2012

First 50 MW Solar PV Power Project Cholistan Feasibility Study Report

Volume 6 Clean Development Mechanism

By

CEEG Solar Energy Research Institute Co, Ltd (CEEG SI) & MR Consultants

For

CWE Investment Corporation

Joint Venture

Welt Konnect (Pvt) Ltd

09/01/2012

CEEG 中电电气 China Electric Equipment Group & MR

中水电国际投资有限公司 CWE INVESTMENT CORPORATION

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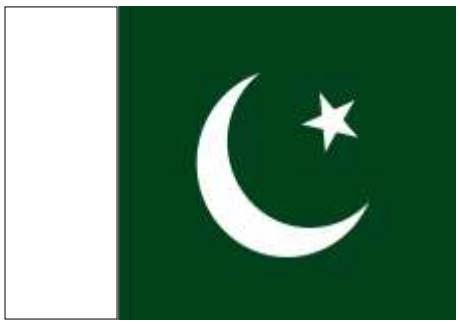
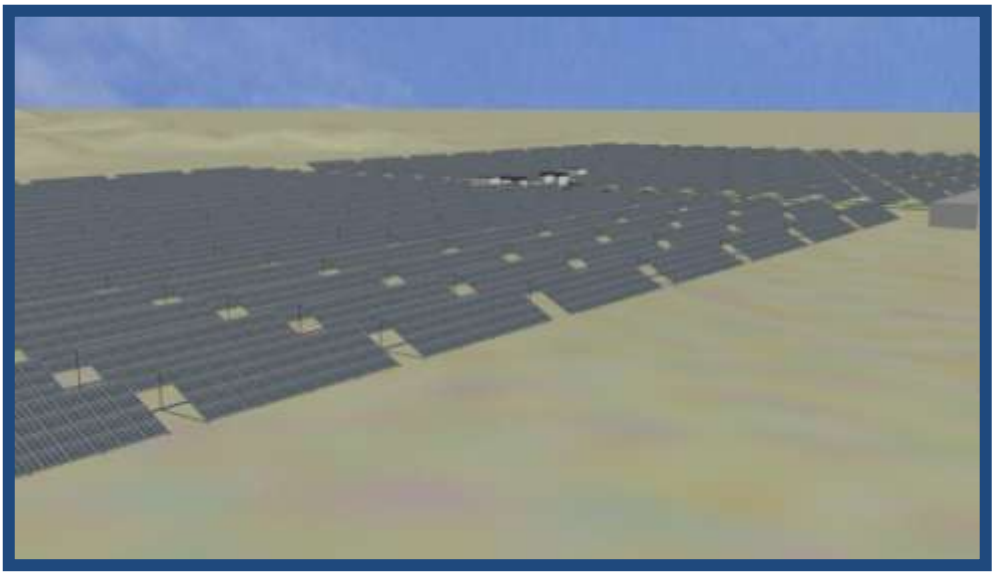


Feasibility Study Report
First 50 MW Solar PV Power Project In Cholistan, Punjab, Pakistan

September, 2012



Volume 6
Clean Development Mechanism

JOINT VENTURE

CHINA WATER AND ELECTRIC INVESTMENT CORPORATION

&

WELT KONNECT (PVT) LTD

中水电国际投资有限公司
CWE INVESTMENT CORPORATION

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APPROVAL SHEET

TITLE : Feasibility Report
50 MW Solar Power Project in Cholistan

DOCUMENT NUMBER : 01-0786-01

CLASSIFICATION : **Un-Classified**

SYNOPSIS

This document is a feasibility study report of 50 MW Solar PV Power Project sponsored by China Three Gorges International Corp. and Welt Konnect (Pvt) Ltd. It is divided into 7 Volumes for ease of review and approvals.

Volume 1: Main Report Part 1: of this report contains detailed information regarding the geographic features of Pakistan, along with the insight to Pakistan's Energy and Electricity market. After discussing the solar energy industry and carbon credit details for information purposes, the volume focuses on mentioning the regulatory regime of the country that is applicable to the project and all legal requirements. The volume also summarizes the salient features of the project.

Volume 2: Main Report Part 2: of the report focuses entirely on the specific details of the project. It provides information on the selected site, the description of the technical equipment and the layout of plant. The report further includes the basis for calculations and designing, by giving details of the grid connections available and yield of power. Prior to conclusion, the report also gives details of the policies and procedures for O&M, Project Management, and tariff calculation. The report concludes with details of the ecological and socio-economic benefits of the project.

Volume 3: Geo-Technical Study Topographic Survey: of the Project Site, with detailed analysis.

Volume 4: Geo-Technical Investigation Report: for the Project Site, including Soil Testing

Volume 5: Environmental Study: contains the Initial Environmental Examination Report (IEE), the Environmental Impact Assessment Report (EIA), and the No Objection Certificate (NOC) for the project issued by the Environmental Protection Agency (EPA) of Punjab.

Volume 6: **Clean Development Mechanism:** is composed of the Project Idea Note (PIN's), the Letter of Intent (LOI) issued by the Designated National Authority (DNA) the Clean Development Mechanism Cell of Pakistan, Ministry of Climate Change, followed by the Prior Consideration form, the Project Design Document (PDD's) and the Host Country Approval (HCA) by the DNA.

Volume 7: Grid Interconnection Study being developed by National Transmission Dispatch Company (NTDC) and to be submitted separately.

DATE: 10th September 2012

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Revisions

S #	REV. #	DATE	VOL #	SECTION	DESCRIPTION OF CHANGE

DISTRIBUTION

1. Punjab Power Development Board (PPDB)
2. Panel of Experts Assembled by PPDB
3. CWE International Investment Corporation
4. Welt Konnect Pvt Ltd
5. M.R. Consultants
6. China Electric Equipment Goup (CEEG)

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LIST OF ABBREVIATIONS

AC	Alternate Current
AEDB	Alternative Energy Development Board
Approx.	Approximately
ASL	Associated Surveyors (Pvt)Ltd
BM	Build Margin
BOO	Build Own and Operate
BOR	Board of Revenue
Bwp	Bahawalpur
CAA	Civil Aviation Authority
CCGT	Combined Cycle Gas Turbine
CDA	Cholistan Development Authority
CDM	Clean Development Mechanism
CDMA	Code division multiple access
CERs	Certified Emission Reductions
CEEG	China Electric Equipment Group
CEEG SI	CEEG Solar Energy Research Institute Co, Ltd
CM	Combined Margin

CMA	Certified Management Accountant
CNG	Compressed natural Gas
CO2	Carbon dioxide
COD	Commercial Operational Date
CoP	Conference of the Parties
CPPA	Central Power Purchasing Agency
CPV	Concentrator photovoltaic
CTG	China Three Gorges
CTGC	China Three Gorges Corporation
CTGI	China Three Gorges International Corp.
CTGPC	China Three Gorges Project Company
CWE	China Water and Electric Corporation
CWEIC	China Water and Electric Investment Corporation
CYP	China Yangtze Power Co. Ltd
DC	Direct Current
deg	Degree
DG	Diesel Generator
DGPs	Dual Global Positioning System

DISCOs	Distribution Companies
DNA	Designated National Authority
DOE	Designated Operational Entity
DSSC	Dye-Sensitized Solar Cells
EE	Energy Efficiency
EF_y	Baseline Emission Factor
EIA	Environmental Impact Analysis
EMC	Electromagnetic Compatibility
EMP	Environment Plan
EPA	Energy Purchase Agreement
EPC	Engineering Procurement Construction
EPIA	European Photovoltaic Industry Association
EU	European Union
FDI	Foreign Direct Investment
FSR	Feasibility Study Report
GDP	Gross Domestic Product
GENCOs	Generation Companies
GHG	Green Gas

GIS	Geographic Information System
GoP	Government of Pakistan
GPS	Global Positioning System
GSM	Global System for Mobile Communications
GTZ/GIZ	Deutsche Gesellschaft für Technische Zusammenarbeit
HCA	Host Country Approval
HFCs	Hydro Fluorocarbons
HOMER	Hybrid Optimization Model for Electric Renewables
HSE	Health Safety and Environment
HSHD	Hard Surface High Duty
Hz	Hertz
IA	Implementation Agreement
IDC	Interest During Construction
IEA	International Energy Agency
IEE	Initial Environmental Examination
IEEE	Institute of Electrical and Electronic Engineers
IFC	International Finance Cooperation
IPPs	Independent Power Producers

IRR	Internal Rate of Return
JEDI	Jobs and Economic Development Impact
JI	Joint Implementation
JRC	European Joint Research Centre
Km	Kilometer
KV	Kilovolt
KW	Kilowatt
LIBOR	London Interbank Offered Rate
LNG	Liquefied Natural Gas
LNG	Liquefied Natural Gas
LOI	Letter of Intent
LOS	Letter of Support
LPG	Liquefied Petroleum Gas
LUC	Local Control Unit
m^2	Meter Square
m^3/h	Meter cube per hour
MEPCO	Multan Electric Power Company
mm	Millimeters

mmcft	Million Cubic Feet
MoU	Memorandum of Understanding
MTDF	Medium Term Development Framework
MVA	Million Volt-Ampere
MW	Megawatt
N_2O	Nitrous Oxide
NAPWD	Northern Area Public Works Department
NASA	National Aeronautics and Space Administration
NCS	National Conservation Strategy
NEC	National Energy Conservation
NEPRA	National Electricity Power Regulatory Authority
NEQs	National Environmental Quality Standards
NGOs	Non-Government Organizations
NOCs	No Objection Certificate
NOCT	Nominal Operating Cell Temperature
NREL	National Renewable Energy Laboratories
NTDC	National Transmission and Dispatch Company
O & M	Operation & Management

OECD	Organization for Economic Cooperation and Development
OEMs	Original Equipment Manufacturer
OHL	Overhead Lines
OLTC	On-Load Tap Changer
OM	Operating Margin
OPV	Organic photovoltaic
OSHA	Occupational Safety and Health Administration
PAEC	Pakistan Atomic Energy Commission
PAEC	Pakistan Atomic Energy Commission
PCM	Pulse Code Modulation
PCRET	Pakistan Council of Renewable Energy and technology
PDD	Project Design Document
PEPA	Pakistan Environment Protection Act
PINs	Project Idea Note
PLC	Programmable Logic Control
PMD	Pakistan Meteorological Department
POE	Panel of Experts
PPDB	Punjab Power Development Board

PPIB	Private Power Infrastructure Board
PV	Photo Voltaic
PVC	Poly Vinyl Carbonate
QC	Quality Control
R & D	Research and Development
RE	Renewable Energy
RE2	Renewable Resources (Pvt) Ltd
RFP	Request for Proposal
RFQ	Request for Quotation
RMP	Risk Management of Project
ROC	Return on Capital
ROE	Return on Equity
RQD	Rock Quality Designation
SECP	Security Exchange of Pakistan
SHYDO	Sarhad Hydro Development Organization
SOP	Standard Operating Procedure
SPT	Standard Penetration Test
SRA	Solar Resource Assessment

SRO	Statutory Regulatory Order
TGP	Three Gorges Project
TOE	Tons Oil Equivalent
tsf	Tones/square foot
TTG	Trans Tech Group
TTP	Trans Tech Pakistan
UNFCCC	United Nations Framework Convention on Climate Change
UPS	Uninterruptible Power Supply
USA	United States of America
WAPDA	Water & Power Development Authority
WK	Welt Konnect (Pvt) Ltd
WMO	World Metrological Organization

ACKNOWLEDGMENTS

The management of CWE Investment Corporation a fully owned subsidiary of China Three Gorges International Corporation & Welt Konnect (Pvt) Ltd comprising the Joint Venture would like to express their gratitude to the support and cooperation extended by the Government of Punjab in the development activities of the project.

We are also thankful to the dedicated team of the Punjab Power Development Board (PPDB) for the generous support throughout all stages of project development.

We hope for and look forward to the continued cooperation of all relevant Government Organizations, Bodies and officials for further advancement in implementing the Project and pioneering the way for Solar Photo Voltaic in Pakistan.

DISCLAIMERS

This document is intended for use by the Stake Holders and relevant Government Authorities for understanding and effective decision making regarding this Project.

The Company and the sponsors are and will not be responsible for any decision made by the intended or unintended users for any other purpose except in relation to this project.

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Further, this is not intended to be a business or operational plan for the project.

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DOCUMENT INFORMATION

Purpose and Scope:

The purpose of this report is to provide information required for the relevant agencies to make informed decision regarding the implementation and execution of this project.

This document presents the technical, financial and commercial viability of this project within Pakistan's economic and regulatory framework.

STRUCTURE OF THE DOCUMENT:

The Feasibility Study has been divided into 2 main parts/volumes followed by supporting Volumes 3 to 7 composed of essential studies:

- Volume 1: is composed of the Executive Summary, Introduction and Overview of the Project along with the relevant regulatory framework and policies. Where as
- Volume 2: contains the Technical and Financial Studies: including Engineering Drawings and Plant 3D layout.
- Volume 3: is composed of the Geo-Technical Study Topographic Survey.
- Volume 4: is the Geo-Technical Investigation Report.
- Volume 5: is a compiled Environmental Study.
- **Volume 6: contains all documents relevant to the Clean Development Mechanism of the UNFCCC**.
- Volume 7: is the Grid Interconnection Study being developed by the National Transmission Dispatch Company (NTDC) and to be submitted separately.

Each Volume is further sub-divided into chapters for ease of reviewing and understanding the project. Information in the document is supplemented by Annexures attached at the end of each volume.

EXECUTIVE SUMMARY OF THE PROJECT

China Three Gorges (CTG) being a large international clean energy company, houses main businesses of including construction and management of water conservancy projects, electric power production and related relevant technological services. In the area of electric power production, CTG, initially starting with water conservancy & power projects, has now expanded its scope of business into Power Production through Wind, Solar and Nuclear Energy. Their vision is to be the World's largest clean energy group specializing in large-scale hydropower project development, management and operations; while also proactively developing Wind Power, Solar Power and other forms of renewable energy; steadily expanding and exploring avenues of overseas business.

The Total assets of the Group stand around 41,316 million USD, with a revenue generation of 3,787 million USD, 99.47% from sales of electricity, and 1,418 million USD net profits.

