Comprehensive Capacity Development Project for the Bangsamoro

Development Plan for the Bangsamoro

Final Report

Sector Report 2-3: Air Transport

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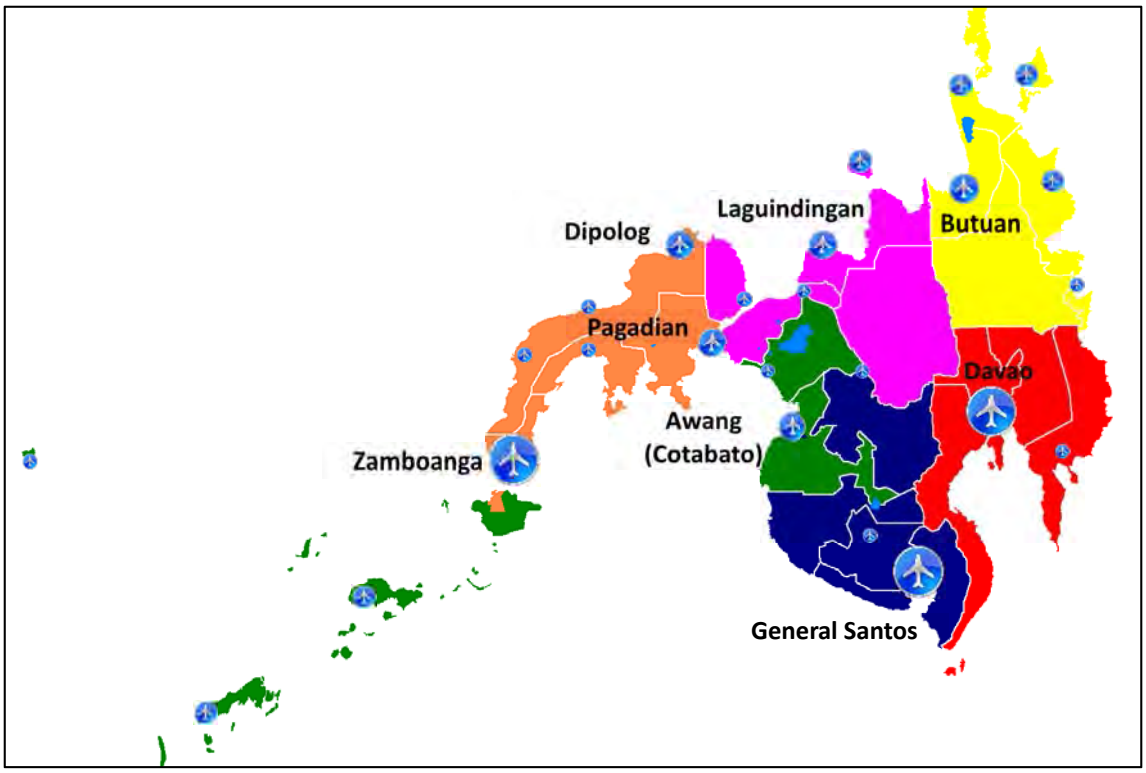
CHAPTER 1 INTRODUCTION

1.1 Airports in Mindanao

Mindanao has three international airports located in Davao, General Santos and Zamboanga; five principal class I airports located in Cagayan De Oro (Laguindingan), Butuan, Pagadian, Dipolog and Awang (Cotabato); six principal class II airports located in Surigao, Siargao, Tandag, Camiguin, Jolo and Sanga-Sanga; and more than 10 community airports in each region (Figure 1.1).



Source: JICA Study Team.

Figure 1.1 Locations of Airports in Mindanao

1.2 Classification of Airports in the Philippines

International airports are airports capable of handling international flights. Airports in this category include airports that currently are serving or have previously served international destinations. Principal airports are airports that only serve domestic destinations. There are two types: Class 1 principal airports capable of serving jet aircraft with a capacity of at least 100 seats and Class 2 principal airports capable of serving propeller aircraft with a capacity of at least 19 seats. Community airports are airports that are used primarily for general aviation. Most feeder airports are in this category. Classification of airports in Mindanao is given in Table 1.1.

