNDP-GEF	None	Annually
Periodic status/ progress reports	Project Manager and team (PB)	None	Quarterly
Mid-Term Review	Project Manager and team (PB) UNDP Nigeria, UNDP-GEF External Consultants (i.e. review team)	Indicative cost: $23,900	At the mid-point of project implementation
Final Evaluation	Project Manager and team (PB) UNDP Nigeria, UNDP-GEF External Consultants (i.e. evaluation team)	Indicative cost: $34,400	At least three months before the end of project implementation
Project Terminal Report	Project Manager and team (PB) UNDP Nigeria External Consultants	None	At least three months before the end of the project
Audit	UNDP Nigeria Project Manager and team (PB)	Indicative cost per year: $3,500 for a total of $17,500 (for 5 years)	Yearly
Visits to field sites	UNDP Nigeria Government representatives (PSC)	For UNDP-GEF project, paid from IA fees and operational budget	Yearly
TOTAL indicative COST Excluding project team staff time and UNDP staff and travel expenses		**$US 80,800**	

6. LEGAL CONTEXT

This document, together with the CPAP signed by the Government and UNDP, which is incorporated by reference, constitute together a Project Document as referred to in the SBAA. All CPAP provisions apply to this document.

Consistent with Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.

The implementing partner shall:

- Put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
- Assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by the UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

7. ANNEXES

Annex 7.1. Nigeria's association with the Copenhagen Accord

FEDERAL MINISTRY OF ENVIRONMENT

Office of the Honourable Minister
Headquarters Mabushi, Abuja.
☎: 09-6702721

FMEHUD/SCCU/101/V.1/1 **21st May, 2010**

Mr. Yve de Boer
Executive Secretary
Climate Change Convention Secretariat
Haus Carstanjen, Martin-Luther King Strasse
Bonn, Germany

Your Excellency,

NIGERIA'S POSITION ON THE STATUS OF THE "COPENHAGEN ACCORD"

I have the honour to write and acknowledge with thanks receipt of your letter Ref: YDB/DBO/drl of 18th January, 2010 relating to the **Copenhagen Accord**, the official outcome of the 15th Session of the UNFCCC Conference of Parties which took place in Copenhagen, Denmark, 7 to 19 December, 2009. Nigeria recalls that during the Closing Plenary of COP 15 at the Bella Centre, Copenhagen on 19 December, 2009 delegates "took note" of this important document.

2. I would like to confirm that Nigeria underscores its support for the Copenhagen Accord and underline its importance as representing a high level political understanding amongst the participants

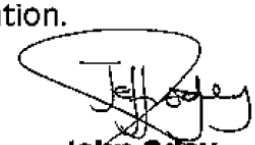
on most of the contentious issues of the Climate Change negotiations. It is the belief of Nigeria that the Copenhagen Accord provides the added impetus for the sustenance of the ongoing two-track process of negotiation under the Bali Roadmap. This Accord therefore provides a propitious foundation which should lead to the successful conclusion of

a robust, transparent, comprehensive and legally binding climate Change deal ahead by COP 16 in Mexico.

4. In this context, it is our expectation that more concerted works of the Ad hoc Working Group on Long-term Cooperative Action (AWG-LCA) and Ad hoc Working Group on the Kyoto Protocol (AWG-KP) could be sustained. Nigeria would also like to state further the need for more robust efforts in ensuring early flow of the pledged fast track funding commitment. In this respect, it is our hope that starting from 2010 the annual pledge of $10 billion USD will become available with a focus on the Least Developed Countries, Small Island Developing States and African countries.

6. Arising from the above and with due regard to other observations and reservations as per the attached schedule (Annex 1), Nigeria wishes to fully associate itself with the Copenhagen Accord.

7. Please, accept, Executive Secretary, the assurances of my highest consideration.



John Odey
Honourable Minister

Annex 7.2. Derisking Renewable Energy Investment (DREI) Analysis

This annex sets out the methodology, assumptions and data that have been used in performing the modelling described in this report.

The modelling closely follows the methodology set out in the UNDP Derisking Renewable Energy Investment Report (2013) ("DREI report (2013)").[78] This annex is organised in line with the four stages of the DREI report's framework: the Risk Environment Stage (Stage 1), the Public Instrument Stage (Stage 2), the Levelised Cost Stage (Stage 3) and the Evaluation Stage (Stage 4).

In addition, the modelling uses the financial tool (in Microsoft Excel) created for the DREI report framework. The financial tool is denominated in 2015 USD and covers a core period from January 1 2015 (approximating the present time) to December 31 2030 (Nigeria's long-term energy targets). Generation technologies may have asset lifetimes which extend beyond 2030, which is captured by the financial tool.

The DREI report and the financial tool are available for download at www.undp.org/DREI.

Risk Environment (Stage 1)

The data for the Risk Environment Stage come from three principal sources:

- UNDP's experience with, and analysis of, large-scale renewable energy, in particular the DREI report (2013).
- Multiple information interviews with relevant stakeholders and experts, such as Government officials, international development practitioners and domestic renewable energy actors.
- 5 structured interviews with investors and developers solar PV in Nigeria and the best-in-class country (Germany).

In order to gather this data, the UNDP project development team made one field mission to Nigeria in March 2015. The UNDP also put in place a local team of experts to support the formulation of the project, including the DREI analyses.

Deriving a Multi-Stakeholder Barrier and Risk Table

The multi-stakeholder barrier and risk table for solar PV is derived from the generic table for large-scale, renewable energy introduced in the DREI report (2013), (Section 2.1.1). It is composed of 9 risk categories and 20 underlying barriers. These risk categories, barriers and their definitions can be found in **Error! Reference source not found.** in the body of the Project Document. The relevance and relative importance of these risks and barriers were assessed quantitatively during the structured interviews that were carried out in this study

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[78] Waissbein et al. (2013).

Calculating the Impact of Risk Categories on Higher Financing Costs

The basis of the financing cost waterfalls produced in the modelling is structured, quantitative interviews undertaken with wind energy investors and developers. The interviews were performed on a confidential basis, and all data across interviews was aggregated. The interviews and processing of data followed the methodology described in Box 7.2.1 below, with investors scoring each risk category according to (i) the probability of occurrence of negative events, (ii) the level of financial impact from these events (should they occur) and (iii) the effectiveness of public instruments. Investors were also asked to provide estimates of their cost of equity, cost of debt, capital structure and loan tenors for typical RE projects in Nigeria. Interviewees were provided beforehand with an information document setting out key definitions and questions, and the typical interview took between 45 and 90 minutes.

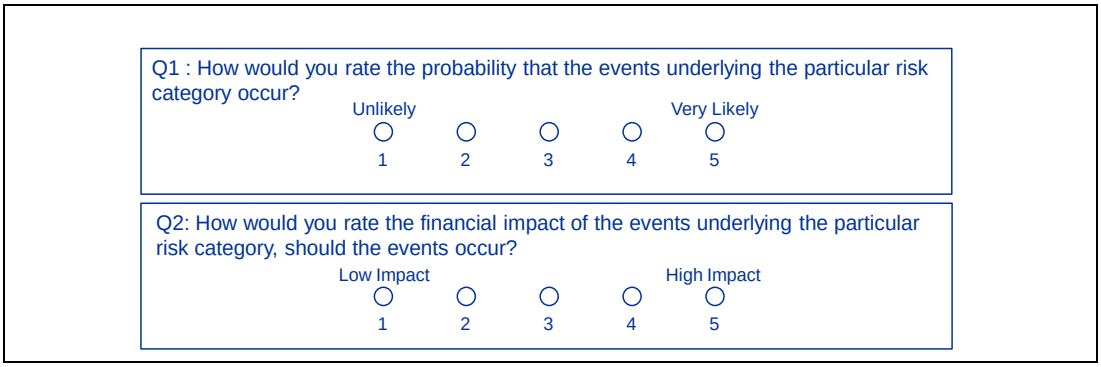
Box 7.2.1. Methodology for quantifying the impact of risk categories on financing costs.

1. Interviews

Interviews were held with debt and equity investors active in solar PV in Nigeria, as well as in a best-in-class country (Germany). The interviewees are asked to provide two types of data:

- Scores for the various risk categories identified in the barrier and risk framework. The scoring examines two aspects of barriers and risks, as set out in Table 13 in the main body of the Project Document.
- The current cost of financing for making an investment today, which represents the end-point of the waterfall (or the starting point in case of the best-in-class country)

The interview questions to quantify the impact of risk categories on the cost of equity and debt were:



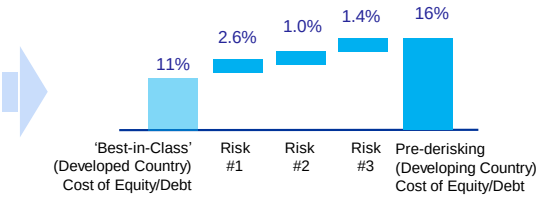
2. Processing the data gathered

The data gathered from interviews is then processed. The methodology involves identifying the total difference in cost of equity or debt between the developing country (Nigeria) and the best-in-class developed country (Germany). This figure for the total difference reflects the total additional financing cost in the developing country.

