

第4章 プロジェクトの妥当性の検証

4-1 プロジェクトの効果

(1) 直接効果

PV システムによる年間発電電力量: 315 MWh/年

$$= 5.24(\text{kWh/m}^2 \cdot \text{day}) \times 220 \text{ kWp} \times 365 \text{ days} \times 0.75 (\text{システム効率})$$

(5.24 kWh/m² · day: 設置予定地の年平均日射量(NASA data)
(<http://eosweb.larc.nasa.gov/cgi-bin/sse/>)

1) 電気料金の低減

計画委員会、技術委員会の年間電力使用量は合計で 980 MWh(内訳: 計画委員会 639,280 kWh、技術委員会 341,244 kWh (いずれも 2008 年 11 月から 2009 年 10 月までの 1 年間の実績値))であり、計画の PV システムによる年間発電電力量 315 MWh は、合計の電力使用量の約 32%に相当する。PV システムの発電電力量により削減される電気料金は、PKR 1.77 百万 /年となる。(= イスラマバード電力供給公社大口契約料金 Rs.5.62/kWh (技術委員会における契約料金・オフピーク時間帯・付加価値税を含まない)×315 MWh)

2) 二酸化炭素排出量の削減

パキスタンで使用されている排出係数デフォルト値の 0.486 t-CO₂/MWh に基づいた場合、PV システムの年間発電電力量による二酸化炭素排出量の削減量は、153 t-CO₂/年となる。(= 315 MWh/年 × 0.486 t-CO₂/MWh)

3) デモンストレーション効果

計画委員会は、中央開発部会(CDWP: Central Development Working Party)の全セクターの会議会場であるため、各省庁の代表が毎月集まる。また、大統領や首相が参加する会議も開催される場所であることから、国内外の来客も計画委員会を多く訪問する。しかし、これらの来客数の定量化は困難である。

技術委員会には、16 万以上の技術者、技術コンサルタント業者、関連業者が登録されており、毎年 1 万の新規登録や登録更新がある。また、情報入手等の目的を含めると毎年 2 万以上の会員の技術委員会への来訪がある。パキスタン国外の業者であっても、パキスタンで事業を行う場合には登録の必要がある。

施設内に本計画の案内板を設置し、国内外からの来訪者に本計画の効果を示すことが可能である。

(2) 間接効果

1) 再生可能エネルギーの導入促進

本計画により設置される系統連系 PV システムは、パキスタンで最初の系統連系 PV システムである。今後の再生可能エネルギーによる発電施設の導入や系統連系の普及、促進に繋がると考

えられる。

また、技術委員会は、パキスタン国内の各地に PV システムを設置するプロジェクトである PMISP (Prime Minister's Initiative for Solar Power) の実施機関となったことから、本計画による設置・運用管理経験の蓄積は、PMISP の実施にも有効であると考えられる。

また、本計画において実施するソフトコンポーネントにより、系統連系 PV システムに関わる運営・維持管理、トラブルシューティングの技術移転を行う。これにより、太陽光発電に係る技術者のみならず、系統側の技術者の育成にも貢献できる。

2) 啓発効果

計画委員会の議長(Chairman)は首相であり、計画委員会は国家計画の策定やその議論、各国との会議やセミナー等が行われる場所でもあることから、パキスタン国内外の政策決定者である政府高官に対する再生可能エネルギーの啓発効果が期待できる。

他方、技術委員会は、関連事業者や技術者に義務付けられている登録やその更新を行う場所であること、定期的開催される会議やセミナーの会場ともなることから、関連事業者や技術者が訪問するケースが多い。このことから、多くの関連事業者や技術者が系統連系 PV システムについて理解することが期待できる。技術委員会の設置サイトは公道に面しており、一般車両や市民の通行も多いことから、一般市民への啓発効果も期待できる。

また、本計画において実施するソフトコンポーネントにより、太陽光発電の役割や地球温暖化対策への一般市民の理解を深め、エネルギーの効率的な利用に対する意識の向上を図ることが可能である。

4-2 課題・提言

本事業は、パキスタンで最初となる太陽光発電の系統連系プロジェクトであり、解決すべき課題も多く残されている。主な課題と提言を以下に示す。

課題

- 太陽光発電を系統連系するための技術基準が整備されていない。
- 系統連系の太陽光発電に関する技術者が育成されていない。
- 再生エネルギーの環境啓発活動に関する体制および組織が整備されていない。

提言

- 系統連系技術基準等を整備する必要がある。
- 技術者教育に用いられるマニュアル類を整備する。
- 導入設備を用いた環境啓発活動が行われるような体制を整備する。

4-3 プロジェクトの妥当性

1) ショーケース効果

首都イスラマバードに位置する(1)政策決定者等が多く訪れる PC サイト、(2)一般市民の往来も多い一般公道に面した PEC サイトであり、プロジェクト案内板、表示パネルにより施設を効果的にアピールする。

2) 我が国に優位性のある技術・ノウハウの積極的活用

パキスタンでは、本件と同様の系統連系型の太陽光発電に関する導入実績はない。一方で、系統連系の PV システムは、我が国で実績も多く普及している技術である。信頼性の高い日本製品を調達し、メーカーの専門員による技術指導により技術移転を図る。

3) 持続的な維持管理体制の構築等

パキスタンでは、系統連系型の太陽光発電設備に関する実績がないため、維持管理を行う技術者を対象としてソフトコンポーネントを実施し、持続的な維持管理体制を構築する。

4) 発電電力

本プロジェクトで導入する PV システムの発電容量は 220 kWp であり、年間約 315 MWh の発電量が期待できる。PC、PEC の必要電力量の 3 割程度の発電が期待できるため、両施設の電気料金の低減が期待できるとともに、主に休日等に生じると想定される余剰電力の系統への売電による売電収入が見込める。

5) 温室効果ガスの削減量

本協力対象事業の PV システムの発電による二酸化炭素排出削減量は、年間で約 153 t-CO₂ に達することが期待され、パキスタンの気候変動対策に寄与することが出来る。

6) 環境教育

本協力対象事業で実施するソフトコンポーネントにおいて、導入する設備を利用した環境啓発活動を行う計画である。

4-4 結論

本協力対象事業の上位目標は、パキスタンの再生可能エネルギー導入促進のための制度整備と再生可能エネルギー導入の実績を高めることである。本プロジェクトはこの上位目標とも整合性が取れており、首都イスラマバードに系統連系される PV システムを設置することで、大きなショーケース効果が期待できる。また、多くの二酸化炭素を排出する石油火力で電力の多くを賄っているパキスタンでは、再生可能エネルギーの導入による二酸化炭素の削減効果は非常に高く、地球温暖化対策に十分寄与することになる。更には、メーカーの専門員による技術指導およびコンサルタントによるソフトコンポーネントにより、技術移転、人材育成を実施し、持続的な運営・維持管理体制を整備することにより、再生可能エネルギーの普及に繋がるものである。

資 料

資料 1. 調査団員氏名

資料 2. 調査行程

資料 3. 関係者(面会者)リスト

資料 4. 討議議事録(M/D)

資料 5. ソフトコンポーネント計画書

資料 1. 調査団員氏名

福地 智恭	業務主任/系統連系太陽光発電システム
ディパック ビスタ	副業務主任/太陽光発電システム全般
鳥喰 貞次	機材・設備計画
小川 良輔	調達計画/積算 2
JM プラダン	制度・基準/系統運用
松村 みか	環境社会配慮/温室効果ガス削減効果評価

資料 2. 調査行程

福地 智恭 業務主任/系統連系太陽光発電システム

- 第1次現地調査: 2009年7月6日～7月18日
- 第2次現地調査: 2009年10月21日～10月31日
- 第3次現地調査: 2010年3月29日～4月2日

ディパック ビスタ 副業務主任/太陽光発電システム全般

- 第1次現地調査: 2009年7月6日～7月18日
- 第2次現地調査: 2009年10月21日～11月20日
- 第3次現地調査: 2010年3月29日～4月2日

鳥喰 貞次 機材・設備計画

- 第2次現地調査: 2009年10月26日～11月9日

小川 良輔 調達計画/積算2

- 第1次現地調査: 2009年7月10日～7月18日
- 第2次現地調査: 2009年11月11日～11月27日

JM プラダン 制度・基準/系統運用

- 第1次現地調査: 2009年7月10日～7月18日
- 第2次現地調査: 2009年10月26日～11月16日

松村 みか 環境社会配慮/温室効果ガス削減効果評価

- 第2次現地調査: 2009年10月26日～11月2日

資料 3. 関係者(面会者)リスト

組織	組織(英語)	名前	役職	部署(英語)	連絡先
計画委員会	Planning Commission (PC)	Mr. Parvez Butt	Member	(Energy)	(92)51-9203615
計画委員会	Planning Commission (PC)	Mr. Zia Ud din Azhar	Chief	Energy Information Systems & Computer Section	(92)51-9204951
パキスタン技術委員会	Pakistan Engineering Council (PEC)	Senator.Eng.Mrs.Rukhsana Zuberi	Chairperson		(92)51-2871271, 9222505
パキスタン技術委員会	Pakistan Engineering Council (PEC)	Engr. Nasir Mahmood Khan	Additional Registrar		(92)51-2875875, 2829296 Ext. 235
パキスタン技術委員会	Pakistan Engineering Council (PEC)	Dr. Ashfaq Ahmed Sheikh	Deputy Registrar		(92)51-2876702
パキスタン技術委員会	Pakistan Engineering Council (PEC)	Mr. Khadim H Bhatti	Manager	IT Department	(92)51-9214882
パキスタン技術委員会	Pakistan Engineering Council (PEC)	Mr. Engr. Aijaz Hussain Shah	Assistant Registrar		(92)51-2871271
代替エネルギー開発委員会	Alternative Energy Development Board (AEDB)	Mr. Arif Alauddin	Chief Executive Officer		(92)51-9262956
代替エネルギー開発委員会	Alternative Energy Development Board (AEDB)	Mr. Mujahid Sqdiq	Director General	(International Cooperation)	(92)51-9262947-50 (Ext. 205)
代替エネルギー開発委員会	Alternative Energy Development Board (AEDB)	Mr. Imran Ahmed	Director	(Rural Electrification Program)	(92)51-2215308
電力規制庁	National Electric Power Regulatory Authority (NEPRA)	Engr. Arshad Khan	Registrar		(92)51-9207200
電力規制庁	National Electric Power Regulatory Authority (NEPRA)	Mr. Imtiaz Hussain Baloch	Director Licensing		(92)51-9026527, 9217654 Ext. 327
イスラマバード電力供給公社	Islamabad Electric Supply Company Ltd. (IESCO)	Mr. Muhammad Yousaf Awan	Chief Engineer	(Development)	(92)51-9252908
イスラマバード電力供給公社	Islamabad Electric Supply Company Ltd. (IESCO)	Mr. Nasin Javed	Deputy General Manager	(Planning & Development)	(92)51-9252902
イスラマバード電力供給公社	Islamabad Electric Supply Company Ltd. (IESCO)	Eng.. Abdul Rashid Khattak	Chief Engineer	(Operation)	(92)51-9252902
イスラマバード電力供給公社	Islamabad Electric Supply Company Ltd. (IESCO)	Mr. Habib Ali Bangash	Chief Engineer/Operations Director	(Operation)	(92)51-9252902
イスラマバード電力供給公社	Islamabad Electric Supply Company Ltd. (IESCO)	Mr. Raja Saeed Ahmed	Chief Engineer	(Planning & Engineering)	(92)51-9252902
水資源電力省	Ministry of Water & Power	Mr. Riaz Ahmad Khan	Advisor		(92)51-9213666
水資源電力省	Ministry of Water & Power	Mr. Saif Ullah	Joint Secretary		(92)51-9203187
科学技術省	Ministry of Science & Technology	Mr. M. Kashif Murtaza	Secretary		(92)51-9203416, 9210208
科学技術省 再生可能エネルギー技術委員会	Pakistan Council of Renewable Energy Technologies, Ministry of Science & Technology	Dr. Parvez Akhter	Director General		(92)51-9258228
環境省	Pakistan Environmental Protection Agency, Ministry of Environment	Mr. Asif S. Khan	Director General		(92)51-9267621
環境省	Ministry of Environment	Mr. Syed Amjad Hussain	Acting Head	CDM Cell	(92)51-9205510
首都圏開発公社	CDA	Mr. Amin Mahmud	Project Director (E & M)		(92)51-9253021
首都圏開発公社	CDA	Mr. Qazi M. Omar	Project Director	F-9 Park	(92)51-925302, Cell 0321-5390080

資料 4. 討議議事録(M/D)

次ページ以降に添付

第 1 次現地調査 Minutes of Discussion

第 1 次現地調査 Memorandum of Understanding of Technical Matter

第 2 次現地調査 Memorandum of Understanding of Technical Matter

第 3 次現地調査 Minutes of Discussion

第 1 次現地調査 Minutes of Discussion

**Minutes of Discussions
on the Preparatory Survey
on the Project for Clean Energy Promotion Using Solar Photovoltaic System**

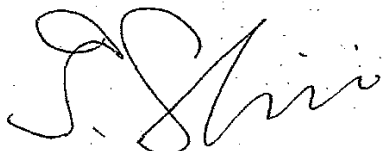
The Government of Japan (hereinafter referred to as "GoJ") has established Cool Earth Partnership as a new financial mechanism. Through this, GoJ is cooperating actively with developing countries' efforts to reduce greenhouse gasses emissions, such as efforts to promote clean energy. A new scheme of grant aid, "Program Grant Aid for Environment and Climate Change", was also created by GoJ as a component of this financial mechanism. According to the initiative of Cool Earth Partnership, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), in consultation with GoJ, decided to conduct a Preparatory Survey (hereinafter referred to as "the Survey") on the Project for Clean Energy Promotion Using Solar Photovoltaic System in Pakistan (hereinafter referred to as "the Project").

JICA sent to the Islamic Republic of Pakistan (hereinafter referred to as "Pakistan") the Preparatory Survey Team (hereinafter referred to as "the Team"), headed by Mr. Tsutomu SHIMIZU, Senior Representative of JICA Pakistan Office, and is scheduled to stay in the country from 6th July to 11th July 2009.

The Team held discussions with the concerned officials of the Government of Pakistan (hereinafter referred to as "GoP") and conducted a field survey.

In the course of discussions and field survey, both sides confirmed the main items described in the attached sheets.

ISLAMABAD, 23 JULY, 2009



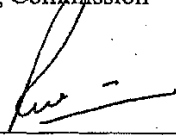
Mr. Tsutomu SHIMIZU
Leader
Preparatory Survey Team
Japan International Cooperation Agency
JAPAN



Mr. Ghulam Muhammad Mahar
Deputy Secretary (ADB/Japan)
Economic Affairs Division



Mr. Parvez Butt HI, 81
Member (Energy)
Planning Commission



Engr. Senator Rukhsana Zuberi
Chairperson
Pakistan Engineering Council

ATTACHMENT

1. Current Situation

GoP has been suffered by the shortage of the power supply. These days the power supply is only for 18-19 hours to the household in the big cities and 12 hours or so in rural areas.

As one of the solutions, GoP has taken the initiative to introduce Solar Energy for the purpose of increasing public awareness to popularize it in the country.

GoP encourages the implementation of Solar Photovoltaic System by means of, for example, Prime Minister's Initiative, introducing Tax Free for Solar Power Equipment etc.

2. Objective of the Project

The objective of the Project is to promote clean energy utilization and achieve emissions reductions by installing the photovoltaic system to be connected to the national grid.

3. Responsible Organization and Implementing Agency

The responsible organization is Planning Commission (hereinafter referred to as "PC"). (The organization chart of the responsible ministry is shown in Annex-1.)

The implementing agency is Pakistan Engineering Council (hereinafter referred to as "PEC"). (The organization chart of the implementing organization is shown in Annex-2.)

4. Items Requested by the Government of Pakistan

4-1. After discussions with the Team, the installation of the on-grid power generating system using photovoltaic including following equipment was requested by the Pakistan side.

- (1) Solar module (panel) total capacity might be around 150 kw
- (2) Junction Box
- (3) Power Conditioner
- (4) Transformer
- (5) Data collecting and display device

4-2. The Pakistan side recommended the following sites as a candidate site/facility for installation of the system, (1) "P" block Pak Secretariat / PC, (2) PEC.

4-3. The Pakistan side explained that there is no duplication between requested contents of the Project and any other plans implemented by the other donors or the Pakistan side.

4-4. The Pakistan side has understood that the final component and the design of the Project shall be determined (confirmed) at the timing of 2nd phase of the Preparatory Survey.

4-5. The Team will report the findings and items requested by the Pakistan side to JICA Headquarters and the GoJ.

5. Japan's Program Grant Aid for Environment and Climate Change

The Pakistan side understood the Japan's Program Grant Aid for Environment and Climate Change scheme explained by the Team, (as described in Annex-3, 4, 5 and 6)

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6. Schedule of the Study

- 6-1. The Team will proceed to further survey in Pakistan until 17th July 2009 as the 1st phase of the Preparatory Survey.
- 6-2. After the completion of the 1st phase of the Preparatory Survey, the Team will report the results to JICA Headquarters and GoJ.
- 6-3. If the Cabinet will approve the Project based on the results of the 1st Preparatory Survey, JICA will conduct the 2nd phase of Preparatory Survey for the basic design.

7. Other Relevant Issues

7-1 Major Undertakings to be taken by Each Government

Pakistan side confirmed that major undertakings as shown in Annex-7 should be taken by GoP at its own budget. In addition, GoP side should be responsible for the following issues;

(1) Securing necessary land

- for PV Modules
- for underground cables between PV Modules and Power Conditioners
- for Power Conditioners

(2) Temporary Stockyard during installation of the equipment and materials

(3) Vehicles for Operation and Maintenance

(4) Tables and PCs, if necessary

7-2 Land Acquisition Procedures

Pakistan side agreed to complete all necessary procedures for official land acquisition for the above 7-1 (1).

7-3 Procurement of Equipment

The Team explained that, in accordance with the policy of GoJ, products of Japan shall be procured for major equipment in the Project. The Pakistan side understood/agreed.

7-4 Coordination of the related Ministries and Agencies

The Responsible Organization for the Project shall be the focal point for the Team, and responsible for the coordination with related organizations.

7-5 Application of the Related Laws and Regulations

The Responsible Organization for the Project shall be responsible for the application of related laws and regulations for the operation of the Grid-Connected PV system before commissioning of the Project.

7-6 Applying JICA Environmental and Social Considerations Guideline

The Team explained the outline of JICA Environmental and Social Considerations Guideline (hereinafter referred to as "the JICA Guideline") to the Pakistan side. The Pakistan side took the JICA Guideline into consideration, and shall complete the necessary procedures

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7-7 Property of Equipment and Materials

The Responsible Organization for the Project shall own the equipment and materials provided under the Project during and after implementation of the Project.

