The Republic of the Union of Myanmar
Ministry of Electericity and Energy

PROJECT FOR CAPACITY DEVELOPMENT OF POWER SECTOR DEVELOPMENT PLANNING IN THE REPUBLIC OF THE UNION OF MYANMAR

PROJECT COMPLETION REPORT

April 2019

Japan International Cooperation Agency

NEWJEC Inc.
The Kansai Electric Power Co., Inc.

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19-032

Project for Capacity Development of Power Sector Development Planning in Myanmar
Project Completion Report

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Annexes

Abbreviations

Symbol	Abbreviations
C/P	Counterpart
DAC	Development Assistance Committee
DEPP	Department of Electric Power Planning
DPTSC	Department of Power Transmission and System Control
EPGE	Electric Power Generation Enterprise
ERC	Electricity Regulatory Commission
ESE	Electricity Supply Enterprise
GoM	Government of Myanmar
IPP	Independent Power Producer
JCC	Joint Coordinating Committee
JICA	Japan International Cooperation Agency
LRMC	Long Run Marginal Cost
MESC	Mandalay Electricity Supply Corporation
MOEE	Ministry of Electricity and Energy
MSDP	Myanmar Sustainable Development Plan
NEMC	National Energy Management Committee
NEMP	National Electricity Master Plan
ODA	Official Development Assistance
PDM	Project Design Matrix
PSSE	Power system simulator for engineering
R/D	Record of Discussions
WASP	Wien Automatic System Planning
WG	Working Group
WS	Workshop
YESC	Yangon Electricity Supply Corporation

I. BASIC INFORMATION OF THE PROJECT

1. Country

Republic of the Union of Myanmar (Myanmar)

2. Title of the Project

Project for Capacity Development of Power Sector Development Planning

3. Duration of the Project (Planned and Actual)

(Planned) From 4th September 2016 to 3rd September 2018
(Actual) From 4th September 2016 to the end of March 2019

4. Background (from Record of Discussions (R/D))

Myanmar has proceeded with power generation development concentrating on hydropower and it accounts for over 70% of total electric power generation. Currently, the electric power demand in Myanmar has been rising rapidly against the background of its steeply growing economy. The peak demand for power in Myanmar nationwide was around 2,000MW in 2013.The power supply and demand balance throughout the country in dry season faces severe imbalance due to declining of electric-generated capacity of hydropower plants, deterioration of aging facilities and shortage of fuel gas and it causes load shedding.

As Myanmar's power demand is forecasted to further increase with the annual growth rate of over 10% due to the growing economy as well as low of electrification ratio at present, the aforementioned situation is likely to continue or could be worsened.

In view of the above situation, the Government of Myanmar (GoM) has put emphasis on the importance of the electric power sector, as one of its priority sector, and has highlighted the elimination of planned electric outage in the short-term and the resolution of electric power shortage in the medium and long-term as a major national priority. The GoM established the National Energy Management Committee (NEMC) in January 2013 to fulfill the long-term plan based to meet the increased demand for electricity. Furthermore, the National Energy Policy formulated by NEMC in January 2015 has require the preparation of long-term electricity development plan, the implementation of electric power development projects on the bases of the said plan and the annual review of the plan.

Against this backdrop, Japan International Cooperation Agency (JICA) has assisting GoM based in its request in formulating the National Electricity Master Plan (NEMP) since 2013, and has further been enhancing GoM's capacity through the Data Collection Survey on Capacity of Power Sector Development Planning in 2015.

Going forward, Ministry of Electricity and Energy (MOEE) and related organizations need to implement and regularly update the NEMP by its own capacity. However, as the NEMP is yet new MOEE, the capacity development on the planning, updating and utilizing of NEMP is required.

5. Overall Goal and Project Purpose (from the R/D)

(Overall Goal)

The power sector development is promoted based on the NEMP.

(Project Purpose)

The capacity of MOEE for power sector development planning is enhanced through the process of reviewing, updating and utilizing the NEMP.

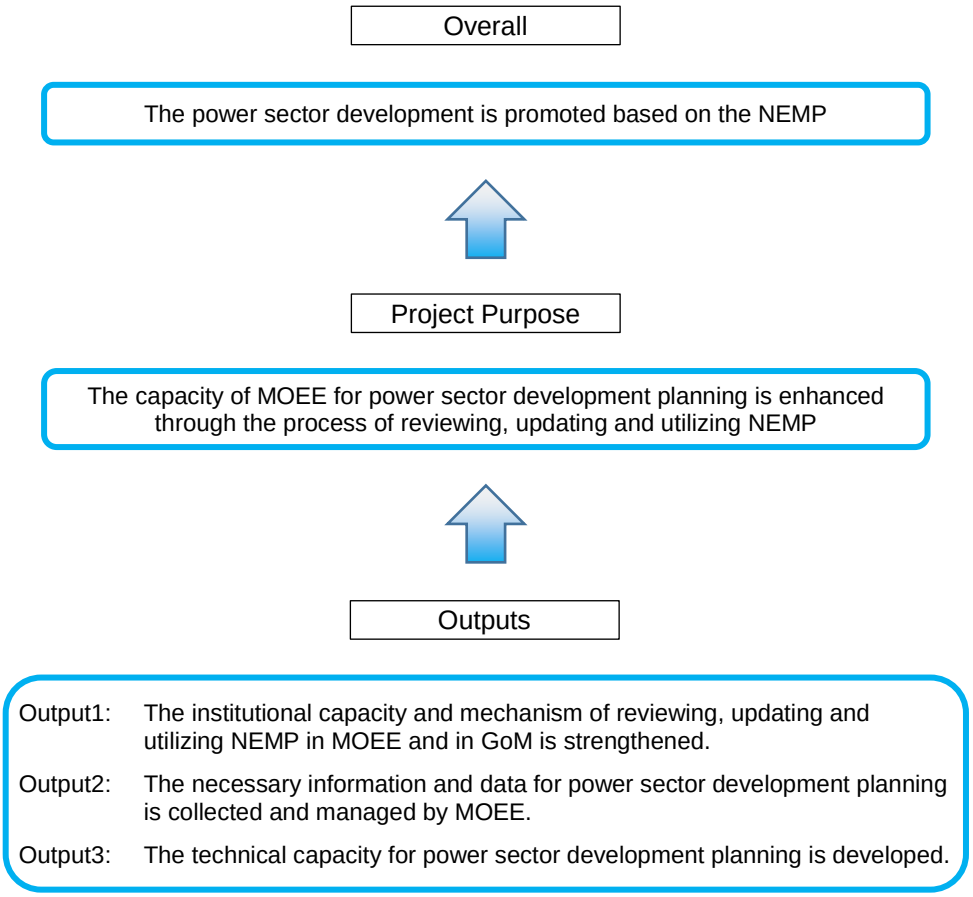


Figure 1 Relation between Project Purpose and Outputs of Project Activities

6. Implementing Agency

Department of Electric Power Planning (DEPP), MOEE

II. RESULTS OF THE PROJECT

1. Results of the Project

1.1 Input by the Japanese Side (Planned and Actual)

Inputs by the Japanese side were dispatched to cover the following expertise fields.

Table 1 Input by the Japanese Side (Planned and Actual)

Planned	Actual
-Long term Resident Expert Power Sector Advisor	- Long term Resident Expert Power Sector Advisor
-Team Leader / Power Sector Planning	- Team Leader / Power Sector Planning
-Power Demand Forecast / Primary Energy	- Power Demand Forecast
	-Primary Energy / Thermal Power Generation
-Power Generation Development Planning	- Power Generation Development Planning
-Power System Planning	- Power System Planning
-Economic and Financial Analysis	- Economic and Financial Analysis
-Data Management/ Institutional Facilitation	- Data Management
	- Institutional Facilitation
-Environmental and Social Consideration	- Environmental and Social Consideration
-Coordinator	-Coordinator / Monitoring

Detailed information is shown in ANNEX 1-(1).

1.2 Input by the Myanmar Side (Planned and Actual)

Inputs by the Myanmar side were assigned as planned, and they are listed below.

- Project Chairperson
- Project Director
- Project Manager
- Project Coordinator
- Working Group Members

Detailed information is shown in ANNEX 1-(2).

1.3 Workshop in Japan (Actual)

The Japanese side planned Workshop (WS) in Japan twice in the duration of the Project and implemented as shown below.

1.3.1 WS in Japan (1)

1) Duration : 25th June 2017 ~ 4th July 2017 (11 days)
2) Number of Participants : 10 persons

1.3.2 WS in Japan (2)

1) Duration : 30th July 2018 ~ 8th August 2018 (10 days)
2) Number of Participants : 5 persons

Detailed information is shown in ANNEX 1-(3).

1.4 Activities (Planned and Actual)

(1) As for the Output 1, "The institutional capacity and the mechanism of reviewing, updating and utilizing NEMP in MOEE and in GoM is strengthened", the expert team submitted the Regulation (Draft) in August 2017 for the systematical formulation works of NEMP.

In addition to this, the expert team also explained the contents and the necessity of Regulation to successful implementation of power development in the future, during the 6th and 7th WSs on 22nd February and 3rd May 2018, respectively. In these WSs, all the Working Group (WG) members acquired understanding of the Regulation.

The Japanese side has implemented its inputs as planned.

The final approval by the Cabinet and the necessary procedures for this approval in the MOEE are the only pending inputs.

On the other hand, totally 35 counterparts (C/Ps) were assigned to the WG for the formulation works of NEMP.

Therefore, most of the activities have been implemented as planned, except for the review of the Regulation (Draft) and final approval of Regulation by the Cabinet

(2) As for the Output 2, "The necessary information and data for power sector development planning is collected and managed by MOEE", the expert team has collected all the necessary information and data to revise NEMP with the cooperation of WG members in the duration of the Project.

And the expert team has established the database system which covers all the necessary fields of NEMP in January 2019, and prepared "Manuals for Data Management of NEMP"

Therefore all the necessary activities have been implemented as planned.

(3) As for the Output 3, "The technical capacity for power sector development planning is developed", the expert team has transferred all the necessary knowledge and technology for formulating NEMP until the 11th dispatch in September 2018.

The NEMP formulation WG led by the Project Manager (PM) drafted the revised NEMP by their own initiative and showed the results in the 10th WS in January 2019.

Therefore all the necessary activities have been implemented as planned.

Project Activities and Achievements of the Output are shown in Table 2.

Table 2 Achievement of Output (Plan and Achievement)

Project Activities	Main Components of Activities	Achievement
Output1. The institutional capacity and mechanism of reviewing, updating and utilizing NEMP in MOEE and in GoM is strengthened.		
1. Establishment of Organization / Institutional System for Power Sector Planning (responsibility, authority, approval/development process, etc.)		
1.1. Clarify the current status and responsibilities of each department/ division for power sector development planning and utilizing the NEMP, and identify the institutional constraints and challenges.	(1) analyze the role and duties of related organizations (2) analyze the problems of institutional system (3) consolidate the problems (4) consider measurement of improvement	(1) The expert team implemented the survey on role and duties of the related organizations in Aug.2017. (2) The expert team proposed the Regulation (draft) to formulate the NEMP systematically.
1.2. Based on the above 1.1, assign the WG members, who are in charge of each field of power sector development planning.	Establishments of WGs (1) Power Demand Forecast WG (2) Power Generation Development Planning WG (3) Power System Planning WG (4) Environment and Social Consideration WG (5) Economic and Financial Analysis (6) Institution Facilitation and Data Management WG	In the first Joint Coordinating Committee (JCC) on 16th November 2016, all the members of the WG were assigned and confirmed in the Minutes of Understandings of JCC. After that some WG members were transferred but the new members were assigned immediately.
1.3. Clarify the roles, process and rules of each department/division based on the work flow of the power sector development planning.	(1) analyze the role and duties of the related organizations in NEMP works (2) analyze the process of NEMP works (3) consider the systematic process of NEMP works	(1) The role and duties of each organization was studied and confirmed in Aug.2017 (2) The systematic process of NEMP works was confirmed in the Role of Cabinet in Cabinet Approval.
1.4. Examine and prepare an institutional mechanism for planning, reviewing and regularly updating the NEMP, and assist in establishing an approval process within GoM.	(1) to analyze the roles and duties of the related organizations in the revising work of NEMP (2) analyze revising work (3) consider the systematic process for the revising work of NEMP (4) consider the administration process of the GoM (5) support the establishment of administration process in the GoM	(1) Establishing WG for NEMP formulation work is recommended in the Regulation (Draft). (2) As for the process of NEMP, annual schedule including approval of the Minister and Cabinet is shown in the Regulation (Draft). (3) As for the establishment of administration process in the Government, the Regulation (Draft) was explained in the 5th WS and 6th WS and the establishment of systematic procedure was recommended.
1.5. Provide technical and/or policy-related advices on institutional arrangements and regulatory framework in the power sector, based on the information obtained through the Project Activities 1, 2 and 3.	(1) recommend the institutional system and legal framework for NEMP drafting and revising work (2) implement institutional reform and improve the legal framework in the GoM based on the recommendation (Myanmar side)	Recommendations were made in the 3rd JCC held in January 2019.
Output 2.The necessary information and data for power sector development planning is collected and managed by MOEE.		
2. Development of Institutional Capacity for Information/Data Collection and Management		
2.1. To identify constraints and challenges for information/data collection and management on power sector development planning.	(1) grasp the current situation of data collection in the related organizations (2) grasp the current situation of data management in the related organizations (3) analyze the problems of data collection, data management and data flow in the related organizations (4) consider adequate institutional and legal system for data management	(1) collected necessary data to revise NEMP (2) Database for primary energy and electric power demand forecasting was established in Feb.2018. Using this database as the prototype of the NEMP data base, the other fields were established step by step. (3) In the 10th WS held in Jan.2019, the management of the database was reported and recommendations were given to the institutional management.