Whereas China Water and Electric Investment Corp. (CTGI) *is a new overseas-investment subsidiary company of CTG,* which was established in Sep. 2011 with the core business and focus on OVERSEAS INVESTMENT in the Power Sector including but not limited to hydropower, wind power and solar power. CWE Investment Corporation (CWEIC) has now officially taken over as main sponsor from China Water and Electric Corporation (CWE) in all projects previously being developed by CWE. CWEIC is tracing on more than a dozen projects located in Asia, Africa, Europe, North America and South America. Some of the projects located in Pakistan include Sonda Jehrruk Coal Mine & Power Generation, 1100 MW Kohala Hydropower Project, 720 MW Karot Hydropower Project, 120MW Taunsa Hydro Power Project, 50MW Wind Energy and First 50 MW Solar PV Power Project in Pakistan.

Whereas Welt Konnect (Pvt) Ltd (a subsidiary of the Transtech Group) is a Power Projects Developing company working in Pakistan. Its niche in the Energy Sector lies in the provision of Renewable Energy Engineering solutions particularly for Wind & Solar Power Projects as Independent Power Producers (IPP's) under the Clean Development Mechanism of the UNFCCC. These integrated solutions and systems are designed, simulated and tested by its team of experts and engineers' using the most advanced software's and tools the industry has to offer at this time. WK believes in doing top quality engineering works and takes immense pride in being one of the few companies in Pakistan to have achieved this level of competence in the ever growing and critical field of Renewable Energy.

In Accordance with their development strategies respectively, in 2009 after consultation with the Esteemed Punjab Government Welt Konnect (Pvt) Ltd (WK) and China Three Gorges (CTG), planned to invest in the development & construction of Pakistan's first 50 MW Solar PV Power Farm in Cholistan in collaboration as a Joint Venture. For development of which consequently two MOU's were signed with the Punjab Government in the presence of the Honorable Chief Minister Mr. Shahbaz Sharif, dated June 5th 2010 and later November 6th 2010 after having chalked out a way forward. An MOU was also signed with GTZ for support in developing the project under the Clean Development Mechanism of the UNFCCC.

The Project Site is located near the Cholistan Desert, District Bhawalnagar, with nearest city of Bahawalpur and will have an installed capacity of 50MWp Photovoltaic Panels and will function as an Independent Power Producer (IPP) under the rules and regulations of Pakistan.

The project pre-feasibility study was completed by mid-2011. Subsequently after submission of the Pre-Qualification Documents, to the Punjab Power Development Board (PPDB) along with the Pre-Feasibility Report, Project Proposal, the required Bank Guarantees of 50'000.USD (fifty thousand) and the requisite fees, the Joint Venture (JV) successfully obtained an LOI (Letter of Intent) from the Board duly signed and accepted by both parties on 27-08-2011, along with Government Approvals and Support.

Teams were then immediately deployed to initiate work on the feasibility analysis of the project, and competent teams of Engineers & Specialists were deployed for conducting the various requisite studies.

In addition the project has been developed under the Clean Development Mechanism (CDM) of the UNFCCC under the Kyoto Protocol. After successfully making and submitting the Project Idea Note (PINs) to the Designated National Authority (DNA), registration with the UNFCCC via Prior Consideration Form and issuance of a Letter Of Intent (LOI) from the DNA for further development of the Project Design Documents (PDD's), the PDD's were made and submitted to the DNA followed by the issuance of the final Host Country Approval (HCA) by the DNA, and the JV is now in the phase of obtaining validation by the Designated Operational Entity (DOE) and issuance of CER's by the Executive Board of UNFCCC.

The Joint Venture is now submitting the final Feasibility Study along with this Volume 5, for approval by the Panel of Experts (POE) of the Punjab Power Development Board (PPDB). After sanctioning of which competent companies in the field of Solar Photovoltaic's will be selected through a Short Listing Criteria based on Experience, Financial And Technical Competencies of such firms in development & construction of Power Projects and Project Management, which shall be advertised

in the News Papers & other relevant media. Consequently the Request for Proposal (RFP) shall be circulated and shared amongst the qualifying companies for finalization of the Engineering Procurement & Construction (EPC) Contract after which a petition for Generation License and a petition for tariff would simultaneously be filed with the National Electric Power Regulatory Authority (NEPRA) directly for the second stage tariff as allowed under their policy, before issuance of the LOS (Letter Of support) by PPDB. This is intended to save time and cut through avoidable red tape in the development of Independent Power Producers in Pakistan.

The Joint Venture has also completed substantial work on the financial modeling for the project. The JV believes that keeping in view the recent improvement and trend in the viability of the technology, possibility of fast track implementation and current energy crises, this project is of paramount importance for Pakistan and will prove to be a pioneer in the Solar PV industry, paving the way for future progress in this ever growing field and at the same time provide a viable profitable investment opportunity to all stake holders of the country.

1. INTRODUCTION

Thorough work has been done to develop the Project under the Clean Development Mechanism of the UNFCCC.

The Project is a power generation project with renewable resource and zero emission. When put into operation, the project can provide power supply to the southern Pakistan power grid, which currently is mainly relying on fossil fuel. Therefore, it can help to reduce the greenhouse gas emission from coal or oil-fired power generation. It can deliver good environmental and social benefits. It is also consistent with the spirit of the Kyoto Protocol and qualifies for the application of CDM projects', NEPRA is allowing almost the same return on equity (RoE) to the thermal and the renewable energy projects.

The Sponsors of the Project require CERs to bring the RoE at a level where they can invest in renewable energy projects in Pakistan in future as well. If the project is approved and registered as a CDM project, CERs can provide slightly extra financial resource for the project it encouraging project sponsors and lenders. Besides providing minutely more favorable conditions for the project financing, it will improve competitiveness of the project, and reduce investment risk during the project implementation process.

Refer to Volume 6 for detailed studies for the Project under the Clean Development Mechanism – Project Idea Note (PIN's), Letter of Intent (LOI) by the Designated National Authority (DNA) Project Design Document (PDD's), PDD Evaluation Matrix, the Prior Consideration Form and the Host Country Approval (HCA) by the DNA of Pakistan.

1	**Location of the Solar Farm**		
1.1	Elevation	m	135
1.2	Longitude (East)		72" 25" 40.40°
1.3	Latitude (North)		29" 10" 52.88°
2	Solar resource		
2.1	Annual Average Horizontal Radiation	kWh/m2/day	5.53
3	Major Equipment		
3.1	PV Modules		
(1)	Quantity	Ea	209,440

(2)	Technology		Mono Silicone
(3)	No. of cells	Ea/panel	60
(4)	Impp	A	30.6
(5)	Vmpp	V	7.87
(6)	Rated Power	Wp	240
3.2	Inverters		
(1)	Quantity	Ea	56
(2)	Pmax	Wp	880
(3)	Input Voltage	V	673
(4)	Input Imax	A	1338
(5)	Output Voltage	V	363
(6)	Output Imax	A	1400
3.3	Medium Transformers		
(1)	Quantity	Ea	28
(2)	Pmax	Wp	1760
(3)	Input Voltage	V	363
(4)	Input Imax	A	2 X 1400
(5)	Output Voltage	kV	20
(6)	Output Imax	A	46.2
3.4	High Voltage Transformer		
(1)	Quantity	Ea	1
(2)	Capacity	kVA	60000
(3)	Input Voltage	kV	11
(4)	Output Voltage	kV	132
(5)	Frequency	Hz	50
(6)	Phase	Ea	3
4	Civil Engineering		
4.1	PV Module Mountings	Simple truss structures for immediate installation at site	
4.2	Foundation for High Voltage Substation		
5	Construction		
5.1	Construction Period	month	9
6	Production Analysis		
	Annual Benchmark Energy Yield	GWh/yr	79.15
7	Budgetary Estimates		
7.1	EPC Cost	Min US $	**130,690,775**
7.2	Total Project Cost	Min US $	**145,651,607**

7.3	O&M Cost for Year 01 – 02	Min US $	**5.10**
7.4	O&M Cost for Year 03 – 05	Min US $	**5.10**
7.5	O&M Cost for Year 06 – 20	Min US $	**5.10**
8	Referenced Levelized Tariff		**-**
8.1	Levelized Tariff (Excluding withholding Tax)	US Cents / KWh	**-**
8.2	Levelized Tariff (Including withholding Tax)	US Cents / KWh	**27.7**

Table 2.1: Technical and Financial Summary of the Project

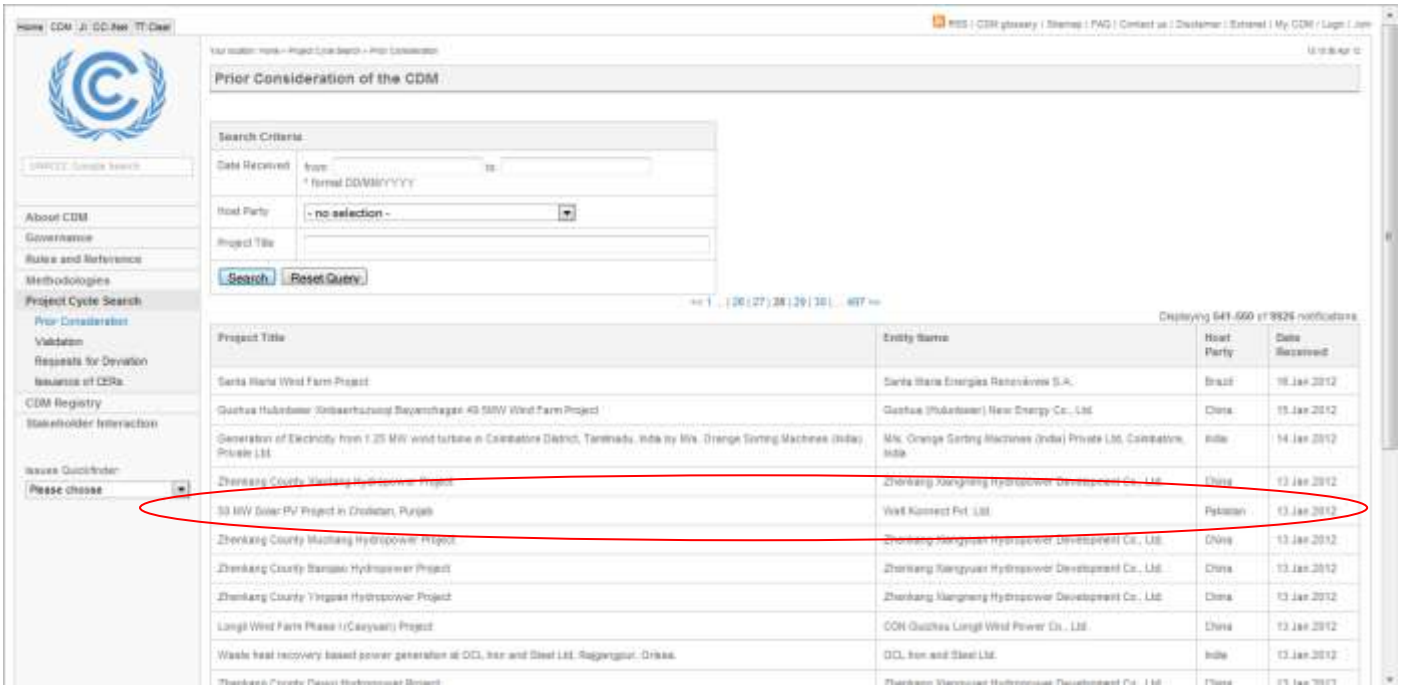


Figure 2.1: Listing on UN Website Snapshot

PROJECT IDEA NOTE (PIN's)

Name of Project: "50 MW Solar PV Project in Cholistan, Punjab" – Project by Welt Konnect

Date submitted: November 10, 2010

Description of size and quality expected of a PIN

Basically a PIN will consist of approximately 5-10 pages providing indicative information on:

- the type and size of the project
- its location
- the anticipated total amount of greenhouse gas (GHG) reduction compared to the "business-as-usual" scenario (which will be elaborated in the baseline later on at Project Design Document (PDD) level)
- the suggested crediting life time
- the suggested Certified Emission Reductions (CERs)/Emission Reduction Units (ERUs)/Verified Emission Reduction (VERs) price in US$ or € /ton CO_2e reduced
- the financial structuring (indicating which parties are expected to provide the project's financing)
- the project's other socio-economic or environmental effects/benefits

While every effort should be made to provide as complete and extensive information as possible, it is recognised that full information on every item listed in the template will not be available at all times for every project.

NOTE: For forestry projects, please use the PIN Template for LULUCF projects available at www.carbonfinance.org.

I. Project description, type, location and schedule

OBJECTIVE OF THE PROJECT *Describe in not more than 5 lines*	To develop Cholistan Solar PV Project – a 50 MW project to be implemented in phases of 5 MW – in the Cholistan desert in Punjab, Pakistan
PROJECT DESCRIPTION AND PROPOSED ACTIVITIES *About ½ page*	The Cholistan Solar PV Project is a 50 MW solar PV installation project, planned to be implemented in phases of 5 MW each. The project will be a pure solar PV grid connected installation. The project would become operational and start generating CERs directly after the completion of the first phase of the project, with work on the other phases continuing. The project is expected to help alleviate the huge energy deficit in Pakistan. It will be the first Solar PV project of its magnitude in Pakistan and will be a large source of clean energy.
TECHNOLOGY TO BE EMPLOYED[1] *Describe in not more than 5 lines*	The project is expected to be using Mono Crystalline silicon solar cells. Meetings are going to be held with various PV manufacturers to sort out the details.

1 Please note that support can only be provided to projects that employ commercially available technology. It would be useful to provide a few examples of where the proposed technology has been employed.

II. TYPE OF PROJECT

Greenhouse gases targeted $CO_2/CH_4/N_2O/HFCs/PFCs/SF_6$ *(mention what is applicable)*	CO_2
Type of activities Abatement/CO_2 sequestration	Abatement
Field of activities *(mention what is applicable)* *See annex 1 for examples*	1g (renewables – photovoltaic)

III. LOCATION OF THE PROJECT

Country	Pakistan
City	Marot, Cholistan
Brief description of the location of the project	The project will be developed in Marot, in the Cholistan Desert of Punjab. The area has scant vegetation and is dry with abundant sunshine.