7-8 Operation and Maintenance

The Responsible Organization agreed to secure the necessary budget and personnel for the Operation and Maintenance of Grid-Connected PV system procured and installed under the Project.

7-9 Customs and Tax exemption

The Pakistan side agreed that the Pakistan side shall be responsible for the exemption and/or reimbursement(payment/assumption) of all customs, tax, levies and duties incurred in Pakistan for implementation of the Project.

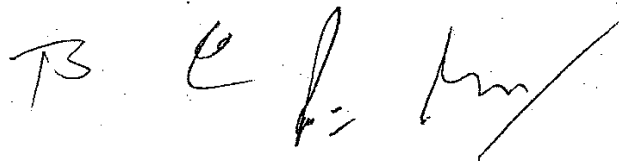
7-10. The Pakistan side shall ensure the security of all concerned Japanese nationals working for the Project, if deemed necessary.

7-11. The Pakistan side shall provide necessary numbers of counterpart personnel to the Team during the period of their studies in Pakistan.

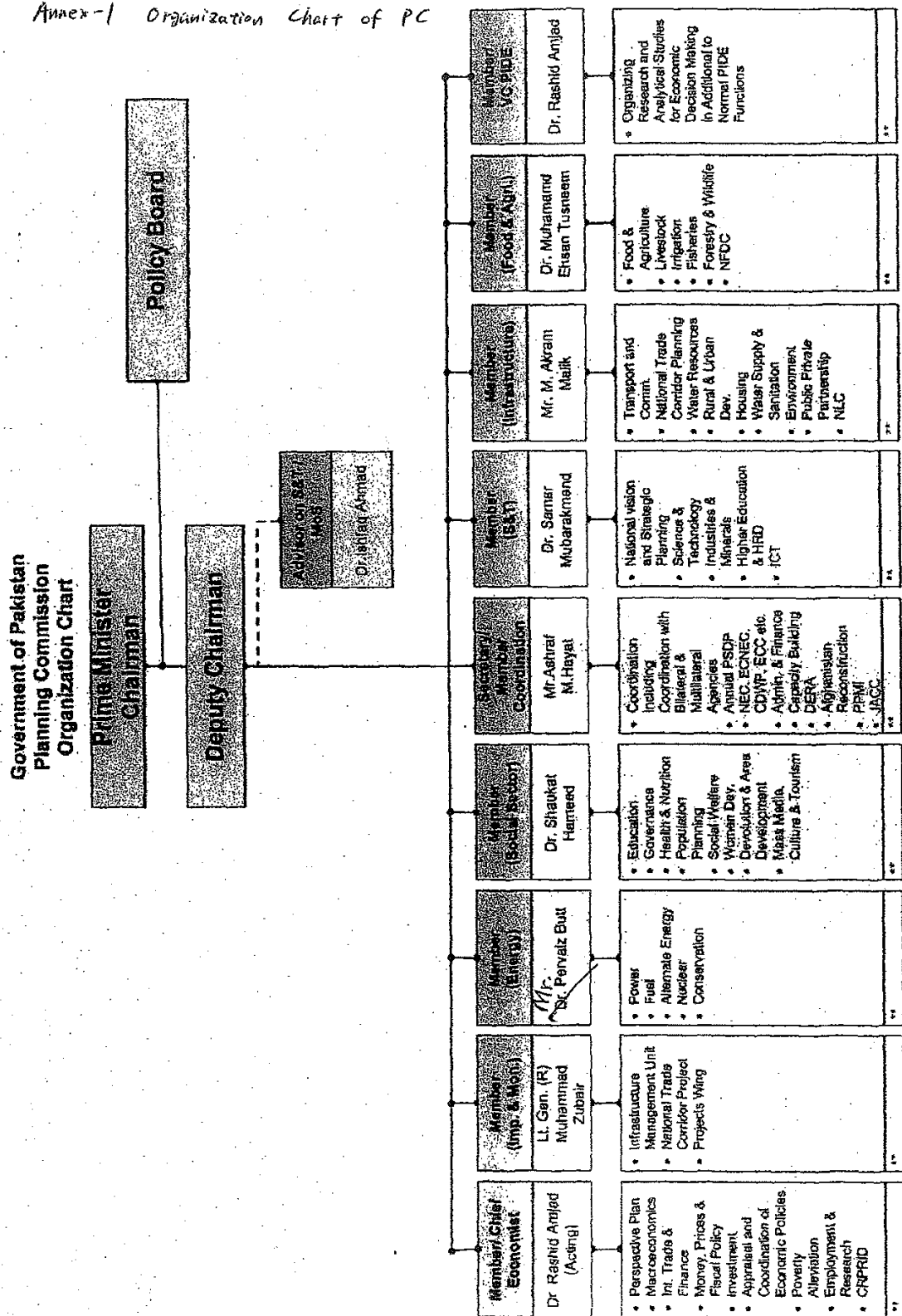
7-12 The Pakistan side shall submit all the answers to the Questionnaire, which the Team handed to the Pakistan side, by 17th July, 2009.

<List of Annex>

- Annex-1 Organization Chart of PC (Responsible Organization)
- Annex-2 Organization Chart of PEC (Implementing Agency)
- Annex-3 Program Grant Aid for Environment and Climate Change
- Annex-4 General Flow of Program Grant Aid for Environment and Climate Change
- Annex-5 Project Implementation System
- Annex-6 Flow of Funds for Project Implementation
- Annex-7 Major Undertakings to be taken by Each Government
- Annex-8 Terms of References of the Consultative Committee

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Annex-1 Organization Chart of PC



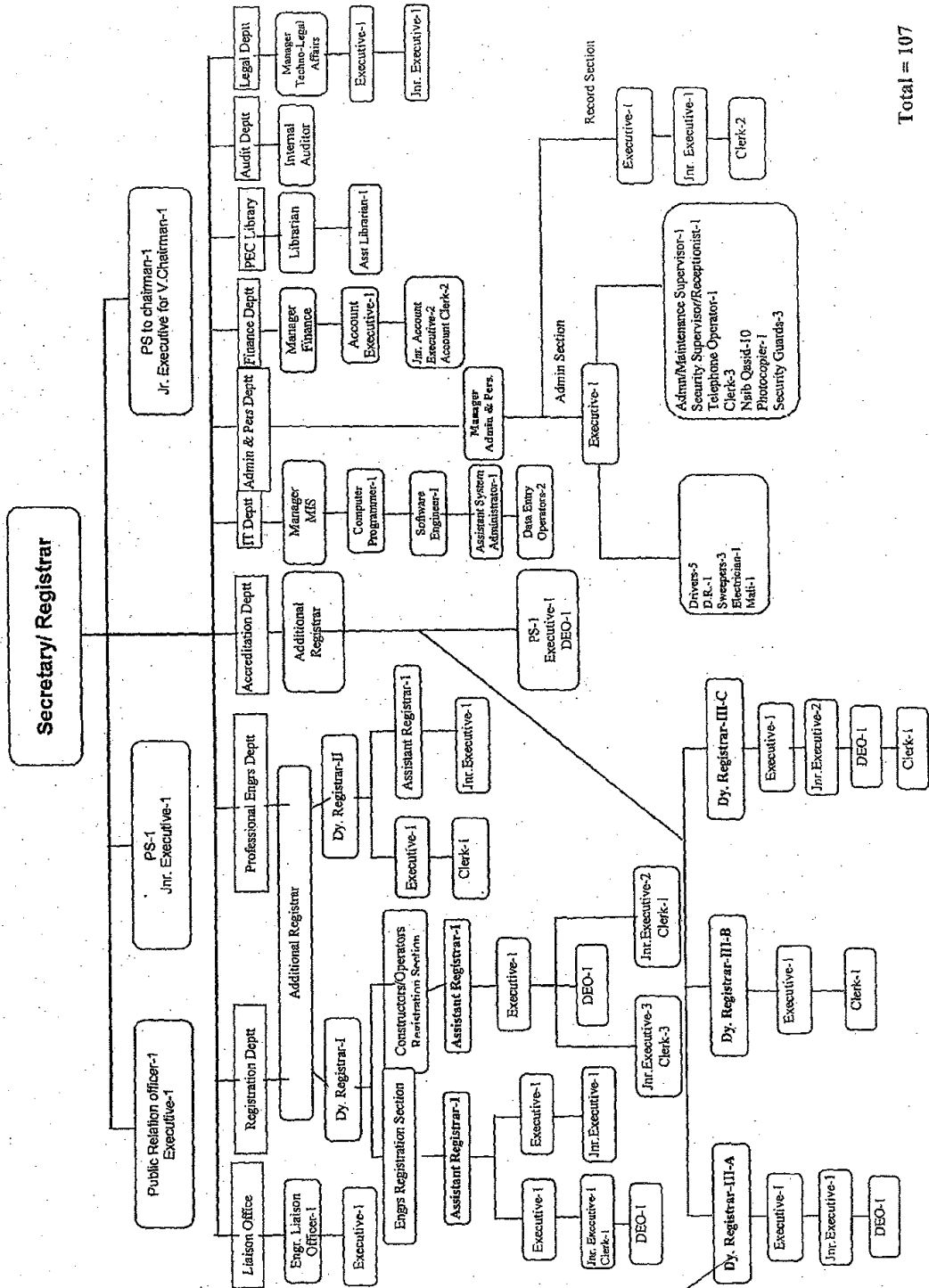
** Any other functions assigned by the Deputy Chairman

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Annex-2 Organization Chart of PEC

PROPOSED ORGANOGRAM OF PEC HQ
ISLAMABAD

Appendix-7
To Annex-G



Total = 107

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Program Grant Aid for Environment and Climate Change
of the Government of Japan
 (Provisional)

The Grant Aid provides a recipient country (hereafter referred to as "the Recipient") with non-reimbursable funds to procure the facilities, equipment, and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

Based on "Cool Earth Partnership" initiative of the Government of Japan, the Program Grant Aid for Environment and Climate Change (hereafter referred to as "GAEC") aims to mitigate effects of global warming by reducing GHGs emission (mitigation; e.g. improvement of energy efficiency) and to take adaptive measures (adaptation; e.g. measures against disasters related to climate change, including disaster prevention such as enhancing disaster risk management). GAEC may contain multiple components that can be combined to effectively meet these needs.

1. Procedures for GAEC

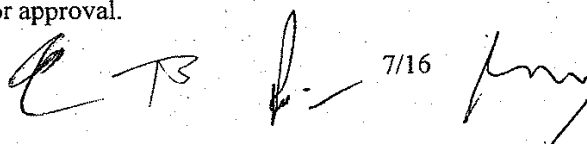
GAEC is executed through the following procedures.

Preparatory Survey 1	Preparatory Survey for projects identification conducted by Japan International Cooperation Agency (JICA)
Application	Request made by a recipient country
Appraisal & Approval	Appraisal by the Government of Japan and Approval by the Cabinet
Determination of Implementation	The Notes exchanged between the Government of Japan and the Recipient Country
Grant Agreement (hereinafter referred to as the "G/A")	Agreement concluded between JICA and the Recipient
Preparatory Survey 2	Preparatory Survey for design conducted by JICA
Implementation	Procurement through the Procurement Agency by the Recipient

Firstly, if the candidate project for a GAEC is identified by the Recipient and the Government of Japan, the Government of Japan (the Ministry of Foreign Affairs) examines it whether it is eligible for GAEC. When the request is deemed appropriate, JICA, in consultation with the Government of Japan, conducts the Preparatory Survey (hereafter referred to as "the Survey") on the candidate project as Phase 1 of the Survey with Japanese consulting firms.

Secondly, the Recipient submits the official request to the Government of Japan, while the appropriateness, necessity and the basic components of the project are examined in the course of Phase 1 of the Survey,

Thirdly, the Government of Japan appraises the project to see whether it is suitable for Japan's GAEC, based on the Survey report prepared by JICA, and the results are then submitted to the Cabinet for approval.


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Program Grant Aid for Environment and Climate Change
of the Government of Japan
 (Provisional)

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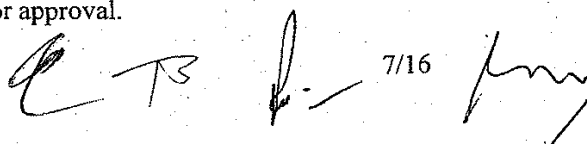
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Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes (E/N) signed by the Governments of Japan and the Recipient.

Fifthly, JICA engages Grant Agreement (G/A) with the Recipient and executes the Grant by making payments of the amount agreed in the E/N and strictly monitors that the funds of the Grant are properly and effectively used.

Procurement Management Agent is designated to conduct the procurement services of products and services (including fund management, preparing tenders, contracts) for GAEC on behalf of the Recipient. The Agent is an impartial and specialized organization that will render services according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by the Government of Japan and agreed between the two Governments in the Agreed Minutes ("A/M").

2 Preparatory Survey

1) Contents of the Survey

The purpose of the Preparatory Survey (hereafter referred to as "the Survey"), conducted by JICA on a requested project (hereafter referred to as "the Project"), is to provide the basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Survey are as follows:

- Confirmation of background, objectives, and benefits of the Project and institutional capacity of agencies and communities concerned of the Recipient necessary for project implementation.
- Evaluation of relevance of the Project to be implemented under the Grant Aid Scheme for Environment and Climate Change from a technical, social, and economic point of view.
- Confirmation of items agreed upon by both parties concerning the basic concept of the Project.
- Preparation of the design of the Project and reference document for tender.
- Estimation of cost for the Project.

The contents of the original request will be modified, as found necessary, in the design of the Project according to the guidelines of Japan's Grant Aid scheme.

The Government of Japan requests the Government of the Recipient to take whatever measures necessary to ensure its responsibility in implementing the Project. Such measures must be guaranteed even if they may fall outside the jurisdiction of the implementing organization of the Recipient. This has been confirmed by all relevant organizations of the Recipient through the Minutes of Discussions.

2) Selection of consulting firms

For the smooth implementation of the Survey, JICA will conduct the Survey with registered consulting firms. JICA selects the firms based on proposals submitted by firms with interest in implementing the Survey. The firms selected will carry out the Preparatory Survey and prepare a report, based on the terms of reference set by JICA.

3. Implementation of GAEC after the E/N

1) Exchange of Notes (E/N)

The content of GAEC will be determined in accordance with the Notes exchanged by the two

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Governments concerned, in which items including, objectives of the project, period of execution, conditions and amount of the Grant Aid are confirmed.

2) Details of Procedures

Details of procedures on procurement and services under GAEC will be agreed between the authorities of the two governments concerned at the time of the signing of the G/A.

Essential points to be agreed are outlined as follows:

- a) JICA will supervise the implementation of the Project.
- b) Products and services will be procured and provided in accordance with JICA's "Procurement Guidelines for the Program Grant Aid for Environment and Climate Change."
- c) The Recipient will conclude a contract with the Agent.
- d) The Agent is the representative acting in the name of the Recipient concerning all transfers of funds to the Agent.

3) Focal points of "Procurement Guidelines for the Program Grant Aid for Environment and Climate Change"

a) The Agent

The Agent is the organization, which provides procurement of products and services on behalf of the Recipient according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by the Government of Japan and agreed between the two Governments in the A/M.

b) Agent Agreement

The Recipient will conclude the Agent Agreement, in principle, within two months after the signing of the G/A, in accordance with the A/M. The scope of the Agent's services will be clearly specified in the Agent Agreement.

c) Approval of the Agent Agreement

The Agent Agreement is prepared as two identical documents and the copy of the Agent Agreement will be submitted to JICA by the Recipient through the Agent. JICA confirms whether the Agent Agreement is concluded in conformity with the E/N, A/M, and G/A and the Procurement Guidelines for the Program Grant Aid for Environment and Climate Change then approves the Agent Agreement.

The Agent Agreement concluded between the Recipient and the Agent will become effective after the approval by JICA in a written form.

d) Payment Methods

The Agent Agreement will stipulate that "Regarding all transfers of the fund to the Agent, the Recipient will designate the Agent to act on behalf of the Recipient and issue a Blanket Disbursement Authorization ("the BDA") to conduct the transfer of the fund (hereinafter referred to as "the Advances") to the Procurement Account from the Recipient Account.

The Agent Agreement will clearly state that the payment to the Agent will be made in Japanese yen from the Advances and that the final payment to the Agent will be made when the total remaining amount become less than three percent (3%) of the Grant and its accrued interests excluding the Agent's fees.

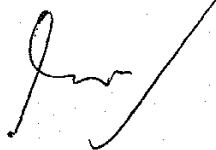
e) Products and Services Eligible for Procurement

Products and services to be procured will be selected from those defined in the G/A.

f) Selection of firms



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In principle, firms of any nationality could be contracted as long as the firms satisfy the conditions specified in the tender documents.

The same applies for any individual consultants who will be involved in the Project and provide services necessary for the training and guidance related to the Project.

The consultants that will be employed to do detail design and supervise the work for the Project, however will be in principle, Japanese nationals recommended by JICA for the purpose of maintaining technical consistency with the Study.

g) Method of Procurement

When conducting the procurement, sufficient attention will be paid to transparency in selecting the firms and for this purpose, competitive tendering will be employed in principle.

h) Tender Documents

The tender documents should contain all information necessary to enable tenderers to prepare valid offers for the products and services to be procured by GAEC.

The rights and obligations of the Recipient, the Agent and the firms supplying products and services should be stipulated in the tender documents to be prepared by the Agent. Aside from this, the tender documents will be prepared in consultation with the Recipient.

i) Pre-qualification Examination of Tenderers

The Agent may conduct a pre-qualification examination of tenderers in advance of the tender so that the invitation to the tender can be extended only to eligible firms. The pre-qualification examination should be performed only with respect to whether the prospective tenderers have the capability of concluding the contracts.

For this, the following points should be taken into consideration:

- (1) Experience and past performance in contracts of similar kind
- (2) Financial credibility (including assets such as real estate)
- (3) Existence of offices and other items to be specified in the tender documents.
- (4) Their potentialities to use necessary personnel and facilities.

j) Tender Evaluation

The tender evaluation should be implemented on the basis of the conditions specified in the tender documents.

Those tenderers which substantially conform to the technical specifications and other stipulations of the tender documents, will be judged in principle on the basis of the submitted price, and the tenderer who offers the lowest price will be designated as the successful tenderer.