Project Activities	Main Components of Activities	Achievement
2.2. To strengthen the mechanism for collecting, managing and updating the required data and information for the following:		
(a) Power demand forecast (including rural electrification)	(1) collect necessary data and information of the Power Demand Forecast (2) consider annual data collection and data management (3) collect necessary data for countermeasures in the short-time (4) consolidate problems of data collection and data management	(1) collected necessary data and information for Power Demand Forecast (2) established the database in Feb.2018 (3) Manuals explaining - how to collect data and information and how to analyze were prepared.
(b) Power generation development plan (including Independent Power Producer (IPP) and renewable energy)	(1) collect necessary data and information of the Power Generation Development Planning including IPP and renewable energy (2) consider annual data collection and data management (3) collect necessary data for micro and macro analysis (4) consolidate problems of data collection and data management	(1) collected necessary data for Power Generation Development Planning (2) established the database for power generation planning in Sep.2018 (3) Manuals explaining - how to collect data and information and how to analyze were prepared.
(c) Power system development	(1) collect necessary data and information of the Power System Planning (2) consider annual data collection and data management (3) collect necessary data for electrification and distribution system plan (4) consolidate problems of data collection and data management	(1) collected necessary data and information for Power System Planning (2) established the database in the field of power system planning in Sep.2018 (3) Manuals explaining - how to collect data and information and how to analyze were prepared.
(d) Economic and financial analysis (in particular with respect to financial burden of electricity tariff and subsidy for users/taxpayers)	(1) collect necessary data and information of Economic and Financial Analysis (2) consider annual data collection and data management (3) collect necessary data of tariff system and subsidy program for Power Sector (4) consolidate problems of data collection and data management	(1) collected necessary data and information for Economic and Financial Analysis (2) Database will be established by the 12th dispatch. (3) Manuals explaining - how to collect data and information and how to analyze were prepared.
(e) Environmental and social consideration in the power sector	(1) to collect necessary data and information of Environmental and Social Consideration related to Power Generation Development Planning and Power System Planning (2) consider annual data collection and data management (3) consolidate problems of data collection and data management	(1) collected necessary data and information for Environmental and Social Consideration related to Power Generation Development Planning and Power System Planning (2) Database was established by the 12th dispatch. (3) Manuals explaining - how to collect data and information and how to analyze were prepared.
2-3. Improve the information/data management system including statistics	(1) consolidate problems of the systematic data collection and data management (2) recommend data collection and data management in Power Sector (3) implement the institutional reform for the systematic data management (Myanmar side)	(1) Data base for the NEMP works was established considering the problems of the systematic data collection and data management (2) Recommendations were made for the data management in the 10th WS in January 2019.
Output 3. The technical capacity for power sector development planning is developed.		
3. NEMP Update through Joint Work, and Development of Technical Capacity for Power Sector Planning		
3.1. Acquire the analysis methods, program and simulation, and enhance the technical capacity for the following assessment, necessary for power sector development planning:		

Project Activities	Main Components of Activities	Achievement
(a) Power demand forecast (both micro and macro methods)	(1) acquire the basic knowledge of Power Demand Forecast (2) understand the analysis and simulation method (3) acquire the technology to analyze and simulate by themselves (4) understand the result of analysis and simulation and acquire the ability to implement the Power Demand Forecast by themselves	(1)~(3) All the necessary basic knowledge and technology were transferred (4) In the second year, power demand forecasting could be analyzed by the Myanmar side in Feb.2018.
(b) Power development plan, including availability of primary energy, optimal energy mix and power generation	(1) acquire the basic knowledge and forecasting method of primary energy demand and supply (2) acquire the technology of primary energy demand and supply (3) understand the results of analysis (4) acquire the basic knowledge for Power Generation Development Planning (5) understand the concept of software for the optimum power development planning (6) acquire the technology for using simulation software (7) acquire the ability to draft the Power Generation Development Plan by themselves	(1)~(6) All the necessary basic knowledge and technology were transferred (7) In the second year, primary energy demand and supply were analyzed by the Myanmar side in Feb.2018. (8) All the necessary technology and knowhow, including how to use Wien Automatic System Planning (WASP), were transferred until the 11th dispatch in Sep.2018.
(c) Power system plan (including consistency with power distribution line expansion and rural electrification)	(1) acquire the basic knowledge for Power System Planning (2) understand the concept of software for the optimum power system planning (3) acquire the technology for using simulation software (4) understand the results of the simulation software and acquire the ability to draft the Power System Plan by themselves	(1)~(3) All the necessary basic knowledge and technology were transferred in the first year of the Project. (4) All the necessary technology and knowhow including how to use Power System Simulator for Engineering (PSSE) were transferred until the 11th dispatch in Sep.2018.
(d) Economic and financial analysis (in particular in the aspect of financial burden of electricity tariff and subsidy on users/taxpayers)	(1) acquire the basic knowledge for Economic and Financial Analysis (2) understand the method of analysis (3) acquire the ability to analyze by themselves (4) understand the results of analysis and to acquire the ability to implement the Economic and Financial Analysis by themselves (5) acquire the ability to evaluate the influence of tariff or subsidy system	(1)~(3) All the necessary basic knowledge and technology were transferred (4) In the second year, Economic and Financial Analysis was conducted by Myanmar side and supplementary knowledge was transferred in the 11th dispatch in Sep.2018.
(e) Environmental and Social Consideration in the power sector	(1) acquire the basic knowledge of Environment and Social Consideration (2) understand the method of Environment and Social Consideration (3) acquire the ability to evaluate the environmental and social impact by themselves (4) understand the results of analysis and acquire the ability to evaluate the impact by themselves	(1)~(3) All the necessary basic knowledge and technology were transferred (4) In the second year, Environment and Social Consideration was conducted by Myanmar side and supplementary knowledge was transferred in the 11th dispatch in Sep.2018.
3.2. Based on the above 3.1, analyze and prepare the short-, medium- and long-term priority investment plans.	(1) understand the method to draft short-/ middle-/long-term investment plan (2) acquire the ability to draft short-/ middle-/long-term investment plan by themselves	(1) All the necessary basic knowledge and technology were transferred during the technology transfer activities for formulating short, middle and long term investment plan in the first year of the Project.

Project Activities	Main Components of Activities	Achievement
		(2) Necessary knowledge was transferred during the revising work of NEMP in the second year of the project.
3.3. Make recommendations based on the following activities and reflect them in power sector development planning:		
(a) Analyze and prepare the recommendations for power generation development plan of each major fuel source based on the above 3.1 and 3.2.	(1) consolidate the problems and make recommendations for each major fuel resource (2) consider the priority of the recommendations	(1) Consolidated the problems and made recommendations for each major fuel resource in the Interim Report in Dec.2017 (2) Recommendations were made at the end of the second year of the Project in the 10th WS in January 2019.
(b) Collect wide information on institutional arrangements and regulatory framework in the power sector (including IPP, corporatization/ privatization of public utilities and policy incentives for renewable energy), analyze the policy implications of such institutional and regulatory changes, and prepare technical and/or policy-related recommendations.	(1) collect wide information on the institutional arrangement and regulatory framework in the power sector (2) analyze the policy implications and clarify the influence of NEMP (3) consider recommendation to the institutional arrangements and regulatory framework in the power sector implementation	(1) Continuously collect data and information on institutional system, legal framework in the power sector (2) Influence by IPP was analyzed and the results were shown in the 10th WS in January 2019.
3.4. Jointly review and update the NEMP with MOEE staff and JICA Experts, including the results of 3.1 through 3.3 above.	(1) review NEMP (2) revise NEMP	(1) Revised NEMP was submitted in the Interim Report in Dec.2017. (2) In the 11th dispatch, the method of revising NEMP was confirmed. NEMP was formulated in the 12th dispatch and shared in the 10th WS in January 2019.
3.5. Prepare manuals for planning process and methodologies for power sector development planning, and utilize it for the policy / planning process of the Government.	(1) Prepare the manuals for drafting and revising works of NEMP (2) utilize the manuals for drafting and revising work of NEMP	(1) Prepared manuals and teaching materials for each activity of technology transfer in the first year of the Project (2) Manuals for each field was prepared step by step. (3) All manuals were prepared in the 12th dispatch and comments from C/P were reflected in the 10th WS in January 2019.

2. Achievements of the Project

2.1 Outputs and Indicators

Table 3 Achievement of Output

Outputs	Verifiable Indicators	Achievement	Recommendation
Output 1 The institutional capacity and mechanism of reviewing, updating and utilizing NEMP in MOEE and in GoM is strengthened.		Output 1 is almost achieved	
	1-1 Operation rules for NEMP is defined.	1. Partially achieved: The Regulation (Draft) was submitted in August 2017. The contents and necessity of the Regulation were explained in the 6th and 7th WSs on 22nd February and 3rd May 2018 respectively, and all the WG members acquired understanding of the Regulation.	• The Process for establishing the Regulation for power development planning should be advanced. • Working plan for the next NEMP update/formulating should be formulated.
	1-2 Twelve (12) full-time staffs for NEMP are assigned in DEPP and DPTSC[*1].	2. Achieved: Totally 35 persons were assigned to the WG.	• Organizational Framework should be confirmed after the Project Completion. • The core members for formulating/updating NEMP should be appointed by the

Outputs	Verifiable Indicators	Achievement	Recommendation
			Minister, and they should be given priority in NEMP updating/ formulating.
Output 2 The necessary information and data for power sector development planning is collected and managed by MOEE.		Output 2 is achieved.	• Data collection and database management should be continued after the Project Completion
	2-1 Power Sector Statistics for NEMP is annually updated.	2-1. Achieved: The necessary data for NEMP were collected during the Project. At the end of the second year, the database was established for NEMP formulation work.	
Output 3 The technical capacity for power sector development planning is developed.		Output 3 is achieved.	• The capability of MOEE staff to formulate the NEMP was acquired thorough the Project and it should be maintained after the Project Completion, thorough the review and update process of NEMP • Manuals for NEMP formulation works should be revised if necessary
	3-1 Two (2) staffs of MOEE acquired the understanding of the method for power demand forecast.	3-1. Achieved: Three (3) staffs of MOEE acquired the understanding of the method for power demand forecast.	
	3-2 Three (3) staffs of MOEE acquired the understanding of the method for power generation plan using WASP.	3-2. Achieved: Four (4) staffs of MOEE acquired the understanding of the method for power generation plan using WASP.	
	3-3 Three (3) staffs of MOEE acquired understanding of the method for power system development using simulation tools.	3-3. Achieved: Four (4) staffs of MOEE acquired the understanding of the method for power system development using simulation tools.	
	3-4 Two (2) staffs of MOEE acquired the understating of the method for Economic and Financial Analysis i.e., calculating LRMC*2.	3-4 Achieved: Three (3) staffs of MOEE acquired the understanding of the method for Economic and Financial Analysis i.e., calculating LRMC.	
	3-5 Two (2) staffs of MOEE acquired the understanding of the method for Environmental and Social Consideration in power sector	3-5. Achieved: Three (3) staffs of MOEE acquired the understanding of the method for Environmental and Social Consideration in power sector	
	3-6 Fifty (50) Manuals are distributed and utilized in the related organizations.	3-6. Achieved: Many kind of materials were distributed during the technology transfer, and these were combined as manuals, finally. Manuals relating to “Power Demand Forecast”, “Power Generation Development Planning”, “Power System Planning”, “Economic and Financial Analysis”, “Environmental Social Consideration”, “Data Management” were developed by the expert team and a total of 61 manuals were delivered.	