IV. PROJECT PARTICIPANT

Name of the Project Participant	Welt Konnect
Role of the Project Participant	Project Operator Owner of the site or project ● Owner of the emission reductions Seller of the emission reductions Project advisor/consultant Project investor Other, please specify:_____
Organizational category	Government Government agency Municipality Private company ● Non-Governmental Organization Other
Contact person	Habil Ahmed Khan, Director Operations
Address	Welt Konnect Associates Suite 8, Ground Floor, Evacuee Trust Complex, Agha Khan Road, F-5/1, Islamabad, Pakistan
Telephone/Fax	+92 300 514 0020 / +92 51 287 0424

E-mail and web address, if any	habil@weltkonnect.com; www.weltkonnect.com
Main activities *Describe in not more than 5 lines*	The Trans Tech group of companies is heavily involved in Infrastructure and Power development projects, including some Alternative energy projects. Welt Konnect, one of the companies of the Group, is involved in Solar PV, Wind, Bio Mass and Hydro Energy projects.
Summary of the financials	The total cost of the project is estimated to be US $128,814,000 with a 80/20 debt/equity arrangement.
Summary of the relevant experience of the Project Participant *Describe in not more than 5 lines*	Welt Konnect is an integrator and solution provider in the solar energy sector in Pakistan. It has implemented small scale Solar PV solutions for various private clients. Trans Tech, the parent concern of Welt Konnect, has successfully implemented many large scale infrastructure projects. A short list of some completed and ongoing Trans Techs projects is as follows:

Project	Client
Improvement of Karakoram Highway (Raikot – Khunjerab Section)	NHA
Pakistan Deep Water Container Port Dredging and Reclamation Works	KPT
Construction of Bridge over River Jehlum at Dangli	WAPDA
560 MW Bin Qasim Combined Cycle Power Project	KESC
New Benazir Bhutto International Airport Package – 2	CAA
Mangla Dam Raising Project	WAPDA

	Indus Crossing, White Oil Pipe Line Project	PEPCO
	Construction of Army Barracks for NLC in AJK.	NLC
	Punjab Road Sector Development Project – Package P3	CWE

Please insert information for additional Project Participants as necessary.

V. EXPECTED SCHEDULE

Earliest project start date *Year in which the plant/project activity will be operational*	April 2014
Estimate of time required before becoming operational after approval of the PIN	1.5 years
Expected first year of CER/ERU/VERs delivery	2014
Project lifetime *Number of years*	**25 years**
For CDM projects: **Expected Crediting Period** *7 years twice renewable or 10 years fixed* **For JI projects:** Period within which ERUs are to	7 years twice renewable

be earned *(up to and including 2012)*	
Current status or phase of the project *Identification and pre-selection phase/opportunity study finished/pre-feasibility study finished/feasibility study finished/negotiations phase/contracting phase etc.* *(mention what is applicable and indicate the documentation)*	Feasibility studies underway
Current status of acceptance of the Host Country *Letter of No Objection/Endorsement is available; Letter of No Objection/Endorsement is under discussion or available; Letter of Approval is under discussion or available* *(mention what is applicable)*	Host Country Approval Received. Letter Attached in Appendix 1
The position of the Host Country with regard to the Kyoto Protocol	Has the Host Country ratified/acceded to the Kyoto Protocol? _____NO / YES, YEAR_2005_____ Has the Host Country established a CDM Designated National Authority / JI Designated Focal Point? _____NO / YES, YEAR__2005_____

VI. METHODOLOGY AND ADDITIONALITY

ESTIMATE OF GREENHOUSE GASES ABATED/ **CO_2 SEQUESTERED** *In metric tons of CO_2-equivalent, please attach calculations*	Annual (if varies annually, provide schedule): Up to and including 2014: 50,305 tCO_2-equivalent Up to a period of 10 years: 503,050 tCO_2-equivalent (2014 being the first year) Up to a period of 7 years: 352,138 tCO_2-equivalent (2014 being the first year) –
BASELINE SCENARIO CDM/JI projects must result in GHG emissions being lower than "business-as-usual" in the Host Country. At the PIN stage questions to be answered are at least: Which emissions are being reduced by the proposed CDM/JI project? What would the future look like without the proposed CDM/JI project? *About ¼ - ½ page*	This project will result in reduction of GHG emissions due to clean energy generation with solar PV technology. CO_2 In case the project is not implemented, more fossil fuel plants will be built creating more greenhouse gases. Furthermore, the electricity deficit will continue unabated.
ADDITIONALITY Please explain which additionality arguments apply to the project: (i) there is no regulation or incentive scheme in place covering the project	There is no regulation in Pakistan covering such a project. Government is providing an incentive by waiving income tax. However, no one else has put up a solar plant of this scale. Welt Konnect is the first company to take such an initiative. A 50MW solar PV plant is a new technology in Pakistan. There are no

(ii) the project is financially weak or not the least cost option (iii) country risk, new technology for country, other barriers (iv) other	trained resources available. Foreign experts will be needed for the design, installation as well as training of local resources. Due to political instability as well as very fragile law and order situation country risk is very high. It is extremely difficult to bring in FDI and foreign resources into the country.
SECTOR BACKGROUND Please describe the laws, regulations, policies and strategies of the Host Country that are of central relevance to the proposed project, as well as any other major trends in the relevant sector. Please in particular explain if the project is running under a public incentive scheme (e.g. preferential tariffs, grants, Official Development Assistance) or is required by law. If the project is already in operation, please describe if CDM/JI revenues were considered in project planning.	Pakistan's grid is predominantly fossil fuel intensive. Due to an average deficit of 3,000 - 4,000 MW load-shedding has become a regular feature of a common man's life. This situation forces planners to turn once again to "quick fix" thermal generation. As an example, there are 19 rental thermal power stations of a total capacity of 2,734 MW at different stages of development. The grid in Pakistan is predominantly thermal and over 65% comprises gas and oil based generation. Heavily subsidized gas has virtually run out and is not available for power generation forcing all forthcoming projects to be set up based on oil (with coal being designated as the fuel of choice in the longer term).
METHODOLOGY Please choose from the following options: For CDM projects:	ACM0002 – Consolidated baseline methodology for grid-connected electricity generation from renewable sources

(i) project is covered by an existing Approved CDM Methodology or Approved CDM Small-Scale Methodology (ii) project needs a new methodology (iii) project needs modification of existing Approved CDM Methodology **For JI projects:** (iv) project will use a baseline and monitoring plan in accordance with Appendix B of the JI Guidelines and further JISC guidance (V) project will use Approved CDM or CDM Small-Scale Methodology	

VII. FINANCE

TOTAL CAPITAL COST ESTIMATE (PRE-OPERATIONAL)	
Development costs	US$ 1 million (Feasibility studies, legal fees, etc.)
Capital cost	**US$ 145,651,607**
Land	2 US$ million

Other costs (please specify)	
SOURCES OF FINANCE TO BE SOUGHT OR ALREADY IDENTIFIED	
Equity Name of the organizations, status of financing agreements and finance (in US$ million)	20%
Debt – Long-term Name of the organizations, status of financing agreements and finance (in US$ million)	80%
Debt – Short term Name of the organizations, status of financing agreements and finance (in US$ million)	N/A
Carbon finance advance payments[2] sought from the World Bank carbon funds. (US$ million and a brief clarification, not more than 5 lines)	N/A
SOURCES OF CARBON FINANCE Name of carbon financiers other than any of the World Bank carbon funds that you are contacting (if any)	TBD

[2] Advance payment subject to appropriate guarantees may be considered.

INDICATIVE CER/ERU/VER PRICE PER tCO_2e[3] *Price is subject to negotiation. Please indicate VER or CER preference if known.*[4]	US $2

[3] Please also use this figure as the carbon price in the PIN Financial Analysis Model (cell C94).

[4] The World Bank Carbon Finance Unit encourages the seller to make an informed decision based on sufficient understanding of the relative risks and price trade-offs of selling VERs vs. CERs. In VER contracts, buyers assume all carbon-specific risks described above, and payment is made once the ERs are verified by the UN-accredited verifier. In CER/ERU contracts, the seller usually assumes a larger component - if not all – of the carbon risks. In such contracts, payment is typically being made upon delivery of the CER/ERU. For more information about Pricing and Risk, see "Risk and Pricing in CDM/JI Market, and Implications on Bank Pricing Guidelines for Emission Reductions".

VIII. TOTAL EMISSION REDUCTION PURCHASE AGREEMENT (ERPA) VALUE

A period until 2021 (end of the first commitment period)	US $591,850
A period of 10 years	US $845,500
A period of 7 years	US $591,850

Please provide a financial analysis for the proposed CDM/JI activity, including the forecast financial internal rate of return for the project with and without the Emission Reduction revenues. Provide the financial rate of return at the Emission Reduction price indicated in section "Indicative CER/ERU/VER Price". DO NOT assume any up-front payment from the Carbon Finance Unit at the World Bank in the financial analysis that includes World Bank carbon revenue stream.

Provide a spread sheet to support these calculations. The PIN Financial Analysis Model available at www.carbonfinance.org is recommended.

IX. EXPECTED ENVIRONMENTAL AND SOCIAL BENEFITS

LOCAL BENEFITS E.g. impacts on local air, water and other pollution.	Environment: Reduced carbon emissions in the national grid and replacement of carbon intensive thermal generation; The project not only reduces or replaces equivalent thermal generation with all the associated environmental benefits but it also promotes an overall environmental wellbeing since the project will help to avoid all associated pollution caused through extraction, processing, storage

	and transportation of conventional fuels required for thermal generation. Development of solar potential in Pakistan: There is tremendous solar potential with year around sunshine in Pakistan. This project will stimulate private investment to develop more large scale solar projects. Saving foreign exchange and reduced cost of electricity: Foreign exchange required to import oil to service an equivalent thermal generating plant will be saved;
GLOBAL BENEFITS Describe if other global benefits than greenhouse gas emission reductions can be attributed to the project.	There will be reduction in GHG emissions through replacement of fossil fuel generated electricity as well as much reduced transportation of oil needed for fossil fuel plants.

X. SOCIO-ECONOMIC ASPECTS

What social and economic effects can be attributed to the project and which would not have occurred in a comparable situation without that project? Indicate the communities and the number of people that will benefit from this project. *About ¼ page*	Economic benefits Greater local employment opportunities during construction (100-200 persons) and during operations. Spin off benefits and stimulation of local economy through creation of business opportunities at different stages of project implementation to provide goods and services for the project both during construction and operations; Reduction of poverty in an economically depressed region with very little industry and high unemployment.
What are the possible direct effects (e.g. employment creation, provision of capital required, foreign exchange effects)? *About ¼ page*	400-500 direct jobs are expected to be created during the construction phase and another 100-150 during operations.
What are the possible other effects (e.g. training/education associated with the introduction of new processes, technologies and products and/or the effects of a project on other industries)?	Opportunity for improved skill set of local inhabitants through training and capacity building for employment in the project contributing to growing technical advancement.

About ¼ page	
ENVIRONMENTAL STRATEGY/ PRIORITIES OF THE HOST COUNTRY A brief description of the project's consistency with the environmental strategy and priorities of the Host Country *About ¼ page*	The National Environmental Policy of Government of Pakistan states: "The government would promote energy efficiency and renewable sources of energy in order to achieve self-reliance in energy supplies and as a means to sustainable development." This project supports the stated objective of the policy.

XI. Technologies

1. Renewables
    I. Biomass
    II. Biogas
    III. Bagasse
    IV. Wind
    V. Hydro
    VI. Geothermal
    VII. Photovoltaic
    VIII. Solar Thermal
2. Fossil Fuel Switch
3. Energy Efficiency
    I. Cement Efficiency Improvement
    II. Construction material
    III. District heating
    IV. Steel Gas Recovery
    V. Other Energy Efficiency
4. Waste Management
    I. Landfill Gas recovery/utilization
    II. Composting
    III. Recycling
    IV. Biodigestor
    V. Wastewater Management
5. Coalmine/Coal bed Methane
6. Oil and Gas Sector
    I. Flared Gas Reduction
    II. Reduction of technical losses in distribution system
7. N_2O removal

8. HFC23 Destruction

9. SF6 Recovery

10. Transportation

    I. Fuel switch

    II. Modal switch

3. Others

LOI FOR CDM FILING OF THE PROJECT

Tel: 92- 51- 9205510
Fax: 92- 51- 9245533
Email: cdmcellpakistan@gmail.com

F. No. 1(143)-CDM/2011
GOVERNMENT OF PAKISTAN
MINISTRY OF ENVIRONMENT
4th Floor, ENERCON Building,
off Ataturk Avenue,
Sector G- 5/ 2, Islamabad, PAKISTAN.
****

Clean Development Mechanism Cell

Islamabad, 14th February, 2011

Subject: Letter of Intent for the CDM Project Activity

Respected Sir,

With reference to your letter, we have pleasure to inform you that we acknowledge your intention to develop the GHGs emission reduction project activity i.e. "Cholistan 50 MW Solar PV Grid Connected Project – Pakistan", for which CDM Project Registration will be sought in the future.

2. We are looking forward to receive the Project Design Document (PDD) for the subject project activity in order to start the process for Host Country Approval inline with our National Sustainable Development aims and objectives.

Kind regards,

(Syed Amjad Hussain)
CDM Expert

Mr. Habil Khan,
Director Operations,
Welt Konnect Associates, Pakistan,
Suite 8, Ground Floor, Evacuee Trust Complex,
Agha Khan Road, F-5/1, Islamabad
Tel: +92-3005140020, Fax: 051-2870424
Email: habil@weltkonnect.com

PROJECT EVALUATION MATRIX

EVALUATION MATRIX

S. No.	Criteria Defined for Host Country Approval of CDM Projects under Pakistan National Operational Strategy for CDM	Comments
1.	**General Criteria**	
i.	The project should: Be consistent with the national laws and sustainable development policies, strategies and plans including:	
	a. Pakistan Environmental Protection Act-1997.	The project is in compliance with the PEPA 1997, and as mentioned in Para 12 of the said act, this project being a solar PV project in a desert with almost no population or wildlife or plantation, does not have any adverse effect on the environment whatsoever. However an Environment studies have been filed with the relevant authorities for their consideration.
	b. National Energy Conservation Strategy.	*The project complies with the three explicit objectives of the NECS: conservation of natural resources, promotion of sustainable development, and improvement of efficiency in the use and management of resources. And would also abide by policies outlined for pollution control as in s.no 4, 8, 10, 12 and 13 of the 14 core programme areas.*
	c. National Environment Policy.	The project is in unison and support of the NEP, particularly contents of 3.4, 3.4(h), 3.6, 3.7, 3.9, 4.1, 4.3, 4.4, 5.4, 5.5 and 5.6.
	d. National Forestry Policy.	The project is in harmony with the National Forestry Policy and although being situated in a desert namely Cholistan it will contribute to the national grid and hence meet the objectives of Para 1.2 by generating power from solar energy which will indirectly hinder cutting of mountain trees for firewood. It also supports para 7, 10.2, and 10.3.