The Agent will submit a detailed evaluation report of tenders to JICA for its information, while the notification of the results to the tenderers will not be premised on the confirmation by JICA.

k) Additional procurement

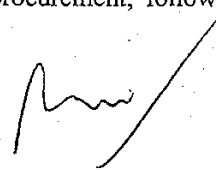
If there is any remaining balance after the competitive and/or selective tendering and/or direct negotiation for a contract, and if the Recipient would like to procure additional items, the Agent is allowed to conduct this additional procurement, following the points mentioned below:

- (1) Procurement of same products and services

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When the products and services to be additionally procured are identical with the initial tender and a competitive tendering is judged not efficient, additional procurement can be conducted by a negotiated contract with the successful tenderer of the initial tender.

(2) Other procurements

When products and services other than those mentioned above in (1) are to be procured, the procurement should be conducted through competitive tendering. In this case, the products and services for additional procurement will be selected from among those in accordance with the G/A.

l) Conclusion of the Contracts

In order to procure products and services in accordance with the guideline, the Agent will conclude contracts with firms selected by tendering or other methods.

m) Terms of Payment

The contract will clearly state the terms of payment. The Agent will make payment from the "advances," against the submission of the necessary documents from the firm on the basis of the conditions specified in the contract. When the services are the object of procurement, the Agent may pay certain portion of the contract amount in advance to the firms on the conditions that such firms submit the advance payment guarantee worth the amount of the advance payment to the Agent.

4) Undertakings required by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the Recipient is required to undertake necessary measures as the following:

- a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the Project.
- b) To provide facilities for distributing electricity, water supply and drainage and other incidental facilities in and around the sites.
- c) To ensure prompt execution for unloading and domestic transportation, and all the expense for customs clearing at the port of disembarkation of products purchased under the Grant Aid,
- d) To ensure that customs duty, internal taxes and other fiscal levies that may be imposed in the Recipient with respect to the purchase of the Components and the Agent's services will be exempted by the Government of the Recipient.
- e) To accord all the concerned parties, whose services may be required in connection with supply of the products and services under the contracts, such facilities as may be necessary for their entry into the Recipient and stay therein for the performance of their work.

5) "Proper use of funds"

The Recipient is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign personnel necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

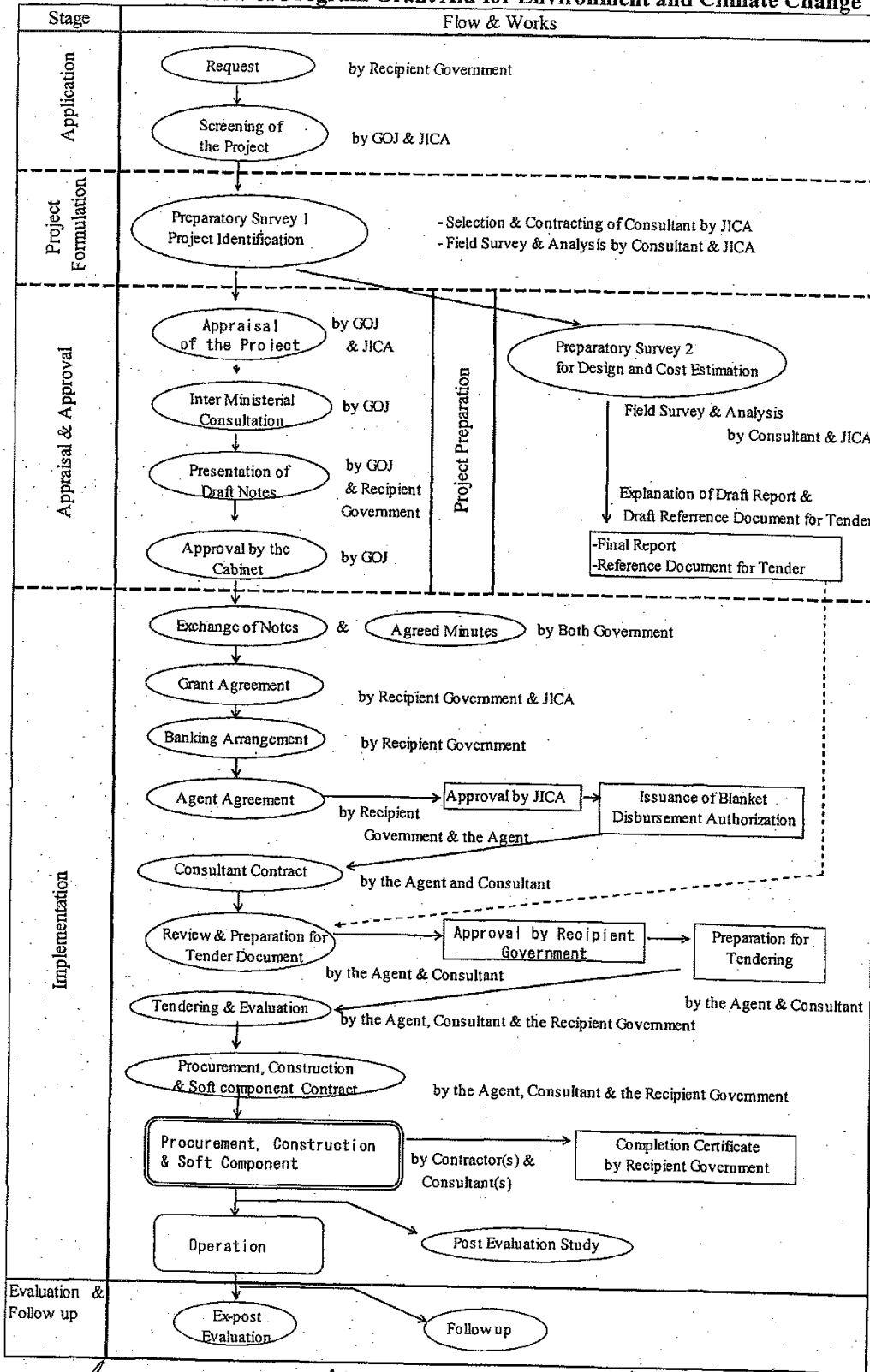
6) "Export and Re-export" of products

The products purchased under the Grant and its accrued interest will not be exported or re-exported from the Recipient.

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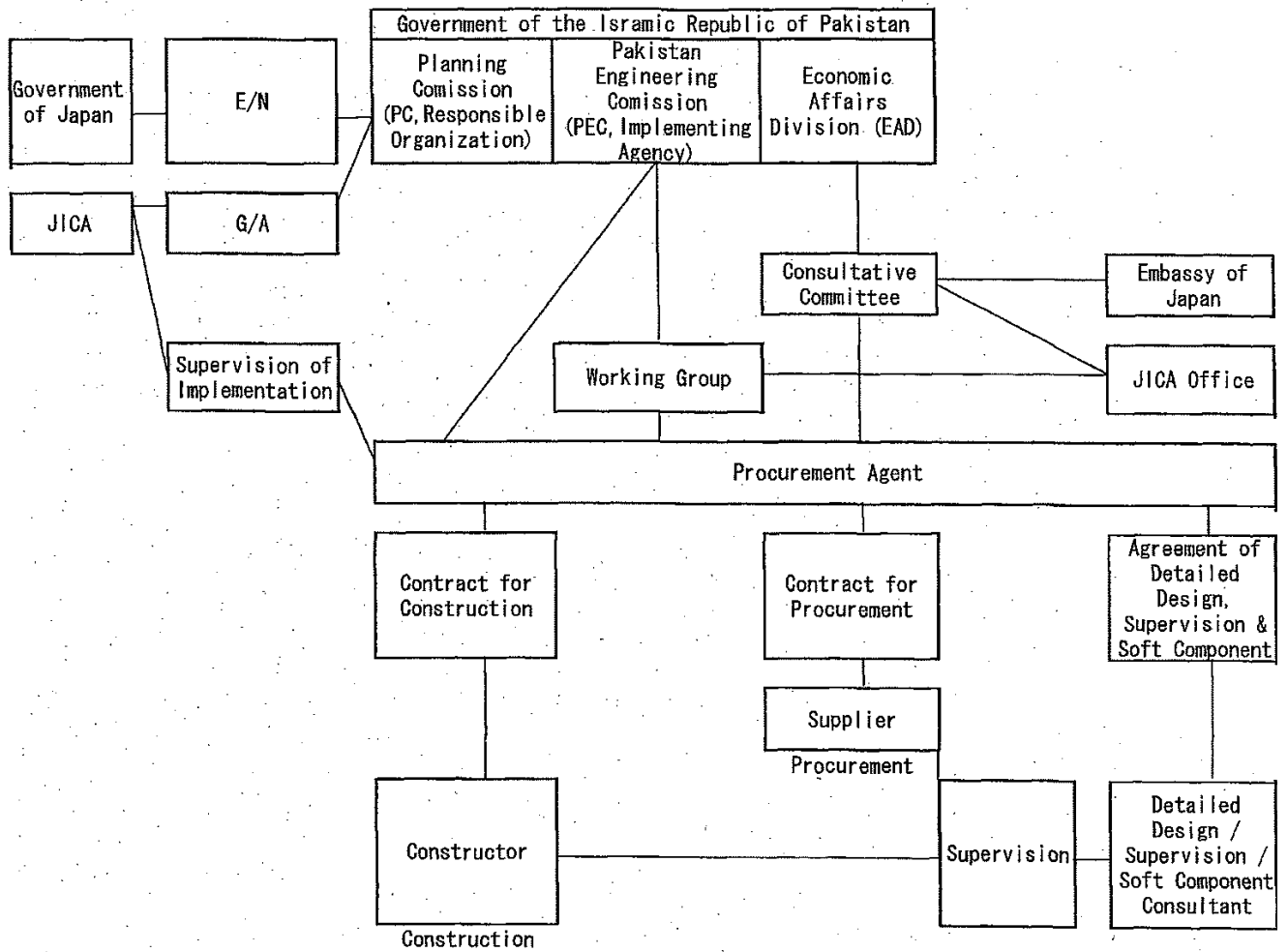
Annex-4

General Flow of Program Grant Aid for Environment and Climate Change



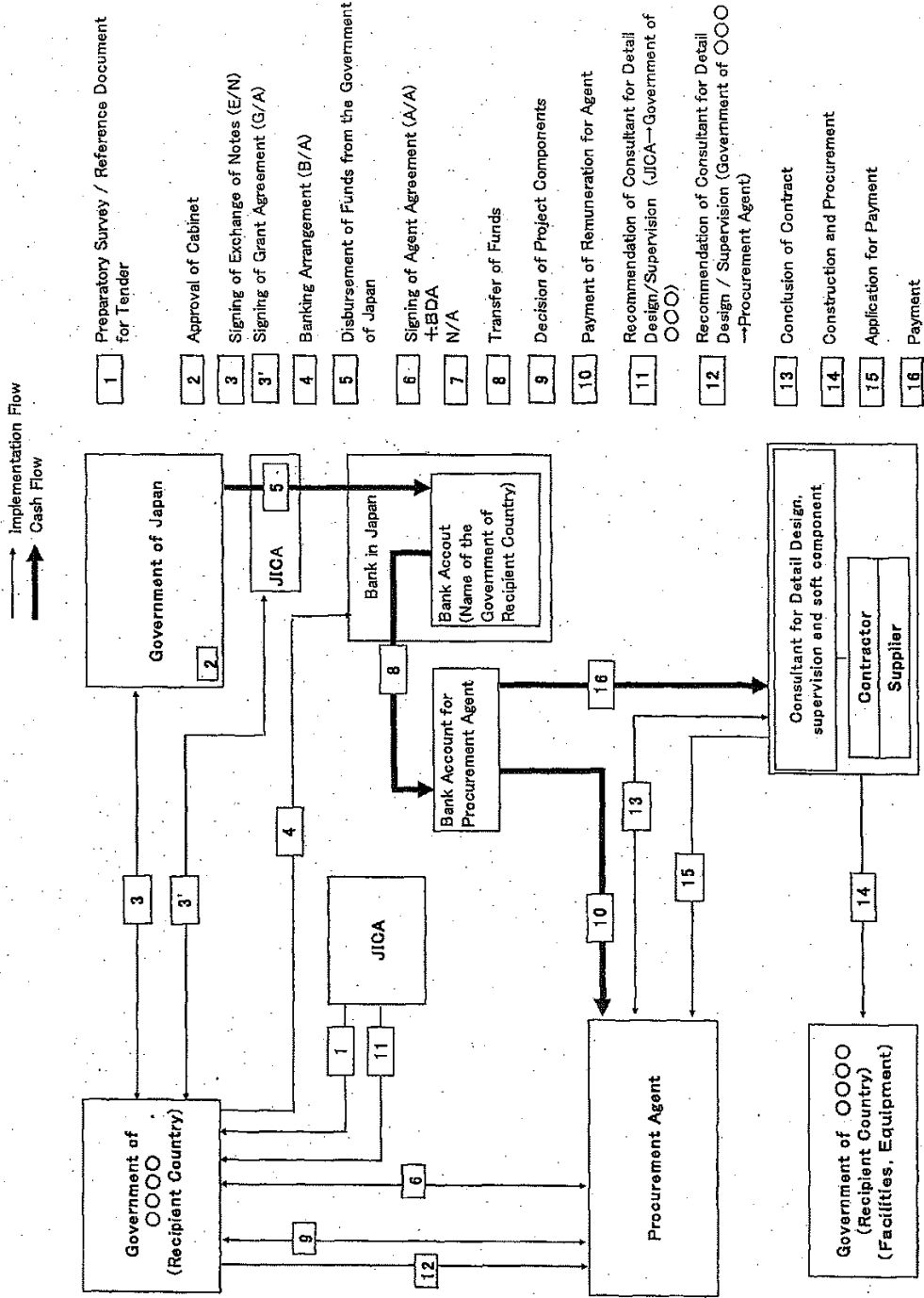
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Project Implementation System



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Flow of Funds for Project Implementation



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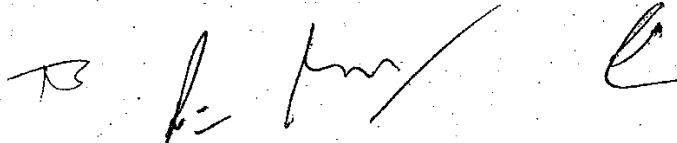
Annex-7

Major undertakings to be taken by each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land		●
2	To clear, level and reclaim the site when needed urgently		●
3	To construct gates and fences in and around the site		●
4	To construct a parking lot if necessary		●
5	To construct roads		
	1) Within the site	●	
	2) Outside the site and Access road		●
6	To construct the facility and install the equipment	●	
7	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities if necessary:		
	1) Electricity		
	a. The power distribution line to the site		●
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer for the site	●	
	2) Water Supply		
	a. The city water distribution main to the site		●
	b. The supply system within the site (receiving and elevated tanks)	●	
	3) Drainage		
	a. The city drainage main (for conveying storm water, sewage, etc. from the site)		●
	b. The drainage system within the site (for sewage, ordinary waste, storm water, etc.)	●	
	4) Gas Supply		
	a. The city gas main to the site		●
	b. The gas supply system within the site	●	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		●
	b. The MDF and the extension after the frame/panel	●	
	6) Furniture and Equipment		
	a. General furniture		●
	b. Project equipment	●	
8	To bear the following commissions applied by the bank in Japan for banking services based upon the Bank Arrangement (B/A):		
	1) Payment of bank commission		●
9	To ensure all the expense and prompt execution of unloading and customs clearance at the port of disembarkation in the recipient country		
	1) Marine or air transportation of the products from Japan or third countries to the recipient	●	
	2) To ensure prompt execution for unloading and domestic transportation, and all the expense for customs clearing and tax exemption at the port of disembarkation of products purchased under the Grant Aid		●
	3) Internal transportation from the port of disembarkation to the project site	●	
10	To accord Japanese nationals and / or nationals of third countries, including persons employed by the agent whose services may be required in connection with the Components such facilities as may be necessary for their entry into recipient country and stay therein for the performance of their work.		●
11	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the Components and to the employment of the Agent will be exempted by the Government of recipient country		●
12	To maintain and use properly and effectively the facilities that are constructed and the equipment that is provided under the Grant.		●
13	To bear all the expenses, other than those covered by the Grant and its accrued interest, necessary for the purchase of the Components as well as for the agent's fees.		●
14	To ensure environmental and social consideration for the Programme.		●

Terms of Reference of the Consultative Committee (Provisional)

1. To confirm an implementation schedule of the Programme for the speedy and effective utilization of the Grant and its accrued interest.
2. To discuss the modifications of the Programme, including modification of the design of the facility.
3. To exchange views on allocations of the Grant and its accrued interest as well as on potential end-users.
4. To identify problems which may delay the utilization of the Grant and its accrued interest, and to explore solutions to such problems.
5. To exchange views on publicity related to the utilization of the Grant and its accrued interest.
6. To discuss any other matters that may arise from or in connection with the G/A.

Four handwritten signatures in black ink, arranged horizontally. The first is a simple 'B', the second is a stylized 'L', the third is a more complex signature, and the fourth is a simple 'C'.

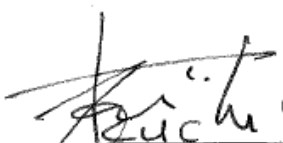
**MEMORANDUM OF UNDERSTANDING
ON TECHNICAL MATTER**

FOR

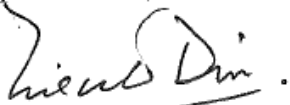
**PREPARATORY SURVEY ON THE PROJECT FOR
CLEAN ENERGY PROMOTION USING SOLAR
PHOTOVOLTAIC SYSTEM
IN
THE ISLAMIC REPUBLIC OF PAKISTAN**

**among
JICA Consultant Survey Team
and
Planning Commission
and
Pakistan Engineering Council**

**Islamabad
July 17, 2009**



**Mr. Tomoyasu Fukuchi
Team Leader,
JICA Consultant Survey Team
Nippon Koei Co., Ltd.**



**Mr. Zia ud Din Azhar
Chief,
Energy Information Systems &
Computer Section
Energy Wing, Planning Commission**



**Dr. Ashfaq Ahmed Sheikh
Deputy Registrar
Pakistan Engineering Council**

The Consultant Survey Team (the Consultant Team) of the Japan International Cooperation Agency (JICA), which is headed by Mr. Tomoyasu FUKUCHI, continuously stayed in Islamabad after the official survey team of JICA left Islamabad on July 10, 2009 for the further survey on technical matter. The Consultant Team, Pakistan Engineering Council (PEC), and Planning Commission (PC) jointly conducted the further survey and discussed the technical matter of the Project for Clean Energy Promotion Using Solar Photovoltaic System (the Project). The three parties confirmed the mutual understanding on the Project as shown below. The Consultant Team will leave Islamabad on July 17, 2009.

1. **Installation Sites** : Photovoltaic (PV) panels will be installed in the following areas.