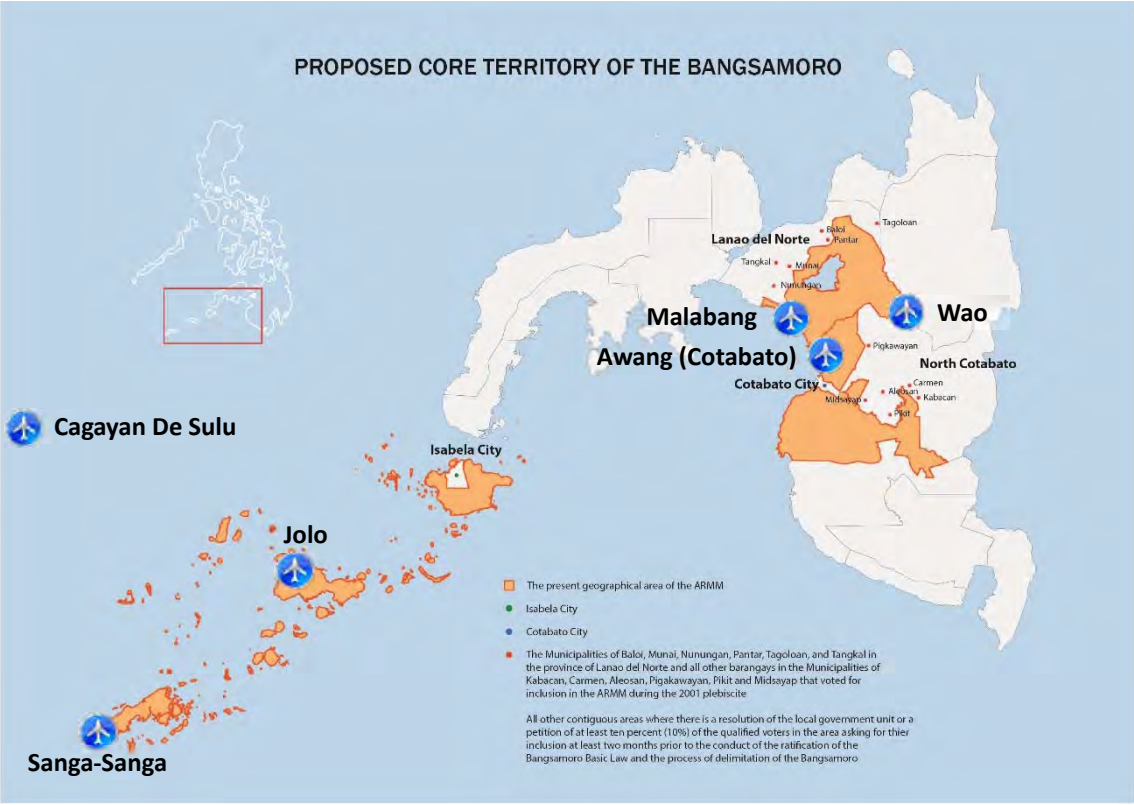
Table 1.1 Airports in Mindanao by Category

Category	Airports
International	Davao, General Santos, Zamboanga
Principal Class 1	Laguindingan (Cagayan De Oro), Butuan, Pagadian, Dipolog, and Awang (Cotabato)
Principal Class 2	Surigao, Siargao, Camiguin, Tandag, and Jolo, Sanga-Sanga
Community	Bislig, Mati, Iligan, Ozamiz, Allah Valley, Liloy, Ipil, Siocon, Malabang, Cagayan De Sulu, etc.

Source: CAAP.

1.3 Airports in Bangsamoro

Bangsamoro has one principal class I airport located in Awang Datu Odin Sinsuat, Maguindanao; two principal class II airports located in Sanga-Sanga, Tawi-Tawi and Jolo, Sulu, and two community airports in Malabang in the province of Lanao del Sur, and Cagayan De Sulu (Mapun), Tawi-Tawi (Figure 1.2). There is a newly established feeder airport in the municipality of Wao which is now operational. Airports in Bangsamoro are classified as shown in Table 1.2 in accordance with the classification of CAAP.



Source: JICA Study Team.

Figure 1.2 Locations of Airports in Bangsamoro

Table 1.2 Airports in Bangsamoro by Category

Category	Airports
International	n/a
Principal Class 1	Awang (Cotabato)
Principal Class 2	Jolo, Sanga-Sanga
Community	Cagayan De Sulu, Malabang, Wao

Source: CAAP.

1.4 Overview of Airports in Bangsamoro

1.4.1 Cotabato airport

The Cotabato airport is an airport serving the general area of Cotabato City, located in the province of Maguindanao in the Philippines (Figure 1.3). The airport is classified as a Class 1 principal (major domestic) airport by the Civil Aviation Authority of the Philippines (CAAP), a body of the Department of Transportation and Communications responsible for the operations not only of this airport but also of all other airports in the Philippines except the major international airports. While the airport services Cotabato City, the airport facilities are located in Barangay Awang in the neighboring municipality of Datu Odin Sinsuat, Maguindanao.

Source: Google Earth.

Figure 1.3 Cotabato Airport (Satellite Photo)

1.4.2 Jolo airport

The Jolo airport is the airport serving the general area of Jolo, located in the island province of Sulu in the Philippines (Figure 1.4). It is the only airport in the province of Sulu. The airport is classified as a Class 2 principal (minor domestic) airport by CAAP.

Source: Google Earth.

Figure 1.4 Jolo Airport (Satellite Photo)

1.4.3 Sanga-Sanga Airport

The Sanga-Sanga airport is an airport serving the general area of Bongao, the capital of the province of Tawi-Tawi in the Philippines (Figure 1.5). The airport is classified as a class 2 principal (domestic) airport by CAAP.

Source: Google Earth.

Figure 1.5 Sanga-Sanga Airport (Satellite Photo)

1.4.4 Cagayan De Sulu airport

The Cagayan de Sulu airport (Filipino: Paliparan ng Cagayan de Sulu, Cebuano: Tugpahanan sa Mapun) also known as the Mapun airport is a remote community airport located in the island and municipality of Mapun, Tawi-Tawi (Figure 1.6). It is classified as a community airport by CAAP. Presently, no airlines are serving this airport but this airport is utilized for military purposes.

Source: CAAP.

Figure 1.6 Cagayan De Sulu Airport (Photo)

1.4.5 Malabang airport

The Malabang airport is an airport of Malabang in the province of Lanao del Sur. It is the only airport in the province (Figure 1.7). This airport is classified as community airport or a minor commercial airport by CAAP. Presently, no airlines are serving this airport and mainly the runway is utilized for drying corns and coconuts.

Source: JICA Study Team.

Figure 1.7 Malabang Airport (Photo)

1.4.6 Wao airport

The Wao community airport is located in the province of Lanao del Sur. This airport has only a few flights for private purposes (Figure 1.8).