S. No.	Criteria Defined for Host Country Approval of CDM Projects under Pakistan National Operational Strategy for CDM	Comments
	e. National Renewable Energy Policy.	The project complies with NREP, articles 4 (4.4), 8.1, and 8.3 (8.3.3)
	f. Medium-term Development Framework.	The project supports Medium term Development Framework objectives such as poverty reduction, upgrading of physical infrastructure, energy security, accelerated development of lesser developed areas, and environment.
	g. Other Relevant Policies and Plans of the Government.	The project complies and is in harmony with all relevant concerned policies of the government of Pakistan.
ii.	Not result in any obligation towards the investor country other than Certified Emission Reduction (CER) authorization.	The project will not result in any obligation towards the investor country other than CER authorization.
2.	**Environmental Criteria**	The project results in quite a significant reduction of GHG. The total CER that would be generated from this project would be 42,275 annually.
	The project should:	
i.	Result insignificant reduction in the emissions of Greenhouse Gas emissions.	
ii.	Result in conservation of local resources and improvement of local environment.	The project will surely result in conservation of local resources and improve local environment, whilst harnessing solar energy from the Sun.
3.	**Social Criteria**	A lot of jobs will be created during the life of this project, in all phases from Construction, to Operations & Maintenance, the population of Pakistan will be provided with significant employment opportunities.
	The project should:	
	Result in poverty alleviation.	
ii.	Result in creation of new jobs.	Being a relatively new field, this project will pioneer the sector of Solar Energy creating new jobs and a new set of skills highly valuable for the future growth & development of Pakistan
iii.	Result in creation of new economic activities.	The project as mentioned above is the first of its kind and will be a pioneer in Solar Technology, creating new economic activities such as trading of PV Panels, Inverters, and Repairing and Maintenance of Equipment, and also creating Engineering Design and Project Management services.

S. No.	Criteria Defined for Host Country Approval of CDM Projects under Pakistan National Operational Strategy for CDM	Comments
iv.	Have positive impacts on local communities.	The scarce local community in the desert, will be exposed to the benefits of latest PV technology and most labor will be trained and hired from these local communities.
v.	Improve equity.	The Project will improve equity by supplying electricity to MEPCO (Multan Electric Production Co) which will then be supplying to those areas which are most deficient of Power in the country.
vi.	Take gender concerns into consideration.	The project will contribute in a positive way to gender considerations and jobs will also be provided to females especially for cleaning the panel's glass which may become dirty with dust.
4.	**Economic Criteria**	The project is economically viable and will help in reducing the trade deficit as power will be generated from Solar Energy and not Fossil Fuels which need to be imported in return of heavy payments of valuable foreign exchange of Pakistan.
	The project should:	
i.	Result in positive impacts on balance of payment.	
ii.	Not result in net increase in external debt burden.	Does not result in net increase of external Debt, burden.
iii.	Be cost effective.	The project is quite cost effective.
5.	**Technological Criteria**	The project will result in not only transfer of latest technology and know-how but will carve the way forward for the entire Solar PV industry in Pakistan.
	The project should:	
i.	Result in technology and know-how transfer.	
ii.	Not result in import of obsolete technology.	Will not result in import of obsolete technology

PRIOR CONSIDERATION FORM

Prior Consideration of the CDM Form

This form is to be used by project participants in order to submit the notification of the commencement of the project activity and the intention to seek CDM status.[5]

Date of submission:	14/January/2011

SECTION 1: PROJECT DETAILS

1. Title of the CDM project activity:	***50 MW Solar PV Project in Cholistan, Punjab***
2. Precise geographical location: (Geo-coordinates, Town/City, Country)	*The Project is located at N.29.11.552, E.72.25.621, Bahawalpur, Cholistan District, Punjab, Pakistan*
3. Name of project proponent (Name, Title, Company, Country)	*Habil Ahmed Khan, Director Operations, Welt Konnect Pvt Ltd, Pakistan.*
4. Brief description of the proposed project activity: (include brief description of technology to be employed and source of baseline emissions to be reduced)	The Cholistan Solar PV Project is a 50 MW solar PV installation project, planned to be implemented in phases of 5 MW each. The project will be a pure solar PV grid connected installation. The project would become operational and start generating CERs directly after the completion of the first phase of the project, with work on the other phases continuing. The project is expected to help alleviate the huge energy deficit in Pakistan. It will be the first Solar PV project of its magnitude in Pakistan and will be a large source of clean energy. The project is expected to be using Poly Crystalline silicon solar cells. CO2 to be reduced through abatement.

SECTION 2: CONTACT INFORMATION

Name of the entity: Welt Konnect Pvt Ltd	
Contact details of authorized representative:	✓ Mr. Ms.
Last name: Khan	Telephone: +92-300-5140020
First name: Habil Ahmed	Fax: +92-51-2870424
Email: habil@weltkonnect.com	Address: Suite#8, Ground Floor, Evacuee Trust Complex, Agha Khan Road, F-5/1, Islamabad, Pakistan
Signature:	

[5] The completed form should be sent to the Host Party DNA and the UNFCCC secretariat (P.O. Box 260124 D-53153 Bonn Germany, cdmregistration@unfccc.int)

PROJECT DESIGN DOCUMENT

CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (F-CDM-PDD)
Version 04.1 - in effect as of: 11 April 2012

Title of the project activity	50 MW Solar Project in Cholistan, Pakistan
Version number of the PDD	06
Completion date of the PDD	09th Aug 2012
Project participant(s)	Welt Konnect (Pvt.) Ltd. China Three Gorges Incorporation
Host Party(ies)	Government of Islamic Republic of Pakistan
Sectoral scope and selected methodology(ies)	Power Sector **Monitoring Methodology:** ACM0002(Ver 12) **Emission Reduction Methodology:** "Tool to calculate the emission factor for an electricity system, ver 2, EB 50 Report Annex 14"
Estimated amount of annual average GHG emission reductions	50,305 **tCO_2e**

CONTENTS

Appendices

Revision History of PDD

Version Number	Date	Description and Reason of Revision
00	15 January 2011	Initial adoption
01	09 March 2011	Location of Project Finalized
02	04 April 2011	Stake Holders Comments
03	05 October 2011	Technology Description Improved
04	24 November 2011	Financial Analysis Improved
05	16 December 2011	Sensitivity Analysis Improved

I. SECTION A: General description of project activity

A.1. Purpose and general description of the project activity:

Cholistan Solar Farm is a 50 MW electricity generation plant designed to produce electricity by solar energy in Cholistan Desert in the province of Punjab, Pakistan. It employs solar photovoltaic (PV) technology that converts solar energy directly into electricity, while emitting zero greenhouse gases (GHG) into the atmosphere. The project is planned to be implemented in phases of 5 MW each and would become operational and start generating CERs right after the completion of the first phase of the project, with work on the other phases continuing. The generated electricity will be supplied to the national grid.

The project conforms to the government policy that promotes development of renewable energy technology and contributes to lowering dependence on electricity generation by fossil fuels which is over 66% of total generation in Pakistan. It is expected to help alleviate the huge energy deficit in Pakistan. It is the first Solar PV project of its size in Pakistan and will be a good source of clean energy.

The area of this project will be about 500Acres and annual amount of electricity going to the grid will be about 76,037 MWh. As a result over 50,350 tons of CO_2 emissions will be abated per year.

Contribution to Sustainable Development

The project will make significant contribution to sustainable development in the area such as:

Environmental Well-being

The project not only replaces equivalent thermal generation with all the associated environmental benefits but it also promotes an overall environmental wellbeing since the project will help avoid all associated pollution caused by extraction, processing, storage and transportation of conventional fuels required for thermal generation.

Social Well-being

There will be reduction of poverty in an economically depressed region with very little industry and high unemployment as jobs are created during installation as well as operation for both unskilled and skilled workers. The skill sets of locals will be

improved through training and capacity building for employment in the project contributing to technical advancement.

Economic Well-being

a) The project will help alleviate the current electricity shortage in the country that causes regular black-outs resulting in industry closures as well as inconvenience to citizens.

b) The project will contribute towards development of solar energy sector in Pakistan as it will stimulate further private investment in this sector of huge neglected potential with low environmental impact.

c) The project will help National Economy through saving of foreign exchange required to import oil to service equivalent thermal generation.

A.2. Location of Project Activity

The Project is located in Chak 314A, Block 3,4,23, Bahawalpur, Cholistan District, Punjab, Pakistan

The project location is shown below:

A.2.1. Host Party (ies):

Government of Islamic Republic of Pakistan

A.2.2. Region/State/Province etc.:

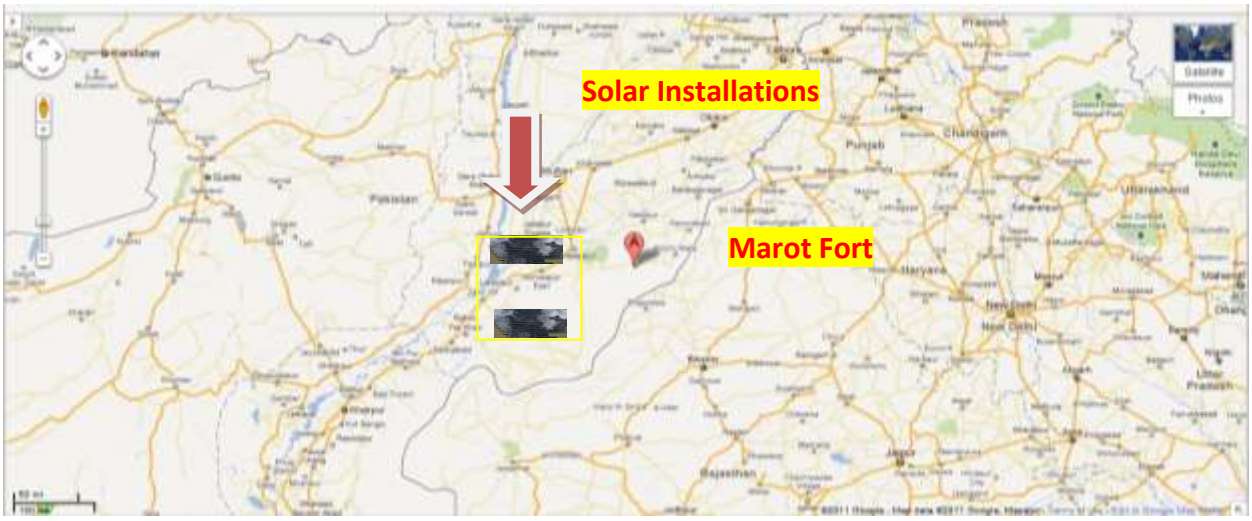
Punjab

A.2.3. City/Town/Community etc.:

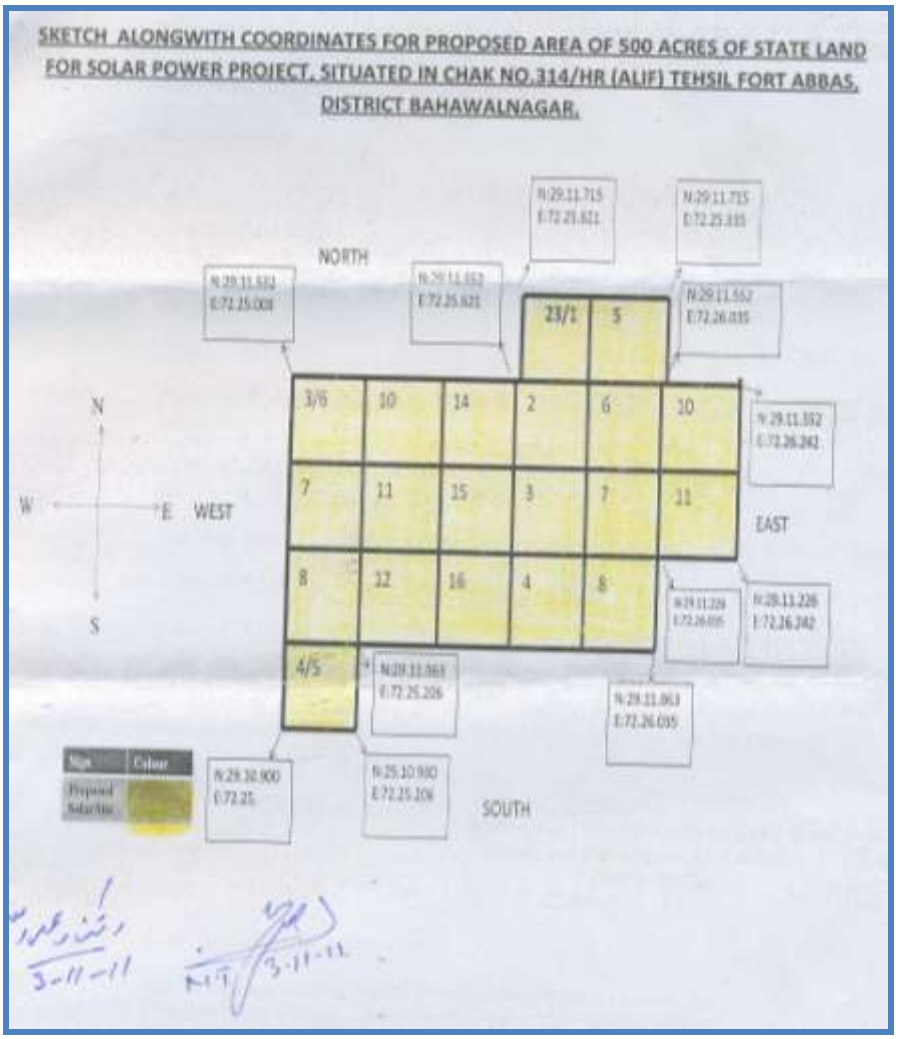
Bahawalpur, Cholistan

A.2.4. Physical / Geographical Location

Maps are provided below:




Solar Installations
Marot Fort
Google earth


SKETCH ALONGWITH COORDINATES FOR PROPOSED AREA OF 500 ACRES OF STATE LAND FOR SOLAR POWER PROJECT, SITUATED IN CHAK NO.314/HR (ALIF) TEHSIL FORT ABBAS, DISTRICT BAHAWALNAGAR.
NORTH
SOUTH
EAST
WEST
N
S
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W
23/1
5
3/6
10
14
2
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8
12
16
4
8
4/5

A.3 Technologies and/or measures

Table A.3.1: Design features & characteristics of the project

Item		Parameters
• **Solar Panels**		
	Type	Mono Crystalline
	Capacity	50MW
	Module maximum output power	50.26 kWp
	Number of modules	209,440
• **Charge Controller**		
	Type	Depends on String
	Capacity	Depends on string size
• **Inverter**		
	Type	DC To AC
	Output	AC
	Max. input voltage	673
	Control method	
	Node Form	3-Phase 3-Wire
	Efficiency	
• **Cables**		
	Type	To be Chosen
• **Civil Works and Mounting Structures**		
	Type	To be Designed
• **Plant Monitoring**		
	Type	

Table A.3.2: Daily Solar Radiation at the Site

Month	Ambient TemperaturesC	Daily Radiation (kWh/m^2/d)
January	33.2	4.076
February	33.2	4.852
March	33.2	5.750
April	33.2	6.311
May	33.2	6.897
June	33.2	7.202
July	33.2	6.949
August	33.2	6.519
September	33.2	5.920
October	33.2	5.380
November	33.2	4.298
December	33.2	6.633

A.4. Parties and Project participant

Name of Party involved ((host) indicates a host party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of Islamic Republic of Pakistan (Host)	Welt Konnect	No

A.5. Public funding of project activity:

The project activity does not involve any public funding from Annex 1 countries.

II. SECTION B: Application of selected approved baseline and monitoring methodology

B.1. Reference of Methodology

ACM0002 (version 12): Consolidated baseline methodology for grid-connected electricity generation from renewable sources

B.2. Applicability of Methodology

SN	Applicability Criteria	Justification
1.	This methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (green-field plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	Cholistan solar project is a grid connected renewable power generation project. It is a green-field project as no renewable energy plant was operated at the site before.
2.	The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	This project is the installation of a solar power plant.

B.3. Project Boundary:

	Source		Included?	Justification / Explanation
Baseline	Emissions from fossil fired power generation supplied to the national grid (gas, oil, diesel & coal)		Yes	Carbon emissions from grid electricity generation through use of hydrocarbons
			No	Not relevant/ Not identified in baseline methodology
			No	Not relevant/ Not identified in baseline methodology
Project Activity	Solar photo-voltaic project		No	Zero emissions from project activity
			No	Zero emissions from project activity
			No	Zero emissions from project activity

B.4. Establishment and Description of baseline scenario is

The approved consolidated baseline methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" recommends an analytical approach, whereby, the following options should be considered:

(a) Existing, actual or historical emissions as applicable; or
(b) Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment.

The approved consolidated methodology further prescribes that if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the Tool to calculate the emission factor for an electricity system.

The Project activity is generation of electricity from renewable energy sources. The electricity generated from the solar PV plant has zero emissions; there is no material leakage and the electricity generated will be fed into the fossil intensive national grid through the interconnection facility at the site.

The grid in Pakistan is predominantly thermal and over 66% comprises gas and oil based generation. Heavily subsidized gas has virtually run out and is not available for power generation forcing all forthcoming projects to be set up based on oil (with coal being designated as the fuel of choice in the longer term). It would be appropriate to state that the Project activity would directly replace oil based thermal generation, i.e. reciprocating engines/steam turbines operating on furnace oil and would thus result in saving such emissions to the extent of its generation. However, a conservative approach was taken by using the approved ACM0002 methodology which considers that the Project activity would replace the weighted average of the ratio of emissions in the system represented by:

(a) The Operating Margin (OM) – the ratio of emissions from generation of all power generating projects in the defined system over the latest three year period *excluding* least cost/must run projects; and
(b) The Build Margin (BM) – the ratio of emissions attributable to the *higher* of (i) generation (MWh) from five most recent power projects built *or* (ii) generation (MWh) of the most recently built power plants equating to 20% of the most current annual system generation.

Accordingly, it is proposed to present in this PDD the measurement of emissions observed when comparing the "business as usual" case (without the project activity) with emissions under the project (the "project scenario" case). The baseline emission factor (EFy) represents a conservative estimate of emissions per MWh of grid generation and the emissions "saved" per MWh of the project generation. All computations are based on official data available in the public domain in the "Pakistan Energy Yearbook" published annually by the Hydrocarbon Development Institute of Pakistan, Ministry of Petroleum & Natural Resources, Government of Pakistan.

The physical project boundary includes the project site and all power plants connected physically to the electricity system that the Project is connected to, i.e. national grid. Pakistan comprises two distinct grids (a) the national grid and (b) the Karachi Electricity Supply Company (KESC) grid. Each grid has its own independent

dispatch center, generation and distribution system. Though interconnected for occasional supply from the national grid to KESC that ranges from 400-600 MW, there are no material interdependencies between the two grids. The generating plants for each grid are clearly identifiable and data for each grid is available. By separating KESC generation (100% thermal) the emission factors for the national grid (thermal + hydro) are significantly reduced, providing a correct and conservative estimate of the impact of the new plant on emissions. At present, no imports or exports occur in the project system because national grid is not linked to any other foreign electricity system. Power projects that feed into the national grid can be built almost anywhere in the country and can be dispatched without significant transmission constraints provided that transmission facilities are available.

B.5. Demonstration of additionality

A step-wise approach has been adopted to demonstrate and assess additionality according to the "Tool for the demonstration and assessment of additionality" Version 5.2. These steps include:

- Step 1- Identification of alternatives to the project activity consistent with current laws and regulations;
- Step 2- Investment analysis to determine that the proposed project activity is not the most economically or financially attractive;
- Step 3- Barrier analysis; and
- Step 4- Common practice analysis

STEP 1 – Identification of alternatives to the project activity consistent with current laws and regulations

Sub-Step 1a. Define alternatives to the project activity

Three realistic and credible alternatives available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM activity are:

- The proposed Project activity is implemented without the CDM;
- The Project is not implemented and other alternatives are considered;
- Current situation is continued (no project activity or alternatives are considered).

a) The proposed Project activity is implemented without the CDM.

Project activity without CDM assistance could result in the following disadvantages:

i) Project Failure: The Project would not come on line as it would be unable to achieve the financial returns necessary to attract equity investment in view of the new technology (Solar PV) being implemented.

ii) Setback to development of Solar PV technology in Pakistan: As it is first of its kind, failure of the Project would adversely affect the solar energy sector in Pakistan and impact equity investment and debt financing of future private solar energy projects. Further investment in the sector will be encouraged through successful implementation of this Project along with financial viability achieved through carbon financing.

b) The Project is not implemented and other alternatives are considered.

Other plausible and credible alternatives to the project activity that deliver electricity with comparable quality are described below:

i) Rental oil/gas based power plants: The country is facing acute daily shortage of power – up to 5000 MW – resulting in blackouts of 8-10 hours per day in cities and even longer in rural areas. This energy crisis is forcing the Government to seek quick but expensive solutions such as rental projects. These are typically based on open-cycle, fuel inefficient and high carbon emitting technologies. Once the capacity shortfall is filled through such means, renewable projects will be put on the back burner resulting in a setback to green power.

ii) Implementation of Combined Cycle Gas Turbine (CCGT) or Diesel Generator (DG) set based projects in the private sector: This appears to be the most preferred alternative as thermal independent power producers (IPPs) are being invited to set up fossil fuel (gas/oil) based projects that will once again cause increased emissions.

iii) Implementation of similar size small/medium hydropower schemes: Some hydro IPPs are under development but the development cycle is typically long to be a practical alternative to mitigate the current and increasing power shortage. Even if they come on line, it would be good for the country as additional cheaper and cleaner power will come on the national grid.

iv) Implementation of large mega hydropower schemes in the public sector: Some mega hydropower projects like Bhasha and Kalabagh in the public sector have been on the table for over twenty years and have turned into a huge political issue with no solution in sight. Even if they are approved today, it would take at least 15-20 years to implement them at a great financial and social cost due to large reservoirs and massive displacement of local population.

v) Other renewables like wind are developed: There are a number of wind projects under consideration but very few are close to real development. Furthermore, typically they are 50 MW in size and will not make a huge dent in the power shortage existing today.

c) Current situation is continued (no project activity or alternatives are considered).

This option is not viable in the current energy crisis situation. A large number of industries are shutting down resulting in an economic crisis and large unemployment. Government has to take some steps quickly to solve the problem.

Outcome of Sub-Step 1a:

Realistic and credible alternatives to the Project activity are options "i" and "ii" of Scenario b.

Sub-step 1b Consistency with mandatory laws and regulations

Each of the potential alternatives to the project discussed above and summarized below

- The project occurring without being registered as a CDM project;
- The Project is not implemented and other alternatives are considered;
- Current situation is continued (no project activity or alternatives are considered).

are consistent with the laws and regulations of Pakistan. What the proposed project, therefore, represents is not the most likely alternative amongst those considered that comply with mandatory regulations.

Outcome of Step 1b:

The alternatives to the Project activity are in compliance with applicable legal and regulatory requirements.

STEP 2 – Investment analysis

Sub-step 2a – Determine appropriate analysis method.

After studying the options that are available to analyze additionality, i.e. simple cost analysis, investment comparison analysis and benchmark analysis, it has been concluded that benchmark analysis is the most appropriate methodology for the Project as benchmark analysis was the evaluation criterion that was used by the Project Developer in their decision.

Sub-step 2b – Apply benchmark analysis

Equity Internal Rate of Return (IRR) is considered the most suitable financial indicator for a project. As suggested in the tool for the demonstration and assessment of additionality, the Project IRR will be used to analyze the financial viability of the Project. Furthermore, the equity IRR will be analyzed to evaluate and justify investor interest. Considering the bank interest rates of above 10% and risk free rate on Government securities and bonds above 10%, the cost of money in Pakistan is high. The Government has fixed IRR returns for thermal private power projects at 15%. Keeping in view that hydro projects have greater construction risks and longer construction period and PPA under Section 4.2(b) of Schedule 6 allows a return of 16% indexed to protect for inflation and exchange rate fluctuations, the hurdle Equity IRR baseline is also considered as minimum16%. It may also be noted here that "Policy Framework and Package of Incentives for Private Sector Power Generation Projects in Pakistan" of 1994 provides that "For hydro projects exceeding 20 MW, the tariff will be decided on project to project basis on a 25% return on equity" (Ref: Para C-1)

The Project is commercially unviable without CDM revenue. The unfavorable financial indicators will render the Project un-fundable and it would be close to impossible to attract equity investment into an enterprise with high country and project risk while returns are low; implementation is thus dependent on CDM registration.

Sub-step 2c – Calculation and comparison of financial indicators

The financial details for the Project, after detailed economic evaluation as per the guidelines of IFC, are listed in the table below:

Table B5.1: Financial Details

Item	Value
Financial Details	
Total Project Cost	US $145,651,607
Tariff agreed with Power Purchaser (during loan period)	US 34.2 cents/unit

Tariff agreed with Power Purchaser (after loan period)	US 14.2 cents/unit
Annual Generation	76,037,369 KWh
Project Life (term)	25 years
Financial Results	
IRR – Hurdle Rate	17.15%
IRR – without CDM revenue	17%
IRR – with CDM revenue	17.17%

Sensitivity Analysis

Table B5.2: Sensitivity Analysis

Ser	Possibility	IRR without CDM	IRR with CDM	Hurdle Rate
1	Base Case	17%	17.35%	17.30%
2	10% increase in O&M	16.9%	17.25%	17.30%
3	10% decrease in O&M	17.10%	17.44%	17.30%
4	10% Project Cost overrun	15.12%	15.44%	17.30%
5	10% decrease in Project Cost	19.26%	19.64%	17.30%
6	10% increase in Annual Generation	19.03%	19.37%	17.30%
7	10% decrease in Annual Generation	14.93%	15.28%	17.30%

The Table B5.2 has been filled and prepared assuming Tariff Petitions have been made as per the law of Pakistan and Tariff finalized and locked, and the only changes being made are those prompted by the Sensitivity Analysis Possibilities stated above.

The base case is made in strict compliance with the Laws Governing the Power Sector of Pakistan, particularly the NEPRA Act which acts as a guide for Determining the Tariff whilst ensuring a minimum 17% IRR. The policy incentives have been drafted to facilitate investors keeping in view the volatile conditions, risks and challenges faced by the country today, which include an acute shortage of power and little or no investments in Solar Energy.

Please also note the entire Revenue which is to be generated by the obtaining of CER's has been added to the Cash Inflows instead of half, as is the case in reality, in accordance with the presiding rules and regulation it is supposed to be shared with

the Government Power Purchaser at the time of receipt of the actual revenue stream, therefore a considerably greater impact on the IRR can be seen in this table.

The resulting variations from addition of CDM's are provided in the second column.