The interview scores provided for each risk category address both components of risk: the *probability* of a negative event occurring above the probability of such event occurring in a best-in-class country and the *financial impact* of the event if such an event occurs. (See DREI Report (2013), Section 2.1.1). These two ratings are then multiplied to obtain a total score per risk category. These total risk scores are then used to pro-rate and apportion the total difference in cost of equity or debt.

A very simplified example to demonstrate the basic approach is shown below.

Cost of equity					
Developing County	16%				
Best-in-class Developed Country	11%				
Total Difference	5%				
Average investor risk scores for cost of equity					
	Incremental Score for Probability		Score for Impact		Total Risk Score
Risk Category #1	4	x	4	=	16
Risk Category #2	2	x	3	=	6
Risk Category #3	3	x	3	=	9
Total Across all Risks					**31**
Pro-rating risk scores across cost of equity					
Risk Category #1	16/31	x	5%	=	2.6%
Risk Category #2	6/31	x	5%	=	1.0%
Risk Category #3	9/31	x	5%	=	1.4%
					5.0%



In addition, the following key steps have been taken in calculating the financing cost waterfalls:

- In order to make interviews comparable, investors were asked to provide their scores while taking into account a list of eight key assumptions regarding solar PV investment, as set out in Box 7.2.2. To maintain consistency, these assumptions have subsequently been used to shape the inputs in the LCOE calculation for solar PV in Stage 3.

Box 7.2.2. The eight investment assumptions for PV energy in Nigeria.

1. Provide scores based on the current investment environment in the country today

2. Assume you have the opportunity to invest in a 10-100 MW solar PV plant

3. Assume a high quality c-Si PV panel manufacturer with proven track record

4. Assume a build-own-operate (BOO) business model

5. Assume a comprehensive O&M contract

6. Assume that well-maintained transmission lines with free capacities are located within 10km of the project site

7. Assume an EPC construction sub-contract with high penalties for breach of contract

8. Assume a non-recourse project finance structure

- Equity investors in renewable energy typically have a greater exposure to development risks. The modelling exercise uses its full set of 9 risk categories for equity investors. The 'permits risk' and 'financing risk' categories are removed for debt investors, assuming that banks will have prerequisites, such as licences and having equity financing in place, before considering a funding request. As such, the modelling exercise uses 7 risk categories for debt investors.

- The modelling exercise selects Germany as the example of a best-in-class investment environment for wind energy and solar PV. In this way, Germany serves as the baseline – the left-most column of the financing cost waterfall.

Stage 2- Public Instruments

Public Instrument Table

The public instrument table for wind energy is derived from the generic table in the DREI report (Section 2.2.1). In order to keep the scope of the modelling exercise manageable, the set of policy derisking instruments for fossil-fuel subsidy reform (part of 'power market risk') are excluded from the modelling exercise.

Individual instruments in the public instrument table were then selected for Nigeria in a comprehensive manner: if the financing cost waterfall identified incremental financing costs for a particular risk category, then the matching public instrument in the table is deployed and modelled.

Policy Derisking Instruments

The following is a summary of the key approaches taken:

- *Public Cost.* Estimates for the public cost of policy derisking instruments are calculated based on a bottom-up modelling approach. This follows the approach for costing set out in the DREI report (Section 2.2.2.). Each instrument has been modelled in terms of the costs of (i) full-time employees and (ii) external consultancies/services. Typically, full-time employees are modelled for the operation of an instrument (e.g. the full-time employees required to staff an energy regulator), and external consultancies/services are modelled for activities such as the design and evaluation of the instrument, as well as certain services such as publicity/awareness campaigns. Policy derisking measures are modelled for up to the 6 year period from 2015 to 2020. Data have been obtained from analyses of Nigerian Government budgets, the budgets of development agency activities in Nigeria, as well as UNDP's in-house experience.

- *Effectiveness.* Estimates for the effectiveness of policy derisking instruments in reducing financing costs are based on the structured interviews with investors, and then further adjusted to reflect UNDP's in-house experience. As certain policy derisking instruments may take time to become maximally effective, a linear ("straight-line") approach to time effects is modelled over the 20-year target investment period. The assumptions for the final effectiveness (after 20 years) are shown in Table 7.2.3.

Table 7.2.3. The modelling assumptions for policy derisking instruments' effectiveness.

Risk Category	Policy Derisking Instrument	Effective-ness	Discount for timing effect	Comment
Energy Market Risk	Long-term targets; regulatory framework; standardised PPA; independent regulator	75%	50%	Interview responses: high effectiveness
Permits Risk	Streamlined process for permits; Establishment of a dedicated one-stop shop for RE permits; contract enforcement and recourse mechanisms	50%	50%	Interview responses: moderate effectiveness.
Social Acceptance Risk	Awareness-raising campaigns targeting general public; pilot models for community involvement at project sites	50%	50%	Interview responses: moderate effectiveness.
Resource & Technology Risk	Resource assessment; technology and O&M assistance	25%	50%	Interview responses: moderate/low effectiveness.

Grid/ Transmission Risk	Grid code; grid management studies	50%	50%	Interview responses: moderate effectiveness.
Counterparty Risk	Strengthening utility's management & operational performance for existing operations	50%	50%	Interview responses: high effectiveness.
Financial Sector Risk	Financial sector reform; strengthening investors' familiarity and assessment capacity for renewable energy	25%	50%	Interview responses: moderate/low effectiveness.

Financial Derisking Instruments

The modelling assumptions for financial derisking instruments are informed by UNDP's in-house experience, interviews with representatives from international financial institutions and interviews with project developers.

Empirically, the selection, pricing and costing of financial derisking instruments for a particular renewable energy investment is determined on a case-by-case basis, and reflects the particular risk-reward characteristics of that investment. The modelling exercise assumptions instead cover the aggregate investments for Nigeria's 2020 solar PV target and represent a simplified, but plausible, formulation for the selection and pricing of financial derisking instruments. The following is a summary of the key assumptions used.

- *Cost.* Estimates of public cost of financial derisking instruments are set out in Table 7.2.4.

Table 7.2.4. The modelling assumptions on costing of financial derisking instruments.

Risk Category	Financial derisking instrument	Description of modelling assumptions
Grid/ Transmission Risk	Take-or-Pay Clause in PPA	• Assumes 100% of IPP's lost revenues due to grid or transmission failures are covered by take-or-pay clause
Counterparty Risk	Government Guarantee	• Assumes the Federal Ministry of Finance (FMF) provides a "Letter of Support" for each PPA entered into between IPP and NBET • Simplifying assumption that no cost attributed to the FMF letter

Financial Sector Risk	Public Loan	• Assumes illustrative, concessional USD/EUR loans of 4% and 20-year tenor from multilateral development banks to cover 50% of total debt needs. This is to address possible lack of capital in Nigerian financial markets.
		• Public cost:
		  ○ Assumes public cost is 100% of the loan amount
		  ○ Assumes 3.5x paid-in-capital multiplier, recognising that multilateral development banks can issue debt on capital

		markets, thereby leveraging their paid-in capital (UN 2010)
Currency/ Macroeconomic Risk	Partial Indexing	• Assumes illustrative mechanism whereby IPPs can request partial indexing of Nigerian Naira-denominated PPA tariffs to USD. • Assumes illustrative 50% of Naira-denominated PPA tariff is indexed. • Assumes 4% annual depreciation of Naira vs USD

- *Effectiveness.* Estimates for the effectiveness of financial derisking instruments in reducing financing costs are based on the structured interviews with investors, and then further adjusted to reflect UNDP's in-house experience. The figures for effectiveness have full and immediate impact once the instrument is implemented (i.e. no timing discount). The assumptions for effectiveness are shown in Table 7.2.5.

Table 7.2.5. The modelling assumptions for financial derisking instruments' effectiveness.

Risk Category	Financial Derisking Instrument	Effective-ness	Discount for timing effect	Comment
Grid / Transmission Risk	Take-or-Pay Clause in PPA	25%	0%	Interview responses: high effectiveness. However, residual risks remain.
Counterparty Risk	Government Guarantee	25%	0%	Interview responses: moderate effectiveness.
Financial Sector Risk	Public Loan	0% [Impact via concessional interest rates]	0%	Interview responses: low effectiveness.
Currency / Macroeconomic Risk	Partial Indexing	50%	0%	Interview responses: high effectiveness. However, residual risks remain.