*1 DPTSC: Department of Power Transmission and System Control
*2 LRMC: Long Run Marginal Cost

2.2 Project Purpose and Indicators

As for the Project Purpose, “The capacity of MOEE for power sector development planning is enhanced through the process of reviewing, updating and utilizing the NEMP”, the Project Purpose has been mostly achieved and it is partially not achieved as of January 2019. The following countermeasures are recommended to achieve the Project Purpose completely.

(a) The procedures for legalizing the Regulation of power development planning should be promoted.
(b) Organizational framework should be confirmed after the Project Completion.
(c) Current work of WG for NEMP revision should be completed.

Regarding above mentioned (c) of revising NEMP works were finished with WS om 14th March and presentation to the Minister of MOEE on 21st March 2019.

Summary on the achievement of the Project Purpose is as follows.

Table 4 Achievement of Project Purpose

Project Purpose	Verifiable indicators	Achievement	Recommendation
The capacity of MOEE for power sector development planning is enhanced through the process of reviewing, updating and utilizing the NEMP.	1. Institutional mechanism is achieved by utilizing the NEMP in MOEE.	1. Partially achieved: The Regulation (Draft) was submitted in August 2017. To allow proper functioning of the institutional mechanism, the Regulation (Draft) should be approved by the Cabinet.	• The procedures for legalizing the Regulation of power development planning should be promoted. • Organizational framework should be confirmed after the Project Completion.
	2. NEMP is updated in MOEE.	2. Partially achieved: In the second year of the Project, NEMP was revised by the WGs by their own initiative and it was presented in the 10th WS on 22nd, Jan. 2019. The WG is currently working on reflecting the comments raised in the WS, and this work is expected to complete during the Project Period. Above mentioned works were finished in March 2019.	• Current work of WG involving the NEMP revision should be completed. • The NEMP should be approved by MOEE and then GoM to be published at the earliest

3. History of Project Design Matrix (PDM) Modification

(1) PDM (Ver.0) changed to PDM (Ver.1) in the first JCC on 16th November, 2016.
(2) PDM (Ver.1) changed to PDM (Ver.2) in the fourth Technical WS on 14rd February, 2018.

Detailed contents are shown in ANNEX-3.

4. Others

4.1 Results of Environmental and Social Considerations

"Environmental and Social Considerations" was studied in the process of the technology transfer.

4.2 Results of Considerations on Gender/ Peace Building/ Poverty Reduction

There are no relevant matters.

III. RESULTS OF JOINT REVIEW

1. Results of Review based on Development Assistance Committee (DAC) Evaluation Criteria

As for the DAC Evaluation Criteria, all the members of the WGs participated in the Questionnaire Survey conducted by the expert team. The DAC Evaluation Criteria was evaluated by the results of Questionnaire Survey and the achievement of the Project mentioned in Chapter II.

1.1 Relevance

The project is considered as a highly relevant project judging for the following points and the results of the Questionnaire Survey.
As per the results of the Questionnaire Survey, most of C/Ps answered "relevant".

1.1.1 Consistency with the Development Plan of Myanmar

In the National Policy prescribed in January 2015, it was pointed out that a long-term Electric Power Development Plan should be formulated and revised annually, and the Electric Power Development should be implemented based on that plan.

In addition to these, it was confirmed that it was necessary to have the capacity and institutional development to formulate and operate the Electric Power Development Plan. The GoM set the strategy as "Provide affordable and reliable energy to populations and industries via an appropriate energy generation mix", in its MSDP (Myanmar Sustainable Development Plan): (2018-2030) published in August 2018.

Judging from these background, it can be said that the Project is consistent with the national development plan of Myanmar.

1.1.2 Consistency with Development Needs

Electricity demand in Myanmar has been increasing very rapidly along with the economic development in the recent years. The maximum power demand was 1,371 MW in 2010, and it increased to 3,480 MW in 2018. The growth rate of power demand is remarkable.

The maximum power demand in the revised NEMP in the Project is forecasted to be 14,500MW in 2030. At the same time, electrification rate (33.4% in 2013) should be improved urgently in order to realize a stable society.

In order to correspond to the rapid increase of electricity demand and the electrification needs, a long-term electricity development plan based on appropriate electricity best mix taking into consideration the environment and social aspects is indispensable. Therefore, it is highly necessary to develop the human resource capacity in order to formulate of the long-term development plan.

1.1.3 Consistency with the Japanese ODA Policy

In 2012, Japan's Basic Policy of Assistance to Myanmar set up the Official Development Assistance (ODA) policy "Capacity building and development of systems to sustain economy and society" and "Development of infrastructure and related systems necessary for the sustainable economic development".

The project is considered consistent with the above mentioned Japan's ODA policy.

1.2 Effectiveness

The project is judged to be moderately effective.

Judging from the achievement of the output of the Project, the capacity of MOEE for power sector development planning is enhanced through the process of NEMP updating and reviewing works.

As per the results of the Questionnaire Survey, most of C/Ps answered - "Project purpose was mostly achieved".

1.2.1 Achievement of Project Outputs

- As for the Output 1, "The institutional capacity and mechanism of reviewing, updating and utilizing NEMP in MOEE and in GOM is strengthened", the expert team submitted the Regulation (Draft) in August 2017 for the systematical formulation works of NEMP.

  In addition to this, the expert team explained the contents and the necessity of Regulation for the successful implementation of power development in the future, in the 6th and 7th WSs on 22nd February and 3rd May 2018 respectively. Through these WSs, all the WG members acquired understanding of the Regulation.

  The final approval by the Cabinet and necessary procedures for this approval in MOEE are only pending outputs.

- As for the Output 2, "The necessary information and data for power sector development planning is collected and managed by MOEE", the expert team has collected all the necessary information and data to revise NEMP with the cooperation of WG members during the Project.

  In January 2019, the expert team had established the database system which covers all the necessary fields of the NEMP and prepared "Manuals for Data Management of NEMP"

- As for the Output 3, "The technical capacity for power sector development planning is developed", the expert team has transferred all the necessary knowledge and technology needed for formulating the NEMP until the 11th dispatch in September 2018.

1.2.2 Achievement of Project Purpose

As for the Project Purpose "The capacity of MOEE for power sector development planning is enhanced through the process of reviewing, updating and utilizing the NEMP", the NEMP formulation WG led by Project Manager, formulated the revised NEMP by their own initiative in January 2019.

1.3 Efficiency

Considering the comparison of planned and actual input, the efficiency of the Project is considered to be moderate.

1.3.1 Project cost

As mentioned in Section II.2. "Achievements of the Project", Project activities such as assignment of experts, allocation of C/P and implementation of WS in Japan were carried out in accordance with the original schedule. On the other hand, project cost by the Japanese side increased due to the additional analysis of NEMP implementation utilizing IPP scheme.

1.3.2 Project period

The Project period was expanded from two years as per the original schedule to two and half years, due to the above mentioned additional analysis.

1.4 Impact

Impact of the Project is considered to be moderate.

1.4.1 Provision of achievement of the Overall Goal of the Project

As per the results of the Questionnaire Survey, half of the C/Ps answered that it would be difficult to achieve the Overall Goal of the Project because they felt that MOEE did not have clear vision to legalize the regulation of NEMP formulation works.

1.4.2 Consciousness reform of MOEE staff

At the beginning of the Project, the importance of the NEMP was not recognized by the MOEE staff at all, but through the two and half years of technical transfer to them, they strongly recognized the importance of NEMP.

1.5 Sustainability

The sustainability of the Project is considered to be moderate.

As for the establishment of institutional mechanism such as legalization of NEMP formulation works, most of C/Ps answered that it is not clear if it will be authorized legally. From this point, sustainability is low.

On the other hand, as per the results of the Questionnaire Survey, most of C/Ps answered positively for the sustainable work of NEMP. The attitude of C/P is very positive. From this point, sustainability is high.

Therefore considering these facts, we judged the sustainability to be moderate.

1.5.1 Policy and institutional aspects

MOEE management is anxious about the long-term development plan causing conflicts among regions and different stakeholders because the country has faced some serious ethnic conflicts in the past.

Therefore, MOEE management is not willing to disclose the long-term development plan: NEMP.

1.5.2 Technical aspects (Capability of the MOEE staff)

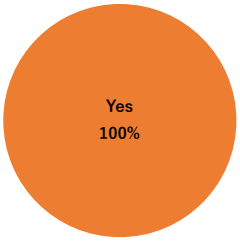
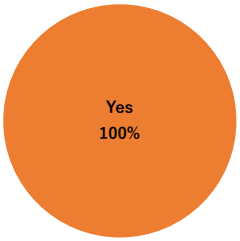
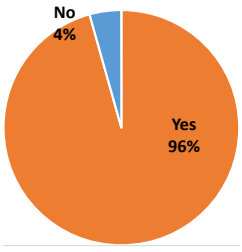
The capability of the MOEE staff was sufficiently strengthened so that they can formulate the NEMP through the technical assistance of JICA.

Most of the C/Ps have the inspiration and positive attitude to formulate and review the NEMP annually.

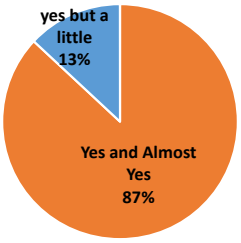
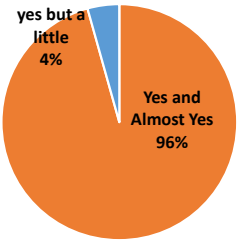
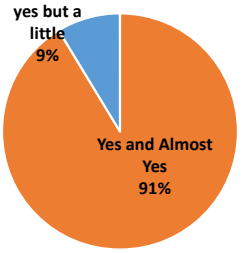
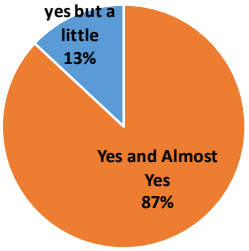
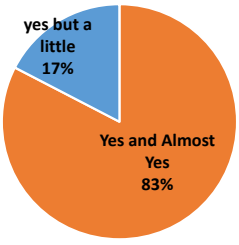
Results of the Questionnaire Survey on DAC Evaluation Criteria are shown in Table 5.

Table 5 Results of the Questionnaire Survey on DAC Evaluation Criteria

① Relevance: High

Evaluation Aspects	Result of Questionnaire for WG
<u>Relevance to Development Policy</u> The GoM set the strategy as "Provide affordable and reliable energy to populations and industries via an appropriate energy generation mix", in its MSDP (2018-2030) published in August 2018.	Do you think that implementation of this project is appropriate to the National Development Policy of Myanmar?  Do you think the purpose of the Project is still valid when you consider the Myanmar Sustainable Development Plan (2018-2030)? 
<u>Relevance to Development Needs</u> Considering the recent rapid and fluid social context, a long-term development plan such as NEMP is indispensable to implement the energy policy in an efficient and consistent manner, and thereby enable economic development of the country. This kind of long-term development plan can reap long-term benefit to the country.	Do you think that the purpose of the project consistent with the development needs of Myanmar? 

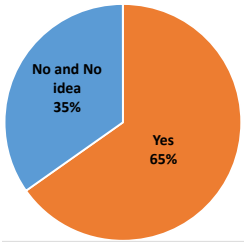
② Effectiveness: Moderate

Evaluation Aspects	Result of Questionnaire for WG
<u>Achievement level of the Output</u> Output 1 The institutional capacity and mechanism of reviewing, updating and utilizing NEMP in MOEE and in GoM is strengthened. Almost achieved. Output 2 The necessary information and data for power sector development planning is collected and managed by MOEE. Achieved Output 3 The technical capacity for power sector development planning is developed. Achieved. <u>Achievement level of the Project Purpose</u> The Project Purpose: "The capacity of MOEE for power sector development planning is enhanced through the process of reviewing, updating and utilizing NEMP", has been mostly achieved and it is partially not achieved.	Output 1: The institutional capacity and mechanism of reviewing, updating and utilizing NEMP in MOEE and in GOM is strengthened.  Output 2: The necessary information and data for power sector development planning is collected and managed by MOEE.  Output 3: The technical capacity for power sector development planning is developed.  Do I think that the project purpose was achieved?  Do I think that achievement of the output led to achievement of the project purpose? 