Source: JICA Study Team.

Figure 1.8 Wao Airport (Photo)

1.5 Relevant Organizations

The relevant organizations regarding air transportation are shown as follows.

1.5.1 DOTC

The Department of Transportation and Communications (DOTC) is the executive department of the Philippine Government responsible for the maintenance and expansion of viable, efficient, and dependable transportation and communications systems as effective instruments for national recovery and economic progress. The department is responsible for the Country's land, air, sea and

communications infrastructure.

1.5.2 CAAP

CAAP is the national aviation authority of the Philippines and is responsible for implementing policies on civil aviation to assure safe, economic and efficient air travel. The agency also investigates aviation accidents via its Aircraft Accident Investigation and Inquiry Board. Formerly the Air Transportation Office, it is a government-owned and controlled corporation attached to DOTC for the purpose of policy coordination.

1.5.3 Airlines

The Philippine Airlines (PAL) is the national flag carrier of the Philippines, and it is the first commercial airline in Asia. The Philippine Airlines remains as the Country's biggest airline company, having the largest number of international flights to/from the Philippines as well as domestic flights.

PAL Express, formerly the Air Philippines or Airphil Express, is operating under the business name of Air Philippines Corporation. The PAL Express is Philippine Airlines' answer to Cebu Pacific Air's dominance on the low cost travel market in the Philippines. As a codeshare of the Philippine Airlines, PAL Express is operating as a full service carrier with low-cost management.

The Cebu Pacific Air is the low fare leader in the Country, and it is the Country's leading domestic airline. After offering low fares to domestic destinations, the Cebu Pacific launched its international operations in November 2001. The airline currently operates hubs in Manila, Cebu and Davao.

Other low-cost airlines in the Country includes AirAsia Zest, PAL Express, and Tigerair Philippines. These airlines serve routes to several tourist destinations in the Country at low prices.

1.6 Related Policies

The concerns and suggestions for the air transport in the ARMM Regional Development Plan Midterm Update [2013–2016] are summarized below.

1.6.1 Concerns on airport transport development in the Region

Improving air transportation in the ARMM area is consistent with the national policies and strategies for the transportation sector. Airports development in the ARMM area reflects the Government's commitment to pursue its peace and development agenda for Mindanao and supportive to the peace agreement between the Government of the Republic of the Philippines and MILF. This will also establish transport and trade links to Philippines within the BIMP-EAGA.

The main challenges of the air transport services in the ARMM area are attributed to high oil prices and slow economic progress. Airlines traffic or routes in the ARMM area are focusing on efficiency and reasonable costs of air services operation. Evolving concerns that hamper the development on air transportation services are attributed to continued high fuel cost, regressive regional economy and inadequate infrastructure development, which must be given priority consideration to meet future demand.

1.6.2 Suggestions of regional spatial strategy for air transportation

Airports development shall focus on the Cotabato airport in Maguindanao which is an entry to Metro Cotabato and Sanga-Sanga airport in Tawi-Tawi for the island provinces. The Cotabato and Sanga-Sanga airports shall be developed to attain the CAAP quality standards and encourage more investors in these provinces.

The siege in Zamboanga City paralyzed the economy of the island provinces, hence, the Autonomous Regional Government of ARMM shall pursue air connectivity of Tawi-Tawi to Metro Manila and vice-versa as an alternate gateway to Zamboanga City. This will be complemented by the opening of the

Sabah, Malaysia to Tawi-Tawi route because of its proximity. This will formalize and enhance the barter trading activities in the province and will maximize the current cooperation under the BIMP – EAGA.

Another air connectivity being proposed is the Davao City to Tawi-Tawi route to facilitate and expedite the flow of goods and services. This development strategy, if materialized, will trigger economic growth of the province and the Region in general for this will increase revenue generation and employment opportunities in the area.

CHAPTER 2 AIR TRAFFIC PROFILE

2.1 Scheduled Flights and Frequencies

The scheduled flights and frequencies of services are shown in Table 1.3.

Table 1.3 Scheduled Flights and Frequencies of Services (as of March 2015)

Airports	Destinations	Aircraft	Frequencies
Cotabato (CBO)	Manila (MNL)	A320 [180]*	Philippine Airlines operated by PAL Express (GAP): Arrival: 11:00, Departure: 11:40 (Daily) Cebu Pacific Air (CEB): Arrival: 06:35, Departure: 07:20 (Daily)† Arrival: 12:10, Departure: 12:50 (Mo/Tu/Th/Sa/Su) Arrival: 12:45, Departure: 13:25 (We/Fr)
Jolo (JOL)	Zamboanga (ZAM)	Q400 [76]*	Philippine Airlines operated by PAL Express (GAP): Arrival: 10:00, Departure: 10:20 (Mo/We/Fr)
Sanga Sanga (TWT)	Zamboanga (ZAM)	A319 [156]*	Cebu Pacific Air (CEB): Arrival: 07:40, Departure: 08:20 (Daily)

*Seating capacity; †only a few times per month

Source: Airlines.

2.2 Air Traffic Statistics

Data on air traffic in Bangsamoro are shown in Tables 2.1 through 2.3 and Figures 2.1 through 2.11.