Stage 3- Levelised Costs

Levelised Cost of Electricity (LCOE) Calculation

The DREI report's financial tool is used for the LCOE calculations. The financial tool is based on the equity-share based approach to LCOE, which is also used by ECN and NREL (IEA, 2011; NREL, 2011). Box 7.2.3 sets out the LCOE formula used. In this approach, a capital structure (debt and equity) is determined for the investment, and the cost of equity is used to discount the energy cash-flows.

Box 7.2.3. The modelling exercise's LCOE formula.

$$\frac{\%\ Equity\ Capital * Total\ Investment + \sum_{t=1}^{T} \frac{(O\&M\ Expense)_t + (Debt\ Financing\ Costs)_t - Tax\ Rate * (Interest\ Expense_t + Depreciation_t + O\&M\ Expense_t)}{(1 + Cost\ of\ Equity)^t}}{\sum_{t=1}^{T} \frac{Electricity\ Production_t * (1 - Tax\ Rate)}{(1 + Cost\ of\ Equity)^t}}$$

Where,

% Equity Capital = portion of the investment funded by equity investors

O&M Expense = operating & maintenance expenses

Debt Financing Costs = interest & principal payments on debt

Depreciation = depreciation on fixed assets

Cost of Equity = after-tax target equity IRR

Tax-deductible, linear depreciation of 95% of fixed assets over the lifetime of investment is used. The standard corporate tax rate for Nigeria of 30% was used (Deloitte, 2012). No tax credits, or other tax treatment, are assumed.

Baseline Energy Mix Levelised Costs and Emissions

The modelling makes a number of important methodological choices and assumptions regarding the baseline. The key steps in the approach taken are set out here:

- A marginal baseline (build margin) approach is used on the basis that Nigeria is characterised by rapidly increasing energy demand and, as such, new solar PV installations will likely not replace existing capacity.
- In addition, a private-sector perspective to baseline investment is similarly used. This reflects the fact that Nigeria is seeking to attract private sector investment irrespective of energy technology, and allows for the comparability of the marginal baseline LCOE with the solar PV LCOE.
- To date in Nigeria, historic private sector IPP investment has been in single cycle gas turbine technology (SCGT). As such, the modelling exercise uses single cycle gas turbine technology as the marginal baseline technology.
- The modelling assumptions for SCGT are shown below in Table 7.2.6.

Table 7.2.6. The modelling assumptions for the baseline energy technology, single cycle gas turbine (SCGT).

Technology Item	Assumption	Source
Initial investment cost (USD/MW_{el})	389,000	Schmidt *et al* (2013)[79]; http://www.ipieca.org/energyefficiency/solutions/77801/
O&M cost excl. fuel (USD/MW_{el})	20,000	Schmidt *et al* (2013); quoted at http://www.power-technology.com/features/featurepower-plant-om-how-does-the-industry-stack-up-on-cost-4417756/

[79] Schmidt T.S., Blum N.U., Sryantoro R. (2013): "Attracting private investments into rural electrification - a case study on renewable energy based village grids in Indonesia", *Energy for Sustainable Development* 17 (2013), 581–595.

Life Span (years)	25	Schmidt *et al* (2013)
System Efficiency	40%	http://en.wikipedia.org/wiki/Simple_cycle_combustion_turbine
Capacity Factor	64.5%	TCN (2014)
Emissions Factor	0.4306 tCO_2/MWh	Calculated in Annex 7.5

- Private-sector financing costs are used to calculate the LCOE of the marginal baseline mix. The cost of equity and cost of debt used for SCGT were those obtained for solar energy (BAU scenario) in Nigeria, discounted by 15% to account for the existing track record of SCGT compared with solar PV energy. Loan tenors were taken as half the lifetime of the particular generation technology.

- Current fuel prices were taken as the starting point and then evolved over time using the IEA medium price projections (WEO, 2014). The current prices were taken from NERC's transfer prices for IPPs as of 1 January 2015.[80] This generates a price of USD 8.52/MWh_{th} in 2015, with a linear increase over the 25-year lifetime of the plant to USD 12.05/MWh_{th} in 2040. Recently, there have been efforts by the government to align the price of gas going to the power sector with international prices in order to reduce shortages of gas for power generation. It is noted that the current NERC transfer price is close to the current Henry Hub spot price. The issue of subsidies can be an area of further research in future applications of this methodology.

- Emissions data for SCGT has been calculated for the determination of the build margin emission factor for the national electricity system of Nigeria.

Solar PV Levelised Costs

The assumptions for the solar PV LCOE calculation are set out in Table 7.2.7.

Table 7.2.7. The modelling assumptions on technology specifications for solar PV.

Technology Item	Assumption	Source
2020 solar PV installed capacity	1,238 MW	see Table 8 and Table 9
solar PV capacity factor	28%	Authors
Solar PV technology	C-Si	Authors
Park size	10-100 MW	Authors
Core investment costs, including balance of plant costs (civil works, transformers)	1,400,000 USD/MW	Nigerian project developer
Annual O&M costs At start of operation	19,000 USD/MW (O&M contractor) + 15,000 USD/MW (security contract to protect staff and assets)	Nigerian project developer

[80] http://www.premiumtimesng.com/business/energy-business/170940-new-tariff-for-nigerian-gas-begins-january-1-2015.html - accessed 12 March 2015.

Annual increase	2.2%	
Lifetime	20 years	Authors

Stage 4 - Evaluation

This assesses the selected public derisking instruments mix using four performance metrics, as well as through the use of sensitivity analyses. The four metrics are: (i) investment leverage ratio, (ii) savings leverage ratio, (iii) end-user affordability, and (iv) carbon abatement. Please see **Figure 16** in main text.

Annex 7.3. Social and Environmental Screening Template

The completed template, which constitutes the Social and Environmental Screening Report, must be included as an annex to the Project Document. Please refer to the Social and Environmental Screening Procedure and Toolkit for guidance on how to answer the 6 questions.

Project Information

Project Information	
1. Project Title	Nigeria Solar Capital Partners
2. Project Number	
3. Location (Global/Region/Country)	West Africa, Nigeria, Bauchi State

Part A. Integrating Overarching Principles to Strengthen Social and Environmental Sustainability

QUESTION 1: How Does the Project Integrate the Overarching Principles in order to Strengthen Social and Environmental Sustainability?
Briefly describe in the space below how the Project mainstreams the human-rights based approach
The Bauchi solar power plant will have a strong positive social impact on the Nigerian people. The supply of clean electricity generated will be sufficient to power approximately 2,750,000 additional households. Further, the number of households provided with electricity could multiply significantly if the country's electrification rate were to increase due to improvements and expansions over time in the transmission and distribution grid. With the implementation of increased renewable energy into the energy system, there will be a decrease in diesel generation resulting in a reduction in pollution, significant health improvements and decrease in health-related expenses. The project will significantly reduce the amount of time and money women and children must spend trying to gather fuels, allowing for more time to be spent on capacity-building activities such as education, work or vocational training. Estimated total time savings could be over 100 million hours per year and $13 million of additional income or equivalent economic value per year due to the reallocation of time. The project will also increase the economic empowerment of women and other disadvantaged or disenfranchised groups through their participation in the project. Local engineers and technicians will benefit from this project, as training programs will be implemented to teach them how to properly manage the solar field. We hope to offer several local engineers the opportunity to attend a renewable energy

training internship at the Arava Institute in Israel to further build technical capacity.

Children will benefit considerably from additional and enhanced reliability of electricity which will allow them to allocate more time to studying. It is estimated that there could be improved school performance for approximately 470,000 school students. Furthermore, the local population will benefit from the increased access to renewable energy services, and selected students will have access to education regarding engineering and solar PV technology provided by NSCP.

The 100 MW solar power plant will benefit Nigeria's economic growth through the creation of employment at all phases of development and throughout its lifetime. At the pre-development phase of the project, local Nigerian experts have been hired and will continue to be employed to complete surveying, feasibility studies, site preparation including ground levelling and road building, financing, regulatory licensing and permitting. During the construction period, we estimate that 500 construction workers will be employed part time, the majority of whom will be Nigerian nationals. We estimate that 100 full time maintenance jobs will be required for the upkeep of the solar field. These jobs include:

- Cleaning – 40 full time workers
- Security – 30 full time workers (3 shifts per day 24/7)
- Heavy maintenance – 7 workers
- Light electrical maintenance – 10 workers
- Infrastructure maintenance – 10 workers
- Parts and inventory management – 3 workers

Briefly describe in the space below how the Project is likely to improve gender equality and women's empowerment

It is expected that under the resettlement action plan and the corporate social responsibility program there will be a focus on the women within the community. Whilst the region remains a traditional patriarchal environment NSCP has employed a female community liaison officer to establish links with the females of the community and ensure their voice is heard on community planning issues. NSCP will also be sponsoring a health clinic which will have a maternity and women's health facility.