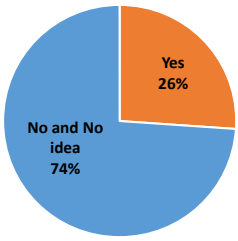
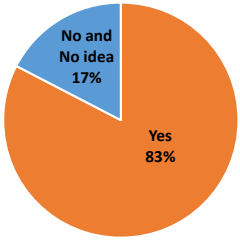
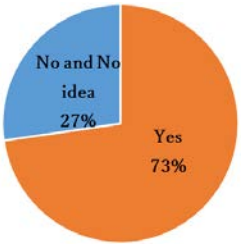
③ Efficiency: Moderate

Evaluation Aspects	Result of Questionnaire for WG
The Project Cost for Japanese Side The Project Cost for Japanese side, which was estimated to be 295 million JPY at the planning stage, has been slightly modified to 314 million JPY. The deviation is mainly because of the additional study on IPP.	N/A
The Project Duration The Project Duration was planned to be 2 years from the date of first arrival of the JICA experts. The duration was extended by 6 month on 26th January, 2017. The Project will again be extended by 3 weeks, and will complete on March 2019.	N/A

④ Impact: Moderate (only provisional, to be evaluated in ex-post evaluation)

Evaluation Aspects	Result of Questionnaire for WG
Prospect of achievement of Overall Goals The Overall Goal of the Project, which is "The power sector development is promoted based on the NEMP", is expected to be achieved by achieving the Project Purpose completely. It is recommended to confirm the institutional framework to formulate NEMP and to regularly update the NEMP.	Do you think that overall goals of the project will be achieved after the termination of the technical assistance of the technical assistance by JICA? 

⑤ Sustainability: Moderate

Evaluation Aspects	Result of Questionnaire for WG
Policy and Institutional Aspects Regulation Draft was proposed during the Project Period. It is recommended to review and revise the Regulation Draft, so that it can be officially authorized and the institutional framework for NEMP is established. But the attitude of MOEE is negative.	Do I you think that Regulation proposed in the Project is approved by the Cabinet (authorized legally)? 
Technical Aspects Total 35 officials have been assigned to the WG throughout the Project. It is recommended to confirm the organizational framework to review and formulate the NEMP after the Project Completion. Most of C/P's attitude is very positive.	After the termination of the Project, do you think that the NEMP will be formulated every five years?  Do you think that the NEMP will be revised every year? 

2. Key Factors Affecting Implementation and Outcomes

2.1 Positive Factor

1) WG members' Positive motivations to the technology

WG members' positive motivations to the technology are very high and this attitude was clearly reflected in the results of the monitoring survey of technology transfer.

This attitude is considered as the positive factor of the Project implementation.

2) Higher authorities of MOEE assigned additional challenges to the WG members and requested them to do further study.

This attitude is also a positive factor and will further enhance the capability of MOEE's staff.

2.2 Negative Factor

1) MOEE management is anxious about a long-term development plan causing conflicts among regions and different stakeholders, and therefore the MOEE management is not willing to disclose the NEMP to the public.

2) The institutional decision system in Myanmar is a top-down system. This system makes it difficult to discuss this freely at the staff level in the ministry, and decrease the positive factor mentioned in 1).

3. Evaluation on the Results of the Project Risk Management

Risk Management was conducted as shown in Table 6 and controlled very well all through the duration of the Project.

Table 6 Changes of Risks and Actions for Mitigation

	Risk Factor	Countermeasures for Mitigation	Results
1	Assignment of C/P	(1) The expert team requested to establish the WGs and to assign the C/P for technology transfer at the Kickoff meeting in September 2016. And confirmed it in the Minutes of Understanding of the first JCC held on 16th November 2016. (2) When the vacancy by staff reassignment occurred, we requested to assign the additional staff in written form.	No problems occurred in C/P allocation. Actual number of C/Ps are more than the original Plan (R/D).
2	Assignment of Japanese Expert	The contents and methods of technology transfer were discussed and confirmed in 2nd JCC in November 2017. Based on the schedule agreed in 2nd JCC, the expert team was dispatched. Experts in the field of Primary Energy/ Thermal Power were changed in Feb.2018. And Expert in the field of Database was changed in July 2018.	No problems have occurred so far
3	Management of Schedule and Implementation	(1) The expert team and Project Manager exchanged views frequently, mainly about the schedule of technology transfer. Especially on important issues of the Project, both the sides confirmed by exchanging official letters. (2) As for the technology transfer, the related activities were implemented based on the schedule agreed in 2nd JCC.	No big problems have occurred so far
4	Information Sharing	Regarding the daily job management, the expert team discussed with the Project Manager and the progress of the project is reported in the JCC and shared among the related people.	No problems have occurred so far
		Since Project Chairperson (Permanent Secretary, MOEE) and Project Director (Director General, DEPP) are too busy to attend the JCC, the expert team is trying to make an appointment to meet the Project Director and report the results of JCC and the progress of the Project.	
5	Office Space and Working Environment	The expert team requested an office space to the Myanmar side in the kickoff meeting in September 2016. Myanmar side provided an office space with air conditioning to the expert team.	No problems have occurred so far. (1) Regarding the office space for the expert team, the office space prepared by Myanmar side is a bit small but there are no problems. (2) Regarding the office space for the long-team expert, Myanmar side provided the office space in the Div. of Planning, and the arrangement of the working environment was done by JICA's budget.
6	Budgetary Allocation by Myanmar side	The expert team requested the necessary budgetary allocation for the Project to the Myanmar side in the kickoff meeting in September 2016. Myanmar side has prepared it so far.	No problems have occurred so far

4. Lessons Learnt

(1) In this technical cooperation project, the activities of technology transfer were divided into two (2) stages.

In the first stage, the expert team transferred the necessary technology to the WG members and at the same time NEMP was formulated mainly by expert team.

In the second stage, WG members formulated NEMP by themselves with some assistance of expert team.

This method of technology transfer was very effective to acquire the necessary technology of NEMP formulation work steadily.

But it was difficult to control the schedule of the project because of the periodical limitation of technology transfer.

Ideally sufficient time should be allocated for the activities to this kind of technology transfer.

(2) When the activities of the technology transfer was finished in one field, WS was held so as to share the results of the technology transfer among the member of other WGs.

This kind of WS was held step by step, in line with the activities of the technology transfer, and this made it easier to confirm the effectiveness of the technology transfer through the presentations of the WG members.

(3) As for the composition of the WG, members were gathered from different organizations such as DEPP, DPTSC, EPGE[1], ESE[2], YESC[3] and MESC[4]. This composition promoted the mutual understanding of each organization's job.

IV. FOR THE ACHIEVEMENT OF OVERALL GOALS AFTER THE PROJECT COMPLETION

1. Prospects to Achieve the Overall Goal

1) Continuous effort to review, update and utilize the NEMP will ensure the achievement of the Overall Goal of the Project.

2. Plan of Operation and Implementation Structure of the Myanmar Side to Achieve Overall Goal

MOEE should continue the NEMP reviewing and updating works, including data management work such as data collection and analysis.

Regarding the new NEMP formulation work, WG members in the project should be assigned continuously and target year should be set 2035.

[1] EPGE: Electric Power Generation Enterprise
[2] ESE: Electricity Supply Enterprise
[3] YEC: Yangon Electricity Supply Corporation
[4] MESC: Mandalay Electricity Supply Corporation

3. Recommendations for the Myanmar Side

(1) The NEMP formulation work should be continued for the smooth implementation of the power development in the future and by the following reasons:

1) The NEMP is indispensable to materialize the energy policy that makes sustainable economic development possible in accordance with the MSDP. The NEMP will help providing affordable and reliable energy to populations and industries via an appropriate energy generation mix.

2) Reviewing, updating and utilizing the NEMP continuously will maintain the capability of MOEE staff, acquired though JICA's technical assistance.

3) Data collection and database management work provides MOEE useful information not only for the NEMP updating/formulating, but also for evaluating and developing electric power development projects.

4) The Manuals for the NEMP formulation works should be revised if necessary, because the manuals would serve as good reference to draft high quality NEMP in the future

(2) The NEMP Regulation provides the legal framework and basis for continuous developing, reviewing and updating the NEMP. Therefore, the regulation should be finalized and legislated at the earliest.

(3) Early release of the authorized NEMP would be critical. The publication of NEMP would make the MOEE's priority clear in the power sector development and help attract private sector's investment in Myanmar by:

1) Making known the government energy and electricity plan to Myanmar people so that community would be able to know the role of the power plant and transmission projects and discuss the need of the power projects at specific sites. The risks of disturbance by the NEMP disclosure could be mitigated by avoiding the specific project names that could be controversial or sensitive.

2) Attracting local and foreign private investment according to the long-term plan. The MOEE would be able to select good projects with more competitions in transparent and fair manners.

(4) In order to formulate the NEMP with good quality all the staff of MOEE including the management and staff levels should have a common target and schedule to achieve.

The institutional decision-making process in Myanmar is top-down, but bottom-up approach should also be applied. The application of bottom-up approach will motivate the staff of MOEE and further enhance the capability of MOEE.

(5) The current form of WG arrangement should continue to keep the momentum. The core members of the WG may be permanently assigned by the Minister for the developing/ updating the NEMP exclusively or having highest priority on the NEMP among other works.

(6) Electric Regulatory Commission (ERC) should be established as the Electricity Law specifies to keep the decision process independent from the interest of executing agencies of electricity generation, transmission and distributions such as EPGE, DPTSC, ESE, YESC,

MESC. The separation of legislative and executing bodies independent will make the selection of alternatives, and procurement process transparent and fair.

(7) Recreation of inter-ministerial and cooperating organization such as NEMC should be considered for better coordination of renewable energy and energy efficiency development that has been assigned to other ministries such and Ministry of Education and Ministry of Industries that is outside MOEE, and difficult to coordinate for the energy policy making.

4. Monitoring Plan from the End of the Project to Ex-post Evaluation

MOEE should report the following activities to JICA Myanmar Office at the end of the year.

(1) Annual performance of NEMP formulation work

(2) Current situation regarding legislation of NEMP formulation works

(3) Annual performance of database

(4) Progress Report regarding implementation of Power Development (Power generating, transmission and distribution facilities)

List of the Annexes

ANNEX-1. RESULTS OF THE PROJECT

(1) Assignment of Expert Team (Plan and Actual progress)

Annex 1-(1) Assignment of Expert Team, Plan and Actual Progress

Name	Plan / Actual progress	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
			First year																	Second year													Third year		
Speciality		8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Hiroshi Kurakata	Plan																																
Team Leader/ Power Sector Planning	Actual progress		4 9 (6.00)		30 19 (21.00)			29 11 (14.00)	19 5 (18.00)		21 10 (21.00)		16 5 (21.00)				5 23 (19.00)	18 23 (6.00)		5 28 (23.00)			13 26 (14.00)				2 23 (22.00)			16 21 (6.00)	13 2 (21.00)		10 23 (14.00)
Kiyotaka Ueno	Plan																																
Power Demand Forecast	Actual progress			30 19 (21.00)				22 11 (21.00)	19 1 (14.00)		21 10 (21.00)		16 29 (14.00)				5 18 (14.00)			4 17 (14.00)			13 26 (14.00)								14 26 (13.00)		
Hidemasa Takashima (Tesuo Sada)	Plan																																
Primary Energy/ Thermal Power Generation	Actual progress			30 19 (21.00)			15 11 (28.00)													5 17 (13.00)											13 26 (14.00)		
Sho Shibata	Plan																																
Power Generation Development Planning	Actual progress		4 9 (6.00)		30 19 (21.00)				4 2 (30.00)		12 7 (27.00)		11 4 (25.00)				5 18 (14.00)	18 22 (5.00)		4 24 (21.00)		25 5 (12.00)					2 15 (14.00)			16 21 (6.00)	13 1 (20.00)		10 16 (6.00)
Seiji Ueoka	Plan																																
Power System Planning	Actual progress		4 10 (7.00)		30 19 (20.00)			22 10 (20.00)	19 1 (14.00)		22 10 (20.00)		16 29 (14.00)				5 18 (14.00)	18 23 (6.00)		4 24 (21.00)			1 6 (26.00)				2 15 (14.00)				13 2 (21.00)		10 15 (6.00)
Masayasu Ishiguro	Plan																																
Economic and Financial Analysis	Actual progress			30 19 (21.00)					12 1 (21.00)				23 12 (21.00)				5 18 (14.00)			11 24 (14.00)							2 29 (28.00)				15 2 (19.00)		
Yoshinori Yoneda (Masaki Kobayashi)	Plan																																
Deta Management	Actual progress			30 5 (7.00)					19 1 (14.00)								5 18 (14.00)			12 24 (13.00)			20 26 (7.00)								13 25 (14.00)		
Satoshi Yamaoka	Plan																																
Institutional Facilitation	Actual progress			30 16 (18.00)									19 8 (21.00)							19 28 (10.00)			30 5 (6.00)								13 27 (15.00)		
ShunsukeMinato	Plan																																
Environmental and Social Consideration	Actual progress				30 19 (21.00)				12 1 (21.00)				23 12 (21.00)				5 18 (14.00)			18 28 (11.00)							9 23 (13.00)				13 2 (21.00)		
Hiroki Yamaguchi	Plan																																
Coodinator/ Monitoring	Actual progress				30 19 (21.00)			29 11 (14.00)	12 1 (21.00)		25 10 (17.00)		19 12 (25.00)				5 23 (19.00)	18 23 (6.00)		4 28 (25.00)			13 2 (21.00)				11 22 (12.00)				13 2 (21.00)		10 23 (14.00)

