

Chapter 13 Technology Transfer & Capacity Building

The survey covers technology transfer activities related to the formulation of the Power Development Master Plan. The plans formed during the work implementation planning called for technology transfer through workshops and OJT. Later, for the following reasons, we narrowed down the approach to workshops alone. Approval from the Angola side' has been obtained for this approach.

- The personnel involved in the planning of the power sector are widely distributed within MINEA, RNT, PRODEL, ENDE, and IRSEA, making it difficult to grasp the target counterparts to whom the technology should be transferred. It will therefore be more efficient to invite the target counterparts to workshops than to visit and cooperate with them through OJT.
- The Survey Team works out of an office located at some distance from the office of the counterpart, making OJT physically impossible.
- MINEA wants as many personnel as possible to master the skills.

13.1 Workshop

The workshops shown in the table below were held over the course of four missions. PDPAT, a demand and supply operation simulation software package, was introduced on the Angola Side.

Table 13-1 Workshop Curriculum

Mission	Date	Curriculum
1st Mission	18-Jul	TEPCO's Power Development History
	25-Jul	Power Demand Forecasts +Methodology of Power Demand Forecasts Generation Development Plan +Supply reliability criteria
2nd Mission	28-Sep	Generation Development Plan +Screening Method
	29-Sep	Transmission Development Plan +Fundamental Concepts of power system planning in TEPCO
	4-Oct	Generation Development Plan +Annual Expenditure Transmission Development Plan +Power Flow Analysis
	5-Oct	Generation Development Plan +Dispatching game
	6-Oct	Transmission Development Plan +Outline of Transmission Line Design & Cost Estimation
	3rd Mission	12-Jan
	18-Jan,	Generation Development Plan +Configuration of data for GDP (1)
	25-Jan,	Power Demand Forecast +Confirming accomplishment Transmission Development Plan +Proceeding with formulation work +Clarifying matters entailed in the formulation of the TDP Generation Development Plan

	+Configuring data for GDP (2)
31-Jan	Environmental & Social Considerations +SEA General +Perspective of the Final Power Development Master Plan
Final Mission	Procedure to formulate the Power Development Master Plan



18-July Workshop



25-July Workshop



25-July Workshop



28-Sept. Workshop



28-Sept. Workshop



29-Sept. Workshop

13.2 Training in Japan

Angola side counterparts were invited to Japan for training to deepen their understanding of the status of Japan's power system operations (including operation at the central dispatching office) for stable power supply, the influence of renewable energy power supplies on the power system, and advanced technologies possessed by Japanese companies (high-efficiency thermal power generation, etc.).

13.2.1 Participants

Ten counterparts were invited to the training in Japan. The participants were affiliated with MINEA (including GAMEK), PRODEL, RNT, ENDE, and IRSEA.

Table 13-2 Participants List

	Name	Entity	Department	Position
Mr.	Osvaldo Marcos Julião Gonçalves	MINEA	National Directorate of Electrical Energy	Engineer
Mr.	Ernesto Milton Pereira da Costa	PRODEL	Hydraulic Production Directorate	Director
Mr.	Cláudio Morais Marques	PRODEL	Statistic and Planning	Senior Engineer
Mr.	Eudes Panzo	RNT	Power System Planning	Head of Department
Mr.	Leonardo Tshama	RNT	Power System Planning	Engineer
Mr.	Délcio Fonseca	RNT	Power System Planning	Engineer
Mr.	Caterça Calumbo da Costa	ENDE	Maintenance Protection	Engineer
Mr.	Kuatel Xeku Conceição	ENDE	Operation Division	Chief of Division Operation
Mr.	Negidio Francisco Neto da Silva Buakela	GAMEK	Technical Department	Engineer
Mr.	Adérito Pedro Manico	IRSEA	Technical Supervision and Quality of Electricity Service	Head of Department

13.2.2 Activity Records

The inspection site was chosen mainly from the following viewpoints.

- To understand the system operation status of the Japanese power utilities and the training policies of the operators
- To visit two plants: first, the mega solar power plant, to grasp the influence of renewable energy on the grid; second, the pumped storage power plant in charge of regulating the stability of the power system
- To grasp the state-of-the-art coal-fired thermal power generation technology and CCGT technology in Japan
- To understand the interconnection of power system technologies between companies

The details of the training program are summarized in the table below.