Briefly describe in the space below how the Project mainstreams environmental sustainability

The 100 MW Solar PV project will have a strong positive impact on the environment by decreasing the share of traditional, polluting sources of energy through the addition of renewable energy to meet the growing energy demand and reduce the shortage of electricity. An estimated 2,469,000 tons of CO2 per year will be inhibited. This will improve the state of fauna and flora in the region, as well as the local communities' well-being.

Part B. Identifying and Managing 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). If no risks have been identified in Attachment 1 then note "No Risks Identified" and skip to Question 4 and Select "Low Risk". Questions 5 and 6 not required for Low Risk Projects.*	**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: Habitats	I = 3 P = 5	**Moderate**	Flora and fauna, soils, and air quality may be adversely impacted during construction of site and transmission line (e.g. disturbance of habitat, destruction of vegetation, loss of grazing area, conversion of farmland, soil compacting, surface water runoff).	An ESIA and ESMP was developed for the project. Impacts on habitats relatively limited in scope and ESMP contains mitigation measures for identified impacts. (e.g. minimization of vegetation loss, replanting, minimization of land clearing, containment). No critical habitats affected.
Risk 2: Community Health and Safety	I = 2 P = 3	**Moderate**	Construction activities may cause risks through	ESMP includes mitigation measures for identified risks (e.g. controls on vehicle routing,

			increased traffic, heavy machinery, as well as occupational accidents. Health: influx of workers may spread sexually transmitted diseases Construction activities may cause disruption of utility services such as electricity, if cables are damaged. This could impact the living conditions in the communities who depend on this resource.	speed limit enforcement, site fencing, worker safety plan, emergency response plan, HIV/AIDS awareness program together with awareness programs on local customs, plans to minimize disruption of services)
Risk 3: Security	I = 5 P = 3	**High**	Northern Nigeria suffers from ongoing political instability and intermittent violence. The violence and insurgency has centred around the emergency States of Yobe, Borno and Adamawa with targeted attacks extended to Gombe, Bauchi, Kano and the Federal Capital Territory.	NSCP has begun to work more closely with the Federal Government on provisions and undertakings to assist us in securing the site and making the Project palatable to the international investment community. Such commitments would include a possible permanent road block in close proximity to the Site with military personnel, trained in advanced anti-terrorism protocol by GardaWorld. An important aspect of the training is to ensure that the lives of workers and neighbouring communities are not harmed by onsite military personnel.
Risk 4: Cultural Heritage	I = 3 P = 2	**Moderate**	Construction could cause adverse impacts to unseen cultural heritage.	While project does not anticipate adverse impacts on Cultural Heritage, ESMP includes adoption of chance find procedures.

Risk 5: Resettlement of Project Affected Persons	I = 4 P =5	**High**	According to Environquest's RAP, an estimated total of 217 individuals (Project Affected Persons) on the proposed solar farm site and transmission line corridor will be affected by the project. There are about 30 households comprising approximately 150 residents on the proposed solar farm site who will be displaced. Includes loss of farmland (200 ha) and sources of income as result of land acquisition	Environquest prepared an initial Resettlement Action Plan as part of their Environmental and Social Impact Assessment. The RAP was prepared in accordance with the World Bank's Operating Procedure 4.12. The plan included screening, identification of key issues, and data collection through site survey and asset valuation conducted in August 2013. The survey determined land demarcations, clarified land access issues, and documented ownership patterns and existing use. Project-affected persons (PAPs) consulted and participated in development of mitigation measures such as compensation and alternative livelihoods.
Risk 6: Pollution (air quality, noise, water, wastes)	I = 3 P = 4	**Moderate**	Construction will increase emissions from equipment dust, and cause increased noise levels from generators and heavy machinery. Water pollution is a risk from surface run-off, disposal of sewage and wastes, and accidental spillage of lubricants and fuels	ESMP include measures to address these risks, including watering of dusty sites, equipment will be serviced regularly and undergo routine maintenance, heavy machinery will be fitted with mufflers, workers will be provided with ear protective devices, and construction will be restricted to day-time. Drainage systems and spill containment facilities will be utilized. Waste management procedures will be put in place.
	QUESTION 4: What is the overall Project risk categorization?			

	Select one (see SESP for guidance)		Comments
	Low Risk	☐	
	Moderate Risk	☐	
	High Risk	X	**Project categorized as High Risk due to resettlement activities. ESIA conducted, ESMP developed, RAP developed**
	QUESTION 5: Based on the identified risks and risk categorization, what requirements of the SES are relevant?		
	Check all that apply		**Comments**
	Principle 1: Human Rights	☐	
	Principle 2: Gender Equality and Women's Empowerment	☐	
	1. Biodiversity Conservation and Natural Resource Management	X	
	2. Climate Change Mitigation and Adaptation	☐	
	3. Community Health, Safety and Working Conditions	X	
	4. Cultural Heritage	X	
	5. Displacement and Resettlement	X	
	6. Indigenous Peoples	☐	
	7. Pollution Prevention and Resource Efficiency	X	

Final Sign Off

Signature	*Date*	*Description*
QA Assessor		UNDP staff member responsible for the Project, typically a UNDP Programme Officer. Final signature confirms they have "checked" to ensure that the SESP is adequately conducted.
QA Approver		UNDP senior manager, typically the UNDP Deputy Country Director (DCD), Country Director (CD), Deputy Resident Representative (DRR), or Resident Representative (RR). The QA Approver cannot also be the QA Assessor. Final signature confirms they have "cleared" the SESP prior to submittal to the PAC.

PAC Chair		UNDP chair of the PAC. In some cases PAC Chair may also be the QA Approver. Final signature confirms that the SESP was considered as part of the project appraisal and considered in recommendations of the PAC.

SESP Attachment 1. Social and Environmental Risk Screening Checklist

Checklist Potential Social and Environmental Risks		
Principles 1: Human Rights		**Answer (Yes/No)**
1.	Could the Project lead to adverse impacts on enjoyment of the human rights (civil, political, economic, social or cultural) of the affected population and particularly of marginalized groups?	N
2.	Is there a likelihood that the Project would have inequitable or discriminatory adverse impacts on affected populations, particularly people living in poverty or marginalized or excluded individuals or groups? [81]	N
3.	Could the Project potentially restrict availability, quality of and access to resources or basic services, in particular to marginalized individuals or groups?	N
4.	Is there a likelihood that the Project would exclude any potentially affected stakeholders, in particular marginalized groups, from fully participating in decisions that may affect them?	N
5.	Is there a risk that duty-bearers do not have the capacity to meet their obligations in the Project?	N
6.	Is there a risk that rights-holders do not have the capacity to claim their rights?	N
7.	Have local communities or individuals, given the opportunity, raised human rights concerns regarding the Project during the stakeholder engagement process?	N
8.	Is there a risk that the Project would exacerbate conflicts among and/or the risk of violence to project-affected communities and individuals?	Y
Principle 2: Gender Equality and Women's Empowerment		
1.	Is there a likelihood that the proposed Project would have adverse impacts on gender equality and/or the situation of women and girls?	N
2.	Would the Project potentially reproduce discriminations against women based on gender, especially regarding participation in design and implementation or access to opportunities and benefits?	N
3.	Have women's groups/leaders raised gender equality concerns regarding the Project during the stakeholder engagement process and has this been included in the overall Project proposal and in the risk assessment?	Y
4.	Would the Project potentially limit women's ability to use, develop and protect natural resources, taking into account different roles and positions of women and men in accessing environmental goods and services? *For example, activities that could lead to natural resources degradation or depletion in communities who depend on these resources for their livelihoods and well being*	N
Principle 3: Environmental Sustainability: Screening questions regarding environmental risks are encompassed by the specific Standard-related questions below		
Standard 1: Biodiversity Conservation and Sustainable Natural Resource Management		
1.1	Would the Project potentially cause adverse impacts to habitats (e.g. modified, natural, and critical habitats) and/or ecosystems and ecosystem services? *For example, through habitat loss, conversion or degradation, fragmentation, hydrological changes*	Y
1.2	Are any Project activities proposed within or adjacent to critical habitats and/or environmentally sensitive areas, including legally protected areas (e.g. nature reserve, national park), areas proposed for protection, or recognized as such by authoritative sources and/or indigenous peoples or local communities?	N

[81] Prohibited grounds of discrimination include race, ethnicity, gender, age, language, disability, sexual orientation, religion, political or other opinion, national or social or geographical origin, property, birth or other status including as an indigenous person or as a member of a minority. References to "women and men" or similar is understood to include women and men, boys and girls, and other groups discriminated against based on their gender identities, such as transgender people and transsexuals.