2.2.1 Cotabato airport

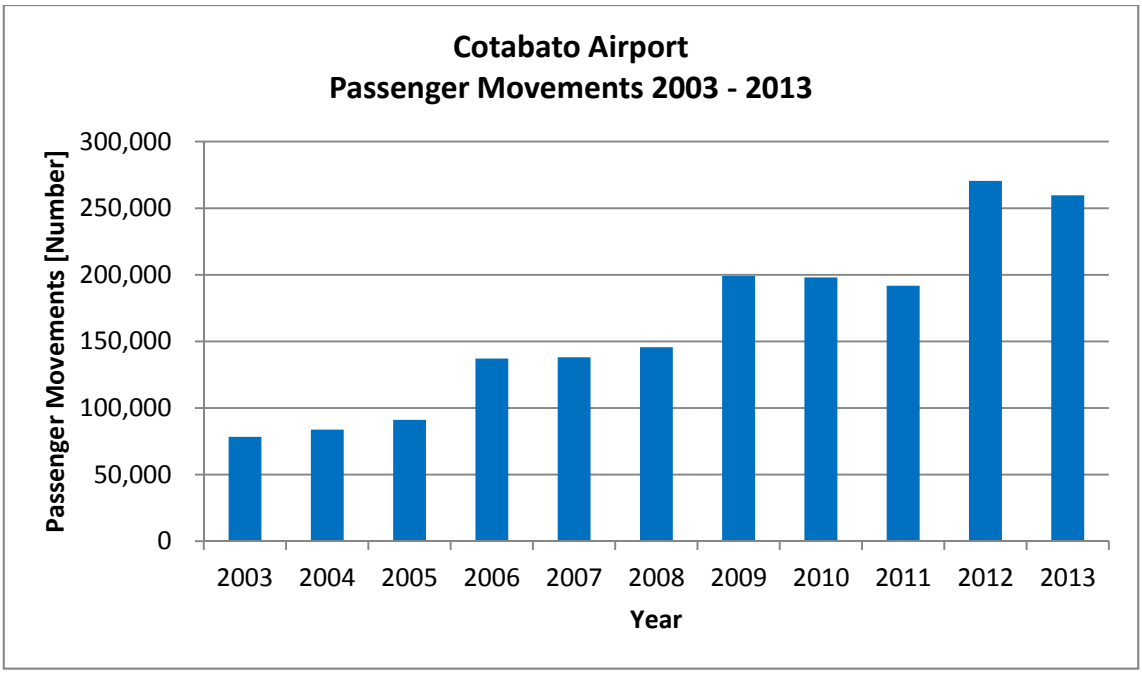
It is notable that the traffic movements at the Cotabato airport increased steadily due to the A320 scheduled flight operation by Cebu Pacific Air, which was commenced in 2009 (Table 1.4). The inbound cargo movements also increased steadily after 2009, but the outbound cargo movements consisting of eel, crab, fruits such as lanzones, and fighting cocks remained almost unchanged from the point of view of the total cargo volume. The outbound cargo movements can be promoted up to around three times at least than existing cargo capacity in consideration of the inbound cargo movements.

The other notable occurrences which might have adversely affected the air traffic movements at the Cotabato airport are as follows: outbreak of SARS, bombing at the terminal building in 2003, global financial crisis during 2007-2008, and runway maintenance in 2011.

Table 2.1 Air Traffic Movements at Cotabato Airport

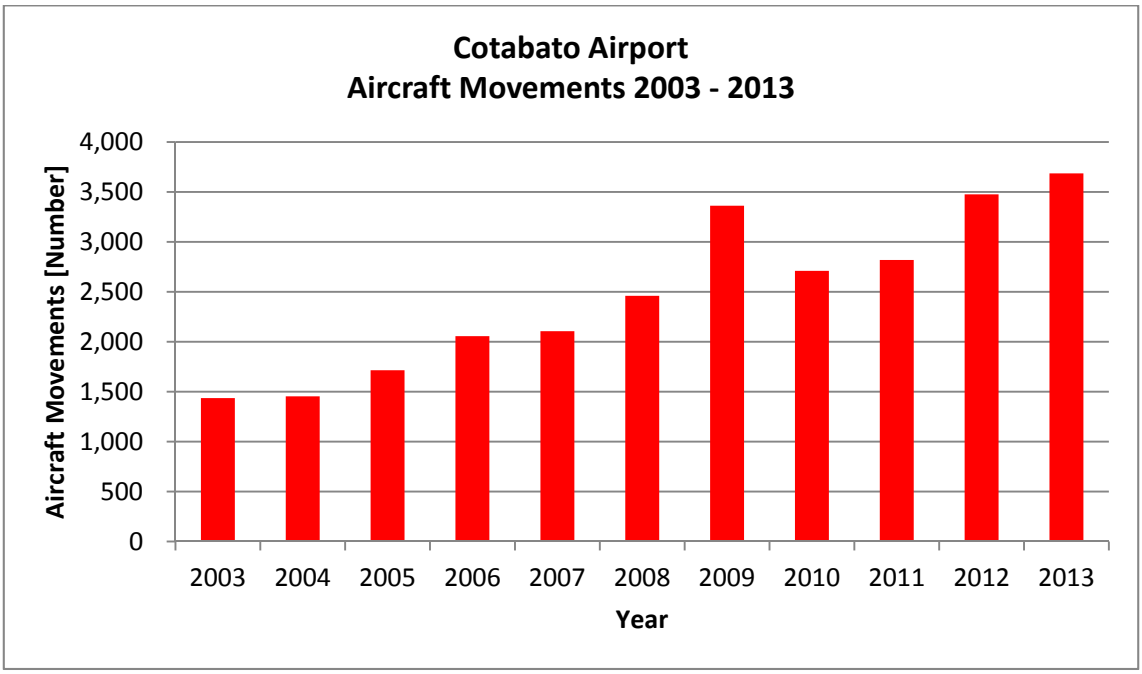
Year	Passenger (n)			Aircraft (n)			Cargo (ton)		
	In	Out	Total	In	Out	Total	In	Out	Total
2003	38,533	39,796	78,329	718	718	1,436	392	276	668
2004	41,911	41,875	83,786	727	727	1,454	438	292	730
2005	45,692	45,411	91,103	857	857	1,714	469	351	820
2006	67,705	69,404	137,109	1,028	1,028	2,056	504	318	822
2007	68,948	69,162	138,110	1,053	1,053	2,106	599	449	1,048
2008	71,796	73,849	145,645	1,230	1,230	2,460	582	303	886
2009	97,069	102,035	199,104	1,681	1,681	3,362	800	335	1,135
2010	97,167	100,838	198,005	1,355	1,355	2,710	989	428	1,417
2011	96,596	95,184	191,780	1,409	1,409	2,818	1,095	421	1,516
2012	131,345	139,100	270,445	1,738	1,738	3,476	1,412	463	1,874
2013	127,109	132,589	259,698	1,843	1,843	3,686	1,613	482	2,095