Table 13-3 Activity Record of Training in Japan

Date	Time		Program	Site
27-Nov-17		~ 22:45	Arrival in Japan	
28-Nov-17	13:00	~ 14:30	Courtesy call to JICA	JICA Ichigaya office
	14:30	~ 15:30	Kick off	
29-Nov-17	9:00	~ 10:00	Role of electric power company's central load dispatching office	TEPCO PG Central Load Dispatching Office
	12:30	~ 14:00	Inspection of load dispatching operator training	TEPCO PG Training Center
	15:00	~ 16:00	Inspection of Tokyo Electric's mega solar	TEPCO Renewable Power Company Ukishima Solar Power Plant
30-Nov-17	11:00	~ 12:00	Confirmation of state-of-the-art coal fired power, IGCC construction status	TEPCO FP Hirono Thermal Power Plant
	14:00	~ 15:00	Inspection of 500 kV switchgear	TEPCO PG Shin-Iwaki S/S
1-Dec-17	9:00	~	Inspection of small and medium type CCGT plant	Mitsubishi Hitachi Power Systems Hitachi Works
		~ 12:00	Inspection of Hitachi Mitsubishi Hydropower related technology	Hitachi MitsubishiHydro Corporation Hitachi Works
2-Dec-17			Experience of Japanese culture	
3-Dec-17			ditto	
4-Dec-17	10:00	~ 11:30	Inspection of More Advanced CCGT	TEPCO FP Kawasaki Thermal Power Plant
	13:00	~ 15:00	Inspection of Toshiba's latest power related technology	Toshiba Energy Systems & Solutions Corporation Keihin Product Operations
5-Dec-17	13:30	~ 16:30	Inspection of the state-of-the-art Large Gas Combined Cycle Manufacturing Factory	Mitsubishi Hitachi Power Systems Takasago Works
6-Dec-17			Experience of Japanese culture	
7-Dec-17	10:30	~ 12:30	Inspection of pumped storage power plant with high head	TEPCO RPC Kannagawa Pumped Storage Power Plant
	15:30	~ 16:30	Inspection of frequency converter substation	TEPCO PG Shin-Shinano Frequency Converter Station
8-Dec-17	15:00	~ 16:30	Ministry of Economy, Trade and Industry	METI; Agency for Natural Resources and Energy
	17:00	~ 18:30	Wrap-up	JICA Ichigaya office
9-Dec-17	22:00	~	Departure to Angola	

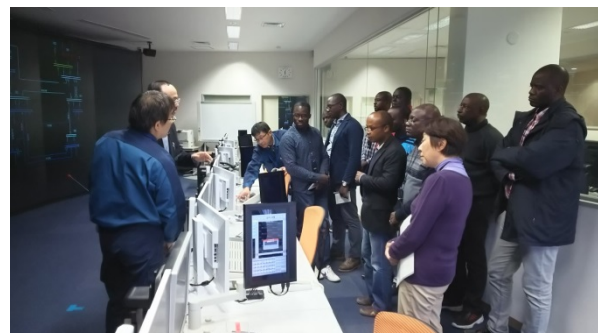
Date: 2017 Nov. 28 / Kick-off meeting (in JICA Ichigaya office)



Date: 2017 Nov. 29 / TEPCO PG Central Load Dispatching



Date: 2017 Nov. 29 / TEPCO PG Training Center



Date: 2017 Nov. 29 / TEPCO/Renewable Power Company Ukishima Solar Power Plant



Date: 2017 Nov. 30 / TEPCO FP Hirono Thermal Power Plant



Date: 2017 Nov. 30 / TEPCO PG Shin-Iwaki S/S





**Date: 2017 Dec. 1 / Mitsubishi Hitachi Power Systems, Hitachi Mitsubishi Hydro Corporation
Hitachi Works**



Date: 2017 Dec. 4 / TEPCO FP Kawasaki Thermal Power Plant



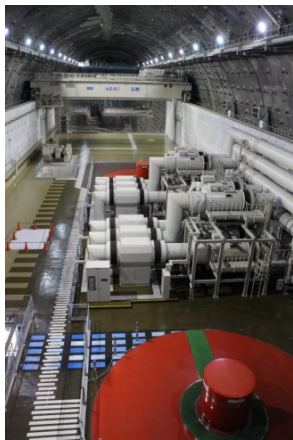
Date: 2017 Dec. 4 / Toshiba Energy Systems & Solutions Corporation Keihin Product Operations



Date: 2017 Dec. 5 / Mitsubishi Hitachi Power Systems Takasago Works



Date: 2017 Dec. 7 / TEPCO RPC Kannagawa Pumped Storage Power Plant





Date: 2017 Dec. 7 / TEPCO PG Shin-Shinano Frequency Converter Station



Date: 2017 Dec. 8 / Ministry of Economy, Trade and Industry; Agency for Natural Resources and Energy



Date: 2017 Dec. 8 / Wrap-up meeting (in JICA Ichigaya office)



13.3 Additional Training in Japan

There was a plan to invite relevant parties of Angolan power industry to Japan for training so that they would have deeper understanding of Japan's power system operations for stable power supply (including operations at a Central Load Dispatching Center), impacts of renewable energy power supplies on electric power systems, and Japanese companies' advanced technologies for high-efficiency thermal power generation, etc. As Angola's power development master plan was formulated and it was expected that additional training of higher-level officials in Japan would deepen the counterparts' understanding and the knowledge would be reflected in Angolan policies, we invited the Minister of Energy and Aqua (MINEA) and other top officials of electric power companies and other controlling government offices for training in Japan. During the training, we also held a seminar about the Angolan Power Sector to present Angola's power development master plan to Japanese companies and attract interest in investment in Angola from Japanese companies through the presence of Angolan officials.