Plan Actual progress

ANNEX-1. RESULTS OF THE PROJECT

(2) Allocation of C/P

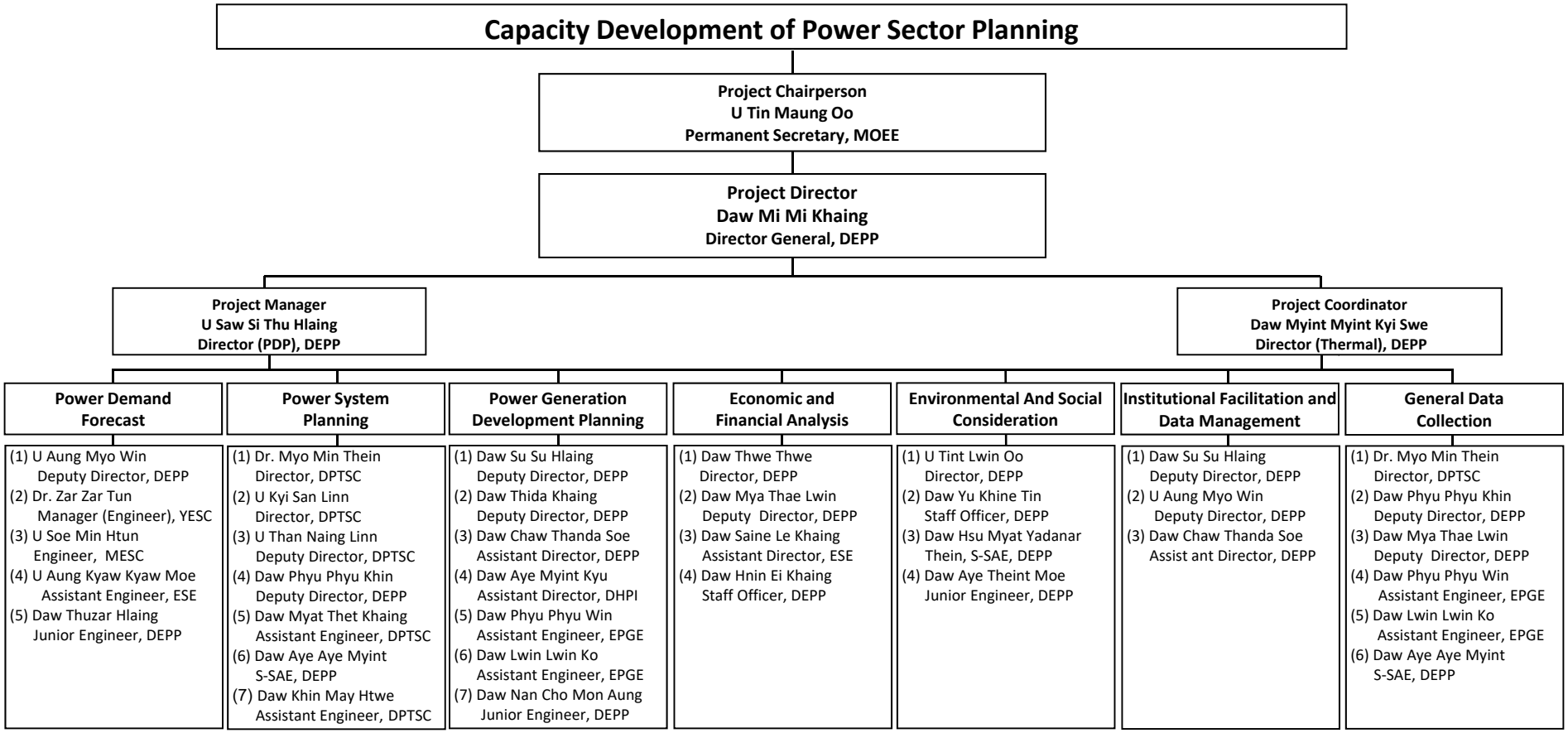
Annex 1-(2) Member List of Counterparts

12th September 2018

No.	name	Assignment period	Position
Power Demand Forecast			
1	U Aung Myo Win	Nov.2016 -	Deputy Director, DEPP
2	U Aung Kyaw Kyaw Moe	Nov.2016 -	Assistant Engineer, ESE
3	Dr. Zar Zar Tun	Nov.2016 -	Manager (Engineer), YESC
4	U Nyein Htet Thu	Nov.2016 - Mar.2017	Assistant Manager, MESC
5	U Soe Min Htun	Mar.2017 -	Engineer, MESC
6	Daw Thuzar Hlaing	Aug.2017 -	Junior Engineer, DEPP
Power System Planning			
1	Dr. Myo Min Thein	Nov.2016 -	Director, DPTSC
2	U Kyi San Linn	Nov.2016 -	Director, DPTSC
3	U Than Naing Linn	Nov.2016 -	Deputy Director, DPTSC
4	Daw Phyu Phyu Khin	Nov.2016 -	Deputy Director, DEPP
5	Daw Aye Aye Myint	Nov.2016 -	S-SAE, DEPP
6	Daw Su Myat Mon	Nov.2016 - Sep.2017	Staff officer, DPTSC
7	Daw Myat Thet Khaing	Nov.2016 -	Assistant Engineer, DPTSC
8	Daw Khin May Htwe	Nov.2017 -	Assistant Engineer, DPTSC
Power Generation Development Planning			
1	Daw Su Su Hlaing	Nov.2016 -	Deputy Director, DEPP
2	Daw Thida Khaing	Nov.2016 -	Deputy Director, DEPP
3	Daw Chaw Thanda Soe	Nov.2016 -	Assistant Director, DEPP
4	Daw Aye Myint Kyu	Nov.2016 -	Assistant Director, DHPI
5	Daw Phyu Phyu Win	Nov.2016 -	Assistant Engineer, EPGE
6	Daw Lwin Lwin Ko	Nov.2016 -	Assistant Engineer, EPGE
7	Daw Nan Cho Mon Aung	Aug.2017 -	Junior Engineer, DEPP
Economic and Financial Analysis			
1	Daw Sandar Win	Nov.2016 - Jul.2017	Director, DEPP
2	Daw Thwe Thwe	Nov.2016 -	Director, DEPP
3	Daw Mya Thae Lwin	Nov.2016 -	Deputy Director, DEPP
4	Daw Hnin Ei Khaing	Nov.2016 -	Staff Officer, DEPP
5	U Tun Ko Ko	Nov.2016- Jun.2017	Deputy Director, ESE
6	Daw Saine Le Khaing	Jun.2017 -	Assistant Director, ESE
7	Daw Thuzar Paing	Nov.2017 - Feb. 2018	Director, DEPP
Environmental And Social Consideration			
1	U Tint Lwin Oo	Nov.2016 -	Director, DEPP
2	Daw Yu Khine Tin	Nov.2016 -	Staff Officer, DEPP
3	Daw Hsu Myat Yadanar Thein	Nov.2016 -	S-SAE, DEPP
4	U Pauk Kyaing Sahm	Nov.2016 - Jun.2017	Assistant Director, DPTSC
5	U Aung Myo Zaw	Jan.2017 - Jun.2017	Staff Officer, DHPI
6	Daw Aye Theint Moe	July.2017 -	Junior Engineer, DEPP
7	U Pyae Phyo Aung	Nov.2017 - Sep.2018	Staff officer, DHPI
Institutional Facilitation and Data Management			
1	Daw Su Su Hlaing	Nov.2016 -	Deputy Director, DEPP
2	U Aung Myo Win	Nov.2016 -	Assistant Director, DEPP
3	Daw Chaw Thanda Soe	Nov.2016 -	Assist ant Director, DEPP
General Data Collection			
1	Dr. Myo Min Thein	Nov.2016 -	Director, DPTSC
2	Daw Phyu Phyu Khin	Nov.2016 -	Assistant Director, DEPP
3	Daw Mya The Lwin	Nov.2016 -	Assistant Director, DEPP
4	Daw Phyu Phyu Win	Nov.2016 -	Assistant Engineer, DEPP
5	Daw Lwin Lwin Ko	Nov.2016 -	Assistant Engineer, EPGE
6	Daw Aye Aye Myint	Nov.2016 -	S-SAE, DEPP

Annex 1-(2) Allocation of Counterparts

(As of September 12, 2018)



ANNEX-1. RESULTS OF THE PROJECT

(3) Workshop in Japan (1) and (2)

Annex 1-(3) Report of Workshop in Japan (1)

Workshop in Japan (First)

The workshop in Japan was planned twice in the period of the Project and First workshop in Japan was carried out for ten days from the end of June, 2017.

In order to strengthen the effect of technology-transfer in the Project, site investigation of the electricity power facilities were mainly arranged. And also the Myanmar side C/P could meet and exchange views with the officials of METI (Ministry of Economy, Trade and Industry) who formulated the Basic Energy Policy in Japan.

At the end of the Workshop leader of the participants express her impression about the Workshop as follows.

Comments from the Leader of the Participants

I think that this Workshop in Japan is very useful for us because we could investigate LNG center, an AC/DC conversion place and we could exchange views with the related engineers and get the very useful information at the thermal power plant.

At the METI we could have the very fruitful discussion with related officials who draft the Basic Energy Policy in Japan. We are planning to utilize this useful knowledge and information into our NEMP.

If it is possible, I would like to ask the Japanese side to allocate more time for the discussion with METI officials and also have meetings or workshop in Myanmar.

The schedule of the Workshop in Japan and participants were shown in the next tables.

Kihoku Converter Station

Isogo Coal Fired Power Station

Table 1 Schedule of the Workshop in Japan

Date	Contents of the Workshop
2017/6/25 (Sun)	Move from Myanmar to Japan
2017/6/26(Mon)	Arrive in Osaka
	Briefing and Orientation
	Courtesy call to the President of NEWJEC
	Central Load Dispatch Center (investigation and discussion)
2017/6/27(Tue)	Sakai LNG Center (investigation and discussion)
	Sakai Solar Power Station (investigation and discussion)
	ECO COOL Sakaikou (Sakaikou Thermal Power Station)
2017/6/28(Wed)	Hitachi Mitsubishi Hydro Co. (investigation and discussion)
	Mitsubishi Electric (investigation and discussion)
2017/6/29(Thu)	Kihoku Converter Station (investigation and discussion)
2017/6/30(Fri)	Human Resources Development Center, the Kansai Electric
	Move from Sin-Osaka to Tokyo
2017/7/1(Sat)	Reporting
2017/7/2(Sun)	Reporting
2017/7/3(Mon)	Isogo Coal Fired Power Station (investigation and discussion)
	Meeting with METI (Ministry of Economy, Trade and Industry)
	Meeting with JICA
	Rup up meeting with Experts Team
2017/7/4(Tue)	Return to Myanmar

Table 2 Member of the Participants

Daw Myint Myint Kwi Swe	Department of Electric Power Planning, Director
U Aung Myo Win	Department of Electric Power Planning, Assistant Director
Daw Su Su Hlaing	Department of Electric Power Planning, Deputy Director
Daw Phyu Phyu Khin	Department of Electric Power Planning, Deputy Director
Daw Mya Thae Lwin	Department of Electric Power Planning, Assistant Director
Daw Su Myat Mon	Department of Power Transmission and System Control, Staff Officer
Daw Aye Myint Kyu	Department of Hydro Power Implementation, Assistant Director
U Aung Myo Zaw	Department of Hydro Power Implementation, Staff Officer
Daw Phyu Phyu Win	Electric Power Generation Enterprise, Assistant Engineer
Daw Aye Aye Myint	Department of Electric Power Planning, S-SAE

Annex 1-(3)　Report of Workshop in Japan (2)

The workshop in Japan was planned twice in the period of the Project and second workshop in Japan was carried out for ten days from the end of July, 2018.

In order to strengthen the effect of technology-transfer in the Project, site investigation of the electricity power facilities were mainly arranged. And also the Myanmar side C/P could meet and exchange views with the officials of METI (Ministry of Economy, Trade and Industry) who formulated the Basic Energy Policy in Japan.