Source: CAAP-CBO.



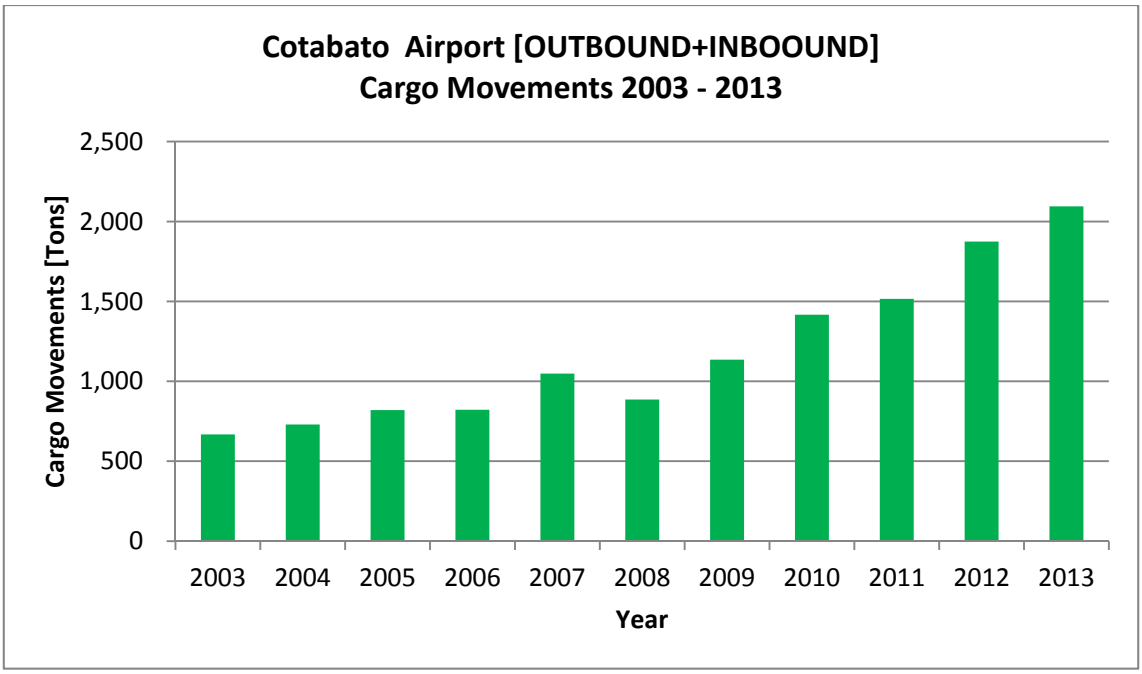
Source: CAAP-CBO.

Figure 2.1 Air Passenger Movement at Cotabato Airport (2003–2013)



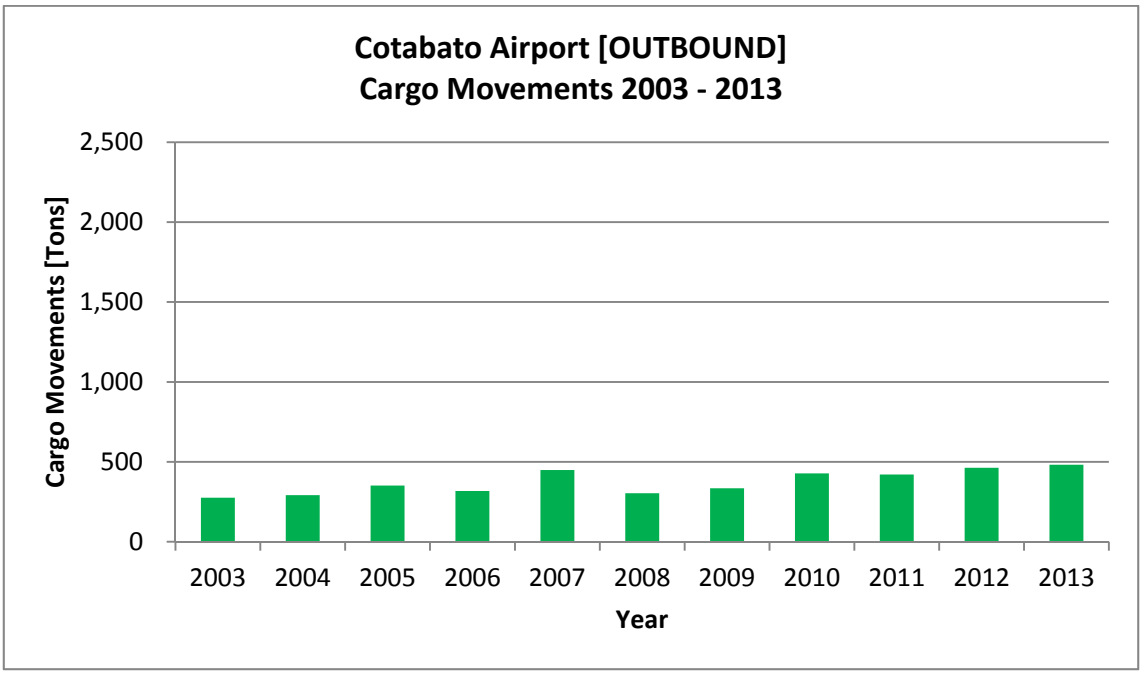
Source: CAAP-CBO.