- i) On the roof of the parking of PC: PC site
- ii) The parking area existing in front of PEC: PEC site

The parking allocated to PC is under control of PC. The parking area for PEC is the property of Capital Development Authority (CDA). PC and PEC will obtain the necessary permission and/or take the necessary procedure in due form for installation of PV system if required. The installation sites of PC and PEC are shown in Attachment-1 and -2, respectively.

2. **Installation Capacity** : The installation capacities of PV panel are shown below.

- i) at PC site: 100 kWp
- ii) at PEC site 100 kWp

The Consultant Team will prepare the initial design of the Project based on the above installation capacity. The Consultant Team, however, will report the existence of the space in which it is available to install PV panel beyond the capacity of 100 kWp at each site to JICA.

3. **Grid Connection** : The PV system will be connected to the distribution line of Islamabad Electricity Supply Company Ltd (IESCO). The commitment for the PV system to be able to connect to the distribution line was given to the Consultant Team by Alternative Energy Development Board (AEDB) in the meeting with them held on July 15, 2009.

4. **Synchronization** : The PV system will be connected to 400 V, 3-phase distribution lines and synchronized with the ones both at PC site and PEC site. The PV system will be designed to supply electricity only when being synchronized with the grid electricity. The PV system will not be synchronized with any emergency and/or back-up power sources like the emergency diesel

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A/B
The
6.

generator of PEC.

5. **Stockyard** : The place of the stockyard to store the materials and equipment to be installed at the sites will be designated. The stockyard shall be secured good access, security, and space enough to work for loading and unloading, and inspection of them. The required space will be informed during the next site survey.
6. **License of Generation** : PC and PEC will obtain the license of generation from National Electricity Power Regulation Authority (NEPRA) immediately after the design of the PV system being finalized.
7. **Connection Agreement** : PC and PEC will have the agreement on connecting PV system to the distribution lines with IESCO immediately after the license of generation being obtained.
8. **Focal Point** : Dr. Ashfaq Ahmed Sheikh was designated as the focal point of the Preparatory Survey (the Survey). The focal point will coordinate PC, PEC, and all the other organizations concerned at practical working level for the Survey.
9. **Office Space** : The office space for the Consultant Team will be provided in PEC building in the next survey period: October to November 2009 for around one month. The office space will be equipped with working desk, meeting facilities, internet connections, copy machine, phone, and the other required equipment for daily works. The maximum number of the team members will be eight including local staff.
10. **Questionnaires** : The questionnaires are shown in Attachment-3. The answer of the questionnaires will be sent to Mr. J. M. Pradhan (cc to Mr. T. Fukuchi) by e-mail by the end of July, 2009. The e-mail addresses of them are shown below.

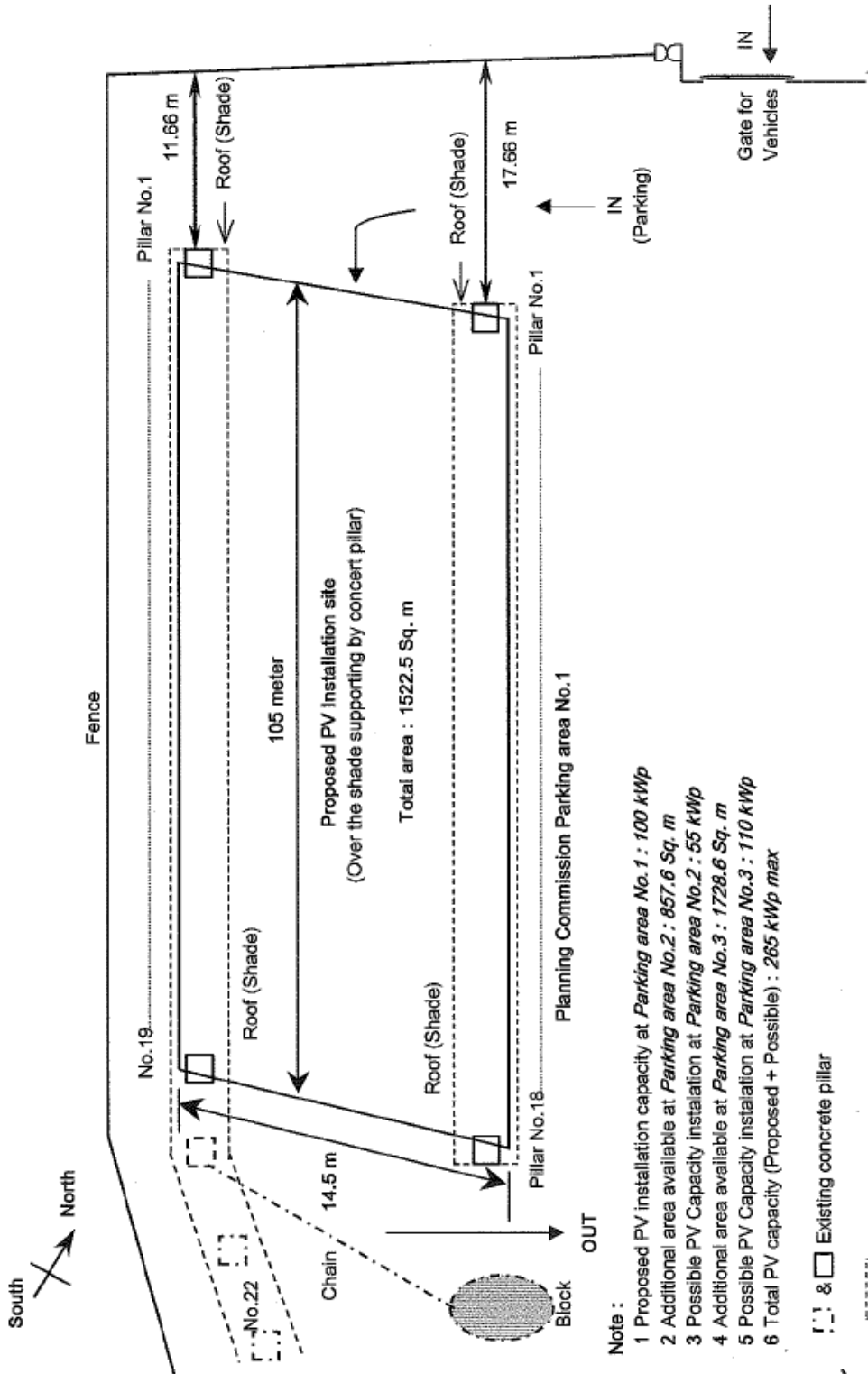
Mr. J. M. Pradhan: jmpradhan51@yahoo.com
Mr. T. Fukuchi: fukuchi-tm@n-koei.jp
11. **Planning Commission Proforma-1 (PC-1)** : PC-1 of the Project was approved on July 17, 2009.
12. **Next Site Survey** : The next site survey is scheduled to be conducted from the end of October to the end of November 2009.

End

Attachment

1. Installation Site of PV System in Planning Commission
2. Installation Site of PV System in Pakistan Engineering Council
3. Questionnaires

Handwritten signatures and initials in black ink, including what appears to be 'AS', 'me', and '6'.

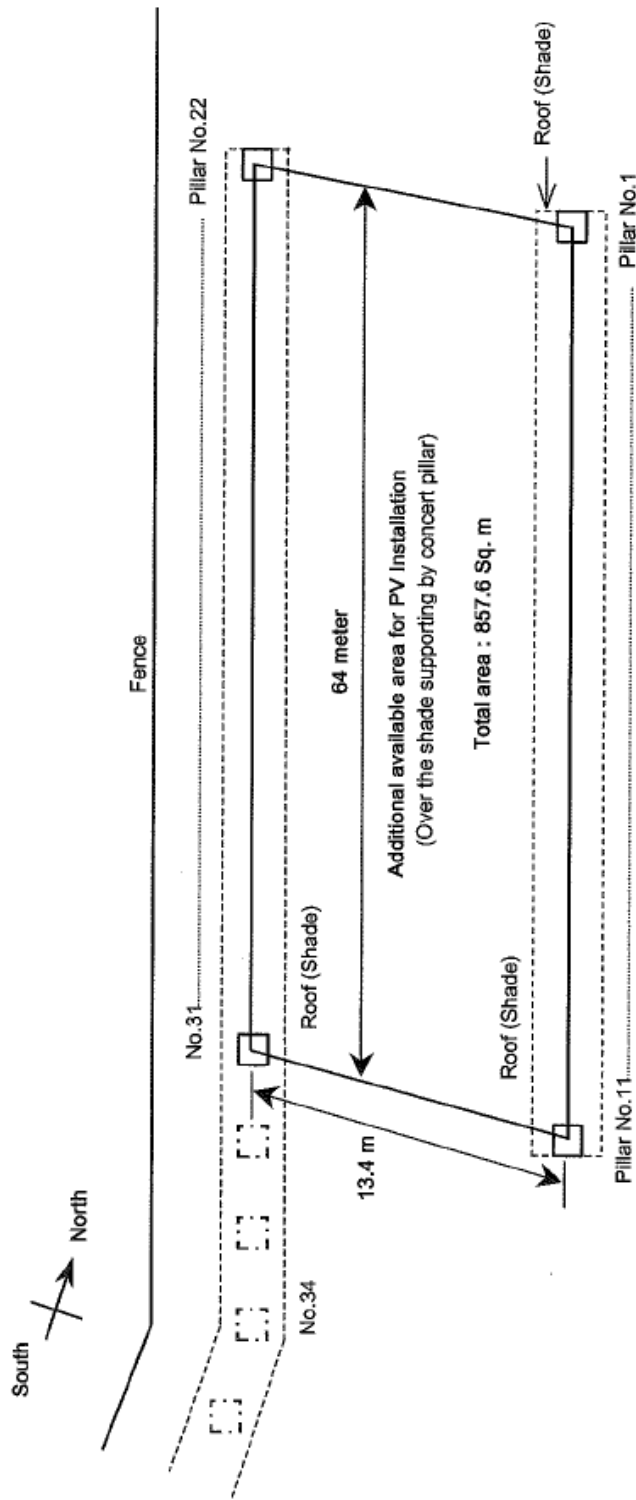


Note :

- 1 Proposed PV installation capacity at *Parking area No. 1 : 100 kWp*
- 2 Additional area available at *Parking area No.2 : 857.6 Sq. m*
- 3 Possible PV Capacity installation at *Parking area No.2 : 55 kWp*
- 4 Additional area available at *Parking area No.3 : 1728.6 Sq. m*
- 5 Possible PV Capacity installation at *Parking area No.3 : 110 kWp*
- 6 Total PV capacity (Proposed + Possible) : *265 kWp max*

- & □ Existing concrete pillar
 - Existing roof of car parking
 - ▭ Available space for installation
- Figures are not in scale

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Planning Commission Parking area No.2

Note :

- 1 Additional space available at Parking area No.2 : 857.6 Sq. m
- 2 Possible PV Capacity installation : 55 kWp

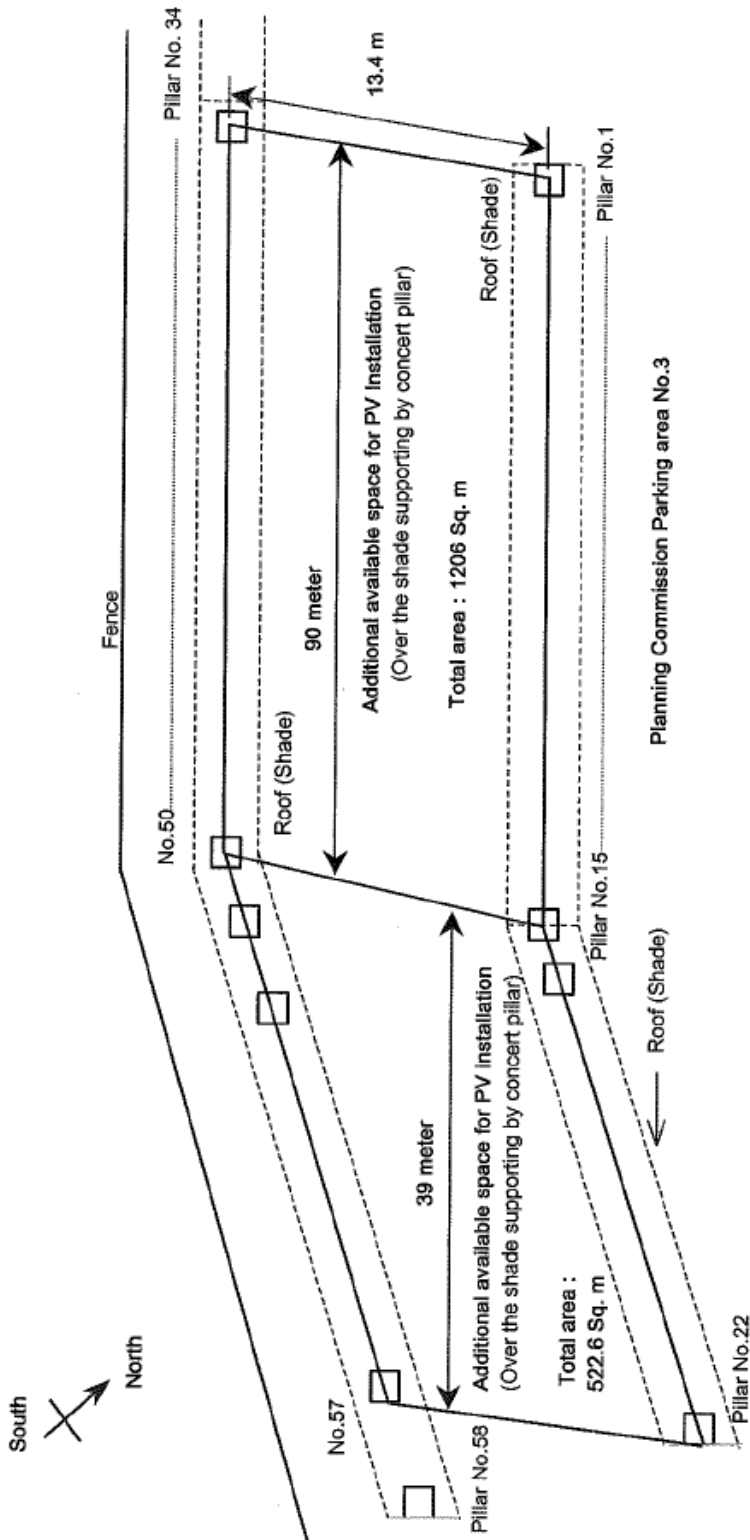
□ & □ Existing concrete pillar

□ Existing roof of car parking

□ Available space for expansion

Figures are not in scale

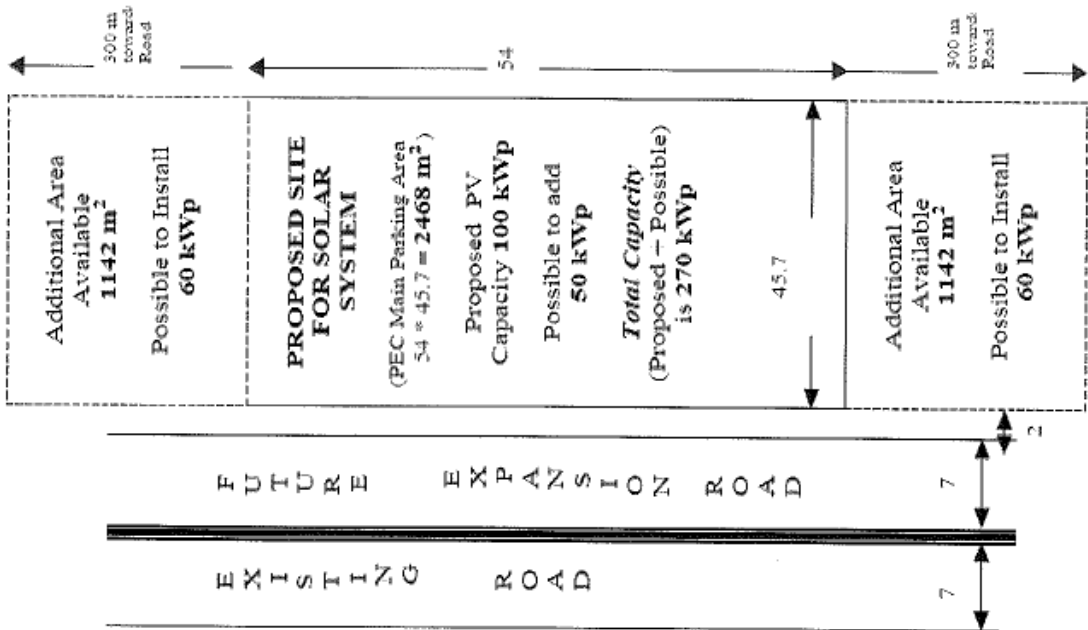
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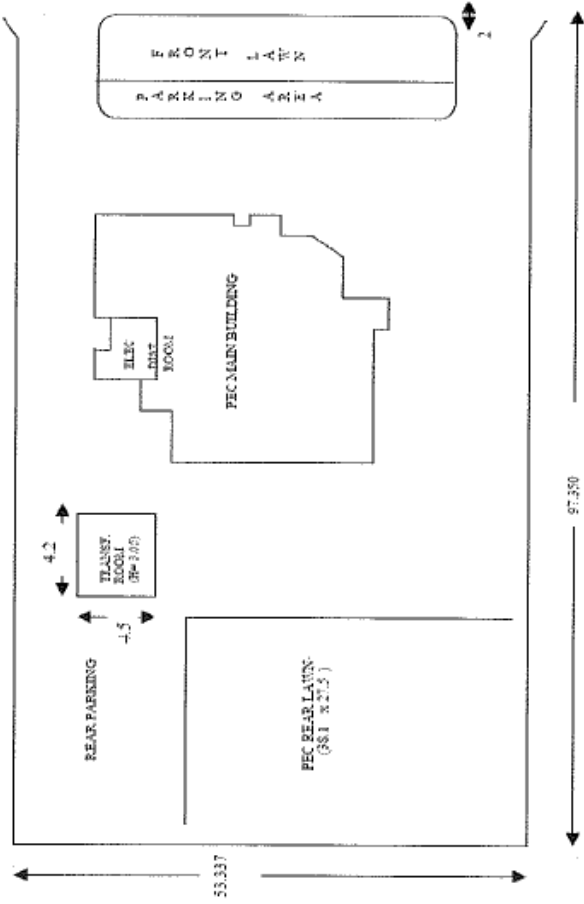
Note :

- 1 Additional area available at No.3 Parking : 1728.6 Sq. m
- 2 Possible PV Capacity Installation : 110 KWp

- [] & [] Existing concrete pillar
 - [] Existing roof of car parking
 - [] Available space for expansion
- Figures are not in scale



LAYOUT OF PAKISTAN ENGINEERING COUNCIL BUILDING (ALONG WITH PROPOSED SITE FOR SOLAR SYSTEM)



- Not to scale
- All dimensions in meters

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Installation Site of PV System in Pakistan Engineering Council

QUESTIONNAIRES

(INFORMATION REQUIRED FROM PAKISTAN)

A. ACTS, REGULATIONS , RULES:

From Line Ministry MOWP/NEPRA/PC

1. Policy and Strategies of Power sector
2. Legislative and Regulatory frame work related to Power Sector like:
Electricity act, Regulations etc

From IESCO/NEPRA

3. Distribution Construction Standard i.e. document is mandatory guide line for construction of distribution system.

From NTDC/NEPRA

4. Transmission Construction Standard i.e. document is mandatory guide line for construction of transmission system.

B. INFORMATION RELATED TO POWER PURCHASE AGREEMENT:

From NEPRA/AEDB

1. Guide line for PPA application.
2. Typical PPA document (preferably for PV cell if exists or Wind power)
3. Typical connection arrangement (schematic diagram with equipments, protection, metering scheme) required for the PPA for reference
4. Type of meters, accuracy class etc required at connection point.
5. Any other mandatory and specific requirement for the connection agreement switching , protection etc at connecting point with IESCO.
6. If there is any embedded generator connected to distribution system i.e. at 11kV, or 400V, please provide the typical connection diagram for reference.
7. Electricity Tariff Of IESCO for PC/PEC
8. Operation code and terms and condition by IESCO for supply and buy to PC/PEC
9. Type of PPA agreement : With net metering if exists



MEMORANDUM OF UNDERSTANDING
ON TECHNICAL MATTER

FOR

PREPARATORY SURVEY ON THE PROJECT FOR
CLEAN ENERGY PROMOTION USING SOLAR
PHOTOVOLTAIC SYSTEM
IN
THE ISLAMIC REPUBLIC OF PAKISTAN

among
JICA Consultant Survey Team
and
Planning Commission
and
Pakistan Engineering Council

Islamabad

November 20, 2009



Mr. Deepak Bista
Sub-Team Leader,
JICA Consultant Survey Team
Nippon Koei Co., Ltd.