Moreover, I visited the Isogo thermal power plant of J-Power which is proud of the environmental performance of the top level in the world, and observed environmental impact reduction technology of Japan.

Furthermore, I visited the environment-monitoring center in Yokohama which guides environmental pollution prevention from an administration side, and took a lecture about the history of environmental prevention, and a policy and the present condition of monitoring.

At the end of the training, we can got the comments from the leader of the trainees that this training is very useful for them to formulate the NEMP in the future.

The schedule of the training and list of the trainee are as follows.


Photo of the training

Table 1 Schedule of the Second Workshop in Japan

Date			Activities
30/07/2018	Mon	AM	Move to Bangkok
		PM	Move to Bangkok from Nawpyitaw Move to Osaka from Bangkok
31/07/2018	Tue	AM	Arrive at Kansai Airport Briefing at JICA Kansai
		PM	Site Visits and Discussion at KANSAI (Central Load Dispatch Center and Procurement of Primary Energy)
01/08/2018	Wed	AM	Site Visit to LNG Terminal at Sakai Port
		PM	Site Visit to Gas Thermal and Solar Power Plants at Sakai
02/08/2018	Thu	AM	Lecture and Discussion at KANSAI
		PM	
03/08/2018	Fri	AM	Site Visit at KANSAI Capacity Development Center
		PM	Reporting
04/08/2018	Sat	AM	Reporting
		PM	
05/08/2018	Sun	AM	Reporting
		PM	
06/08/2018	Mon	AM	
		PM	Site visit at Isogo Coal Thermal Power Station (14:00~16:00)
07/08/2018	Tue	AM	Lecture and Discussion at City of Yokohama (10:00~11:30)
		PM	Lecture and Discussion at Ministry of Economic, Trade and Industry (Coal and International Affairs Division) (14:00~16:30)
08/08/2018	Wed	AM	Move to Bangkok from Tokyo Move to Nawpyitaw from Bangkok
		PM	

Table 2 List of the Trainee

No.	Name	Organization	Working Group
1	Dr. Zar Zar Tun	Yangon Electrical Supply Corporation	Power Demand Forecast
2	Daw Sein Lae Khaing	Electrical Supply Enterprise	Economic and Financial Analysis
3	Daw Myat Thet Khaing	Department of Power Transmission and System Control	Power System Planning
4	U Pyae Phyo Aung	Department of Hydro Power Implementation	Environmental and Social Consideration
5	U Aung Kyaw Kyaw Moe	Electrical Supply Enterprise	Power Demand Forecast

ANNEX-1. RESULTS OF THE PROJECT

(4) Results of the Monitoring Survey

Annex 1-(4) Results of the Monitoring Survey

As for the Project Purpose, when we achieve the Outputs 1~3 as described in 1-3, the Project Purpose "The capacity of MOEE for power sector development planning is enhanced through the process of reviewing, updating and utilizing National Electricity Master Plan (NEMP)." will be achieved.

At the beginning of the Project in November 2016, almost of the WG members didn't have any experience to join the drafting works of NEMP. Through the technology transfer they learned the basic knowledge, technology and simulation analysis method.

The effectiveness of technology transfer was measured by the monitoring survey (Questionnaire and interview survey) when the technology transfer was finished in each field.

We report the results of the monitoring survey at end of technology transfer (at the end of 11th dispatch in Sep.2018) shown as follows.

Target level of the technology transfer was set as the following table. In order to carry out the NEMP formulation job in normal level smoothly, the target level of the technology transfer was set over 3.5.

Level 3.5 means that ① Basic knowledge and technology were acquired perfectly, ② Ability to solve the normal level job and some applied cases.

Table 1 Grade of the capability level

Level	Capability
5	Ability to solve any cases
4	- ability to use fundamental technology and applied technology - ability to solve difficult and applied cases
3	- acquired basic knowledge and technology - ability to solve normal cases
2	- acquired basic knowledge and technology but not enough - not enough to solve normal cases
1	Shortage of basic knowledge and technology

(1) Power Demand Forecast

At the beginning of the Project, November 2016, four (4) staffs were assigned to this WG and one staff was transferred until Sep. 2018. In March and August 2017, one C/P was assigned respectively, therefore five (5) members are allocated in this WG now.

As for the monitoring survey, original three (3) members assigned from the Baseline survey in Nov.2016 are the target of this investigation.

Results of the monitoring survey are shown as follows.

Effectiveness of the technology transfer can be recognized very high through the results of the questionnaire and interview survey and we can know that the capability of WG members are improving from 2.4 to 3.8 in average in this field.

All three (3) members have achieved 3.5 of the target level. In the interview, all the members answered that they could forecast the future demand by themselves.

Power Demand Forecast WG : Results of the Monitoring

Item		A		B		C		Total	
		Vol.0	Vol.2	Vol.0	Vol.2	Vol.0	Vol.2	Vol.0	Vol.2
WG Member's Answer	Average	2	3.5	2.7	3.6	3.9	4.1	2.9	3.7
	Experience	1.8	3.8	3	3.8	4	4	2.9	3.9
	Knowledge	2	3.4	2.6	3.5	3.8	4.1	2.8	3.7
Interviewer's Input	Average	1.8	3.6	2.2	3.6	3.3	4.3	2.4	3.8
	Experience	1.7	3.6	2.2	3.7	3.4	4	2.4	3.8
	Knowledge	1.8	3.6	2.2	3.5	3.1	4.5	2.4	3.9

Note; Vol.0 Base line Vol.2: After technical transfer

(2) Power Development Planning WG

At the beginning of the Project, November 2016, six (6) staffs were assigned to this WG and nobody changed until Sep. 2018. In Aug. 2018, one C/P was joined newly to this WG, therefore seven (7) members are assigned in this WG now.

As for the monitoring survey, original six (6) members assigned from the Baseline survey in Nov.2016 are the target of this survey.

Results of the monitoring survey are shown as follows.

Power Generation Planning WG: Results of the monitoring survey

Item		A		B		C		D		E		F		Total	
		Vol.0	Vol.3	Vol.0	Vol.3	Vol.0	Vol.3	Vol.0	Vol.3	Vol.0	Vol.3	Vol.0	Vol.3	Vol.0	Vol.3
WG Member's Answer	Average	2.0	4.8	2.7	4.0	2.8	3.7	1.3	3.8	1.9	3.7	1.4	3.1	2.0	3.7
	Experience	1.9	4.7	2.6	3.9	2.4	3.7	1.3	4.0	2.0	3.7	1.6	3.0	2.0	3.6
	Knowledge	2.1	4.9	2.7	4.1	3.0	3.7	1.3	3.7	1.9	3.7	1.3	3.2	2.1	3.7
Interviewer's Input	Average	3.0	4.4	2.4	3.5	2.5	4.1	1.6	4.3	1.2	3.1	1.0	3.1	1.9	3.6
	Experience	2.8	4.3	2.3	3.5	2.5	4.3	1.8	4.3	1.0	3.0	1.0	3.3	1.9	3.6
	Knowledge	3.2	4.5	2.5	3.5	2.5	4.0	1.3	4.3	1.3	3.3	1.0	3.0	2.0	3.6

Vol.0: Base line, Vol.3: After technical transfer

When we see the results of the average figures, they are improved from 1.9 at the beginning (baseline survey) to 3.6. We can confirm clearly the effectiveness of technology transfer. Especially, preparation of the project list and wasp input by their own initiatives required much time but it gave the big contribution to enhance their capabilities. Four (4) C/P out of six (6) have achieved the target level of 3.5.

(3) Power System Planning WG

At the beginning of the Project, November 2016, seven (7) staffs were assigned to this WG and only one member transferred in Sep.2017. And two members have been assigned continuously but too busy to join the activities of the WG. Therefore four (4) members are the targets of the monitoring survey. Results of the monitoring survey are shown as follows.

Power System Planning WG: Results of the monitoring survey

Item		A		B		C		D		Total	
		Vol.0	Vol.2	Vol.0	Vol.2	Vol.0	Vol.2	Vol.0	Vol.2	Vol.0	Vol.2
WG Member's Answer	Average	2.0	4.2	2.3	3.0	1.1	3.7	3.0	3.7	2.1	3.7
	Experience	1.8	4.2	1.5	2.8	1.0	3.7	2.7	3.3	1.8	3.5
	Knowledge	2.1	4.2	2.8	2.9	1.0	3.9	3.3	4.1	2.3	3.8
Interviewer's Input	Average	2.8	4.2	2.2	3.5	1.1	3.5	3.1	4.4	2.3	3.9
	Experience	2.7	4.1	2.2	3.5	1.0	3.4	3.1	4.3	2.2	3.8
	Knowledge	2.8	4.3	2.2	3.5	1.2	3.6	3.0	4.5	2.3	4.0

Vol.0: Base line, Vol.2: After technical transfer

When we see the results of the average figures, they are improved from 2.3 at the beginning (baseline survey) to 3.9. We can confirm clearly the effectiveness of technology transfer.

In the interview survey, almost of WG members seemed enough confidence to say that they could make a model of power transmission system and analyze it by using PSSE software by their own initiatives.

All the C/P, four (4) members, have achieved the target level of 3.5.

(4) Economic and Financial Analysis WG

WG member's eagerness to learn is very high and it shows the high rate of attendance rate. When the exercise using Excel started, member of the WG positively reviewed the exercise and they tried to enhance themselves. In spite of the difference of their individual ability, their eagerness to learn is commonly very high.

At the beginning of the Project, November 2016, five (5) staffs were assigned to this WG and two (2) members were transferred up to now. And one member joined in July 2017. Therefore four (4) members are learning in this WG.

The targets of the monitoring survey are three (3) members who continuously assigned to this WG. Results of the monitoring survey are shown as follows.

Economic and Financial Analysis WG: Results of the Monitoring Survey

Item		A		B		C		Total	
		Vol.0	Vol.2	Vol.0	Vol.2	Vol.0	Vol.2	Vol.0	Vol.2
WG Member's Answer	Average	4.1	4.2	2.6	3.7	2.6	3.5	3.1	3.8
	Experience	3.8	4.2	2.1	3.1	1.4	2.4	2.4	3.3
	Knowledge	4.7	4.3	3.1	4.1	3.3	4.1	3.7	4.2
Interviewer's Input	Average	3.6	4.4	2.7	4.3	2.8	4.5	3.0	4.4
	Experience	3.6	4.5	2.9	4.3	2.5	4.5	3.0	4.4
	Knowledge	3.5	4.3	2.5	4.3	3.1	4.5	3.0	4.4

Vol.0 Base line, Vol.2 After technical transfer

Judging from the results of the monitoring survey, knowledge and technical level were improved steadily.

All the C/P, three (3) members, have achieved the target level of 3.5.

(5) Environment and Social Consideration WG

Comparing with the other WGs, there are many members with slightly little basic knowledge or experience, and they started from a little lower level.

The leader of and subleader of WG have high capability of understanding and other members also have very strong aspiration.

At the beginning of the Project, November 2016, four (4) staffs were assigned to this WG and one (1) member was transferred up to now. And two (2) members joined in 2017, but one of them were transferred. Therefore four (4) members are learning in this WG now.

But the targets of the monitoring survey are three (3) members who continuously assigned to this WG. Results of the monitoring survey are shown as follows.

Environment and Social Consideration WG: Results of the Monitoring Survey

Item		A		B		C		Total	
		Vol.0	Vol.2	Vol.0	Vol.2	Vol.0	Vol.2	Vol.0	Vol.2
WG Member's Answer	Average	1.6	2.6	2.1	3.3	1.1	2.4	1.6	2.8
	Experience	1.3	2.1	1.3	2.7	1.1	2.3	1.2	2.4
	Knowledge	2.0	3.2	2.9	3.9	1.2	2.5	2.1	3.2
Interviewer's Input	Average	2.5	4.8	2.2	4.2	1.1	3.8	1.9	4.2
	Experience	2.5	4.8	2.4	4.2	1.0	3.8	2.0	4.2
	Knowledge	2.5	4.8	2.0	4.2	1.1	3.8	1.9	4.2

Note: Ver.0: Base line, Ver.2: After technical transfer

Judging from the results of the monitoring survey, knowledge and technical level were improved steadily from 1.9 to 4.2 in average through the technology transfer activities in the Project.

All the C/P, three (3) members, have achieved the target level of 3.5.

ANNEX-1. RESULTS OF THE PROJECT

(5) Donation of the Equipment to DEPP

Annex 1-5 Donation of the Equipment to DEPP

Donation of the Equipment from Japan International Cooperation Agency (JICA) to Department of Electric Power Planning (DEPP), Ministry of Electricity and Energy (MOEE)

With regard to the article II.1 (c) of the Record of Discussions between JICA and DEPP signed on 30th March 2016, JICA provided equipment as listed as follows on 14th March 2019.