Figure 2.2 Air Traffic Movement at Cotabato Airport (2003–2013)



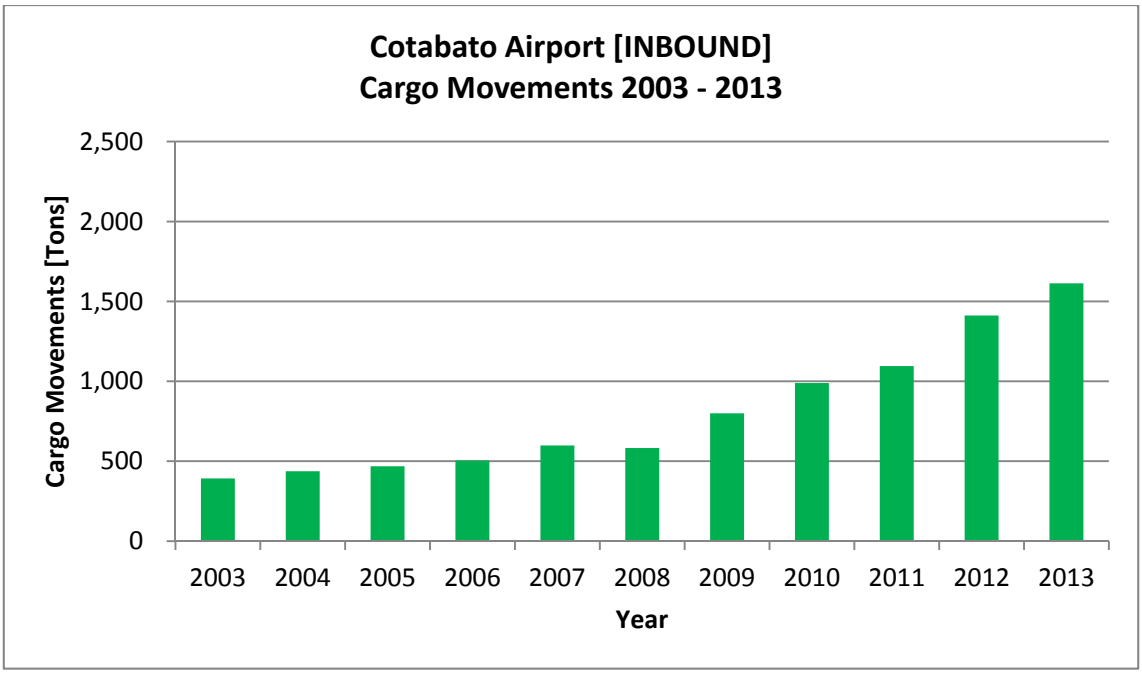
Source: CAAP-CBO.

Figure 2.3 Air Cargo Movement at Cotabato Airport (2003–2013)



Source: CAAP-CBO.

Figure 2.4 Outbound Air Cargo Movement at Cotabato Airport (2003–2013)



Source: CAAP-CBO.

Figure 2.5 Inbound Air Cargo Movement at Cotabato Airport (2003–2013)