Mr. Zia ud Din Azhar
Chief,
Energy Information Systems &
Computer Section
Energy Wing, Planning Commission



Dr. Ashfaq Ahmed Sheikh
Deputy Registrar
Pakistan Engineering Council

The Consultant Survey Team (the Consultant Team) of the Japan International Cooperation Agency (JICA), which is headed by Mr. Tomoyasu FUKUCHI, conducted the 2nd site survey from October 22nd to today and continues to 25th November 2009. As the result of the 2nd site survey the Consultant Team, Pakistan Engineering Council (PEC), and Planning Commission (PC) discussed and confirmed the following matters.

1. **Installation Sites : Photovoltaic (PV) panels will be installed in the following areas.**
 - i) On the structure to be erected covering existing roof and space between the parking of PC: PC site
The new installation of frame structure will maintain the almost same height of present existing roof.
 - ii) On the structure to be erected at existing parking area in front of PEC building, crossing over the existing road in front of PEC: PEC site.
The height of the erected structure frame shall be 2500mm in an average from ground level.

Over view of PV array installation plan at PC and PEC sites are shown in Attachment-1 and -2, respectively.

2. **Power Generation License :** From the NEPRA Act, what ever the capacity of generation, transmission and distribution be, if connection for distribution or supply is there, it is mandatory to get license from NEPRA. From this by the regulation, PC and PEC shall apply and get license from NEPRA for power generation.
3. **Interconnection Voltage and Energy Meter :** The PV power generation system will interconnect with existing system of PEC and PC at secondary side of existing transformer with 3 phase 4 wire, 400V. The bidirectional LT CDP (Common Delivery Point) Energy Meter will be installed at LT 400V side of existing transformer at both sites. PC and PEC are confirming the detail specification of Energy meter from NTDC.
4. **Grid connection MOU between IESCO and PEC/PC :** PEC and PC will sign MOU with IESCO after signing E/N. For this, JICA survey team will provide information of technical matter related to PV power generation system and interconnection to IESCO grid.
5. **Synchronization :** The PV system will be connected to 400 V, 3-phase LT distribution lines and synchronized with the ones both at PC and PEC site, and will be designed to supply electricity only when being synchronized with the grid electricity. The PV system will not be synchronized with any emergency and/or back-up power sources like the emergency diesel generator of PEC.



6. **Soil Resistivity data :** The soil resistivity data measured at PC and PEC sites will be provided to JICA survey team until 24th November for PV power generation system deigning purpose.
7. **Custom Clearances :** The Statutory Rules and Orders (S.R.O.) notification on 9th June, 2007 explains that the items with dedicated use of solar energy namely, equipment and components for Solar Home System is exempted on one time basis for setting up of new project expansion, and it is subject to certification by Alternative Energy Development Board (AEDB). From this, for tax exemption PC and PEC will apply to the Ministry of Finance, Revenue and Economic Affairs, Revenue Division and if any tax is required, will be arranged by PC and PEC.
8. **Land Clearance of PV installation sites :** The land clearing and leveling, and removal of trees inside PV installation site shall be done after signing E/N. If in case the trees required to be destroyed then, at least same number of trees should be planted at appropriate site. The removal or trimming of other trees around the PV installation site should be done at the time of construction period. All required work related to land clearance and trees, will be arranged by PC and PEC.
9. **Fencing and Security of Project sites :** After installation if required, fencing and security system for PV as well as electrical equipment/instrument installation site, will be arranged by PC and PEC.
10. **Excavation and rebuilding of road :** For cabling and piping, road as well as ground excavation is required at both PC and PEC sites. For this necessary approval/permission for the excavations from concerned agency/department and management of parking at the time of installation will be arranged by PC and PEC.
11. **Stockyard :** The place of the stockyard to store the materials and equipment to be installed at the sites will be designated. The stockyard shall be secured good access, security, and space enough to work for loading and unloading, and inspection of them. The required space will be informed after finalization of procurement documents by JICA survey team.

End

Attachment

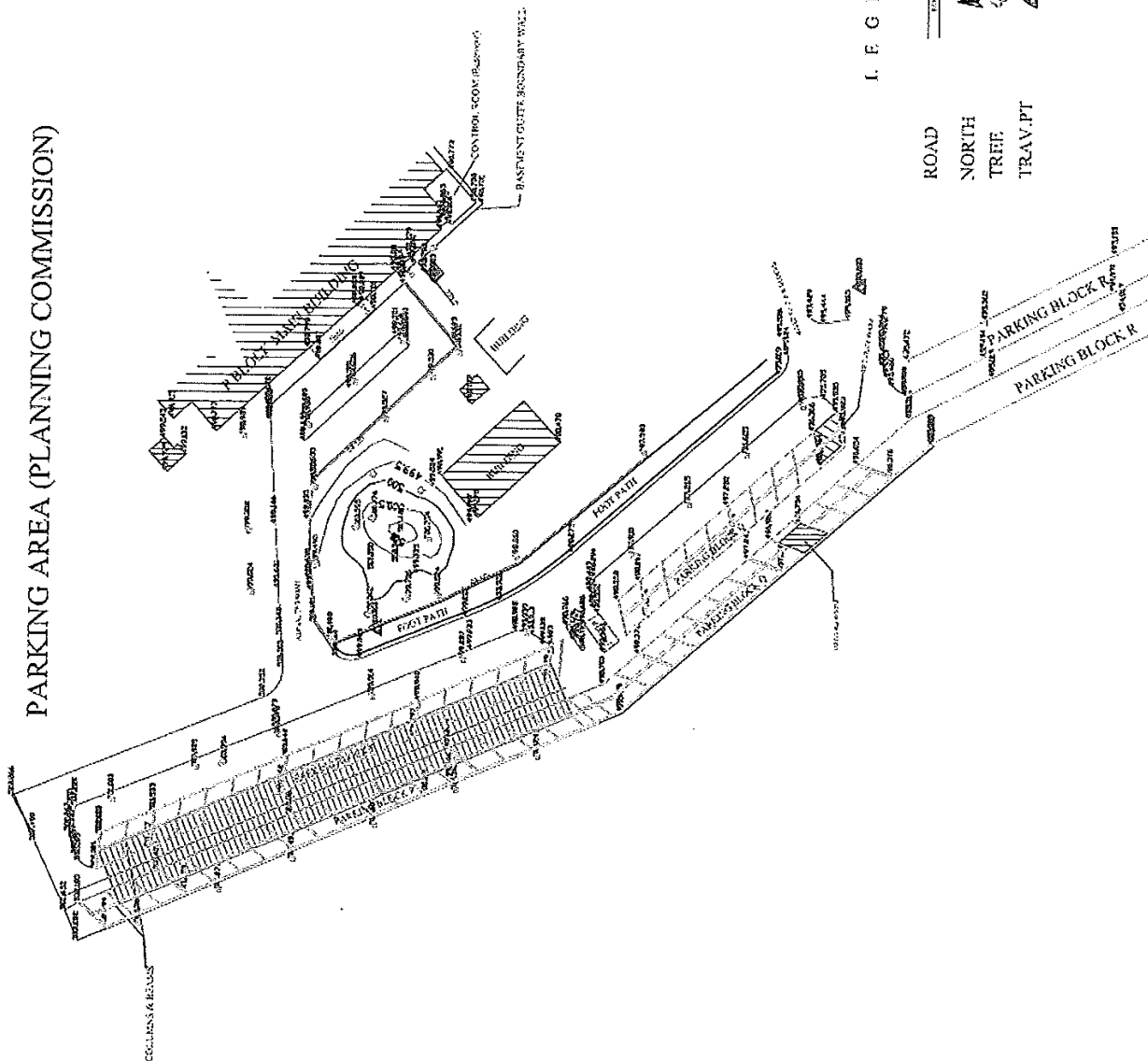
1. Overview of PV array installation at Planning Commission (PC)
2. Overview of PV array installation at Pakistan Engineering Council (PEC)

1


2



PARKING AREA (PLANNING COMMISSION)



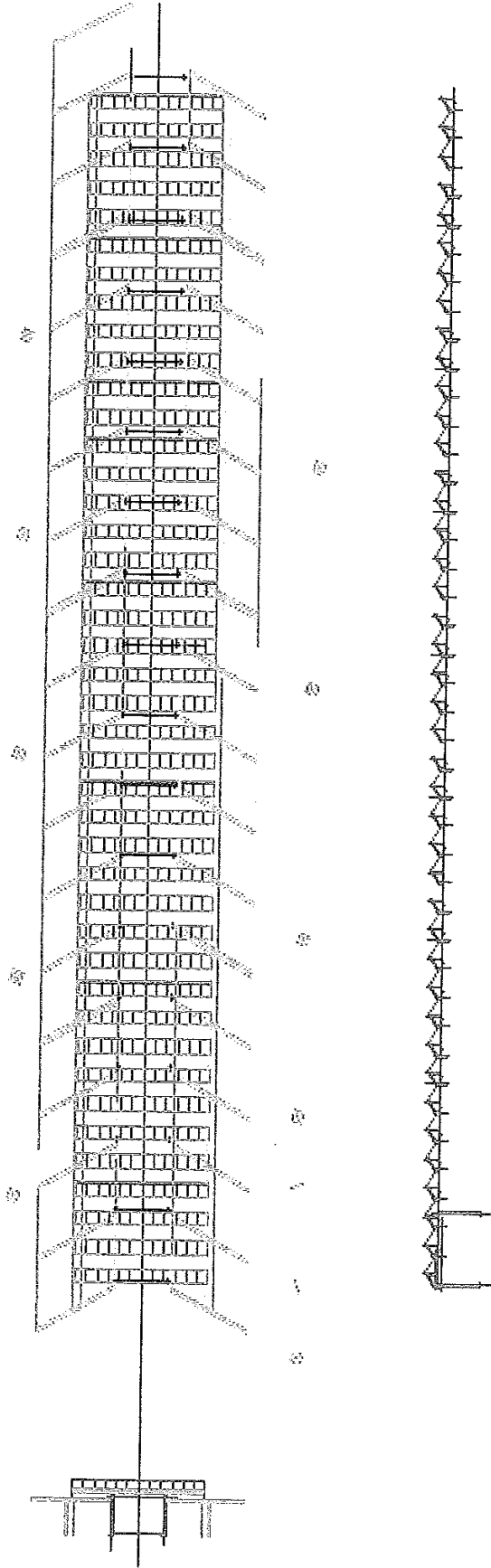
L E G E N D

ROAD		BUILDING	
NORTH		LT. POLE	
TRFF		DRAIN	
TRAV. PT.		WALL	

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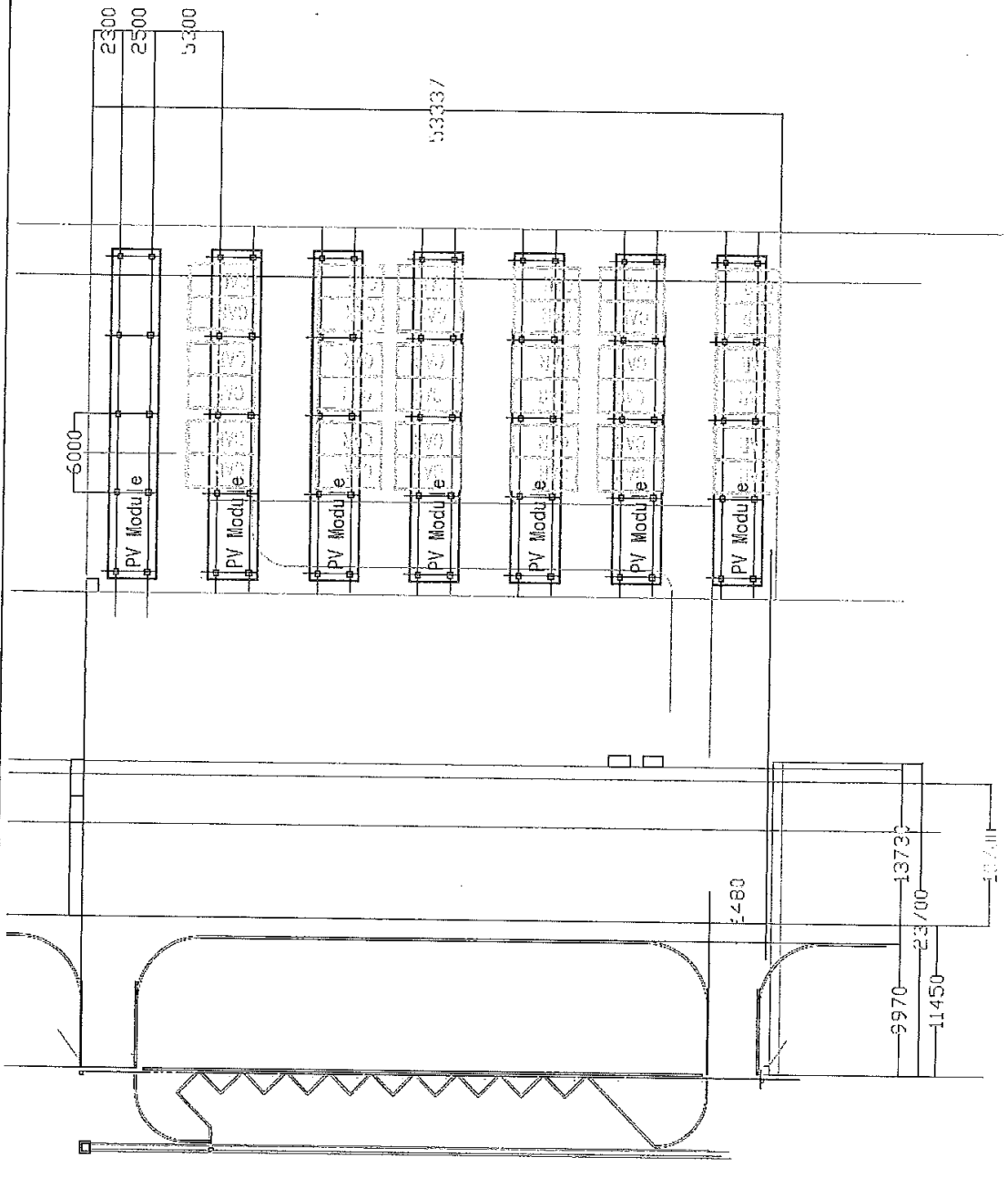
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PARKING AREA (PLANNING COMMISSION)



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PARKING AREA (ENGINEERING COUNCIL)



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第 3 次現地調査 Minutes of Discussion

Minutes of Discussions
on
the Preparatory Survey (Outline Design)
on
The Project for Introduction of Clean Energy by Solar Electricity Generation System
in
the Islamic Republic of Pakistan


(Explanation on Draft Final Report)

In December 2009, the Japan International Cooperation Agency (hereinafter referred to as "JICA") conducted the Preparatory Survey on the Project for Clean Energy Promoting Using Solar Photovoltaic System (hereinafter referred to as "the Program") in the Islamic Republic of Pakistan (hereinafter referred to as "Pakistan"), and through discussions, field survey and technical examination of the results of the survey in Japan, JICA prepared a Draft Final Report of the Outline Design.


In order to explain and to consult with the concerned officials of the Government of Pakistan on the component of the Draft Final Report, JICA has dispatched to Pakistan the Preparatory Survey Team for Draft Final Report Explanation (hereinafter referred to as "the Team"), which is headed by Dr. Akira NIWA, Senior Advisor of JICA, from March 29th to April 2nd, 2010.

As a result of discussion, both sides confirmed the main items described on the attached sheets.

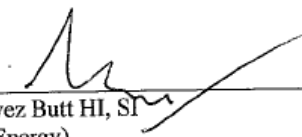
Islamabad, April 1, 2010



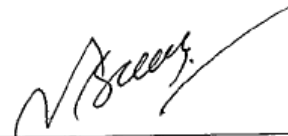
Dr. Akira NIWA
Leader
Preparatory Survey Team
Japan International Cooperation Agency



Mr. Zafar Hasan Reza
Joint Secretary (ADB/Japan)
Economic Affairs Division
Government of Pakistan



Engr. Parvez Butt HI, SI
Member(Energy)
Planning Commission



Engr. Senator Rukhsana Zuberi
Chairperson
Pakistan Engineering Council

ATTACHMENT

1. Components of the Draft Final Report

Planning Commission (hereinafter referred to as "PC") and Pakistan Engineering Council (hereinafter referred to as "PEC") agreed and accepted in principle the components of the Draft Final Report explained by the Team.