The Cash Inflows change significantly for analysis in Row 6 and Row 7, hence showing a greater impact on the IRR's as is the case whenever total annual production either increases or decreases.

a) The sensitivity analysis in table B5.2 demonstrates that in the base case CER revenue boosts the IRR to a little over 17.3% and thus takes it over the hurdle rate.

b) In case of increase in O&M costs by 10% (ser 2 above) the return falls marginally below the hurdle rate of 17.3%, however, without such income the project becomes totally unviable.

c) With increase in project cost by 10% (ser 4 above) in the presence of CER income, the acceptable IRR cannot be maintained. However, increase in the project cost is unlikely due to the following reasons:

   - The project construction arrangements are based on a tightly structured EPC contract approved by non-recourse lenders and based on a special FIDIC licensed version of EPC contract which requires fixed price and time certain completion; and
   - In the unlikely event of any variation orders, the project cost includes sufficient contingency to provide for up to about 5% project cost increase.

d) The decreased generation by 10% (ser 7 above) has no impact on IRR because of assured minimum monthly amount every month

Supporting arguments for additionality

In addition to well-known institutional barriers – country risk, preference for nominally cheaper thermal power capacity and weak commercial viability without CER income as a Solar PV Power project with a high upfront cost component – the Project is also subject to the following risk factors:

- Construction completion risk
- Technology Skills Risk
- Technology Introduction and Amalgamation into Existing Infrastructure risk

- Implementation Risk (being the first project in Pakistan of its scale and magnitude in Solar PV technology)
- Technology, design and performance risk

The project being the first of its kind in Pakistan comes with inhabited risks, some of which are the availability of skilled labor risk, contractors risk, compatibility risk of infrastructure to accommodate such an installation, and policy hurdles.

Though the Project is attractive with low environmental and social impacts, the low IRR (without CER income), high-perceived country risk and project location in Cholistan Desert – generally considered as one of the most deprived and desolate areas of the country – is such that implementation is only possible with CDM support and encouragement.

STEP 3- Barrier analysis

Sub-step 3a – Identify barriers that would prevent the implementation of the proposed Project activity.

In Pakistan availability of project financing and access to international capital markets is greatly affected by the investment barriers. The investment barriers not only make project financing in Pakistan more difficult to secure but also make the terms and conditions of the debt more onerous. In the context of the above following barriers are considered relevant to the Project:

a) Institutional Barrier

In countries that have seen growth of solar PV generation on large scale, generally, it has been due to availability of Feed-in-Tariffs. Pakistan currently does not offer such a facility. The tariff has to be negotiated, typically, on cost plus basis just like it is done for thermal projects. Furthermore the regulatory authorities expect solar projects to be cost competitive with thermal projects – an unrealistic expectation as solar PV inherently is an expensive technology. So the institutional environment is not conducive to setting up grid-connected solar PV projects.

b) High Upfront Capital Cost and High Costs of Capital

A solar project requires high upfront capital investment. Furthermore, high costs of capital pose another problem. The costs of capital are high due to scarcity of financial resources with sufficiently long tenure to mitigate impact on tariff of high capital cost, country risk and implementation risk.

i) Country risk

Country risk is measured by the sovereign ratings of International Credit Rating Agencies. Table B5.3 below is reproduced from "The Political Risk Survey (PRS) Group" ratings. This data shows the risk of Pakistan relative to other Asian countries. The countries in the range of 51-100 are declared less risky and 0-49 high-risk countries.

Table B5.3: Country Risk[6]

COUNTRY	CURRENT RATINGS			COMPOSITE RATINGS	
	Political Risk 01/10	Financial Risk 01/10	Economic Risk 01/10	Year Ago 02/09	Current 01/10
Bangladesh	55.0	41.5	33.5	64.3	65.0
China, Peoples' Rep.	65.5	48.0	40.0	78.3	76.8
Hong Kong	81.5	41.5	39.5	80.0	81.3
India	63.5	44.5	33.0	68.8	70.5
Indonesia	61.0	37.0	36.0	66.5	67.0
Iran	52.5	47.0	28.0	68.3	63.8
Iraq	41.5	42.0	35.5	60.8	59.5
Japan	82.0	42.5	37.5	80.5	81.0
Korea, D.P.R.	48.0	33.5	26.0	58.0	53.8
Korea, Republic	79.0	39.0	33.0	77.3	75.5
Malaysia	73.5	44.0	31.5	77.3	74.5
Pakistan	44.5	39.0	30.5	54.0	57.0
Philippines	60.0	41.5	35.5	66.5	68.5
Singapore	84.5	44.5	36.0	86.0	82.5
Taiwan	79.0	46.0	35.0	80.3	80.0
Thailand	56.5	43.0	30.5	65.0	65.0
Vietnam	66.5	41.0	30.0	67.0	68.8

ii) Scarce Foreign Direct Investment (FDI)

Pakistan actively seeks foreign investment; government investment liberalization initiatives began in 1992 and have progressively opened Pakistan to foreign investment, offering broad arrays of incentives to attract new capital inflows. Notwithstanding this pro-investment stance, foreign direct investment (FDI) activity

[6] Source: http://www.prsgroup.com/icrg

remains relatively modest due to significant security threats to foreign interests in Pakistan; ongoing war on terror; concerns about political instability; inadequate infrastructure; delays in the privatization of state-owned enterprises; past protracted disputes between foreign investors and the government; intellectual property piracy, arbitrary and non-transparent application of government regulations; and resistance to the adoption of new policies by some elements of federal and provincial bureaucracies who have not yet fully embraced the new, more open economic environment.

All of these factors have created perceptions of Pakistan as a high risk country, resulting in low levels of foreign investment.

iii) Low levels of foreign investment translate into scarcity of capital and high interest rates

The reference rate for credit operations has been nominated by the Central Bank – State Bank of Pakistan – as KIBOR (Karachi Interbank Offered Rate). KIBOR which reflects the market liquidity and other factors such as core inflation is currently quoted above 14%. The operations of domestic banks are not geared towards infrastructure development and have more of an emphasis on consumer finance. Such banks are mainly engaged in short to mid-term financing and, therefore, the offered interest rates are incompatible with the requirements of capital-intensive solar projects with significant up-front investments and long payback periods.

Capital-intensive projects with long payback periods require long-term credits for their development. However, the Pakistani government has not been able to attract those investments due to its high country risk classification. Also, no long-term finance has been provided by international creditors to the Pakistani government, forcing the Country to rollover its external debts at very short terms.

Governments are major providers of log-term money to the local banks within developing countries. The lack of credit of the Pakistani government is directly reflected in the scarcity of long-term loans available for private companies in Pakistan.

c) Technology Barrier

Skilled and/or properly trained labor to operate and maintain solar PV technology is not readily available in the country. To-date small scale solar PV projects have been set up for electrification of homes in remote villages. Cholistan Solar Project being a grid-connected solar PV plant will require highly trained and experienced technical

personnel who will need to come from a foreign country. With the country in the midst of war on terror, it would be difficult and expensive to bring such individuals into the country. Secondly, solar PV is going through an explosive growth in rest of the world with scores of projects springing up, making availability of such resources all the more difficult.

d) Barriers due to prevailing practice

The Project activity is the "first of its kind" in the country. As stated earlier, over 66% of the power projects are thermal with the rest being hydro and nuclear. The project activity certainly goes against the prevailing practice.

Sub-step: 3b – Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

In this section we will demonstrate that while some of the same barriers generally exist for alternative projects, their influence on those projects is greatly reduced and in most cases non-existent.

i. Institutional Barrier: No feed-in tariff for solar projects

Solar energy has taken off on a large scale in those countries that have proactively offered feed-in tariff. Pakistan has not done so for solar projects but did better for thermal projects. From 1994 to 2002, tariff under Power Policy 1994 was available to thermal projects and some 15 IPPs were commissioned in Pakistan during this period. From 2002 onwards the Power Policy 2002 provided tariff guidelines and the regulator, NEPRA, announced upfront as well as cost-plus tariffs of several alternative thermal projects. Furthermore, tariff determinations by NEPRA assured the IRR of 15% for all alternative thermal projects opting for "cost plus tariff".

ii. High Cost of Capital

While it is acknowledged that all infrastructure projects in Pakistan are affected by the country risk, scarce foreign direct investment and lack of local financing, the degree of risk varies from project to project. Alternative projects in Pakistan are less capital intensive on per kilowatt basis (thermal projects can be set up at half the cost), thereby, lowering their exposure to such risk.

iii. Technology Barrier

While large hydro projects in private sector and some of the more sophisticated thermal projects, such as combined cycle, face some impact of the technology barrier due to lack of trained and experienced manpower, the problem is much more severe for solar PV as the resources are just non-existent in the country.

STEP 4 – Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

There is currently no other published solar PV activity of this size in the country.

Sub-step 4b Discuss any similar options that are occurring

i) Past Activity

Despite large solar potential in the country, foremost activity in private power sector has been focused around thermal power as 2/3 of the power generated in the last 5 years was by thermal. Data is shown in table B5.4 below:

Table B5.4: Statistics of Generation[7]

Year	Total	2009	2008	2007	2006	2005
Hydro	144,977	27,784	28,707	31,953	30,862	25,671
Nuclear	12,262	1,618	3,077	2,288	2,484	2,795
Total Least Cost/Must Run	157,239	29,402	31,784	34,241	33,346	28,466
%	33.83%	32.09%	33.23%	34.86%	35.62%	33.24%
Gas	183,170	29,678	32,923	35,811	41,286	43,472
Oil	123,650	32,423	30,818	28,025	18,868	13,516
Coal	689	113	136	136	129	175
Total Thermal	**307,509**	**62,214**	**63,877**	**63,972**	**60,283**	**57,163**
%	**66.17%**	**67.91%**	**66.77%**	**65.14%**	**64.38%**	**66.76%**
Total System	464,748	91,616	95,661	98,213	93,629	85,629

[7] Pakistan Energy Yearbook 2009

ii) New Activity

Private Power Infrastructure Board (PPIB) is responsible for promoting and facilitating power generation activities in the private sector of Pakistan. Table B5.5 below shows the projects being processed by the Board.

Table B5.5: Projects Being Processed by (PPIB)[8]

S.N.	Project Name	Technology	Location	Capacity (MW)	Expected COD
1	Liberty Power Tech		Faisalabad	195	Nov-10
2	Bhikki (Halmore) Power		Bhikki, Punjab	209	Nov-10
3	Fauji Mari Power		Daharki, Sindh	176.66	Nov-10
4	Hubco-Narowal		Narowal, Punjab	213.6	Apr-11
5	Power Generation Systems		Patoki, Punjab	180	Dec-11
6	Radian Power		Pasrur, Punjab	150	June-12
7	Grange Holding Power		Arifwala, Punjab	146.5	Dec-12
8	New Bong Escape Hydel	Hydro	Jehlum River, AJK	84	May-13
9	Green Power		Dadu, Sindh	170.95	Jun-13
10	Star Thermal		Daharki, Sindh	125.84	Jun-13
11	Uch II Power		Dera Murad Jamali, Balochistan	375.2	Dec-13
12	Kandra Power		Kandra, Sindh	120	Dec-13
13	Gulpur Hydro	Hydro	Poonch River, Gulpur, AJK	100	Jun-14
14	Patrind Hydro	Hydro	Kunhar River, KPK/AJK	150	Dec-14

[8] www.ppib.org.pk

15	Kotli Hydel	Hydro	Poonch River, Kotli, AJK	100	Dec-14
16	Sehra Hydel	Hydro	Poonch River, AJK	130	Dec-14
17	AES Imported Coal		Gadani, Sindh	1200	Jun-15
18	Rajdhani Hydro	Hydro	Ponch River, Near Mangla, AJK	132	Jun-15
19	Karot Hydel	Hydro	Jehlum River, AJK	720	Aug-15
20	Madian Hydro	Hydro	Swat River, KPK	157	Dec-15
21	Asrit-Kedam Hydel	Hydro	Swat River, KPK	215	Dec-15
22	Kohala Hydro	Hydro	Jehlum River, AJK	1100	Jul-16
23	Azad Pattan Hydel	Hydro	Juhlum River, Sudhnoti, AJK	222	Aug-16
24	Kalam-Asrit Hydel	Hydro	Swat River, KPK	197	Dec-16
25	Chakoti-Hattian	Hydro	Muzaffarabad, AJK	139	Dec-16
26	Shogosn Hydro	Hydro	Luthko River, Chitral, KPK	132	Dec-16
27	Shushgai Zhendoli Hydel	Hydro	Turkho River, Chitral, KPK	144	Dec-16
28	Suki Kinari Hydro	Hydro	Kunhar River, Mansehra, KPK	840	Jun-17
29	Kaigah Hydel	Hydro	Indus River, Kaigah, KPK	548	Dec-17

As the above table shows all projects close to COD are primarily thermal. Hydro projects start appearing a few years down the road. No solar projects make the list. Similarly the Alternative Energy Development Board, responsible for promoting solar energy in the country, shows no upcoming grid-connected solar projects on its website.

Outcome of Sub-steps 4a and 4b:

The Cholistan Solar Project activity does not represent common practice.

In depth analysis in section B5 above clearly demonstrates that the proposed CDM activity is not part of the baseline scenario and is, therefore, additional.

B.6. Emission Reductions:

B.6.1. Explanation of methodological choices:

The project activity does not modify or retrofit an existing electricity generation facility. The baseline scenario is the following:

Electricity delivered to the grid by the project would otherwise have been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described below.

The baseline scenario is the continuing operation of the existing thermal intensive grid and future expansion mainly through increase in capacity of the system by the addition of new fossil fuel based generation sources. In the project scenario, the same electricity demand is met with the incremental contribution of the Project electricity generation. Because the Project uses a renewable source to produce electricity, there are no additional emissions from the Project activity and emissions attributable to an equivalent thermal plant are saved.

"Tool to calculate the emission factor for an electricity system, ver 2, EB 50 Report Annex 14" has been used to calculate the baseline emission factor as a combined margin (CM) – consisting of the simple average of the weighted operating margin emission factor (OM) and weighted build margin emission factor (BM) by utilizing an ex-ante 3 years data period.

$EF_y = w_{OM} * EF_{OM,y} + w_{BM} * EF_{BM,y}$

The default weights of w_{OM} and w_{BM} are 50% (i.e., $w_{OM} = w_{BM} = 50\%$).

All margins are expressed in tCO_2/MWh.

The baseline emissions are calculated using the following four steps:

- STEP 1 - Calculate the OM emission factor.
- STEP 2 – Calculate the BM emission factor.
- STEP 3 – Calculate the combined margin (CM) as baseline emission factor.
- STEP 4 – Calculate baseline emission reductions.