1.3	Does the Project involve changes to the use of lands and resources that may have adverse impacts on habitats, ecosystems, and/or livelihoods? (Note: if restrictions and/or limitations of access to lands would apply, refer to Standard 5)	Y
1.4	Would Project activities pose risks to endangered species?	N
1.5	Would the Project pose a risk of introducing invasive alien species?	N
1.6	Does the Project involve harvesting of natural forests, plantation development, or reforestation?	N
1.7	Does the Project involve the production and/or harvesting of fish populations or other aquatic species?	N
1.8	Does the Project involve significant extraction, diversion or containment of surface or ground water? *For example, construction of dams, reservoirs, river basin developments, groundwater extraction*	N
1.9	Does the Project involve utilization of genetic resources? (e.g. collection and/or harvesting, commercial development)	N
1.10	Would the Project generate potential adverse transboundary or global environmental concerns?	N
1.11	Would the Project result in secondary or consequential development activities which could lead to adverse social and environmental effects, or would it generate cumulative impacts with other known existing or planned activities in the area? *For example, a new road through forested lands will generate direct environmental and social impacts (e.g. felling of trees, earthworks, potential relocation of inhabitants). The new road may also facilitate encroachment on lands by illegal settlers or generate unplanned commercial development along the route, potentially in sensitive areas. These are indirect, secondary, or induced impacts that need to be considered. Also, if similar developments in the same forested area are planned, then cumulative impacts of multiple activities (even if not part of the same Project) need to be considered.*	N
Standard 2: Climate Change Mitigation and Adaptation		
2.1	Will the proposed Project result in significant[82] greenhouse gas emissions or may exacerbate climate change?	N
2.2	Would the potential outcomes of the Project be sensitive or vulnerable to potential impacts of climate change?	N
2.3	Is the proposed Project likely to directly or indirectly increase social and environmental vulnerability to climate change now or in the future (also known as maladaptive practices)? *For example, changes to land use planning may encourage further development of floodplains, potentially increasing the population's vulnerability to climate change, specifically flooding*	N
Standard 3: Community Health, Safety and Working Conditions		
3.1	Would elements of Project construction, operation, or decommissioning pose potential safety risks to local communities?	Y
3.2	Would the Project pose potential risks to community health and safety due to the transport, storage, and use and/or disposal of hazardous or dangerous materials (e.g. explosives, fuel and other chemicals during construction and operation)?	N
3.3	Does the Project involve large-scale infrastructure development (e.g. dams, roads, buildings)?	N
3.4	Would failure of structural elements of the Project pose risks to communities? (e.g. collapse of buildings or infrastructure)	N
3.5	Would the proposed Project be susceptible to or lead to increased vulnerability to earthquakes, subsidence, landslides, erosion, flooding or extreme climatic conditions?	N
3.6	Would the Project result in potential increased health risks (e.g. from water-borne or other vector-borne diseases or communicable infections such as HIV/AIDS)?	Y
3.7	Does the Project pose potential risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during Project construction,	Y

[82] In regards to CO_2, 'significant emissions' corresponds generally to more than 25,000 tons per year (from both direct and indirect sources). [The Guidance Note on Climate Change Mitigation and Adaptation provides additional information on GHG emissions.]

	operation, or decommissioning?	
3.8	Does the Project involve support for employment or livelihoods that may fail to comply with national and international labor standards (i.e. principles and standards of ILO fundamental conventions)?	N
3.9	Does the Project engage security personnel that may pose a potential risk to health and safety of communities and/or individuals (e.g. due to a lack of adequate training or accountability)?	Y
Standard 4: Cultural Heritage		
4.1	Will the proposed Project result in interventions that would potentially adversely impact sites, structures, or objects with historical, cultural, artistic, traditional or religious values or intangible forms of culture (e.g. knowledge, innovations, practices)? (Note: Projects intended to protect and conserve Cultural Heritage may also have inadvertent adverse impacts)	Y
4.2	Does the Project propose utilizing tangible and/or intangible forms of cultural heritage for commercial or other purposes?	N
Standard 5: Displacement and Resettlement		
5.1	Would the Project potentially involve temporary or permanent and full or partial physical displacement?	Y
5.2	Would the Project possibly result in economic displacement (e.g. loss of assets or access to resources due to land acquisition or access restrictions – even in the absence of physical relocation)?	Y
5.3	Is there a risk that the Project would lead to forced evictions?[83]	N
5.4	Would the proposed Project possibly affect land tenure arrangements and/or community based property rights/customary rights to land, territories and/or resources?	Y
Standard 6: Indigenous Peoples		
6.1	Are indigenous peoples present in the Project area (including Project area of influence)?	N
6.2	Is it likely that the Project or portions of the Project will be located on lands and territories claimed by indigenous peoples?	N
6.3	Would the proposed Project potentially affect the human rights, lands, natural resources, territories, and traditional livelihoods of indigenous peoples (regardless of whether indigenous peoples possess the legal titles to such areas, whether the Project is located within or outside of the lands and territories inhabited by the affected peoples, or whether the indigenous peoples are recognized as indigenous peoples by the country in question)? *If the answer to the screening question 6.3 is "yes" the potential risk impacts are considered potentially severe and/or critical and the Project would be categorized as either Moderate or High Risk.*	N
6.4	Has there been an absence of culturally appropriate consultations carried out with the objective of achieving FPIC on matters that may affect the rights and interests, lands, resources, territories and traditional livelihoods of the indigenous peoples concerned?	N
6.5	Does the proposed Project involve the utilization and/or commercial development of natural resources on lands and territories claimed by indigenous peoples?	N
6.6	Is there a potential for forced eviction or the whole or partial physical or economic displacement of indigenous peoples, including through access restrictions to lands, territories, and resources?	N
6.7	Would the Project adversely affect the development priorities of indigenous peoples as defined by them?	N
6.8	Would the Project potentially affect the physical and cultural survival of indigenous peoples?	N
6.9	Would the Project potentially affect the Cultural Heritage of indigenous peoples, including through	N

[83] Forced evictions include acts and/or omissions involving the coerced or involuntary displacement of individuals, groups, or communities from homes and/or lands and common property resources that were occupied or depended upon, thus eliminating the ability of an individual, group, or community to reside or work in a particular dwelling, residence, or location without the provision of, and access to, appropriate forms of legal or other protections.

	the commercialization or use of their traditional knowledge and practices?	
Standard 7: Pollution Prevention and Resource Efficiency		
7.1	Would the Project potentially result in the release of pollutants to the environment due to routine or non-routine circumstances with the potential for adverse local, regional, and/or transboundary impacts?	Y
7.2	Would the proposed Project potentially result in the generation of waste (both hazardous and non-hazardous)?	Y
7.3	Will the proposed Project potentially involve the manufacture, trade, release, and/or use of hazardous chemicals and/or materials? Does the Project propose use of chemicals or materials subject to international bans or phase-outs? *For example, DDT, PCBs and other chemicals listed in international conventions such as the Stockholm Conventions on Persistent Organic Pollutants or the Montreal Protocol*	N
7.4	Will the proposed Project involve the application of pesticides that may have a negative effect on the environment or human health?	N
7.5	Does the Project include activities that require significant consumption of raw materials, energy, and/or water?	N

Annex 7.4. Agreements

Six co-financing letters are submitted, from ECN, NSCP, FMP, FME, LEA, and UNDP.

Annex 7.5. Calculation of GHG emission reductions

The direct emission reduction calculations have been calculated as the product of the expected energy generation from RE plants and the grid emission factor of Nigeria.

$$ER_y = El_y \times EF_{grid} \quad (1)$$

Where, ER_y is the emission reduction in year *y*,

El_y is the electricity generated by the RE plant in year *y*, and

EF_{grid} is the grid emission factor of the Nigeria electricity system.

The expected renewable electricity generation from the baseline project is 262,800 MWh/yr (given in Section 1.3.1).

Calculating the grid emission factor, EF_{grid}

The Combined Margin (CM) grid emission factor was calculated using the CDM Methodological Tool 07 – i.e. "Tool to calculate the emission factor for an electricity system (Version 04.0)".[84]. The calculation of the CM is carried out in four steps as follows:

Step 1: The CM has been calculated as the weighted average of the Operating Margin (OM) emission factor and the Build Margin (BM) emission factor;

$$EF_{grid} = EF_{CM} = w_{OM} \times EF_{OM} + w_{BM} \times EF_{BM} \quad (2)$$

Where, w_{OM} and w_{BM} are weights (see **Step 4**),

EF_{OM} is the operating margin emission factor, and

EF_{BM} is the build margin emission factor.