2. Program Grant Aid for Environment and Climate Change of the Government of Japan

The Pakistani side understood components of the Minutes of Discussion signed by both sides on 23rd July, 2009 (hereinafter referred to as "the previous M/D"), and would take the necessary measures confirmed on the previous M/D for smooth implementation of the Program in accordance with the procedures of the Program Grant Aid for Environment and Climate Change of the Government of Japan as shown in **Annex-1**.

3. Confirmation of progress made for the previous M/D

3.1. Project sites and capacity of PV module

Both sides confirmed that project sites are (1) parking lot of "P" block Pak Secretariat / PC and (2) parking lot for PEC, opposite to PEC building. The Team explained that the capacity of PV module can be increased up to 220 kW by the result of outline design and cost estimation. Pakistani side accepted the change.

3.2. Official permission to set the PV system on the site for the Program

Both sides confirmed that all the necessary procedures for official permission from related organizations to set the PV system in the project sites have been completed.

4. Items of Equipment to be procured

The Team explained that the items of equipment to be procured as shown in **Annex-2** based on the result of the Preparatory Survey conducted in July, 2009. Both sides confirmed that major equipment such as PV module, Power Conditioner and Transformer are products of Japan, and also accepted products of Pakistan or third country for other equipment.

5. Procurement Process of the Program

Both sides reconfirmed that procurement process would be supervised by the Procurement Agent (hereinafter referred to as "the Agent") with necessary consultation by the Consultative Committee (hereinafter referred to as "the Committee"). And both sides also reconfirmed roles of the Agent as follows;

- (1) The Agent renders the services stipulated in the provisions of the G/A as well as the E/N for the Program;
- (2) The Agent will undertake the procurement procedure necessary for the Program according to the provisions of the G/A and E/N and any other concerned guidelines;
- (3) JICA will provide the draft Final Report and Final Report to the Agent and PC/PEC; and
- (4) The Agent will commence the procurement according to the contents of the Final Report of the Outline Design.

The Team explained that if tender price exceeds the amount agreed on G/A and E/N,

quantity or/and items of the equipment would be reduced until the cost for the Program comes down to the amount agreed on G/A and E/N.

The Pakistani side agreed that if there is a remaining amount of the cost for the Program after tenders, additional items of equipment would be procured based on priorities, which are set in the Final Report.

The Pakistani side also understood that decision on addition or reduction of the equipment to be procured would be made through necessary consultation among members of the Committee.

6. Project Cost

The Pakistani side agreed that the cost for the Program should not exceed the upper limit of amount agreed on in E/N. Both sides also confirmed that the cost for the Program contains procurement cost of equipment, the cost for transportation up to the site for the Program, installation cost, the Agent fee, and the cost for soft component for the technical support of operation and maintenance of equipment.

7. Confidentiality of the Program

(1) Detailed specifications of the Facilities

Both sides confirmed that all the information related to the Program including detailed drawings and specifications of the facilities and equipment and other technical information shall not be released to any outside parties (i.e. outside of JICA, Pakistani side and the Agent) before conclusion of all the contract(s) for the Program.

(2) Confidentiality of the Cost Estimation

The Team explained the cost estimation of the Program as described in **Annex-3**. Both sides agreed that the cost for the Program Estimation should never be duplicated or released to any outside parties (i.e. outside of JICA, Pakistani side and the Agent) before tender for the Program. The Pakistani side understood that the cost for the Program Estimation attached as Annex-3 is not final and is subject to change by the result of examination through revision of the Outline Design Study.

8. The Consultative Committee

The Pakistani side understood that the PC will chair the Committee in order to facilitate consultation and procurement process. The Terms of Reference of the Committee was settled in Annex-8 of the previous M/D.

The members of the Committee are as follows:

- (1) Representative(s) of PC (Chair): Engr. Parvez Butt HI, SI, Member (Energy)
- (2) Representative(s) of PEC: Engr. Dr Ashfaq Ahmed Sheikh, Deputy Registrar
- (3) Representative(s) of EAD: Mr. Waqar Hussain Abbasi, Deputy Secretary (ODA/Japan)
- (4) Representative(s) of IESCO: Chief Executive Officer/Chief Engineer (Planning and Engineering)
- (5) Representative(s) of JICA Pakistan Office

The first meeting of the Committee shall be held after the signing of the contract between the Agent and the consultant. Further meetings shall be held upon request of either the

Pakistani side or the Japanese side. The Procurement Agent may advise both sides on the necessity to call a meeting of the Committee.

9. Other Relevant Issues

9.1. Undertakings required by the Pakistan Country

The Team requested the Pakistani side to abide by the following undertakings by the Pakistani side in addition to major undertakings described in the previous M/D. The Pakistani side agreed to do so.

(1) Land usage for PV system

The owner of the land for the following equipment and materials for PV system is the Government of Pakistan. The project site (1) parking lot of "P" block Pak Secretariat / PC is managed by PC, and project site (2) parking lot for PEC, opposite to PEC building is managed by Capital Development Authority (CDA).

- 1) PV Modules
- 2) Underground cables between equipments
- 3) Power house
- 4) Temporary stockyards

PC and PEC has reconfirmed that land usage of the two sites has been secured and there is no objection for the implementation of the Program. PC and PEC has also reconfirmed that construction of fence for security protection at the project site (2) parking lot for PEC shall be the responsibility of Pakistan side.

(2) Approval of PC-1

CDWP approved, in principle, the project of PEC at the special CDWP meeting held on July 17, 2009. Ministry of Science and Technology has refined the PC-1 application form based on the definite design information of the project, and submitted to CDWP for final approval by the Planning and Development Division, PC. Pakistani side shall obtain the final approval of PC-1 on PEC project in the next CDWP, scheduled on April or May 2010.

(3) Generated Energy by PV system

Pakistani side confirmed that PC/PEC shall obtain generation license from NEPRA, and establish agreement on the grid connection including the tariff to be applied between IESCO and PC/PEC for power generation of PV system by adopting the existing Policy for Development of Renewable Energy for Power Generation, Government of Pakistan 2006, before the end of April 2011. The Japanese side shall assist the Pakistani side to introduce necessary procedures through soft component during the implementation of the Program.

(4) Environmental and Social Considerations

The Pakistani side reconfirmed that EIA and IEE are not required for the project implementation of solar generation in accordance with the environmental regulations of Pakistan Environmental Protection Agency, Statutory Notification S.R.O. 339(I)/2000. PC/PEC has prepared the application form for the project review, and submitted to Environmental Protection Agency for final approval for issuance of the environmental clearance of the project. PC has agreed to complete all the necessary procedures for obtaining



the environmental clearance from Pakistan Environmental Agency as soon as after the Final Report has been received from JICA.

(5) Application of the Related Laws and Regulations

The Pakistani side agreed the structural design for the installation of PV system shall comply with the Architectural Regulation in Japan and Pakistan. Electrical design for Grid-connected PV system should be done in accordance with JIS/IEC.

The Pakistani side agreed that the PC shall be responsible for the application of related laws and regulations for the operation of the PV system for interconnection with the distribution lines before commissioning of the Program. The Japanese side shall assist the Pakistani side to introduce necessary procedures through soft component during the implementation of the Program.

(6) Customs and Tax Exemption

The Pakistani side agreed that the PC shall be responsible for the exemption and/or reimbursement of all customs, tax, levies and duties incurred in Pakistan for the implementation of the Program.

(7) Assignment of Counterpart Personnel

1) Overall project management

The Pakistani side assigned following personnel for overall project management and coordination in each organization.

PC :Engr. Parvez Butt HI, SI, Member (Energy)
PEC :Engr. Ashfaq Ahmad Sheikh, Deputy Registrar

2) Soft Component

The Pakistani side agreed to assign the following personnel as the focal members for Counterpart Personnel and other necessary members in accordance with the soft component plan proposed by the Team.

PC : Engr. Khalid Mahmood
PEC : Engr. Khadim H. Bhatti

9.2. Ownership and Responsibilities for Operation and Maintenance (O&M) of Equipments

The Pakistani side has reconfirmed that the PC and PEC are the owner of Equipments for respective site. PC and PEC are responsible for securing necessary budget and personnel for Operation and Maintenance (O&M) of Equipments under the joint leading team, the estimated cost of which is described in Annex-3. The Pakistani side confirmed that the Equipments procured under the Program shall be operated and maintained in accordance with the organization structure for operation & maintenance of equipment as described in Annex-4.

<List of Annex>

Annex-1 Program Grant Aid for Environment and Climate Change of the Government of Japan

Annex-2 List of Equipments

Annex-3 Project Cost Estimation (Confidential)

Annex-4 Organization Structure for Operation and Maintenance of Equipment



Program Grant Aid for Environment and Climate Change
of the Government of Japan
(Provisional)

The Grant Aid provides a recipient country (hereafter referred to as “the Recipient”) with non-reimbursable funds to procure the facilities, equipment, and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

Based on “Cool Earth Partnership” initiative of the Government of Japan, the Program Grant Aid for Environment and Climate Change (hereafter referred to as “GAEC”) aims to mitigate effects of global warming by reducing GHGs emission (mitigation; e.g. improvement of energy efficiency) and to take adaptive measures (adaptation; e.g. measures against disasters related to climate change, including disaster prevention such as enhancing disaster risk management). GAEC may contain multiple components that can be combined to effectively meet these needs.

1. Procedures for GAEC

GAEC is executed through the following procedures.

Preparatory Survey 1	Preparatory Survey for project identification conducted by Japan International Cooperation Agency (JICA)
Application	Request made by a recipient country
Appraisal & Approval	Appraisal by the Government of Japan and Approval by the Cabinet
Determination of Implementation	The Notes exchanged between the Government of Japan and the Recipient Country
Grant Agreement (hereinafter referred to as the “G/A”)	Agreement concluded between JICA and the Recipient
Preparatory Survey 2	Preparatory Survey for design conducted by JICA
Implementation	Procurement through the Procurement Agency by the Recipient

Firstly, if the candidate project for a GAEC is identified by the Recipient and the Government of Japan, the Government of Japan (the Ministry of Foreign Affairs) examines it whether it is eligible for GAEC. When the request is deemed appropriate, JICA, in consultation with the Government of Japan, conducts the Preparatory Survey (hereafter referred to as “the Survey”) on the candidate project as Phase 1 of the Survey with Japanese consulting firms.

Secondly, the Recipient submits the official request to the Government of Japan, while the appropriateness, necessity and the basic components of the Program are examined in the course of Phase 1 of the Survey,

Thirdly, the Government of Japan appraises the Program to see whether it is suitable for Japan's GAEC, based on the Survey report prepared by JICA, and the results are then

submitted to the Cabinet for approval.

Fourthly, the Program, once approved by the Cabinet, becomes official with the Exchange of Notes (E/N) signed by the Governments of Japan and the Recipient.

Fifthly, JICA engages Grant Agreement (G/A) with the Recipient and executes the Grant by making payments of the amount agreed in the E/N and strictly monitors that the funds of the Grant are properly and effectively used.

Procurement Management Agent is designated to conduct the procurement services of products and services (including fund management, preparing tenders, contracts) for GAEC on behalf of the Recipient. The Agent is an impartial and specialized organization that will render services according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by the Government of Japan and agreed between the two Governments in the Agreed Minutes ("A/M").

2. Preparatory Survey

1) Contents of the Survey

The purpose of the Preparatory Survey (hereafter referred to as "the Survey"), conducted by JICA on a requested project (hereafter referred to as "the Project"), is to provide the basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Survey are as follows:

- Confirmation of background, objectives, and benefits of the Project and institutional capacity of agencies and communities concerned of the Recipient necessary for project implementation.
- Evaluation of relevance of the Project to be implemented under the Grant Aid Scheme for Environment and Climate Change from a technical, social, and economic point of view.
- Confirmation of items agreed upon by both parties concerning the basic concept of the Project.
- Preparation of the design of the Project and reference document for tender.
- Estimation of cost for the Project.

The contents of the original request will be modified, as found necessary, in the design of the Project according to the guidelines of Japan's Grant Aid scheme.

The Government of Japan requests the Government of the Recipient to take whatever measures necessary to ensure its responsibility in implementing the Project. Such measures must be guaranteed even if they may fall outside the jurisdiction of the implementing organization of the Recipient. This has been confirmed by all relevant organizations of the Recipient through the Minutes of Discussions.

2) Selection of consulting firms

For the smooth implementation of the Survey, JICA will conduct the Survey with registered consulting firms. JICA selects the firms based on proposals submitted by firms with interest in implementing the Survey. The firms selected will carry out the Preparatory Survey and prepare a report, based on the terms of reference set by JICA.

3. Implementation of GAEC after the E/N

1) Exchange of Notes (E/N)
The content of GAEC will be determined in accordance with the Notes exchanged by the two Governments concerned, in which items including, objectives of the project, period of execution, conditions and amount of the Grant Aid are confirmed.

2) Details of Procedures
Details of procedures on procurement and services under GAEC will be agreed between the authorities of the two governments concerned at the time of the signing of the G/A.

Essential points to be agreed are outlined as follows:

- a) JICA will supervise the implementation of the Project.
- b) Products and services will be procured and provided in accordance with JICA's "Procurement Guidelines for the Program Grant Aid for Environment and Climate Change."
- c) The Recipient will conclude a contract with the Agent.
- d) The Agent is the representative acting in the name of the Recipient concerning all transfers of funds to the Agent.

3) Focal points of "Procurement Guidelines for the Program Grant Aid for Environment and Climate Change"

a) The Agent
The Agent is the organization, which provides procurement of products and services on behalf of the Recipient according to the Agent Agreement with the Recipient. The Agent is recommended to the Recipient by the Government of Japan and agreed between the two Governments in the A/M.

b) Agent Agreement
The Recipient will conclude the Agent Agreement, in principle, within two months after the signing of the G/A, in accordance with the A/M. The scope of the Agent's services will be clearly specified in the Agent Agreement.

c) Approval of the Agent Agreement
The Agent Agreement is prepared as two identical documents and the copy of the Agent Agreement will be submitted to JICA by the Recipient through the Agent. JICA confirms whether the Agent Agreement is concluded in conformity with the E/N, A/M, and G/A and the Procurement Guidelines for the Program Grant Aid for Environment and Climate Change then approves the Agent Agreement.

The Agent Agreement concluded between the Recipient and the Agent will become effective after the approval by JICA in a written form.

d) Payment Methods
The Agent Agreement will stipulate that "Regarding all transfers of the fund to the Agent, the Recipient will designate the Agent to act on behalf of the Recipient and issue a Blanket Disbursement Authorization ("the BDA") to conduct the transfer of the fund (hereinafter referred to as "the Advances") to the Procurement Account from the Recipient Account.

The Agent Agreement will clearly state that the payment to the Agent will be made in Japanese yen from the Advances and that the final payment to the Agent will be made when the total remaining amount become less than three percent (3%) of the Grant and its accrued interests excluding the Agent's fees.

e) Products and Services Eligible for Procurement



Products and services to be procured will be selected from those defined in the G/A.

f) Firm and Consultant

The firm and consultant who would contract with the Agent shall be Japanese Nationals.

The consultants that will be employed to do detail design and supervise the work for the Project, however will be in principle, Japanese nationals recommended by JICA for the purpose of maintaining technical consistency with the Study.

g) Method of Procurement

When conducting the procurement, sufficient attention will be paid to transparency in selecting the firms and for this purpose, competitive tendering will be employed in principle.

h) Tender Documents

The tender documents should contain all information necessary to enable tenderers to prepare valid offers for the products and services to be procured by GAEC.

The rights and obligations of the Recipient, the Agent and the firms supplying products and services should be stipulated in the tender documents to be prepared by the Agent. Aside from this, the tender documents will be prepared in consultation with the Recipient.

i) Pre-qualification Examination of Tenderers

The Agent may conduct a pre-qualification examination of tenderers in advance of the tender so that the invitation to the tender can be extended only to eligible firms. The pre-qualification examination should be performed only with respect to whether the prospective tenderers have the capability of concluding the contracts.

For this, the following points should be taken into consideration:

- (1) Experience and past performance in contracts of similar kind
- (2) Financial credibility (including assets such as real estate)
- (3) Existence of offices and other items to be specified in the tender documents.
- (4) Their potentialities to use necessary personnel and facilities.

j) Tender Evaluation

The tender evaluation should be implemented on the basis of the conditions specified in the tender documents.

Those tenderers which substantially conform to the technical specifications and other stipulations of the tender documents will be judged in principle on the basis of the submitted price, and the tenderer who offers the lowest price will be designated as the successful tenderer.

The Agent will submit a detailed evaluation report of tenders to JICA for its information, while the notification of the results to the tenderers will not be premised on the confirmation by JICA.

k) Additional procurement

If there is any remaining balance after the competitive and/or selective tendering and/or direct negotiation for a contract, and if the Recipient would like to procure additional items, the Agent is allowed to conduct this additional procurement, following the points mentioned below:

- (1) Procurement of same products and services

When the products and services to be additionally procured are identical with the initial tender and a competitive tendering is judged not efficient, additional procurement can be conducted by a negotiated contract with the successful tenderer of the initial tender.

(2) Other procurements

When products and services other than those mentioned above in (1) are to be procured, the procurement should be conducted through competitive tendering. In this case, the products and services for additional procurement will be selected from among those in accordance with the G/A.

l) Conclusion of the Contracts

In order to procure products and services in accordance with the guideline, the Agent will conclude contracts with firms selected by tendering or other methods.

m) Terms of Payment

The contract will clearly state the terms of payment. The Agent will make payment from the "advances," against the submission of the necessary documents from the firm on the basis of the conditions specified in the contract. When the services are the object of procurement, the Agent may pay certain portion of the contract amount in advance to the firms on the conditions that such firms submit the advance payment guarantee worth the amount of the advance payment to the Agent.

4) Undertakings required by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the Recipient is required to undertake necessary measures as the following:

- a) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the Project.
- b) To provide facilities for distributing electricity, water supply and drainage and other incidental facilities in and around the sites.
- c) To ensure all the expense and prompt execution for unloading, customs clearing at the port of disembarkation and domestic transportation of products purchased under the Grant Aid,
- d) To ensure that customs duty, internal taxes and other fiscal levies that may be imposed in the Recipient with respect to the purchase of the Components and the Agent's services will be exempted by the Government of the Recipient.
- e) To accord all the concerned parties, whose services may be required in connection with supply of the products and services under the contracts, such facilities as may be necessary for their entry into the Recipient and stay therein for the performance of their work.