STEP 1 – Calculate the Operating Margin Emission Factor ($EF_{OM,y}$)

The tool prescribed by UNFCCC offers 4 options for calculating OM:

(a) Simple OM
(b) Simple adjusted OM
(c) Dispatch Data Analysis
(d) Average OM

The methodology of choice should be Dispatch Data Analysis, however, as prescribed and allowed in the methodology the Simple OM has been selected for the following reasons:

(i) The National Transmission & Dispatch Company (NTDC) of Pakistan operates the national dispatch center but detailed hourly dispatch data is not available in the public domain.
(ii) Low cost must run resources constitute less than 50% of the total grid generation in average of the five most recent years.

The simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants:

$$EF_{grid,OM,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y}$$

Where:

$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	Amount of fossil fuel type *i* consumed in the project in year *y*
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type *i* in year *y*
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type *i* in year *y*
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants, in year *y*
i	All fossil fuel types combusted in power plants in year y
y	The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option); in this case 2007-2009

The information has been utilized as follows:

The consolidated grid system generation and energy statistics (Pakistan Energy Yearbook published by Hydrocarbon Development Institute of Pakistan) have

been available in Pakistan for several years and being reliable official data are being used to compute the required factors. Pakistan comprises two distinct grids – the national grid and the Karachi Electricity Supply Company (KESC) grid. Each grid has its own independent dispatch center and generation and distribution system. Though interconnected for occasional supply from the national grid to KESC in the range of 400-600 MW, there are no material interdependencies between the two grids. The generating plants for each grid are clearly identifiable and data for each grid is available. By separating KESC generation the emission factors for the national grid are reduced, thus providing an accurate and conservative estimate of the impact of the new plant on emissions.

a) Grid system statistics have been analyzed for five years to provide evidence for under 50% of the system being must run-least cost generation and thus justify use of the Simple OM method;

b) Grid system statistics have been analyzed for the most recent three years to compute the following:

i) Total generation and analysis by type of fuel used
ii) Calorific values of the fuel
iii) Total heat value of the fuel
iv) Emissions and computation of CEF

STEP 2 – Calculate the Build Margin Emission Factor ($EF_{BM, y}$)

The BM is the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants "m" as follows:

The Methodology prescribes that one of the two following options may be selected with the proviso that once selected the Methodology cannot be changed during the crediting period:

a) Option 1: $EF_{BM,y}$ ex ante based on the most recent information of plants already built; or
b) Option 2: $EF_{BM,y}$ updated annually in the first crediting period for actual project emissions and associated emissions reductions and ex-ante thereafter.

Option 1: $EF_{BM,y}$ ex ante, has been selected.

The sample group m consists of the higher in terms of generation of:

i) The five power plants that have been built most recently; **or**

ii) The power plant capacity additions in the electricity system that comprise 20% of the system generation (MWh) and that have been built most recently.

To determine sample group m, the five most recent additions to the system were compared with the additions to the electricity system that comprise 20% of the system generation and that have been built most recently. It was found that the power plant capacity additions in the electricity system that comprise 20% of the system generation and that have been built most recently provided the larger annual generation and were, therefore, selected as the prescribed method stipulated in the Methodology.

The methodology results are as follows:

(a) Five power plants that have been built most recently contributed 6,222,000 MWh to the grid in 2008;
(b) The most recent published total electricity generation (excluding must run) in 2011 was 55,920,000 MWh and 20% of system generation comes to 11,184,000 MWh.

Thus (b) above would be selected and the Build Margin emission factor would be computed based on the sample of the power plant capacity additions in the electricity system that comprises 20% of the system generation (in MWh) and that have been built most recently.

STEP 3 – Calculate the Baseline Emission Factor (EFy)

The Baseline Emission Factor is the weighted average of the OM emission factor ($EF_{OM,\,y}$) and the BM emission factor ($EF_{BM,\,\mathbf{y}}$).

The baseline emissions factor $EFy = w_{OM} * EF_{OM,y} + w_{BM} * EF_{BM,y}$
$= (0.5 * 0.772) + (0.5 * 0.34) = 0.556\ tCO_2/\ MWh.$

STEP 4 – Calculate Baseline Emissions

Baseline emissions are the product of energy generated and the emission factor:

BE = EG * EF

B.6.2. Data and parameters fixed ex-ante:

Data / Parameter:	$F_{i,j,y}$

Data unit:	Metric tons for oil; mmcft for gas
Description:	Amount of fuel
Source of data used:	Pakistan Energy Yearbook 2011, Hydrocarbon Development Institute of Pakistan
Value applied:	Values used for 2011, 2010 & 2009 (See Annex 3)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Methodology requires use of published/official data; the required data has been extracted and collated from such official sources.
Any comment:	None

Data / Parameter:	NCV_i
Data unit:	GJ
Description:	Net calorific value of the fuel; per ton/per mmcft
Source of data used:	Pakistan Energy Yearbook 2011, Hydrocarbon Development Institute of Pakistan
Value applied:	Gas: 930.51 (gross 1033.9 × 90%) Furnace Oil: 40.85 (gross 43.0 × 95%) Diesel: 44.18 (gross 46.5 × 95%) Coal: 27.75 (gross 29.1 × 95%)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Methodology requires use of published/official data; the required data has been extracted and collated from such official sources
Any comment:	None

Data / Parameter:	$EG_{j,y}$
Data unit:	MWh
Description:	Electricity generated
Source of data used:	Pakistan Energy Yearbook 2009, Hydrocarbon Development Institute of Pakistan
Value applied:	Values used for 2009, 2008 & 2007 (See Annex 3)
Justification of the choice of data or	The Methodology requires use of published/official data; the required data has been extracted and collated from such

description of measurement methods and procedures actually applied :	official sources.
Any comment:	None

Data / Parameter:	$COEF_{i,j\,y}$
Data unit:	tCO_2/TJ
Description:	Carbon Emission Coefficient for each type of fuel
Source of data used:	IPCC default values
Value applied:	Gas: 56.1 Furnace Oil: 77.4 Diesel Oil: 74.1 Coal: 94.6
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default values have been used as no reliable national values are available.
Any comment:	None

B.6.3. Ex-ante calculation of emission reductions:

The project activity reduces carbon dioxide through substitution of grid electricity, based on fossil fired power plants, with renewable electricity. The emission reduction ERy by the project activity during a given year y is the difference between the baseline emissions (BEy), project emissions (PEy) and emissions due to leakage (Ly) as follows:

ERy = BEy - PEy - Ly

For the project activity PEy and Ly = 0 and ERy the emissions reduction is equal to BEy in tCO_2.

As computed in annex III the combined margin $EF_{CM,y} = w_{OM} * EF_{OM,y} + w_{BM} * EF_{BM,y}$ is 0.4973

The electricity supplied by the project activity to the grid is EGy in MWh and the emission reductions can be calculated as ERy (tCO_2) = EFy * EGy.

Thus ERy = 0.4973 * 76,037 = 42,275 tCO_2

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
2012	0	42,275	0	42,275
2013	0	42,275	0	42,275
2014	0	42,275	0	42,275
2015	0	42,275	0	42,275
2016	0	42,275	0	42,275
2017	0	42,275	0	42,275
2018	0	42,275	0	42,275
Total	0	295,925	0	295,925

B.7. Monitoring Plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	EG_y
Data unit:	GWh
Description:	Electricity delivered by the project activity to the national grid under the power purchase agreement (PPA).
Source of data to be used:	(a) Measured by the metering system in accordance with a transparent and strict procedure as agreed in the PPA; (b) Confirmed by officially published generation data provided in the Pakistan Energy Yearbook; (c) Direct confirmation from the power purchaser.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The annual generation of the 76,037,488 kWh is the basis for computation of emissions through application of the Combined Margin. The given generation is based on the calculated energy output agreed with the power purchaser; the estimate of generation may be subject to some variation.
Description of measurement methods and procedures to be applied:	All requirements for metering will be in accordance with the PPA and a sample summary extracted from a PPA is as follows: 1) There will be installed a metering system and a back-up metering system; furthermore, there will be magnetic media and a sequential event recorder; 2) Testing of the metering system will be part of the complex commissioning procedures; 3) Inaccuracy of the metering system to be not greater than 0.2%; 4) Joint sealing of metering system after any inspection/examination; 5) Reading and recording, thereof, at the beginning of each day; 6) Joint reading with power purchaser's representative on the last business day of each month.
QA/QC procedures to be applied:	*In accordance with QA/QC procedures:* 1) The metering system and the back-up metering system will be under continuous surveillance and in the event of greater than specified inaccuracy recalibration is specified; 2) Seals will be checked regularly; 3) Cross checking between the different metering systems

	will be carried out.
Any comment:	Meter tampering is a company act of default and may lead to termination by the power purchaser.

B.7.3. Other Elements of monitoring plan:

The generation and delivery of electricity to the power purchaser under the terms of the PPA is a well-structured activity. The critical areas which are relevant under the approved methodology ACM0002 are to ensure that the estimation of emissions reductions under the methodology is a reasonable estimate of the actual emission reductions during the crediting period. To achieve this objective the measurement of emissions will be carried out throughout the crediting period through a well-organized and managed organizational structure and an adequate monitoring plan.

The *ex-ante* estimate of the emissions is derived from *ERy (tCO_2) = EFy * EGy.* The critical functions are (a) the project generation and (b) baseline emission factor established *ex ante*. The monitoring would focus on these aspects with greatest attention to the project energy generation and any leakages as the other element, i.e., baseline emission factor is a function of computational work performed on official published data publicly available and given that the methodology once selected and applied cannot be changed.

A CDM directorate will be established with a three- member core team and other clerical support staff with the following broad structure:

i) The CDM directorate will function as the auditors for the project and related CDM activities. Standard procedures, forms and tests will be developed and designed to carry out the audit work and achieve the required objectives and output.

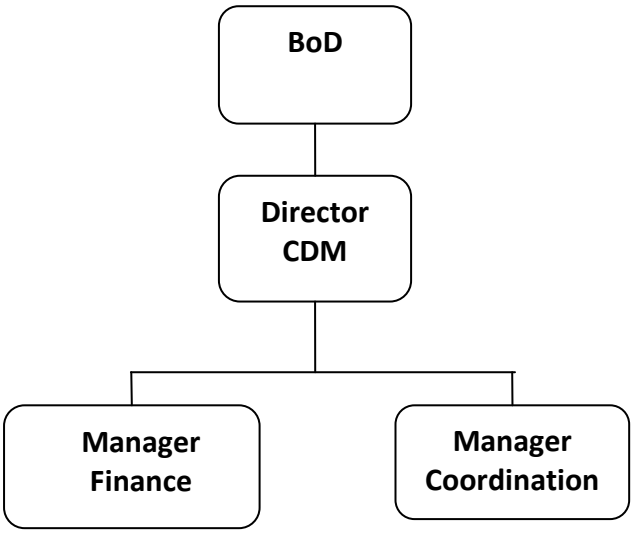
ii) At the end of each year of the crediting period, the gross annual generation of the Project and electricity delivered to the national grid will be certified by the Company. Such certification will be verified and authenticated through the Power Purchaser, the Company's Annual Accounts and any other authentic published or unpublished sources and/or Government or statutory bodies.

iii) Such information will be used to compute the Avoided emissions of CO_2 by the Project, using the combined Margin and Project's actual generation for the year, applying the formulae and methodology as described in section B.6.1 of this document.

iv) The project is a solar PV project with well-defined project 'boundaries', without any significant 'leakage' and with a good quality of official published data related to generation and fuel consumption covering all projects in the national grid. The baseline will be subject to revalidation for each crediting period based on such reliable data. The only critical task is the independent and reliable verification of project metering and for solar PV projects this is a relatively simple task. It is worth pointing out that no special training for such monitoring would be required; professionals either with a finance or management background would be considered to be of sufficient caliber to undertake this simple task which would be dealt with in normal procedures and operations within the project management plans.

v) Procedures and preparedness for dealing with emergencies that could cause unintended emissions are most relevant and significant for CDM projects dealing with thermal/combustion technologies, e.g., condensate flare gas generation, agricultural waste based generation, methane recovery and combustion, landfill gas based generation, etc. A solar PV project faces none of such issues. Other than a minor accidental fire in an office environment which may result in insignificant unintended emissions, it is not expected that any of the emergencies envisaged for a solar PV project of this type would turn into emergencies that would or could result in emissions.

Organization Chart of CDM Directorate



In addition, responsibility will be assigned to the O&M operator to develop emergency procedures. The data monitored and required for verification and issuance will be archived and maintained for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever, occurs later.

III. SECTION C: Duration and crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

Jan 2013

C.1.2. Expected operational lifetime of the project activity:

The term of 25 years as agreed and incorporated in the power purchase agreement

C.2. Crediting period of project activity

C.2.1. Type of Crediting Period:

9 years, Plus 1 year grace

C.2.2. Start Date of Crediting period

Jan 2013

C.2.2. Length of Crediting period

10 years

IV. SECTION D: Environmental impacts

D.1. Analysis of Environmental Impacts:

The operation of the proposed project will not discharge wastewater, nor emit air pollutants to the local environment. Noise from the construction will have little impact on the neighborhood as the project area is away from populated areas. The soil extracted will be refilled, thus neither causing damage to vegetation, nor any water and soil degradation.

Therefore, we conclude that the environmental impact of the proposed project is minor, and the proposed
project is definitely an environment friendly way of providing power.

D.2. Environmental Impact Assessment:

No significant negative environmental impact is expected from this project activity.

V. SECTION E: Local Stakeholder Consultation

E.1. Solicitation of comments from local stakeholders:

The project follows a three-part dialogue process with the local community. In the First Dialogue, the nearby community comprising of approximately a dozen mud houses with scarce population, as it is the middle of the Cholistan desert with harsh conditions for life to prosper, are briefed about the nature of the solar Photovoltaic' s power project, the intended outcomes and mutual obligations between the Project Owners towards the community and vice versa. After which the technical staff of Welt Konnect (Pvt) Ltd. worked with the community representatives to assess the solar resource of the desert area, survey potential sites and prepare cost estimates.

The outcome of this initial spade work paves the way for the Second Dialogue which consists of conducting of the feasibility study. Survey results, Site selected, duration of construction and cost estimates are presented to a full meeting of the locals and their feedback requested. A design and cost estimation of the project is completed based on the feasibility study.