Step 2: Since renewable electricity is less than 50% of total electricity generation in the electricity system (which has no off-grid power plants), OM has been computed using the Simple OM method. Table 7.5.1 shows that the share of renewable electricity has been less than 25% between 2011 and 2013 (the latest year for which generation data is available).

Table 7.5.1. Hydro and thermal generation in GWh, 2011 – 2013.

			2011	2012	2013	3-yr average
Hydro			6,657.59	6,455.12	6,100.73	
Thermal	**(NG)**		**21,034.26**	**23,116.66**	**23,527.97**	**22,559.63**
Hydro as % of Total			24.04	21.83	20.59	
Total			27,691.85	29,571.78	29,628.70	

The Simple OM emission factor has been calculated using the ex-ante option using 3-year generation-weighted average ((Table 7.5.1)), and fuel consumption (Table 7.5.2) based on the most recent data available. Low-cost/must-un power plants/units are excluded.

Table 7.5.2. Total consumption of natural gas, 2011 – 2013.

			2011	2012	2013	3-yr average
standard cubic feet NG, scf			1.2021E+11	1.25689E+11	1.5571E+11	
1 billion scf	2.10E+04	tonnes NG				
Tonnes of NG			2.52E+06	2.64E+06	3.27E+06	**2.81E+06**

[84] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf - accessed 12 December 2013.

Using an emission factor of 2.6928 tCO2/t(natural gas), and using the weighted average thermal electricity generated and natural gas consumption in Table 7.5.1 and Table 7.5.2, respectively, the **Operation Margin (OM) emission factor has been calculated as 0.3356 tCO2/MWh**.

Step 3: The BM emission factor has been calculated using the ex-ante option using generation statistics for 2013 (latest statistical data available). The procedure used to determine the group of power units to determine the BM is shown in Figure 7.5.1.

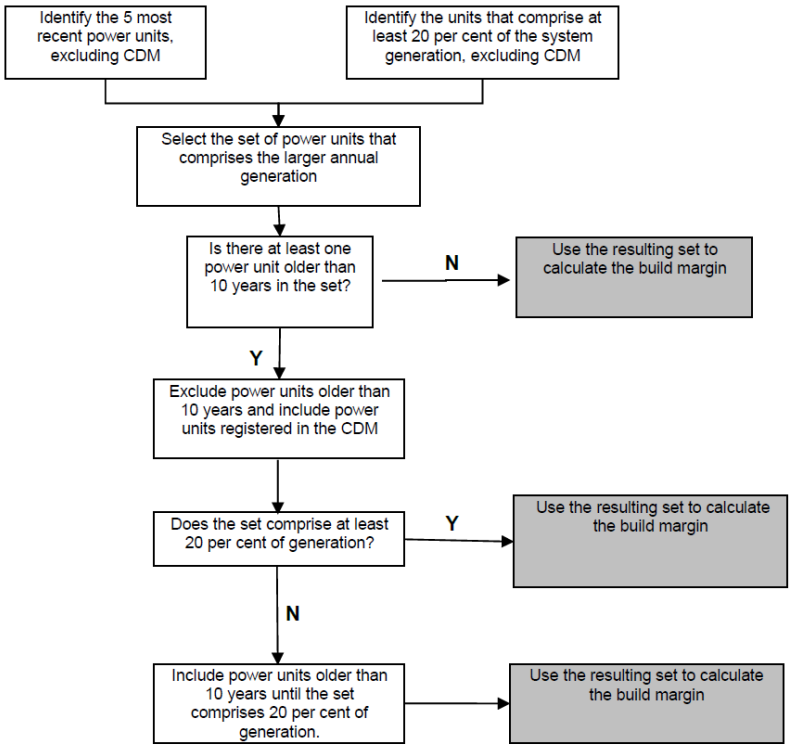


Figure 7.5.1. Procedure to determine the sample group of power units used to calculate the build margin.

The procedure shown in Figure 7.5.1 has been applied to the power park to arrive at the sample group of power units shown in Table 7.5.3.

Table 7.5.3. Determining the group of power units to calculate BM

5 most recently built power plants (using 2013 generation data)					
Plant	**date commissioned**	**MWh**	**scf (NG)**	**t(NG)**	**tCO2**
Ihovbor	2013	444,448.17	2.544E+10	5.34E+05	
Geregu	Q1 2013	856,199.94	5.153E+10	1.08E+06	
Olorunsogo II	2012	917,639.58	1.112E+10	2.33E+05	
Omotosho II	2012	1,719,998.97	509262252	1.07E+04	
Sapele II	2012	1,215,883.94	1.411E+10	2.96E+05	
		5,154,170.60		**2.16E+06**	5.81E+06
fraction of electricity generated by 5 most recently built plants					
total electricity in 2013		29,628,700.00			
	%	**17.4**			
SET20% - Need to add more plants to reach at least 20%					
Afam VI	2010	3,305,252.39	4.351E+09	9.14E+04	2.46E+05
SET>20%		**8,459,422.99**			**6.05E+06**
	%	**28.6**			

The BM emission factor has been calculated for the group of power units determined in Table 7.5.3 as $\boldsymbol{EF_{BM}}$ **= 0.7157 tCO_2/MWh.**

Step 4: The weights accorded to OM and BM in calculating CM depends on the intervention measure that is being targeted. This is because EE or RE interventions (i.e. EE or RE) do not affect the electricity system in similar ways. For instance, PV and wind are variable renewable energy sources and are non-dispatchable in nature. For PV and wind energy projects, weights of 0.75 and 0.25 are applied to OM and BM, respectively. Hence, the Combined Margin (CM) grid emission factor, $\boldsymbol{EF_{CM}}$ **= 0.4306 tCO_2/MWh**.

Calculating direct emission reductions (baseline projects)

The emission reduction from the baseline solar PV project is calculated from Equation 1 using the generation data of 262,800 MWh/yr[85] and EF_{grid} = 0.4306 tCO_2/MWh. The results are summarised in Table 7.5.4. The baseline project is expected to deliver cumulative emission reductions of 452,633 tCO_2 between 2017 and 2020. Assuming technology lifetimes of 20 years, the cumulative lifetime emission reductions have been calculated as 2.263 $MtCO_2$. Using this methodology, the direct emissions reductions calculated here are similar to those given in the PIF after correcting for the updated grid emission factor and the quantity of renewable electricity generated by the 100 MW PV project. In this case, the cost-effectiveness of the GEF interventions in reducing global emissions is estimated at 1.94 US$/$tCO_2$.

Table 7.5.4. Emission reductions from baseline project.

[85] The electricity generated is calculated using the following parameters: installed capacity = 100 MW and plant capacity factor = 30% (as provided by the project developer).

year		2016	2017	2018	2019	2020		Cumulative	Impact factor
%capacity		0%	100%	100%	100%	100%			25%
Electricity		0	262,800	262,800	262,800	262,800			
tCO2		0	113,158	113,158	113,158	113,158		452,633	**113,158**

Adjusted direct emission reductions

In order to calculate the cost-effectiveness of the GEF interventions more accurately, the emission reductions from the baseline projects have been adjusted to take into account the fact that the baseline projects would have taken place in the absence of the UNDP-GEF project. However, optimal generation of renewable electricity, and hence the reduction of GHG emissions, would not be achieved because of specific flaws in the baseline projects (e.g. inadequate PV technology for application in desert conditions and the absence of grid stability considerations in interconnections) that are discussed in Sections 1.3 and 2.4. In this respect, a more conservative approach has been adopted in the Project Document. A causality factor of 25% has been applied to adjust emission reductions accruing from enhancements in baseline projects through GEF funding.

The more realistic cumulative (20 years) adjusted direct emissions reductions are therefore estimated as 0.565 $MtCO_2$, giving an abatement cost of 7.78 US$/$tCO_2$.

Indirect emissions reductions

The indirect emissions reductions that will result from the implementation of the power sector RE NAMA have been calculated using the top-down and bottom-up approaches.

Bottom-up approach

This approach applies a replication factor to the direct project emissions reductions of 1.094 $MtCO_2$. The full project emissions reductions have been used because the indirect emissions reductions are based on the future market potential. The replication factor for market transformation and demonstration capital – i.e. a replication factor 3 (market transformation and demonstration capital) – has been chosen because of: (1) direct capital investments in baseline projects (and enhanced by GEF funding); and (2) the implementation of public instruments to derisk investments in RE to implement power sector RE NAMA The bottom-up approach gives indirect emissions reductions of around 6.79 $MtCO_2$.