2.2.2 Jolo airport

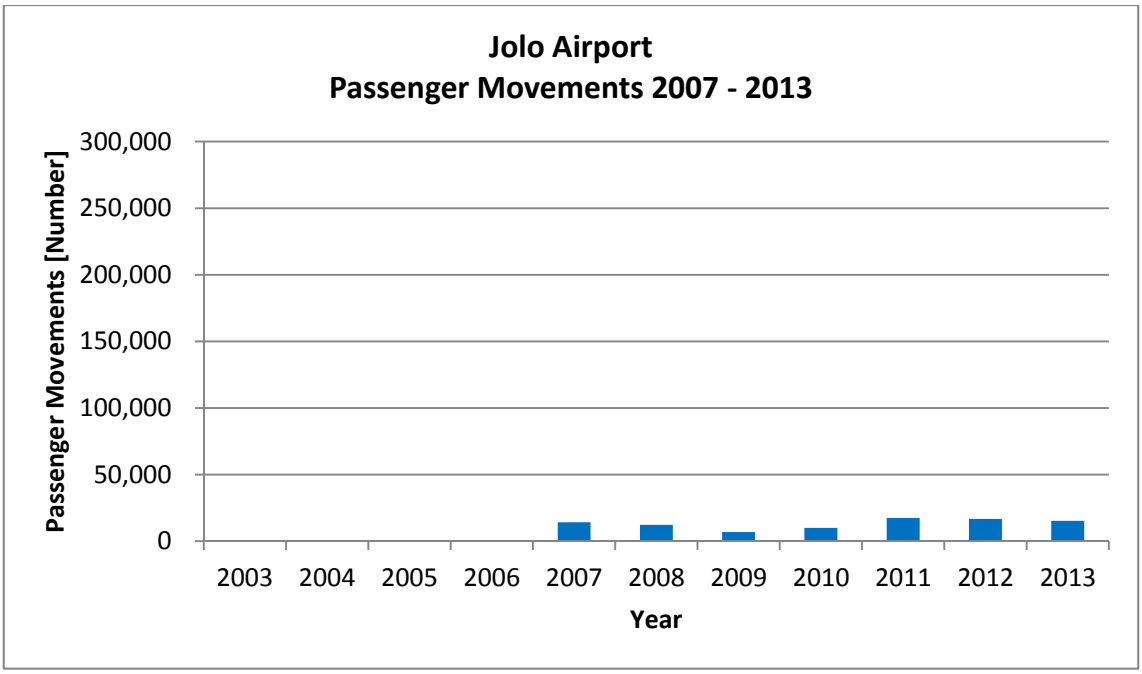
The passenger movement at the Jolo airport remains almost unchanged since 2007 (Table 2.2). The aircraft movement decreased as the small aircraft with 17 seats was operated until 2008 but PAL and CEB started the flight to the airport by bigger aircrafts from 2009 until 2014. Then CEB finished the operation in 2014. Currently, only PAL operates the flight to the airport up to now. The cargo movement drastically increased by the operation of the courier companies from 2013.

According to PAL, they temporarily stopped operation in the middle of 2015. It is considered to be one of the causes that the high speed vessel service between Zamboanga and Sulu has been promoted much lower fare than before.

Table 2.2 Air Traffic Movements at Jolo Airport

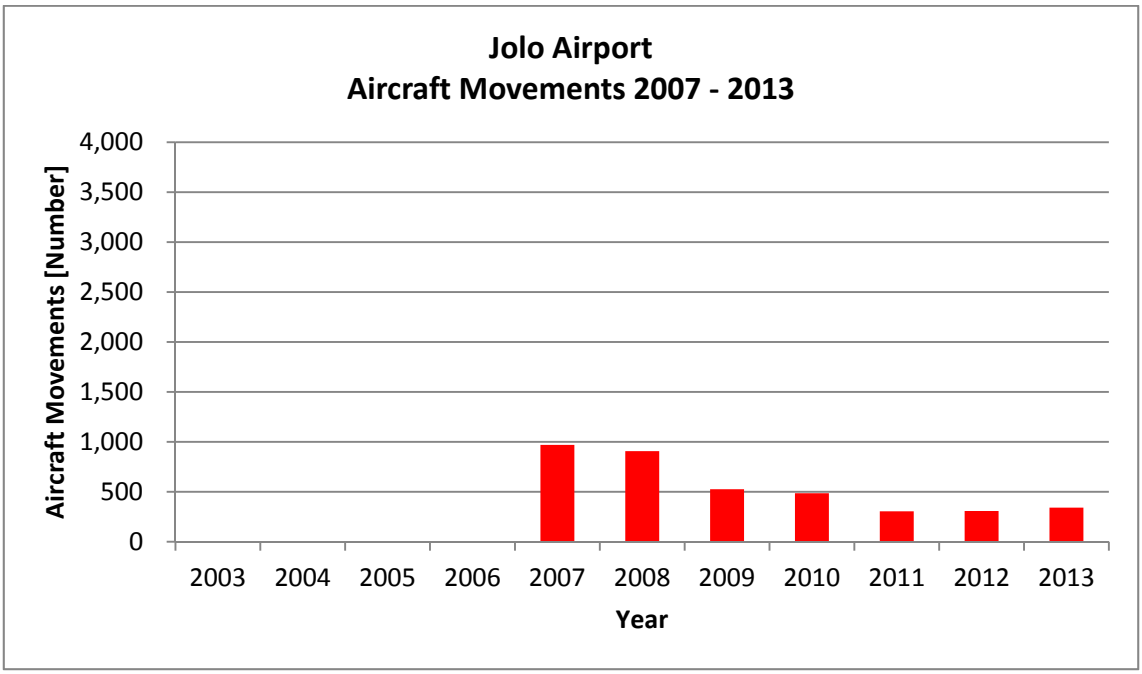
Year	Passenger (n)			Aircraft (n)			Cargo (ton)		
	In	Out	Total	In	Out	Total	In	Out	Total
2003									
2004									
2005									
2006									
2007	6,434	7,731	14,165	485	485	970	8	2	10
2008	6,079	6,158	12,237	454	454	908	7	5	13
2009	3,356	3,505	6,861	263	263	526	8	6	15
2010	4,890	5,016	9,906	243	243	486	12	8	20
2011	8,525	8,908	17,433	152	152	304	18	6	24
2012	8,381	8,239	16,620	154	154	308	34	5	39
2013	7,482	7,793	15,275	171	171	342	136	302	439

Source: CAAP-JOL.