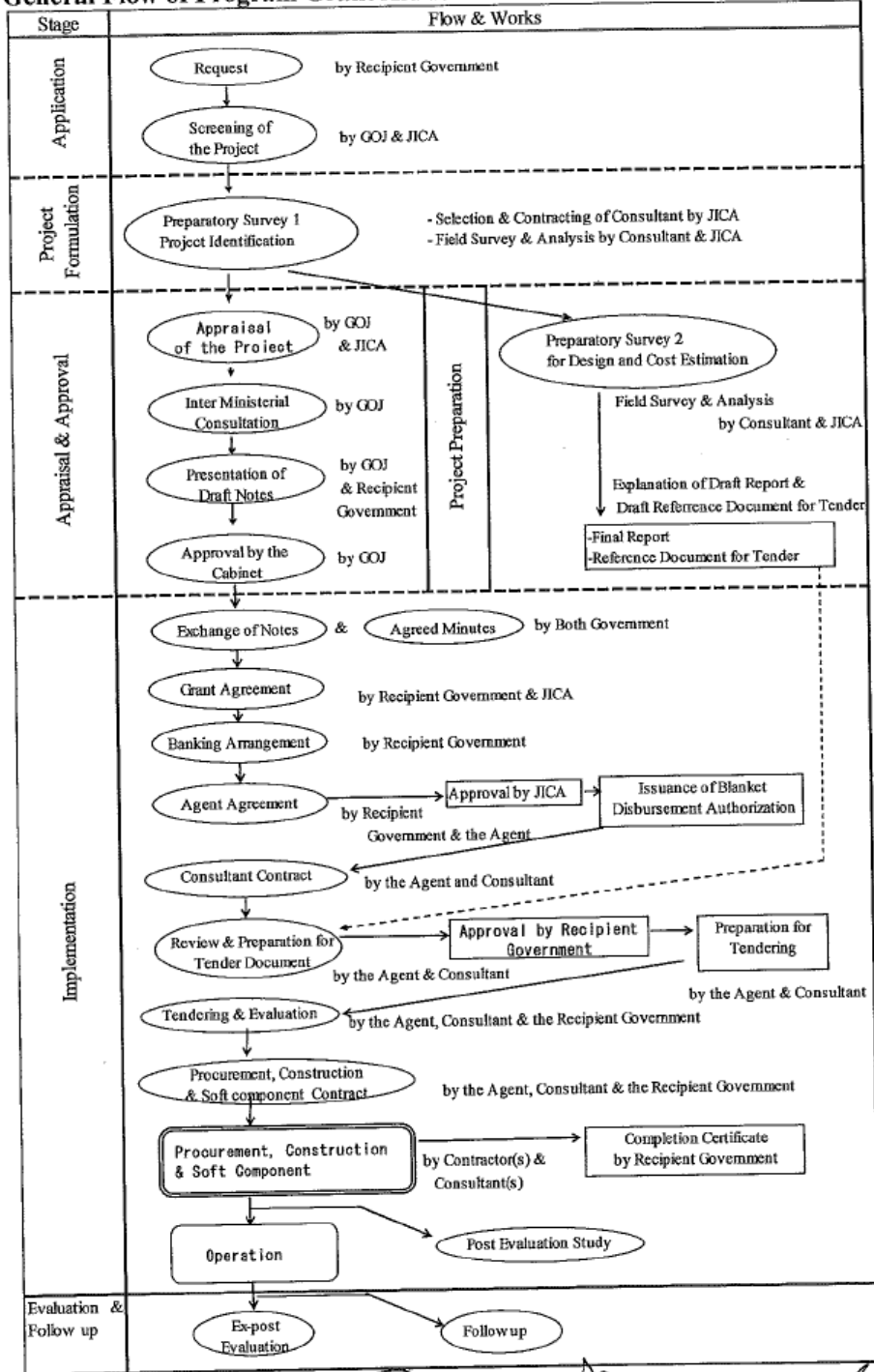
5) "Proper use of funds"

The Recipient is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign personnel necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

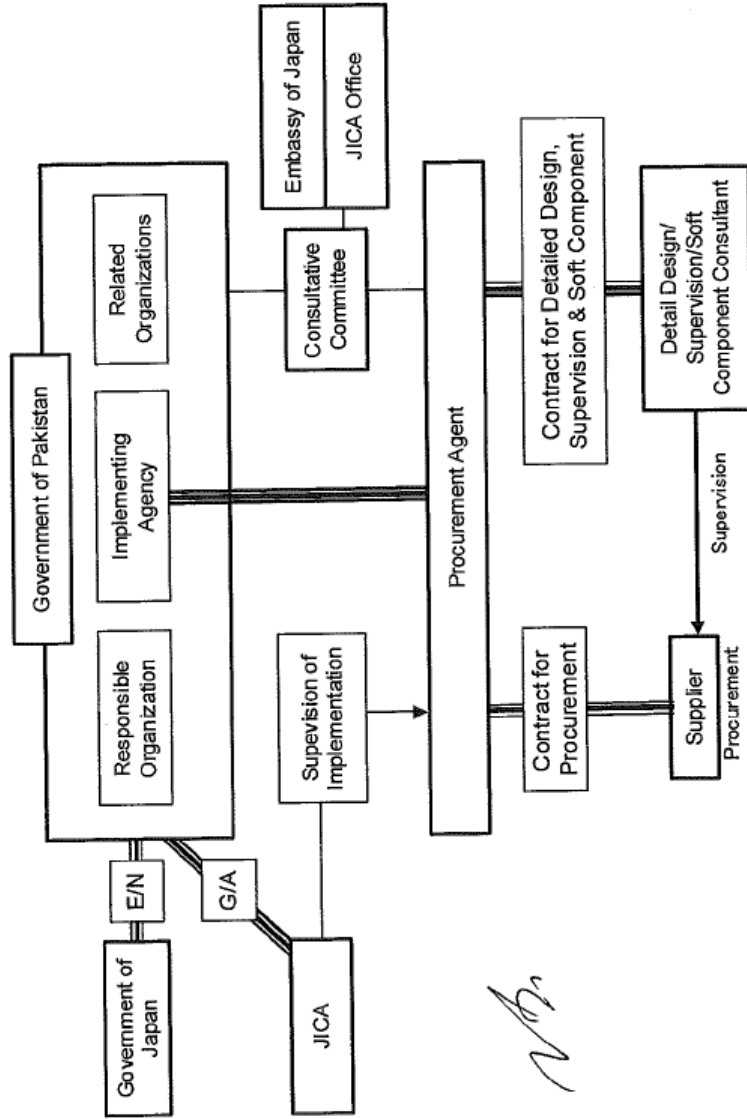
6) "Export and Re-export" of products

The products purchased under the Grant and its accrued interest will not be exported or re-exported from the Recipient.

General Flow of Program Grant Aid for Environment and Climate Change



Project Implementation System



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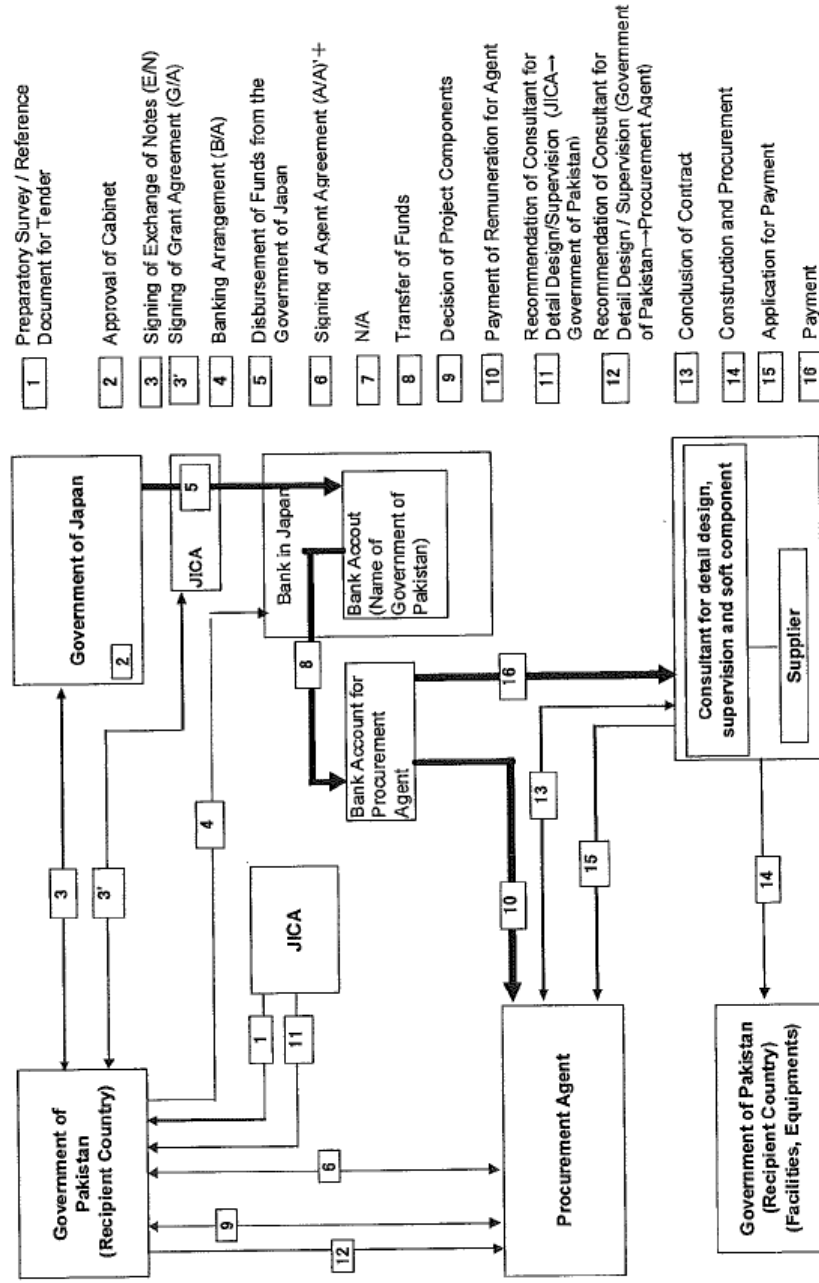
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Flow of Funds for Project Implementation

Flow of Funds for Project Implementation

↑ Implementation Flow
 → Cash Flow



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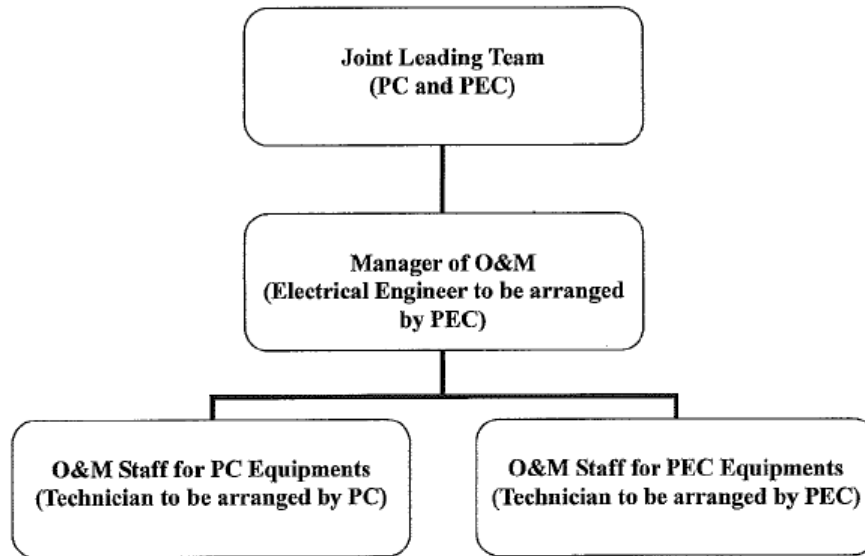
List of Major Equipments

The following table shows a list of equipments procured under the Program.

List of Major Equipments (Unit Price above JPY 1,000 Thousand)

Components	Specification	Qty.	Unit	Purpose
PV Module	Total capacity 110 kWp and above at each site with no. of series and parallels to match the system voltage 3 Phase 400 V to be decided by supplier	1	Set	To generate power by receiving solar insolation
PV Structure	Galvanized finishing	1	Set	To support PV module at required height and angle
Junction Box	Outdoor use with reverse power flow protection, circuit breaker and surge absorber	1	Set	To collect and arrange the strings of modules at PV site
Connection Box	Outdoor use with reverse power flow protection, circuit breaker and surge absorber	1	Set	To connects and arrange the strings from Junction box to match the input of power conditioner
Power Conditioner	Indoor self standing, 110kW and above in total, output AC 400 V 3 Phase 4 Wire, efficiency 90% and above at rated capacity, with grid-connecting facility and safety protection relays (OCR, UVR, OVR, UFR, OFR)	1	Set	To convert the DC power generated by PV array to AC power and to match and supply power to load and grid.
Distribution Board	Indoor self standing, 3 Phase 3Wire, 50 Hz with protection relays	1	Unit	To connect 400 V distribution network
Low Voltage Switching Panel	Indoor self standing, 400 V, 3 Phase, 4 Wire, 50 Hz with no. of circuit breaker.	1	Unit	To connect several power conditioner to main 400 V system
Outdoor Cubicle	Outdoor self standing, dust, insects and vermin proof	1	Unit	To install power conditioner, 400 V distribution board, 400 V distribution panel and data collecting system
400 V Distribution Board	Indoor self standing with power distribution circuit breaker	1	Unit	To connect main feeder, existing load and distribution panel
400 V Distribution Panel	Indoor self standing with power distribution circuit breaker	1	Unit	To connect PV system and distribution board, supply power to equipments
Display Board	Outdoor display board of size W1,200 x L800 mm	1	Unit	To display PV power generation system information
Data Monitoring, Recording and Display System	Meteorological data and system data collection units for data management.	1	Unit	To collect and manipulate the system information to provide information to general public and for system operation and maintenance management.

Organization Structure for Operation and Maintenance of Equipment



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資料 5. ソフトコンポーネント計画書

次ページ以降に添付

ソフトコンポーネント計画書 (パキスタン国)

1. ソフトコンポーネントを計画する背景

太陽光を活用したクリーンエネルギー導入計画は、首都イスラマバードの計画委員会及び技術委員会を対象に太陽光発電システム(以下、PV システム)および関連機材を供与し、太陽光発電の普及啓発、太陽光発電や系統連系に係る技術的な蓄積及び設置サイトにおける電力の確保を目的とするとともに、温室効果ガスの排出量削減を促進するものである。更にデモンストレーション効果を通じて、再生可能エネルギーの普及、促進を図る。

パキスタンでは 2006 年に策定した「再生可能エネルギーの開発政策」の目的の 1 つとして、環境保護が謳われている。効率の低い伝統的なバイオマス燃料の利用や化石燃料による発電を、クリーンで再生可能なエネルギーにより代替することで、環境や健康への悪影響を回避するとしている。また、同政策では「気候変動枠組み条約」の下でパキスタンが約束した行動を通じて、温室効果ガス排出量の削減をすることも謳っている。

パキスタン国における電力不足を補うため、パキスタン国政府の電力規制庁(NEPRA)は 2007/08 年度に、10 の発電事業者に合計 1,536 MW の発電許可を発行済みである。しかし、電力需要を満たせていない。電力不足を解消するとともに、可能な限り再生可能エネルギーを利用することを目的として、パキスタン国政府は代替エネルギー開発委員会(AEDB)を設立するとともに、2006 年に初めて上述の「再生可能エネルギーの開発政策」を策定し、水力発電(50 MW 以下)、風力発電及び太陽光発電の活用を目指す方針を示し、系統連系も可能であることを明確にしている。

しかし、現在までのところ、再生可能エネルギーによる発電施設が系統に連系された事例はない。本プロジェクトにおいて PV システムの系統連系が実現されれば、再生可能エネルギーの初の系統連系の事例となる。

このような状況であることから、パキスタン側には太陽光発電設備を系統連系において円滑に運転する経験・能力が蓄積されていない。そのため、①プロジェクトの円滑な立ち上がりを促進し、プロジェクト完成後は、②その成果の持続性確保を目指した、ソフトコンポーネントによる支援が必要となる。

具体的には、既存系統や PV システムについて、系統連系と売電契約について、データロガーのデータ分析、停電復旧・故障対応手法のそれぞれの理解に対する支援、普及啓発活動の支援が必要である。

2. ソフトコンポーネントの目標

パキスタンでは、系統連系 PV システムの実例はなく、本プロジェクトはパキスタンで初めての事例となる。そのため、技術面や売電契約などの実務面での蓄積が現時点では十分ではない。

円滑な立ち上がりのためには、一定の技術面、実務面の蓄積が必要である。また、持続性の

担保のためにも、同様に、想定されるトラブル対応、発電実績や運用効率の評価、同様の系統連系施設の立ち上げ(技術、実務両面)に係る技術面、実務面の蓄積が求められる。

ソフトコンポーネントの目標として設定するのは、このプロジェクト実施後一定期間経過した時点で到達されるべき状況とし、以下の通り設定した。

- (1) 計画委員会(PC)及び技術委員会(PEC)が系統連系 PV システムを運転し、イスラマバード電力供給公社(IESCO)も PV システムが系統に連系された状態¹で系統を支障なく運転している。
- (2) PV システムで発電した電力は計画委員会(PC)及び技術委員会(PEC)施設内で消費され、余剰電力は系統に送り込まれている。計画委員会(PC)及び技術委員会(PEC)とイスラマバード電力供給公社(IESCO)の間では、系統に送り込んだ電力の売買の基となる売電契約が結ばれている。
- (3) 本協力対象事業の援助効果の定量化と測定可能化がより確実になっている。定量化されたデータを基に、PV システムの運用効率を高めることができている。新たな PV システム導入の計画立案がより高い精度で行えるようになっている。
- (4) PV システムが故障した場合、計画委員会(PC)及び技術委員会(PEC)は修復の対応を円滑に行っている。
- (5) 本プロジェクトがモデルケースとなり、パキスタンで系統連系による再生可能エネルギーの導入が増加している。

3. ソフトコンポーネントの成果

ソフトコンポーネント実施の成果として設定するのは、その完了時に達成されるべき状況とし、以下の通り設定した。

(1) 既存系統と PV システム

計画委員会(PC)、技術委員会(PEC)及びイスラマバード電力供給公社(IESCO)が、以下の点を理解している。

- ① PV システムが連系される既存系統のシステム構成
- ② 同既存系統の保護方式
- ③ 同既存系統の電力供給状況
- ④ 同既存系統から供給されている計画委員会(PC)及び技術委員会(PEC)施設内の電力の質(電圧変動・周波数変動など)
- ⑤ PV システムの基礎知識
- ⑥ 系統連系 PV システムの運転方法・保護方式