Top-down approach

The top-bottom approach uses the post-project 10-year market potential as the starting point. The UNDP-GEF project is expected to terminate at the end of 2020. Hence, the 10 year market potential coincides with the emissions reductions expected between 2021 and 2030, which are the long-term targets shown in **Table 8**. The capacity addition of solar PV between 2021 and 2030 can be calculated as 17,000 MW, 21,000 MW and 25,000 MW for the Reference, High Growth and Optimistic II Growth scenarios, respectively. As discussed in Section 1.2.5.3, and using the data given in **Table 9**, only one third of all solar PV installations are expected to be utility-scale applications. An assumption has been made that the scaling factor that is derived for the Optimistic II scenario will also be applicable to the Reference and High Growth scenarios. Further, a conservative average capacity factor of 25% for solar PV has been used to calculate the annual electricity produced. Also, the grid emission factor for 2013 has been used ex ante to estimate the cumulative emission reductions between 2010 and 2030. To calculate the cumulative emission reductions, a further assumption has been made that the capacity addition of solar PV takes places linearly between 2021 and 2030. Using these assumptions, the 10-year emissions reductions potential are given in Table 7.7.5 for three GDP

growth scenarios. In order to be conservative, a weak causality factor of 25% has been applied to give indirect emissions reductions. Depending on the GDP growth scenario, the top-down indirect emission reductions are found to be between 6.61 $MtCO_2$ (reference scenario) and 9.72 $MtCO_2$ (Optimistic II scenario). The assumptions used to calculate the indirect emissions will be reviewed at the mid-term and final evaluations of the project.

Table 7.5.5. Top-down indirect emission reductions (2021 – 2030) for different growth scenarios.

Growth Scenario	Net utility-scale solar PV added between 2021 and 2030 (MW)	Net decrease in GHG emissions at the end of 2030 ($MtCO_2$/yr)	Cumulative (2021 – 2030) indirect GHG emission reductions ($MtCO_2$)	Cumulative (2021 – 2030) indirect GHG emission reductions with 25% causality factor
Reference (7%)	5,610	5.29	26.45	6.61
High Growth (10%)	6,930	6.53	32.67	8.17
Optimistic II (13%)	8,250	7.78	38.90	9.72

Annex 7.6. Terms of reference and description of sub-contracts

The proposed terms of reference are only indicative. They are to be further developed in more detail before tendering.

1. Government counterparts

Project Board (PB)

Duties and responsibilities:

The Project Board (PB) is the principal body supervising the project implementation in accordance with UNDP rules and regulations, and referring to the specific objectives and the outcomes of the project with their agreed performance indicators.

The main functions of the PB are:

- General monitoring of project progress in meeting its objectives and outcomes and ensuring that they continue to be in line with national development objectives;
- Facilitating co-operation between the different Government entities, whose inputs are required for successful implementation of the project, ensuring access to the required information and resolving eventual conflict situations arising during project implementation when trying to meet its outcomes and stated targets;
- Supporting the elaboration, processing and adoption of the required institutional, legal and regulatory changes to support the project objectives, and overcoming the related barriers;
- Facilitating and supporting other measures to minimise the identified risks to project success, remove bottlenecks and resolve eventual conflicts;
- Approval of the annual work plans and progress reports, the first plan being prepared at the outset of project implementation;
- Approval of the project management arrangements; and
- Approval of any amendment to be made in the project strategy that may arise from a change in circumstances, after careful analysis and discussion of the ways to solve problems.

PB Structure and Reimbursement of Costs

The PB will be chaired by the FME. The PB will comprise the federal Ministry of Power, the Federal Ministry of Finance, the Nigerian Electricity Regulatory Commission, the Energy Commission of Nigeria, the Presidential Task Force on Power, the Lagos Energy Academy, and a representative of the private sector (Nigeria Solar Capital Partners), representative of CSO/NGO (e.g. involved in the development of the 100 MW solar PV project in Bauchi State), as well as the Project Manager. UNDP will participate as project implementer. If required, representatives of the project stakeholders or other co-financing partners such as GIZ, DFID/NIAF, AfDB and WB, can be invited into the PB meetings at the discretion of the PB.

The costs of the PB's work, except the work of the Project Manager, shall be considered as the Government's or other project partners' voluntary in-kind contribution to the project and shall not be paid separately by the project. Members of the PB are also not eligible to receive any monetary compensation for their work as experts or advisers to the project.

Meetings

It is suggested that the PB will meet at least once a year. A tentative schedule of the PB meetings will be agreed to as a part of the annual work plans, and all representatives of the PB should be notified again in writing 14 days prior to the agreed date of the meeting. The meeting will be organised provided that the executing agency, UNDP and at least 2/3 of the other members of the PB can confirm their attendance. The Project Manager shall distribute all materials associated with the meeting agenda at least 5 working days prior to the meeting.

National Programme Director, NPD

As a representative of the Government and the project's implementing agency, the NPD has the principal responsibility of ensuring that the project is executed in accordance with the Project Document and the UNDP guidelines for nationally-implemented (NIM) projects.

His/her main duties and responsibilities include:

- Coordinating and guiding the work of the Project Manager with the work of the national implementing agency through meetings at regular intervals to receive project progress reports and provide guidance on policy issues;
- Certifying the annual and, as applicable, quarterly work plans, financial reports, (Combined Delivery Report), audit reports, inventory of the equipment, and ensuring their accuracy and consistency with the project document and its agreed amendments;
- Taking the lead in developing links with the relevant authorities at the national, provincial and governmental levels and supporting the project in resolving any institutional- or policy-related conflicts that may emerge during its implementation.

2. <u>Local project Staff</u>

Project Manager – Local consultant (full-time)

Duties and responsibilities:

Operational project management in accordance with the Project Document and the UNDP guidelines and procedures for nationally-implemented projects, including:

- General coordination, management and supervision of project implementation;
- Ensuring the delivery of project results and leading the implementation process for the 3 project outcomes;
- Developing the terms of references for the technical studies required in the project;
- Management of the procurement and the project budget under the supervision of UNDP to ensure timely involvement of local and international experts, organisation of training and public outreach, purchase of required equipment etc., in accordance with UNDP rules and procedures;
- Submission of quarterly progress reports and provision of inputs for the Annual Project Implementation Reviews to the PB, Executing Agency and UNDP in accordance with the "Monitoring Framework and Evaluation" section of the Project Document;
- Guide and coordinate the review of the Project Results Framework, including:
  a. Provide technical advice for the revision of performance indicators.
  b. Identify sources of data, collection methods, who collects data, how often, cost of collection and who analyses the data.
  c. Facilitate annual review of risks.

- Ensuring effective dissemination of, and access to, information on project activities and results, including regular participation in relevant selected networks;
- Provision of technical inputs in technical assistance outputs of the project;
- Oversight and coordination of the contracts of the international and local consultants working for the project; and
- Ensuring otherwise successful completion of the project in accordance with the stated outcomes and performance indicators summarised in the project's log-frame matrix and within the planned schedule and budget.

Expected Qualifications:

- Advanced university degree and at least 7 years of professional experience, or university degree with 10 years of professional experience, in the specific areas the project is dealing with, including solid knowledge of the energy sector in Nigeria and climate change mitigation (ideally including NAMAs).
- Experience in managing or participating in projects of similar complexity and nature, including a demonstrated capacity to actively explore new, innovative implementation and financing mechanisms to achieve the project objectives;
- Demonstrated experience and success in the engagement of, and working with, the private sector and NGOs, creating partnerships for activities of common interest;
- Good analytical and problem-solving skills and the related ability to adaptively manage with prompt action on the conclusion and recommendations coming out from the project's regular monitoring and self-assessment activities as well as from periodic evaluations;
- Ability and demonstrated success to work in a team, to effectively organise it, and to motivate its members and other project counterparts to effectively work toward the project's objectives and expected outcomes;
- Good communication skills and competence in handling project's external relations at all levels; and
    - Fluent/good knowledge of English;
    - Familiarity and prior experience with UNDP and GEF requirements and procedures are considered an asset.

Allocated Budget: US$ 122,330

Project Administration and Finance Associate (full-time/Service Contract)

A project administration assistant will be recruited on a full-time basis to support project implementation, track contracts and budget delivery, liaise with UNDP Nigeria's Administrative and Finance units to facilitate project implementation, and prepare administrative and financial reports as part of the M&E framework of the project. The following will also be covered:

- Prepare reporting formats and support the NPD to prepare the required reports. Guide project task teams in preparing their progress reports and perform quality assurance in accordance with the approved reporting formats. This includes quarterly progress reports, annual project reports, field visit reports, inception reports, and ad-hoc technical reports.
- Assist the NPD to collate technical reports and other documents from the project.

Expected Qualifications:

- University degree and at least 2 years of professional experience in finance and administration;

- Demonstrated accounting skills;
- Advanced computer software knowledge, including database management and accounting software;
- Demonstrated ability to work in a team;
- Good communication skills and competence in handling the project's external relations at all levels; and
- Fluent/good knowledge of English.