Following this a general meeting of the community which will benefit through economic activating in the region and job creation, will be called upon in the village premises to initiate the project (3rd Dialogue). During the Third Dialogue, jobs will be allocated to members of the beneficiary community, and the implementation of the project initiated.

Comments are invited from community members at each step of the dialogue process. The received comments, their response and agreed upon actions are compiled by Welt Konnect (Pvt) Ltd. after each of the Dialogue steps.

In addition to detailed interaction with the beneficiary community, WK (Pvt) Ltd has had discussions about the project with several public and private sector partners. These are other local stakeholders in the development of the Solar PV Power Projects. Discussions have so far been held with the Cholistan Development Authority (CDA); the Punjab Power Development Board (PPDB), Alternative Energy Development Board, and the Pakistan Council for Renewable Technology (PCRET). These discussions are recorded.

The host country DNA does not have any specific requirements for public consultation as a requirement for project approval other than what is included in the IEE/EIA process. The Federal and Provincial environmental authorities require compliance with their policies with respect to the projects, on account of which a No

Objection Certificate (NOC) has been issued by the Federal Ministry of Water and Power.

E.2.
Summary of comments received:

The comments received from the beneficiary community have in generally been highly encouraging. The Community is very interested in moving ahead with the project. However they do have comments and questions concerning the details of the project. Comments received include the following:

1. Who will provide the land for the construction of the project? And will it affect their lifestyles in anyway?
2. Who will be responsible for project management and maintenance after completion of the project?
   Who will be the employer in case they take jobs which will be offered to them?
3. What kind of jobs will be provided to them?
4. Will they receive training for such jobs?

The meetings with the public and private sector partners have resulted in the following actions:

1. CDA in collaboration with the Board of Revenue of Punjab (BOR) has allocated 5000 Acres of Land for Solar Power Projects in the area with approval of the Honorable Chief Minister of Punjab Mr. Shahbaz Sharif. A specific emphasis is on developing solar project in that part of Punjab now. Private Sector Entities, NGOs and other organizations are being encouraged to invest in Solar Power projects and to develop them as CDM project
2. PPDB has been provided the responsibility to manage and lease the land to interested parties.
3. PPDB is considering developing a team to focus primarily on CDM Projects and Renewable Energy in the area and may enter into a cooperative arrangement with WK (Pvt) Ltd to assist in the process and capacity building measures.

E.3. Report on consideration of comments received:

Comments and questions from the local community are responded to during public meetings. All outstanding issues, if any, are resolved before taking the next step. A record of the Minutes of such meetings is maintained by the staff of WK (Pvt) Ltd.

VI. SECTION F Approval and Authorization

Host Country Approval attached at the end of the volume.

Appendix 1: Contact information of project participants

Organization:	Welt Konnect/Trans Tech Pakistan
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URL:	www.weltkonnect.com
Represented by:	
Title:	Director
Salutation:	Mr.
Last name:	Khan
Middle name:	Ahmed
First name:	Habil
Department:	Operations
Mobile:	(92)300-514-0020
Direct FAX:	(92)-51-287-0424
Direct tel:	
Personal e-mail:	habil@weltkonnect.com

Appendix 2: Affirmation regarding public funding

The project activity does not involve any public funding from Annex 1 countries.

Appendix 3: Applicability of Selected methodology

- Refer to Section B.2 for complete Justifications of Monitoring Methodology,
- Refer to Section B.6.1 for complete Justifications of Emission Reduction Methodology

Appendix 4: Further background information on ex-ante calculation of emission reductions

The Baseline Methodology stipulates that baseline emission be calculated using the formulae contained in the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources (ACM0002)".

The baseline emission factor is calculated as the combined margin (CM) of the grid to which the Project is connected. The CM is defined as the weighted average of the OM and the BM. Baseline emissions are calculated for the Project as outlined below:

- STEP 1 - Calculate the OM emission factor
- STEP 2 – Calculate the BM emission factor
- STEP 3 – Calculate the baseline emission factor (CM)
- STEP 4 – Calculate baseline emission reductions

STEP 1 – Calculate the OM Emission Factor

As stated in B6.2 the Simple OM method (method a) from ACM0002 is selected to calculate the OM for the Project.

The Simple OM is defined as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all generating sources serving the system, not including low-operating cost/ must-run power plants.

Both the state run electricity authority (WAPDA) and a number of IPPs supply electricity to NTDC. This makes accurate data collection difficult. However, actual data is available for the last five years on the aggregate fuel consumption / electricity generation for each generation type in Pakistan Energy Year Book published by Hydro Carbon Development Institute of Pakistan.

No local values for carbon emission factors are available yet and accordingly IPCC default values for calorific values and carbon emission factors were used for different fuel types in the PDD, in compliance with ACM0002. Thus, the data supplied by WAPDA is used along with IPCC figures to calculate OM.

Table 3.1 (GWh)[9]

Year	Total	2011	2010	2009	2008	2007
Hydro	148,348	31,811	28,093	27,784	28,707	31,953
Nuclear	12,828	2,952	2,894	1,617	3,077	2,288
Total Least Cost/Must Run	161,176	34,763	30,987	29,401	31,784	34,241
%	34.18%	38.33%	32.50%	32.09%	33.23%	34.86%
Natural Gas	149,112	22,621	28,079	29,678	32,923	35,811
Oil	160,627	33,186	36,175	32,423	30,818	28,025
Coal	614	113	116	113	136	136
Total Thermal	310,353	55,920	64,370	62,214	63,877	63,972
%	65.82%	61.67%	67.50%	67.91%	66.77%	65.14%
Total System	771,529	90,683	95,357	91,616	95,661	98,213

As table 3.1 above shows the least cost/must run plants represent hydropower and nuclear; as such generation is less than 50% over the latest 5 year period this can be excluded from the computation of emissions for the OM factor.

Tables 3.2 – 3.5 below show the computations for OM factor for years 2009 to 2011 and the summary. The composite number for OM factor is 0.772.

[9] Pakistan Energy Yearbook 2009

Table 3.2[10]: *OM Factor -2011*

Type of Fuel	Electricity Generated *(GWh)*	Fuel Used		Grid Emission *(tCO_2)*	EF = C/A *(tCO_2/MWh)*
Hydroelectric	31,811				
Nuclear (Chasnup)	2,731				
Nuclear (Kanup)	221				
Total	**34,763**				
Natural Gas	22,621	337,401 MMCFT	6,493,766 TOE	20,130,675	
Furnace Oil	33,186		7,827,500 TOE	24,265,250	
Diesel Oil			105,160 TOE	325,996	
Coal	113	96,488 t	43,169 TOE	133,823,	
Total Thermal	**55,920**			**44,855,744**	**0.811**

[10] Pakistan Energy Yearbook 2011,

Table 3.3: ***OM Factor -2010***

Type of Fuel	**Electricity Generated** ***(GWh)***	**Fuel Used**		**Grid Emission** ***(tCO_2)***	**EF = C/A** ***(tCO_2/MWh)***
Hydroelectric	28,093				
Nuclear (Chasnup)	2,257				
Nuclear (Kanup)	637				
Total	**30,987**				
Natural Gas	28,079	366,906 MMCFT	7,106,962 TOE	22,031,582	
Furnace Oil	36,175		8,339,330 TOE	25,851,923	
Diesel Oil			262,799 TOE	841,677	
Coal	116	125,482 t	56,141 TOE	174,037	
Total Thermal	**64,370**			**48,899,219**	**0.759**

Table 3.4: ***OM Factor -2009***

Type of Fuel	Electricity Generated *(GWh)*	Fuel Used		Grid Emission *(tCO_2)*	EF = C/A *(tCO_2/MWh)*
Hydroelectric	27,784				
Nuclear (Chasnup)	1,142				
Nuclear (Kanup)	475				
Total	**29,401**				
Natural Gas	29,678	404,140 MMCFT	7,830,065 TOE	24,273,201	
Furnace Oil	32,423		7,210,211 TOE	22,351,654	
Diesel Oil			173,947 TOE	539,235	
Coal	113	12,520 t	50,341 TOE	156,057	
Total Thermal	**62,214**			**47,320,147**	**0.760**

Table 3.5: ***OM Summary***

Year	Electricity Generated – Thermal *(GWh)*	Grid Emission *(tCO_2)*	EF *(tCO_2/MWh)*
2011	**55,920**	**44,855,744**	
2010	**64,370**	**48,899,219**	
2009	**62,214**	**47,320,147**	
Grand Total	**182,504**	**277,546,281**	**0.772**

STEP 2 – Calculate the BM Emission Factor

According to the Methodology, the Build Margin is defined as the generation-weighted average emission factor of either five most recent or the most recent 20% of power plants built (in terms of generation), whichever group's annual generation is greater. Both lists of plants exclude CDM-status plants.

- Five power plants that have been built most recently contribute 6,222,000 MWh to the grid;
- The most recent published total electricity generation (excluding must run) in 2011 was 55,920,000 MWh and 20% of system generation comes to 11,184,000 MWh.

As 20% of the most recent published generation in the system (2011) is greater than the generation of the five most recent plants built, it was decided to consider the BM based on the most recent 20% of power plants built.

Table 3.6

Power Plant	Electricity generated* GWh	Fuel type*	Date of Commissioning	Fuel burnt** TOE	CO_2 Emission*** Ton	EF_{BM}
Liberty Power Tech	760	oil	13-01-11	181,667	563,169	
Nishat Chunian Power	1416	oil	21-07-10	338,475	1,049,273	
Orient Power	1000	gas	24-05-10	250,927	777,876	
Engro Energy Ltd	1563	gas	27-03-10	392,200	1,215,820	
Attock Gen	1483	oil	17-03-09	354,490	1,098,921	
Ghazi Barotha	7434	hydro	**-**-04	0	0	
Total	**13,656**			**1,517,761**	**4,705,061**	**0.34**

*Data acquired from Pakistan Energy Yearbook 2011
** Due to unavailability of data fuel burnt was calculated from ratios of energy generated from fuel type to power plant times the electricity generated by the powerplant
*** CO_2 emission = fuel burnt * NCV * emission factor (fuel type)

Table 3.7

	Coal	Oil	Gas
Electricity Generated (GWh)	86	33186	25879
Fuel Burnt (TOE)	43169	7932660	6493760

***** Data acquired from Pakistan Energy yearbook 2011

Table 3.8

crude oil values	
NCV	Emmision Factor
TJ/kt	Kg/TJ
42.3	73300

* Data acquired from IPCC 2006

STEP 3 – Calculate the Baseline Emission Factor

The Baseline Emission Factor was calculated as combined margin (CM), consisting of simple average of both the resulting OM and the resulting BM. All margins are expressed in tCO_2/ MWh.

The baseline emissions factor $EFy = w_{OM} * EF_{OM,y} + w_{BM} * EF_{BM,y}$
$= (0.5 * 0.772) + (0.5 * 0.34) = 0.556\ tCO_2$/ MWh.

STEP 4 – Calculate Baseline Emission Reductions

The electricity supplied by the project activity to the grid EGy in MWh will be 76,037 MWh and the emissions reductions can be calculated as ERy (tCO_2) = EFy * EGy.

Thus $ERy = 0.556 * 76,037 = 42,275\ tCO_2$

The computation of 42,275 tCO_2 represents the most conservative estimate of the emissions reductions that would arise from the project activity and would be the applicable emissions reductions for the crediting period.

Table 3.7: *Combined Margin*

Segment	Margin	Weightage	Combined Margin
OM	0.772	0.5	0.386 tCO_2/MWh
BM	0.34	0.5	0.17tCO_2/MWh
CM			0.556 tCO_2/MWh
Generation			76,037 MWh
CERs/Yr			42,275

Appendix 5: Further background information on Monitoring plan

The directorate established by the Company will prepare and submit monthly reports and institute procedures to monitor:

(a) Daily electricity readings of the metering system, the backup metering system, the magnetic media and the sequential event recorder;

(b) Monitoring of the monthly meter reading on the last business day of the month;

(c) Maintaining a log showing comparison of the data readings from each source and investigating discrepancies, if any;

(d) Maintaining a log of meter calibrations;

(e) Receiving, tabulating and comparing billing data for energy generation and comparing with meter data;

(f) Extracting data from official published sources and comparing with cumulative meter reading data;

(g) Extracting data from audited accounts and comparing with meter reading data;

(h) Computing emissions in tCO_2 on a monthly basis from all data and estimates collected and compare with ex ante estimates which form the basis for CERs during the crediting period.

(i) Development of a reporting structure with monthly, quarterly and annual reports;

Appendix 6: Summary of post registration changes

Not Applicable at this stage.

HOST COUNTRY APPROVAL

FROM :ENERCON FAX NO. :9202657 15 Aug. 2012 12:20PM P1

Tel: 92-51-9245528
Fax: 92-51-9245533

F. No. MoCC/CDM/HCA-1(47)/2012

GOVERNMENT OF PAKISTAN
Ministry of Climate Change
Clean Development Mechanism
4th Floor, ENERCON Building,
Sector G-5/2, Islamabad, PAKISTAN
****

Director General
(Environment)

Islamabad, the 13th August, 2012

Subject: **Grant of Host Country Approval to CDM Project Titled "50 MW Solar Project in Cholistan, Pakistan".**

This is to inform you that the Clean Development Mechanism (CDM), Project Design Document (PDD) for "50 MW Solar Project in Cholistan, Pakistan" was considered by the Designated National Authority (DNA) in the Ministry of Climate Change.

2. The DNA hereby approves the above mentioned project as:

a. The project activity is the installation of 50 MW electricity generation plant designed to produce electricity by solar energy in Cholistan Desert, in the province of Punjab, Pakistan. It is expected that the project will reduce significant amount of CO_2 and project is a Zero (0) carbon producing form of energy generation, using 100% of renewable source of production of 50 MW of power through highest standard of photovoltaic panels.

b. The project will contribute to sustainable development and improvement of local environmental conditions in Pakistan.

c. This approval is for the voluntary participation of the WELT KONNECT (Pvt.) Ltd in the proposed CDM project activity.

3. It may further be noted that Government of Pakistan has got accession to the Kyoto Protocol on 11th January, 2005.

(Jawed Ali Khan)
Director General (Environment)

(Mr. Habil Ahmad Khan)
Director Operations,
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