このソフトコンポーネントは、既存の系統がどんな状態にあり、そこに連系される PV システムとはどんなものなのかという、言わば計画している 5 つのソフトコンポーネント全体の導入部分と位置づけられる。また、実際に PV システムが系統と連系するためにはどのような

¹ 系統連系とは導入する PV システムが既存の電力系統と接続され、電力系統と一体となって運転される状態をいう。電力系統は交流電力のシステムであるため、直流である PV システムの発電電力は交流に変換し、さらにこの交流電力が系統電力の交流と同期が取れていないと接続できない。また、PV システム側の故障が系統に影響を与えないように、保護装置が必要となるなど、バッテリーを持った自立型 PV システムと比較し、より高度な技術が必要となる。

な技術が必要かを理論で学ぶ理論編のソフトコンポーネントともいえる。

(2) 系統連系と売電契約

パキスタンでは発電設備容量に関係なく、発電された電力を個人使用目的以外に送配電する場合、電力規制庁(NEPRA: National Electric Power Regulatory Authority)に発電事業者として申し込み、ライセンスを取得する必要がある。イスラマバード電力供給公社(IESCO: Islamabad Electricity Supply Company)との系統連系に際して、電力計の管轄機関であるパキスタン国営送電会社(NTDC: National Transmission & Dispatch Company Ltd.)の仕様を満たし、許可を得たメーターを売買電力量の記録のために設置することが求められている。

今まで再生可能エネルギーが系統に連系された実績のないところで、最初の契約を実現させるのは現実として簡単なことではない。しかし、ひとつの前例ができれば、その前例が後に続くプロジェクトの計画実現を促進させる効果は著しく高い。ソフトコンポーネントによってこの売電契約締結を確実なものにすることは、本プロジェクトの目的である再生可能エネルギーの普及促進に最も効果的な成果の1つになると考える。

(3) データロガーのデータ分析

PVシステムの一部であるデータロガー装置で記録された日射量、発電電力、発電電力量、電圧などの①データの分析方法、②分析結果のPVシステム運転保守への活用方法、③本プロジェクトの拡充計画、または他の系統連系PVシステムの計画立案へのデータ分析結果の活用方法を習得している。

データロガーでデータを確実に蓄積し、そのデータを的確に利用できるようにすることは、本協力対象事業の援助効果の定量化と測定可能化に大きな効果を発揮する。また、それらの定量化されたデータを基に、PVシステムの運用効率を高めることができる。加えて、新たなPVシステム導入の計画立案がより高い精度で行えるようになり、PVシステムの導入促進に貢献できる。

(4) 停電復旧・故障対応手法

系統が停電した場合、PVシステムは自動で電力供給を停止する。系統が復旧した時点で、計画委員会(PC)及び技術委員会(PEC)は支障なく系統連系操作ができています。また、PVシステムの故障に対して適切な修復の対応ができています。

ソフトコンポーネント(1)を基礎理論編とすれば、このソフトコンポーネントは実践編と位置づけることができる。機器を見て触りながら実践的な操作方法を身につける訓練を中心に行う。

(5) 普及啓発活動

関係省庁の政策立案者が現場見学会に参加することなどにより、それら政策立案者の間でPVシステムの知識・情報が十分に浸透する。計画委員会(PC)への来訪者、技術委員会(PEC)関係の技術者や、希望者があれば周辺住民も対象として、PVシステムの見学会が開催されている。

4. 成果達成度の確認方法

成果達成度の確認方法は以下のとおりである。

(1) 既存系統と PV システム

①研修用テキスト、②準備調査時取得した計画委員会(PC)及び技術委員会(PEC)施設内の電力品質データ、③日常運転保守マニュアルによって、計画委員会(PC)及び技術委員会(PEC)の職員、また関連する項目についてはイスラマバード電力供給公社(IESCO)の職員が、「3. ソフトコンポーネントの成果」で示した内容を理解しているかどうかで達成度を確認する。ソフトコンポーネントの最終段階で、研修内容確認の筆記試験などにより理解度を確認する。

(2) 系統連系と売電契約

①売電が可能となり再生可能エネルギー法の実現できる、②電力販売ライセンスが交付される、③計画委員会(PC)及び技術委員会(PEC)とイスラマバード電力供給公社(IESCO)とが売電契約を締結すること。そしてこの売電契約を前例として後続のプロジェクトが現れることで成果を確認する。

(3) データロガーのデータ分析

データロガーの活用マニュアルによって、計画委員会(PC)及び技術委員会(PEC)職員が①データロガーで収集したデータを分析でき、②分析結果を PV システムの運転保守に活用でき、③プロジェクトの拡充計画または他の系統連系 PV システムの計画立案に活用できていることをソフトコンポーネント最終時期に実習課題を実施させ、その達成度で確認する。

(4) 停電復旧・故障対応手法

①系統停電を想定した復旧操作実習で適切に PV システムの系統連系復旧ができていないこと、②PV システムの故障を想定した修復作業実習にて、その故障に適切な対応をしていることをソフトコンポーネント最終時期に実習課題を実施させ、その達成度で確認する。

(5) 普及啓発活動

現場見学会でアンケート調査を実施し、そのアンケート結果より確認する。また、関係機関へのアンケートより確認する。

5. ソフトコンポーネントの活動(投入計画)

(1) 既存系統と PV システム

(日本側)

- (a) 必要な技術・業種: 電力設備と太陽光発電・コンサルタント
- (b) 要とされる技術水準: 電力設備全般に詳しく電力系統の運用についても知識があり、太陽光発電の系統連系について講義のできる技術水準。
- (c) 実施方法: テキスト作成・保守マニュアル作成・研修・実習 - 「3. ソフトコンポーネントの成果」で述べた①から⑥の項目について研修と実習により行う。特に④の計画委員会(PC)及び技術委員会(PEC)施設内の電力の質(電圧変動・周波数変動など)については、本調査期間中に記録した実データを活用し、解析・分析の実習を行う。
- (d) 実施リソース(派遣人材/人数・期間): 電力設備-太陽光発電技術者/1名・2.0 M/M
 - 研修テキストの作成及び研修準備:0.5 M/M
 - 以下の項目に係る研修の実施

- ① PV システムが連系される既存系統のシステム構成:0.1 M/M
 - ② 同既存系統の保護方式:0.1 M/M
 - ③ 同既存系統の電力供給状況:0.1 M/M
 - ④ 同既存系統から供給されている計画委員会(PC)及び技術委員会(PEC)施設内の電力の質(電圧変動・周波数変動など):0.2 M/M
 - ⑤ PV システムの基礎知識:0.1 M/M
 - ⑥ 系統連系 PV システムの運転方法・保護方式:0.3 M/M
- 試験の実施:0.1 M/M
 - 保守マニュアルの作成:0.2 M/M
 - 保守実習の実施:0.3 M/M

(パキスタン側)

- (e) 必要な技術・業種: 電力設備・コンサルタント
- (f) 必要とされる技術水準: シニアエンジニアクラス
- (g) 実施方法: テキスト作成・研修・実習
- (h) 実施リソース(人材/人数・期間): コンサルタント/1名・1.5 M/M
- (i) 対象者: 計画委員会(PC)及び技術委員会(PEC)職員、イスラマバード電力供給公社(IESCO)職員

(2) 系統連系と売電契約

(日本側)

- (a) 必要な技術・業種: 系統連系/電力経営・コンサルタント
- (b) 必要とされる技術水準: 電力系統の運営及び制度について指導のできるレベル。
- (c) 実施方法: 手続きマニュアル作成と実施支援 - 再生可能エネルギーを系統連系するための技術的条件、制度上の手続きをマニュアルにまとめる。イスラマバード電力供給公社(IESCO)との売電契約締結のための作業支援を行う。
- (d) 実施リソース(派遣人材/人数・期間): 系統連系-電力経営専門家/1名・1.5 M/M
 - 手続きマニュアルの作成: 0.5 M/M
 - 売電契約締結のための以下の作業支援
 - ① 電力調整局との協議: 0.1 M/M
 - ② 電力販売ライセンス申請書作成支援: 0.1 M/M
 - ③ 希望販売電力料金の算定支援: 0.2 M/M
 - ④ イスラマバード電力供給公社(IESCO)との協議: 0.3 M/M
 - ⑤ イスラマバード電力供給公社(IESCO)との再生可能エネルギー法に基づく売電契約書作成支援: 0.3 M/M

(パキスタン側)

- (e) 必要な技術・業種: 電力経営・コンサルタント
- (f) 必要とされる技術水準: シニアエンジニアクラス
- (g) 実施方法: 手続きマニュアル作成と実施支援
- (h) 実施リソース(人材/人数・期間): コンサルタント/1名・1.0 M/M

- (i) 対象者: 計画委員会(PC)及び技術委員会(PEC)職員、イスラマバード電力供給公社 (IESCO)職員

(3) データロガーのデータ分析

(日本側)

- (a) 必要な技術・業種: 太陽光発電/データ解析・コンサルタント
- (b) 必要とされる技術水準: 太陽光発電を熟知していることに加え、データ解析・分析の知見のあること。
- (c) 実施方法: データロガー活用マニュアル作成・研修・実習 - 具体的な研修・実習内容は、①データロガーシステムの機器構成とその機能の理解、②使用されるソフトウェアの理解、③適応されるデータサンプリング手法とサンプリングした生データから記録データの選択(または加工)手法の理解、④記録データから日・週・月・年報告書の作成手法の習得、⑤データ変化から故障を発見する訓練、⑥発電電力の効率的消費のためのパワーコンディショナーなどの適切な設定値の調整訓練、⑦将来計画立案へのデータ活用方法訓練である。
- (d) 実施リソース(派遣人材/人数・期間): 太陽光発電技術者/1名・1.5 M/M
- データロガー活用マニュアルの作成:0.5 M/M
 - データロガー活用研修の実施
 - ① データロガーシステムの機器構成とその機能の理解:0.1 M/M
 - ② 使用されるソフトウェアの理解:0.1 M/M
 - ③ 適応されるデータサンプリング手法とサンプリングした生データから記録データの選択(または加工)手法の理解:0.1 M/M
 - ④ 記録データから日・週・月・年報告書の作成手法の習得:0.1 M/M
 - ⑤ データ変化から故障を発見する訓練:0.2 M/M
 - ⑥ 発電電力の効率的消費のためのパワーコンディショナーなどの適切な設定値の調整訓練:0.2 M/M
 - ⑦ 将来計画立案へのデータ活用方法訓練:0.2 M/M

(パキスタン側)

- (e) 必要な技術・業種: データ解析/コンピュータ・コンサルタント
- (f) 必要とされる技術水準: シニアエンジニアクラス
- (g) 実施方法: マニュアル作成・研修・実習
- (h) 実施リソース(人材/人数・期間): コンサルタント/1名・1.0 M/M
- (i) 対象者: 計画委員会(PC)及び技術委員会(PEC)職員

(4) 停電復旧・故障対応手法

(日本側)

- (a) 必要な技術・業種: 太陽光発電・コンサルタント
- (b) 必要とされる技術水準: 系統連系 PV システムの運営・維持管理について十分な知識を持った技術者。

- (c) 実施方法: マニュアル作成・研修・実習 - 系統の停電及び PV システムの停電からの復旧操作手順をマニュアルにまとめる。このマニュアルをテキストにして、系統停電を想定した復旧操作実習を行う。PV システムで発生する可能性の高い故障を想定し、①その場合現れる現象から故障カ所を特定する方法、②部品交換など修理の方法、③日本のメーカーへ問い合わせる場合、正確に伝えるべき情報などを、トラブルシューティングとして同様にマニュアルにまとめる。同マニュアルをテキストとして、模擬故障の現象から故障箇所の特定、その故障カ所の部品交換などの実習を行う。
- (d) 実施リソース(派遣人材/人数・期間): 太陽光発電技術者/1名・1.5 M/M
- 停電からの復旧操作マニュアル作成:0.5 M/M
 - 復旧操作実習:0.4 M/M
 - 故障箇所の特定及び部品交換実習:0.6 M/M

(パキスタン側)

- (e) 必要な技術・業種: 電力設備・コンサルタント
- (f) 必要とされる技術水準: シニアエンジニアクラス
- (g) 実施方法: マニュアル作成・研修・実習
- (h) 実施リソース(人材/人数・期間): コンサルタント/1名・1.2 M/M
- (i) 対象者: 計画委員会(PC)及び技術委員会(PEC)職員

(5) 普及啓発活動

(日本側)

- (a) 必要な技術・業種: 再生可能エネルギー普及政策・コンサルタント
- (b) 必要とされる技術水準: 再生可能エネルギーの普及啓発活動について経験または知識のある技術者。
- (c) 実施方法: 普及啓発パンフレット作成・見学会の実施
- (d) 実施リソース(派遣人材/人数・期間): 再生可能エネルギー普及政策専門家/1名・0.5 M/M
- 普及啓発パンフレット作成:0.1 M/M
 - 現場見学会開催準備:0.1 M/M
 - 普及啓発活動実施計画素案作成:0.2 M/M
 - 普及啓発活動実施に係る関係機関との調整:0.1 M/M

(パキスタン側)

- (g) 必要な技術・業種: 太陽光発電・コンサルタント
- (h) 必要とされる技術水準: シニアエンジニアクラス
- (i) 実施方法: 普及啓発パンフレット作成・見学会の実施
- (j) 実施リソース(人材/人数・期間): コンサルタント/1名・0.4 M/M
- (k) 対象者: 計画委員会(PC)及び技術委員会(PEC)職員

6. ソフトコンポーネントの実施リソースの調達方法

ソフトコンポーネントの実施リソースの調達方法は、本邦コンサルタントの直接支援型とする。

パキスタンで系統連系型の太陽光発電設備の導入は本プロジェクトが最初であり、パキスタン国内において、本ソフトコンポーネント計画書で示すソフトコンポーネントを実施できるローカルリソースを見つけることは困難である。本邦コンサルタントをサポートする目的でローカルコンサルタントを限定的に採用する予定である。

7. ソフトコンポーネントの実施工程

実施工程を次ページに示す。

いずれのソフトコンポーネントも、実際に導入される PV システムを見て触れて、また据付工事過程を見ながら行えば、学習効果も高まり効果的である。したがって、全てのソフトコンポーネントを機材据付工事期間中ないしはその直後に行うこととした。

ソフトコンポーネント実施工程

	会計年度	平成22年度			平成23年度					
	暦年	2011年								
	カレンダー月	2	3	4	5	6	7	8	9	
工事 本 体	機材据付工事			■						
	コミッショニング						■			
	検収・竣工引渡し							▲		
ソフト コン ポー ネン ト	(1) 既存系統とPVシステム			■						
	(2) 系統連系と売電契約			■						
	(3) データロガーのデータ分析				■					
	(4) 停電復旧・故障対応手法				■					
	(5) 普及啓発活動						■			
	報告書									
					▲		▲			
					実施状況報告書			完了報告書		

国内作業: □ 現地作業: ■

(1) 既存系統と PV システム: 機材据付工事期間の前半に実施

本ソフトコンポーネントは他のソフトコンポーネントの導入の役割があり、また、理論を学ぶ研修が中心となるため、機材の必要性は相対的に低いため、他のソフトコンポーネントより先の機材据付期間の中盤に行うこととする。

(2) 系統連系と売電契約: 機材据付工事期間の前半に実施

売電契約が締結され、その後機材が据え付けられ、系統連系が実施される工程が一般的である。ある程度機材の据付が実現し始め売電契約のための条件が見えてきた段階で本ソフトコンポーネントを実施することが、売電契約を実現させる上で効率的と考える。

一方、本ソフトコンポーネントでは、機材を使った実習はなく、機材の据付完了時期に実施する必要性は低いため、他のソフトコンポーネントが集中する後半を避け、機材据付工事の中盤とした。

- (3) データロガーのデータ分析: 機材据付工事期間の後半に実施
実際の機材を使った実習があり、機材据付工事期間の後半に実施することが効率的である。
- (4) 停電復旧・故障対応手法: 機材据付工事期間の後半に実施
実際の機材を使った実習があり、機材据付工事期間の後半に実施することが効率的である。
- (5) 普及啓発活動: 機材据付工事期間の後半に実施
現場見学会を行うことから、機材据付工事期間の後半に実施することが効率的である。

8. ソフトコンポーネントの成果品

以下を成果品とする。

- (1) 既存システムと PV システム研修用テキスト(英語): 10 部
- (2) PV システム日常運転保守マニュアル(英語): 10 部
- (3) システム連系手続きマニュアル(英語): 10 部
- (4) データロガーの活用マニュアル(英語): 10 部
- (5) 停電復旧・故障対応マニュアル(英語): 10 部
- (6) 普及啓発パンフレット(ウルドゥ語・英語): 各 200 部
- (7) 実施状況報告書(英語・日本語): 各 4 部
- (8) 完了報告書(英語・日本語): 各 5 部

ソフトコンポーネント(5)普及啓発活動については、実施期間が短いことから実施状況報告書の作成は行わず、完了報告書の作成のみとする。

9. ソフトコンポーネントの概算事業費

ソフトコンポーネントの概算事業費は以下のとおりである。

事業費合計	18,813,000 円
(1) 直接人件費	5,502,000 円
(2) 直接経費	6,269,000 円
(3) 間接費	7,042,000 円

10. 相手国実施機関の責務

「ソフトコンポーネントの目標」を達成するためには、実施機関である計画委員会(PC)及び技術委員会(PEC)及び関連組織の継続的な運営維持管理活動及び普及啓発活動が必要である。この継続的な取り組みについて、実施可能性、阻害要因、必要な措置を以下に記載する。

(1) 実施可能性

計画委員会(PC)及び技術委員会(PEC)は PV システムの導入に強い関心を示している。今回の計画準備調査においても、特に、技術委員会(PEC)の協力的かつ積極的な対応が評価できる。現在、総理大臣計画予算でパキスタン国内に PV システムを導入する計画が進められており、この計画の立案や実施責任者として技術委員会(PEC)が選定されている。これらの状況から判断して、目標達成の実現可能性は十分高いといえる。

(2) 阻害要因

運営維持管理については、技術移転を受けた職員の配置転換や転職が阻害要因である。これにより、継続的な維持管理が実施されなくなる。再生可能エネルギーの導入促進では、トップダウンの方針決定が最も重要である。政府上層部の方針決定者に再生可能エネルギーの重要性を十分理解できていない人物がいる場合、それは導入促進の大きな阻害要因になる。

(3) 必要な措置

運営維持管理については、複数の職員に技術移転を行う。マニュアルを整備して、各組織内で継続的に運営維持管理の担当者を育成できる体制を整える。導入促進については、普及啓発活動によって政府上層部で導入促進の中心となる人物に十分な説明を行う。

以上