Allocated Budget: US$ 82,650

3. Project Experts (International/National consultancies and/or specialised firms)

Note: The tasks listed below will be performed either by consultancy firms that include both national and international specialists, or through the procurement of individual national and international consultants brought together to deliver a product. This will be left to the discretion of the Project Manager, subject to approval by UNDP and the PB through annual work plans and budgets. Whichever approach is chosen, a common principle is that these consultancies are short-term and the payment structure will be based on the delivery of products.

Consultancy to carry out DREI analysis

This consultancy will support the in-depth application of DREI analysis to solar PV, wind energy and biomass energy in order to determine the optimum mix of public derisking instruments that will support each technology. The overall work will be coordinated by UNDP's Finance Specialist, New York.

- A post-graduate degree in geospatial modelling or related field.
- A minimum of 10 years' work experience, especially in developing risk profiles for renewables
- Prior experience in carrying out DREI analysis to promote renewable energy.
- Experience in working in Nigeria will be beneficial
- Demonstrable ability for team work
- Fluency in English – both written and spoken – is essential.

Allocated budget (US$ 250,000 International; US$ 50,000 National)

Consultancy for investigating financial sector reform, identify financial derisking instruments and propose and implement means of capitalisation

In conjunction with the in-depth DREI analysis, a study will be carried out by a consultancy firm or an entity, such as the OECD, in order to investigate and propose the various practicable ways of implementing domestic financial sector reform in order to unlock lower cost financing in Nigeria. Green infrastructure, with its high capital intensity and requirement for loans with long tenures, can face a number of barriers to accessing finance. The study will analyse the breadth of the Nigerian financial sector, including, but not limited to, commercial/corporate banking, equity funds and institutional investors (pension funds). The study will examine both the various barriers that exist (for example, domestic constraints capital reserve/liquidity constraints), and incentives that can be put in place. Once completed, the study will also propose specific policy reforms that are applicable to Nigeria for green infrastructure investment, and propose a road map or action plan for their implementation. This work will be carried out under the guidance of the Federal Ministry of Power.

- The firm or entity will have a worldwide reputation and credibility for carrying out studies on financial sector reform. It will have a track record of carrying out review of financial sector reforms in at least 5 countries
- The team will have competencies of at least 10 years spanning topics such as finance and economics, policy and regulatory frameworks, development of financial instruments to incentivise private sector investment, and the team will need to demonstrate a thorough understanding of energy markets. Other competencies will be enumerated when the detailed ToR will be finalised
- Prior experience working in Nigeria is desirable
- The firm or entity will need to demonstrate its ability to work in close relationships with key government institutions such as the Ministry of Finance

- All deliverables must be in English

Consultancy to develop a GIS-based tool for identifying the practicable sites for various RE sources

This consultancy will support the development of a GIS-based tool to identify the practical locations for implementing large-scale solar PV, wind energy and biomass energy projects in Nigeria. This consultancy will be coordinated with the GIS-based work that is being carried out by the WB, NIAF and GIZ concerning grid extension in Nigeria. Wherever possible the GIS-based tool will use existing geospatial layers for resources assessment, grid coverage, human settlements, public infrastructures, environmentally sensitive areas (e.g. wetlands, protected areas, corridor for migrating soaring birds), and strategic infrastructure (e.g. military facilities, airports etc…), among others.

- A post-graduate degree in geospatial modelling or related field.
- A minimum of 10 years' work experience, especially in developing spatial modelling for the energy sector
- Prior experience in developing geospatial systems to promote renewable energy.
- Experience in working in Nigeria will be beneficial
- Demonstrable ability for team work
- Fluency in English – both written and spoken – is essential.

Allocated budget (US$ 200,000 International; US$ 50,000 National)

Consultancy to monitor and extract lessons-learned from NAMA development

A consultancy will be procured to extract lessons-learned from the NAMA development experience. This consultancy will be carried out at the end of the project lifetime, following the NAMA design and implementation process over the course of the project with bi-annual progress meetings. In addition to supporting project monitoring, the consultancy will help in recording the NAMA process and identifying lessons-learned during project implementation, rather than offering a retroactive view at the end of the project. It will be carried out prior to the Terminal Evaluation of the project.

Allocated budget: US$ 70,000 USD (US$ 30,000 International, US$ 40,000 National)

Consultancies for Mid-Term Review and Final Evaluation

As per the described M&E plan, an international consultant will perform the Mid-Term Review and a different consultant will be recruited for the Final Evaluation. Both consultancies will be fully independent and will follow UNDP/GEF evaluation procedures.

Allocated budget: (US$ 29,200 International)

Annex 7.7. UNDP Direct Project Services Costs

Letter of Agreement

A STANDARD LETTER OF AGREEMENT BETWEEN UNDP AND THE GOVERNMENT FOR THE PROVISION OF SUPPORT SERVICES

Under project "Derisking Renewable Energy NAMA for the Nigerian Power Sector"

Federal Government of Nigeria,

1. Reference is made to consultations between officials of the Federal Government of Nigeria (hereinafter referred to as "the Government") and officials of UNDP with respect to the provision of support services by the UNDP country office for nationally managed programmes and projects. UNDP and the Government hereby agree that the UNDP country office may provide such support services at the request of the Government through its institution designated in the relevant project document, as described below.

2. The UNDP country office may provide support services for assistance with reporting requirements and direct payment. In providing such support services, the UNDP country office shall ensure that the capacity of the Government-designated institution is strengthened to enable it to carry out such activities directly. The costs incurred by the UNDP country office in providing such support services shall be recovered from the administrative budget of the office.

3. The UNDP country office may provide, at the request of the designated institution, the following support services for the activities of the project:

(a) Identification and/or recruitment of project and programme personnel;

(b) Identification and facilitation of training activities;

(c) Procurement of goods and services;

(d) Financial support services

4. The procurement of goods and services and the recruitment of project and programme personnel by the UNDP country office shall be in accordance with the UNDP regulations, rules, policies and procedures. Support services described in paragraph 3 above shall be detailed in an annex to the project document, in the form provided in the Attachment hereto. If the requirements for support services by the country office change during the life of a project, the annex to the project document is revised with the mutual agreement of the UNDP resident representative and the designated institution.

5. The relevant provisions of the SBAA, including the provisions on liability and privileges and immunities, shall apply to the provision of such support services. The Government shall retain overall responsibility for the nationally managed programme or project through its

designated institution. The responsibility of the UNDP country office for the provision of the support services described herein shall be limited to the provision of such support services detailed in the annex to the programme support document or project document.

6. Any claim or dispute arising under or in connection with the provision of support services by the UNDP country office in accordance with this letter shall be handled pursuant to the relevant provisions of the SBAA.

7. The manner and method of cost-recovery by the UNDP country office in providing the support services described in paragraph 3 above shall be specified in the annex to the project document.

8. The UNDP country office shall submit progress reports on the support services provided and shall report on the costs reimbursed in providing such services, as may be required.

9. Any modification of the present arrangements shall be effected by mutual written agreement of the parties hereto.

If you are in agreement with the provisions set forth above, please sign and return to this office two signed copies of this letter. Upon your signature, this letter shall constitute an agreement between your Government and UNDP on the terms and conditions for the provision of support services by the UNDP country office for nationally managed programmes and projects.

Yours sincerely,

_____

For the Federal Government of Nigeria

_____

Signed on behalf of UNDP
M. Pa Lamin Beyai
Country Director
UNDP Nigeria

Attachment 1

DESCRIPTION OF UNDP COUNTRY OFFICE SUPPORT SERVICES

1. In accordance with the provisions of the letter of agreement and the project document, the UNDP country office shall provide support services for the National Agency for Energy Conservation as described below.

2. Support services to be provided:

Support services	**Schedule for the provision of the support services**	**Cost to UNDP of providing such support services (where appropriate)**	**Amount and method of reimbursement of UNDP (where appropriate)**
Services related to procurement (including but not limited to): Procurement of goods Procurement of services o Review of terms of reference for recruitments o Consultant recruitment o Advertising o Short-listing & selection o Contract issuance	Throughout project implementation when applicable	As per the pro-forma costs: o 32 days over 60 months of GS5 Procurement Assistant: US$ 4,936 o 11 days over 60 months of NOB Procurement Manager: US$ 4,302	UNDP will directly charge the project upon receipt of request of services from the Implementing Partner (IP)
Services related to finance (including but not limited to): o Payments o Creation of vendor forms o Issuing cheques	Ongoing throughout implementation when applicable	As per the pro-forma costs: o 65 days over 60 months of GS5 Finance Associate: US$ 10,026 o 11 days over 50 months of NOB Finance Manager: ……US$ 5,736	As above
Total		**US$ 25,000**	