List of the Equipment

1.	Power System Analysis Software PSSE		2 License (*)
2.	Desktop PC		2 sets
3.	External HDD		2 sets
4.	Laptop PC		29 sets (**)
5.	USB Memory		29 sets (**)
6.	Laser Printer	Canon C3520i	1 set
7.	Multifunction of Printer and Copier	Canon C3325	1 set
8.	PSSE M&S Agreement (Until the end of 2019)		2 Licenses

(*) Two (2) Licenses of Power System Analysis Software PSSE are installed in the Laptop PC (PF0L9PQ8) and (PF0L9Q48).

(**) 27 Laptop PCs and 27 USB memories are now lending to the WG members as the attached list.

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Attachment 1

Programs and Program Options Delivered

Program	Program Options
PSS®E	Base Module - Includes: • Graphical User Interface and Contour Plotting • Power Flow • Contingency Analysis • Voltage Stability (PV/QV) Analysis • Python and IPLAN Scripting • Transmission Reliability Assessment Unbalanced Fault Analysis Dynamic Simulation Control Section Line Properties Calculation

Code Delivery:	Executable only

Attachment 2

Computer System Specification

Current recommended PC system requirements can be located on our website (http://www.usa.siemens.com/psse) under PSS®E User Support area.

Attachment 3

Identification of Usage Site

Ministry of Electricity and Energy
Building No. (6), Nay Pyi Taw,
The Republic of the Union of Myanmar

Project for Capacity Development of Power Sector Development Planning in the Republic of the Union of Myanmar

12/03/2019

Lending List of Laptop Personal Computers

No	Name	Working Group	Department	Lending Period	Serial Number	Remarks
1	Daw Thida Khaing	Power Generation Development Planning	DEPP	17.3.2017 -	PF0LCKTG	
2	Daw Su Su Hlaing	Power Generation Development Planning	DEPP	17.3.2017 -	PF0L9RFQ	
3	Daw Chaw Thanda Soe	Power Generation Development Planning	DEPP	17.3.2017 -	PF0L9Q05	
4	Daw Phyu Phyu Win	Power Generation Development Planning	EPGE	17.3.2017 -	PF0LCG8T	
5	Daw Lwin Lwin Ko	Power Generation Development Planning	EPGE	17.3.2017 -	PF0LCGP5	
6	Daw Aye Myint Kyu	Power Generation Development Planning	DHPI	17.3.2017 -	PF0LCGT2	
7	U Than Naing Linn	Power System Planning	PSD	30.3.2017 -	PF0LCKQ6	
8	Daw Thwe Thwe	Economic and Financial Analysis	EPGE	28.3.2017 -	PF0L9PQ8	
9	Daw Myat Thet Khaing	Power System Planning	DPTSC	29.3.2017 -	PF0L9PWT	Installed PSSE
10	U Aung Myo Win	Power Demand Forecast	DEPP	30.3.2017 -	PF0L9PZA	
11	Daw Mya Thae Lwin	Economic and Financial Analysis	DEPP	28.3.2017 -	PF0K7JXL	
12	Daw Aye Aye Myint	Power System Planning	DEPP	29.3.2017 -	PF0L9Q48	Installed PSSE
13	Daw Hnin Ei Khaing	Economic and Financial Analysis	DEPP	28.3.2017 -	PF0LCKBL	
14	Daw Saino Lo Khaing	Economic and Financial Analysis	ESE	24.7.2017 -	PF0L0PTB	
15	U Tint Lwin Oo	Environmental And Social Consideration	DEPP	7.11.2017 -	G4QV7H2	
16	Daw Yu Khine Tin	Environmental And Social Consideration	DEPP	7.11.2017 -	76LZ7H2	
17	Daw Su Myat Yadar Thein	Environmental And Social Consideration	DEPP	7.11.2017 -	2RHO8H2	
18	Daw Aye Thint Moe	Environmental And Social Consideration	DEPP	7.11.2017 -	317Z7H2	
19	U Pyae Phyo Aung	Environmental And Social Consideration	DHPI	8.11.2017 - 12.9.2018	2940SH2	Store in company
20	Daw Nan Cho Mon Aung	Power Generation Development Planning	DEPP	9.11.2017 -	5940SH2	
21	Daw San Yu Swe	Power System Planning	DPTSC	8.11.2017 -	8NDZ7H2	U Kyi San Linn
22	Daw Khin May Htwe	Power System Planning	DPTSC	8.11.2017 -	DX6Z7H2	
23	Daw Phyu Phyu Khin	Power System Planning	DEPP	8.11.2017 -	PF0LCKUZ	
24	U Tun Tun Win	Power System Planning	DPTSC	8.11.2017 -	J2GQ7H2	Dr. Myo Min Thein
25	Dr. Zar Zar Tun	Power Demand Forecast	YESC	14.11.2017 -	DRYZ7H2	
26	U Soe Min Htwn	Power Demand Forecast	MESC	14.11.2017 -	225Q7H2	
27	U Aung Kyaw Kyaw Moe	Power Demand Forecast	ESE	14.11.2017 -	2X8Z7H2	
28	Daw Thuzar Hlaing	Power Demand Forecast	DEPP	14.11.2017 -	1CLZ7H2	
29	Daw Thuzar Paing	Economic and Financial Analysis	DEPP	15.11.2017 - 20.2.2018	DZ6Z7H2	Store in company

ANNEX-2. LIST OF PRODUCTS

Annex-2 List of the Products

(1) NEMP 2014 Rev.2
(2) Supporting Report for NEMP 2014 Rev.2
(3) Report of Institutional Facilitation including Regulation (Draft)
(4) Data Management Report
(5) Manual for NEMP
(6) Manual for Data Management
(7) Materials of the Presentation to the Minister (21st March, 2019)
(8) Interim Report (NEMP 2014 Rev.1)

ANNEX-3. PDM (ALL VERSION OF PDM)

Annex 3 PDM (all version of PDM)

Project Design Matrix (PDM) Ver.0

Project Title: **Project for Capacity Development of Power Sector Development Planning**
Project Duration: Apr. 2016 to Sep. 2018 (tentative)
Target Area: Nay Pyi Taw, Myanmar
Target Group: Employees in charge of power sector development planning in the Ministry of Electric Power (MOEP) Dec-15
Counterpart Organization : DEPP(Department of Electric Power Planning), MEPE(Myanma Electric Power Enterprise) Version.0

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal			
The power sector development is promoted based on the National Electricity Master Plan (NEMP).	Approval system of NEMP in the Government of Myanmar is established.	Interview to DEPP, MOEP	
	Based on NEMP, investment plan of power generation (xx MW by year xx) is concretized.	Data from DEPP, MOEP	
	Based on NEMP, investment plan of power system (T/L xxkm, S/S xxMVA by year xx) is concretized.	Data from MEPE	
	Electrification rate will be improved by more than xx% by year xx.	Data from DEPP, MOEP	
Project Purpose			
The capacity of MOEP for power sector development planning is enhanced through the process of reviewing, updating and utilizing National Electricity Master Plan (NEMP).	1. Institutional mechanism is functioned through utilizing NEMP in MOEP.	Interview to counterpart organizations	- Sufficient budget is allocated for power sector development.
	2. NEMP is updated in MOEP.		
Outputs			- Institutional structure for the NEMP is not changed due to the power sector reform (unbundling). - The Myanmar Government's policy and MOEP's policy in the power sector are not drastically changed.
1. The institutional capacity and mechanism of reviewing, updating and utilizing NEMP in MOEP and in GOM is strengthened.	1-1 Operation rules for NEMP is defined.	Operation rules	
	1-2 Twelve (12) full-time staff for NEMP are assigned in DEP and MEPE.	Assignment order, personal document	
2. The necessary information and data for power sector development planning is collected and managed by MOEP.	2-1 Power Sector Statistics for NEMP is annually updated.	Statistics	
3. The technical capacity for power sector development planning is developed.	3-1 Two (2) staff of MOEP acquired the method of power demand forecast.	Exam results (Pre-exam and Post-exam)	
	3-2 Three (3) staff of MOEP acquired the method of power generation plan using WASP.	Exam results (Pre-exam and Post-exam)	
	3-3 Three (3) staff of MOEP acquired the method of power system development using simulation tools.	Exam results (Pre-exam and Post-exam)	
	3-4 Two (2) staff of MOEP acquired the method of Economic and Financial Analysis calculating LRMC.	Exam results (Pre-exam and Post-exam)	
	3-5 Two (2) staff of MOEP acquired the method of Environmental and Social Consideration in power sector	Exam results (Pre-exam and Post-exam)	
	3-6 Fifty (50) of Manual is distributed and utilized in related organizations.	Distribution records, interview to related organizations	
Activities	**Inputs**		
	Japanese side	**Myanmar side**	
1. Establishment of Organization / Institutional System for Power Sector Planning (responsibility, authority, approval/development process, etc.) 1.1. To clarify the current status and responsibilities of each department/division for power sector development planning and utilizing the National Electricity Master Plan (NEMP), and identify the institutional constraints and challenges. 1.2. Based on the above 1.1, to assign the working group members who are in charge of each field of power sector development planning.	a. Experts Long-term Resident Expert: Power Sector Advisor Visiting Expert (Consultant): - Team Leader / Power Sector Planning - Power Demand Forecast/ Primary Energy - Power Generation Development Planning - Power System Planning	1. Counterpart Personnel a. Assignment of Counterpart personnel - Project Director (who will bear overall responsibility for the administration and implementation of the project): - Project Manager (who will bear responsibility	- Counterpart personnel remain the same, no frequent turnover during the project period.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
1.3. To clarify the roles, process and rules of each department/division based on the work flow of the power sector development planning. 1.4. To examine and prepare an institutional mechanism for planning, reviewing and regularly updating the NEMP and assist in establishing an approval process within GOM. 1.5. To provide technical and/or policy-related advices on institutional arrangements and regulatory framework in the power sector, based on information obtained through the Project Activities 1, 2 and 3.	- Economic and Financial Analysis - Data management / Institutional Facilitation - Environmental and Social Consideration - Coordinator b. Training - Training in Japan (tailor-made courses and/or existing group training courses) - In-country training c. Equipment - The necessary equipment for the Project if any	on the managerial and technical matters): - Project Coordinator: - Working group members: 2. Office space and necessary facilities for Japanese experts 3. Other operational cost	**Preconditions**
2. Development of Institutional Capacity for Information/Data Collection and Management 2.1. To identify constraints and challenges for information/data collection and management on power sector development planning. 2.2. To strengthen the mechanism for collecting, managing and updating the required data and information for the following: (a) Power demand forecast (including rural electrification) (b) Power generation development plan (including IPP and renewable energy) (c) Power system development (d) Economic and financial analysis (in particular in the aspect of financial burden of electricity tariff and subsidy on users/taxpayers) (e) Environmental and social consideration in the power sector 2.3. To improve the information/data management system including statistics.			
3. NEMP Update through Joint Work, and Development of Technical Capacity for Power Sector Planning 3.1. To acquire the analysis methods, program and simulation, and enhance the technical capacity for the following assessment necessary for power sector development planning: (a) Power demand forecast (both micro and macro methods) (b) Power development plan, including availability of primary energy, optimal energy mix and power generation development plan (including renewable energy) (c) Power system plan (including consistency with power distribution line expansion and rural electrification) (d) Economic and financial analysis (in particular in the aspect of financial burden of electricity tariff and subsidy on users/taxpayers) (e) Environmental and Social Consideration in the power sector 3.2. Based on the above 3.1, to analyze and prepare the short, medium and long-term priority investment plans. 3.3. To make recommendations based on the following activities and reflect them in power sector development planning: (a) To analyze and prepare the recommendations on power generation development plans for each major fuel source based on the above 3.1 and 3.2. (b) To widely collect information on institutional arrangements and regulatory framework in the power sector (including IPP, corporatization/privatization of public utilities and policy incentives for renewable energy), analyze the policy implications of such institutional and regulatory changes, and prepare technical and/or policy-related recommendations. 3.4. To jointly review and update the NEMP with MOEP staff and JICA Experts, including the results of 3.1 through 3.3 above. 3.5. To prepare a manual for planning process and methodologies for power sector development planning, and utilize it for the policy / planning process of the Government.			