13.3.1 Participants

There were 8 participants – 4 members from MINEA including the MINEA Minister Borges, directors and chairpersons of the power companies and organizations of ENDE, PRODEL, RNT and IRSEA.

Table 13-1 Angolan Participants

	Name	Entity	Ministry or Company	Position
M r.	João Baptista <u>Borges</u>	MINEA	Ministry of Energy and Water Affairs	Minister
M r.	Carlos Gil Ferreira De Sousa	MINEA	Minister's Office of Energy and Water Affairs	Director
M r.	Oswaldo Marcos Julião Gonçalves	MINEA	Ministry of Energy and Water Affairs, National Directorate of Electric Energy	Director
M r.	Ruth Cardoso De Almeida Safeca	ENDE	National Electricity Distribution Company	Chairman of Board of Directors
M r.	José Antônio Neto	PRODEL	Public Electricity Production Company	Chairman of Board of Directors
M r.	Rui Pereira Do Amaral Gourgel	RNT	National Electricity Transportation Company	Chairman of Board of Directors
M r.	Luís Mourão Da Silva	IRESA	Regulatory Institute of Electricity and Water Services	Chairman of Board of Directors
M r.	Benevides Cabral Marcelino	MINEA	Minister's Office of Energy and Water Affairs	Head of Public Relations and Protocol Section

13.3.2 Activity Results

The participants learned Japan's state-of-the-art technologies mainly through the attendance at the Angolan Power Sector Seminar, which was the major purpose of the training, and the activity contributed to the future technical cooperation for Angola.

The sites for visits were selected mainly from the following viewpoints.

- Understanding of the power system operations of the Japanese power companies and understanding of the operator training policies
- Understanding of Japan's technologies for state-of-the-art coal-fired power generation and gas-combined cycle power generation
- Understanding of Japan's latest technologies used for gas insulated transformers/switchgears installed at unmanned underground substations

The training program and contents are as shown in Table 13-5.

Table 13-2 Additional Training Activities in Japan

Date	Time	Program Contents	Destination
2018/12/8 (Sat.)	~ 22:45	Arrive in Japan	Haneda Airport
2018/12/9 (Sun)	All day	Briefings by the Embassy of Angola in Japan	Embassy of Angola in Japan
2018/12/10 (Mon)	10:00 ~ 11:30	Explanation of the itinerary, explanation of MP and potential Japanese collaborators	JICA Headquarters
	11:30 ~ 12:30	Courtesy visit to JICA executives	JICA Headquarters
	14:00 ~ 14:15	Courtesy visit to President of TEPCO Power Grid	Headquarters of Tokyo Electric Power Company Holdings
	14:15 ~ 14:30	Overview of major electric power companies in Japan	Central Load Dispatching Center of TEPCO Power Grid
	14:30 ~ 15:15	Explanation of roles of load dispatching centers of Japanese electric power companies	Central Load Dispatching Center of TEPCO Power Grid
	15:30 ~ 17:00	Visit to a state-of-the-art underground substation in Japan	Higashi Uchisaiwai-cho Substation of TEPCO Power Grid
2018/12/11 (Tue)	10:00 ~ 12:00	Seminar for Japanese companies & FR Transfer Ceremony	JICA Ichigaya Building
	14:00 ~ 16:00	Visit to a combined cycle gas turbine (CCGT) power station	Kawasaki Thermal Power Plant of TEPCO Fuel & Power
2018/12/12 (Wed)	9:45 ~	Leave Japan (Minister and others for London)	Haneda Airport
	22:00 ~	Leave Japan (Director and others for Angola)	Narita Airport

Report on the training results and materials used have already been submitted to JICA.

Date: 2018 Dec. 10 / Kick-off meeting (in JICA Head Quarter)



Date: 2018 Dec. 10 / TEPCO PG Central Load Dispatching Center



Date: 2018 Dec. 10 /TEPCO PG Higashi-uchisaiwai-cho Underground Substation



Date: 2018 Dec. 11 /Angolan Power sector Seminar in JICA Ichigaya Office





Date: 2018 Dec. 11 /TEPCO FP Kawasaki Thermal Power Plant