Project Design Matrix (PDM)　Ver.1

Project Title: **Project for Capacity Development of Power Sector Development Planning**
Project Duration: Sep. 2016 to Feb. 2019 (tentative)
Target Area: Nay Pyi Taw, Myanmar
Target Group: Employees in charge of power sector development planning in the Ministry of Electricity and Energy (MOEE)　Nov-16
Counterpart Organization : DEPP (Department of Electric Power Planning) and Power Transmission and System Control Department (PTSCD)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal			
The power sector development is promoted based on the National Electricity Master Plan (NEMP).	Approval system of NEMP in the Government of Myanmar is established.	Interview to DEPP, MOEE	
	Based on NEMP, investment plan of power generation (xx MW by year xx) is concretized.	Data from DEPP, MOEE	
	Based on NEMP, investment plan of power system (T/L xxkm, S/S xxMVA by year xx) is concretized.	Data from PTSCD	
	Electrification rate will be improved by more than xx% by year xx.	Data from DEPP, MOEE	
Project Purpose			
The capacity of MOEE for power sector development planning is enhanced through the process of reviewing, updating and utilizing National Electricity Master Plan (NEMP).	1. Institutional mechanism is functioned through utilizing NEMP in MOEE.	Interview to counterpart organizations	- Sufficient budget is allocated for power sector development.
	2. NEMP is updated in MOEE.		
Outputs			- Institutional structure for the NEMP is not changed due to the power sector reform (unbundling). - The Myanmar Government's policy and MOEE's policy in the power sector are not drastically changed.
1. The institutional capacity and mechanism of reviewing, updating and utilizing NEMP in MOEE and in GOM is strengthened.	1-1 Operation rules for NEMP is defined.	Operation rules	
	1-2 Twelve (12) full-time staff for NEMP are assigned in DEP and PTSCD.	Assignment order, personal document	
2. The necessary information and data for power sector development planning is collected and managed by MOEE.	2-1 Power Sector Statistics for NEMP is annually updated.	Statistics	
3. The technical capacity for power sector development planning is developed.	3-1 Two (2) staff of MOEE acquired the method of power demand forecast.	Pre and Post Questionnaire, Interview	
	3-2 Three (3) staff of MOEE acquired the method of power generation plan using WASP.	Pre and Post Questionnaire, Interview	
	3-3 Three (3) staff of MOEE acquired the method of power system development using simulation tools.	Pre and Post Questionnaire, Interview	
	3-4 Two (2) staff of MOEE acquired the method of Economic and Financial Analysis calculating LRMC.	Pre and Post Questionnaire, Interview	
	3-5 Two (2) staff of MOEE acquired the method of Environmental and Social Consideration in power sector	Pre and Post Questionnaire, Interview	
	3-6 Fifty (50) of Manual is distributed and utilized in related organizations.	Distribution records, interview to related organizations	
Activities	**Inputs**		
	Japanese side	**Myanmar side**	
1. Establishment of Organization / Institutional System for Power Sector Planning (responsibility, authority, approval/development process, etc.) 1.1. To clarify the current status and responsibilities of each department/division for power sector development planning and utilizing the National Electricity Master Plan (NEMP), and identify the institutional constraints and challenges. 1.2. Based on the above 1.1, to assign the working group members who are in charge of each field of power sector development planning. 1.3. To clarify the roles, process and rules of each department/division based on the work flow of the power sector development planning. 1.4. To examine and prepare an institutional mechanism for planning, reviewing and regularly updating the NEMP and assist in establishing an approval process within GOM.	a. Experts Long-term Resident Expert: Power Sector Advisor Visiting Expert (Consultant): - Team Leader / Power Sector Planning - Power Demand Forecast/ Primary Energy - Primary Energy / Thermal Power Generation - Power Generation Development Planning - Power System Planning - Economic and Financial Analysis - Data management / Institutional Facilitation - Institutional Facilitation	1. Counterpart Personnel a. Assignment of Counterpart personnel - Project Director (who will bear overall responsibility for the administration and implementation of the project): - Project Manager (who will bear responsibility on the managerial and technical matters): - Project Coordinator: - Working group members:	- Counterpart personnel remain the same, no frequent turnover during the project period.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
1.5. To provide technical and/or policy-related advices on institutional arrangements and regulatory framework in the power sector, based on information obtained through the Project Activities 1, 2 and 3.	- Environmental and Social Consideration - Coordinator / monitoring b. Training - Training in Japan (tailor-made courses and/or existing group training courses) - In-country training c. Equipment - The necessary equipment for the Project if any	2. Office space and necessary facilities for Japanese experts 3. Other operational cost	**Preconditions**
2. Development of Institutional Capacity for Information/Data Collection and Management 2.1. To identify constraints and challenges for information/data collection and management on power sector development planning. 2.2. To strengthen the mechanism for collecting, managing and updating the required data and information for the following: (a) Power demand forecast (including rural electrification) (b) Power generation development plan (including IPP and renewable energy) (c) Power system development (d) Economic and financial analysis (in particular in the aspect of financial burden of electricity tariff and subsidy on users/taxpayers) (e) Environmental and social consideration in the power sector 2.3. To improve the information/data management system including statistics.			
3. NEMP Update through Joint Work, and Development of Technical Capacity for Power Sector Planning 3.1. To acquire the analysis methods, program and simulation, and enhance the technical capacity for the following assessment necessary for power sector development planning: (a) Power demand forecast (both micro and macro methods) (b) Power development plan, including availability of primary energy, optimal energy mix and power generation development plan (including renewable energy) (c) Power system plan (including consistency with power distribution line expansion and rural electrification) (d) Economic and financial analysis (in particular in the aspect of financial burden of electricity tariff and subsidy on users/taxpayers) (e) Environmental and Social Consideration in the power sector 3.2. Based on the above 3.1, to analyze and prepare the short, medium and long-term priority investment plans. 3.3. To make recommendations based on the following activities and reflect them in power sector development planning: (a) To analyze and prepare the recommendations on power generation development plans for each major fuel source based on the above 3.1 and 3.2. (b) To widely collect information on institutional arrangements and regulatory framework in the power sector (including IPP, corporatization/privatization of public utilities and policy incentives for renewable energy), analyze the policy implications of such institutional and regulatory changes, and prepare technical and/or policy-related recommendations. 3.4. To jointly review and update the NEMP with MOEE staff and JICA Experts, including the results of 3.1 through 3.3 above. 3.5. To prepare a manual for planning process and methodologies for power sector development planning, and utilize it for the policy / planning process of the Government.			

Project Design Matrix (PDM)　Ver.2

Project Title: **Project for Capacity Development of Power Sector Development Planning**
Project Duration: Sep. 2016 to March. 2019
Target Area: Nay Pyi Taw, Myanmar
Target Group: Employees in charge of power sector development planning in the Ministry of Electricity and Energy (MOEE)
Counterpart Organization : DEPP (Department of Electric Power Planning) and Power Transmission and System Control Department (PTSCD)

February 7, 2018

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal			
The power sector development is promoted based on the National Electricity Master Plan (NEMP).	Approval system of NEMP in the Government of Myanmar is established.	Interview to DEPP, MOEE	
	Based on NEMP, investment plan of power generation (2235 MW by year 2020) is concretized.	Data from DEPP, MOEE	
	Based on NEMP, investment plan of power system (T/L 3479km, S/S 8700MVA by year 2020) is concretized.	Data from PTSCD	
	Electrification rate will be improved by more than 47% by year 2020.	Data from DEPP, MOEE	
Project Purpose			
The capacity of MOEE for power sector development planning is enhanced through the process of reviewing, updating and utilizing National Electricity Master Plan (NEMP).	1. Institutional mechanism is functioned through utilizing NEMP in MOEE.	Interview to counterpart organizations	- Sufficient budget is allocated for power sector development.
	2. NEMP is updated in MOEE.		
Outputs			- Institutional structure for the NEMP is not changed due to the power sector reform (unbundling). - The Myanmar Government's policy and MOEE's policy in the power sector are not drastically changed.
1. The institutional capacity and mechanism of reviewing, updating and utilizing NEMP in MOEE and in GOM is strengthened.	1-1 Operation rules for NEMP is defined.	Operation rules	
	1-2 Twelve (12) full-time staff for NEMP are assigned in DEPP and DPTSC.	Assignment order, personal document	
2. The necessary information and data for power sector development planning is collected and managed by MOEE.	2-1 Power Sector Statistics for NEMP is annually updated.	Statistics	
3. The technical capacity for power sector development planning is developed.	3-1 Two (2) staff of MOEE acquired the method of power demand forecast.	Pre and Post Questionnaire, Interview	
	3-2 Three (3) staff of MOEE acquired the method of power generation plan using WASP.	Pre and Post Questionnaire, Interview	
	3-3 Three (3) staff of MOEE acquired the method of power system development using simulation tools.	Pre and Post Questionnaire, Interview	
	3-4 Two (2) staff of MOEE acquired the method of Economic and Financial Analysis calculating LRMC.	Pre and Post Questionnaire, Interview	
	3-5 Two (2) staff of MOEE acquired the method of Environmental and Social Consideration in power sector	Pre and Post Questionnaire, Interview	
	3-6 Fifty (50) of Manual is distributed and utilized in related organizations.	Distribution records, interview to related organizations	
Activities	**Inputs**		
	Japanese side	**Myanmar side**	
1. Establishment of Organization / Institutional System for Power Sector Planning (responsibility, authority, approval/development process, etc.) 1.1. To clarify the current status and responsibilities of each department/division for power sector development planning and utilizing the National Electricity Master Plan (NEMP), and identify the institutional constraints and challenges. 1.2. Based on the above 1.1, to assign the working group members who are in charge of each field of power sector development planning. 1.3. To clarify the roles, process and rules of each department/division based on the work flow of the power sector development planning. 1.4. To examine and prepare an institutional mechanism for planning, reviewing and regularly updating the NEMP and assist in establishing an approval process within GOM.	a. Experts Long-term Resident Expert: Power Sector Advisor Visiting Expert (Consultant): - Team Leader / Power Sector Planning - Power Demand Forecast/ Primary Energy - Primary Energy / Thermal Power Generation - Power Generation Development Planning - Power System Planning - Economic and Financial Analysis - Data management / Institutional Facilitation - Institutional Facilitation	1. Counterpart Personnel a. Assignment of Counterpart personnel - Project Director (who will bear overall responsibility for the administration and implementation of the project): - Project Manager (who will bear responsibility on the managerial and technical matters): - Project Coordinator: - Working group members:	- Counterpart personnel remain the same, no frequent turnover during the project period.

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
1.5. To provide technical and/or policy-related advices on institutional arrangements and regulatory framework in the power sector, based on information obtained through the Project Activities 1, 2 and 3.	- Environmental and Social Consideration - Coordinator / monitoring b. Training - Training in Japan (tailor-made courses and/or existing group training courses) - In-country training c. Equipment - The necessary equipment for the Project if any	2. Office space and necessary facilities for Japanese experts 3. Other operational cost	**Preconditions**
2. Development of Institutional Capacity for Information/Data Collection and Management 2.1. To identify constraints and challenges for information/data collection and management on power sector development planning. 2.2. To strengthen the mechanism for collecting, managing and updating the required data and information for the following: (a) Power demand forecast (including rural electrification) (b) Power generation development plan (including IPP and renewable energy) (c) Power system development (d) Economic and financial analysis (in particular in the aspect of financial burden of electricity tariff and subsidy on users/taxpayers) (e) Environmental and social consideration in the power sector 2.3. To improve the information/data management system including statistics.			
3. NEMP Update through Joint Work, and Development of Technical Capacity for Power Sector Planning 3.1. To acquire the analysis methods, program and simulation, and enhance the technical capacity for the following assessment necessary for power sector development planning: (a) Power demand forecast (both micro and macro methods) (b) Power development plan, including availability of primary energy, optimal energy mix and power generation development plan (including renewable energy) (c) Power system plan (including consistency with power distribution line expansion and rural electrification) (d) Economic and financial analysis (in particular in the aspect of financial burden of electricity tariff and subsidy on users/taxpayers) (e) Environmental and Social Consideration in the power sector 3.2. Based on the above 3.1, to analyze and prepare the short, medium and long-term priority investment plans. 3.3. To make recommendations based on the following activities and reflect them in power sector development planning: (a) To analyze and prepare the recommendations on power generation development plans for each major fuel source based on the above 3.1 and 3.2. (b) To widely collect information on institutional arrangements and regulatory framework in the power sector (including IPP, corporatization/privatization of public utilities and policy incentives for renewable energy), analyze the policy implications of such institutional and regulatory changes, and prepare technical and/or policy-related recommendations. 3.4. To jointly review and update the NEMP with MOEE staff and JICA Experts, including the results of 3.1 through 3.3 above. 3.5. To prepare a manual for planning process and methodologies for power sector development planning, and utilize it for the policy / planning process of the Government.			


JICA