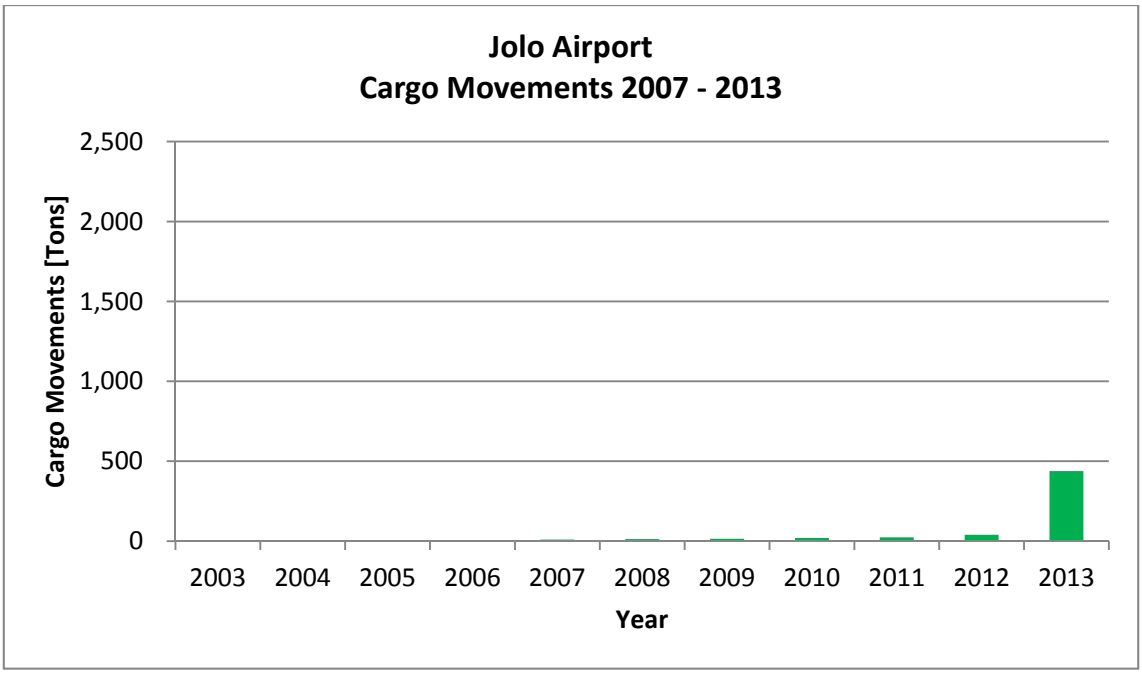
Source: CAAP-JOL.

Figure 2.6 Air Passenger Movement at Jolo Airport (2007–2013)



Source: CAAP-JOL.

Figure 2.7 Air Traffic Movement at Jolo Airport (2007–2013)



Source: CAAP-JOL.

Figure 2.8 Air Cargo Movement at Jolo Airport (2007–2013)

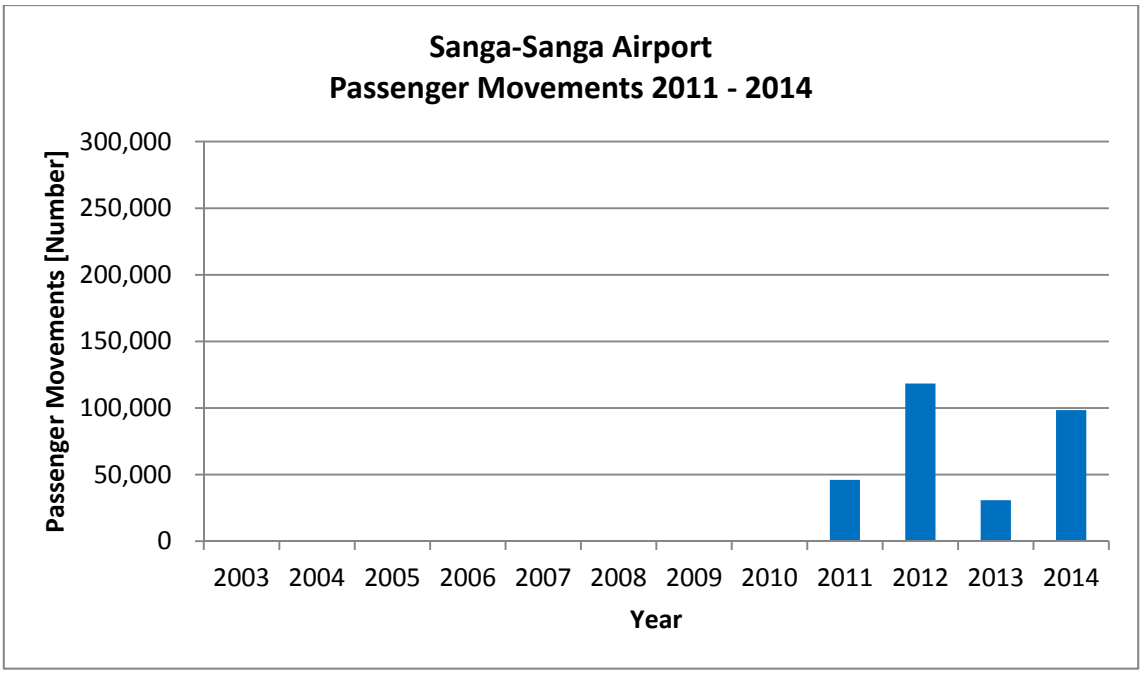
2.2.3 Sanga-Sanga airport

CEB started operation at the Sanga-Sanga airport in October 2011 utilizing Airbus 319. PAL stopped operation in April 2014 utilizing Bombardier DHC-8-402. Due to these changes in commercial operation and the lack of major part of the statistical data in 2013, it is difficult to make reference to the trends (Table 2.3).

Table 2.3 Air Traffic Movements at Sanga-Sanga Airport

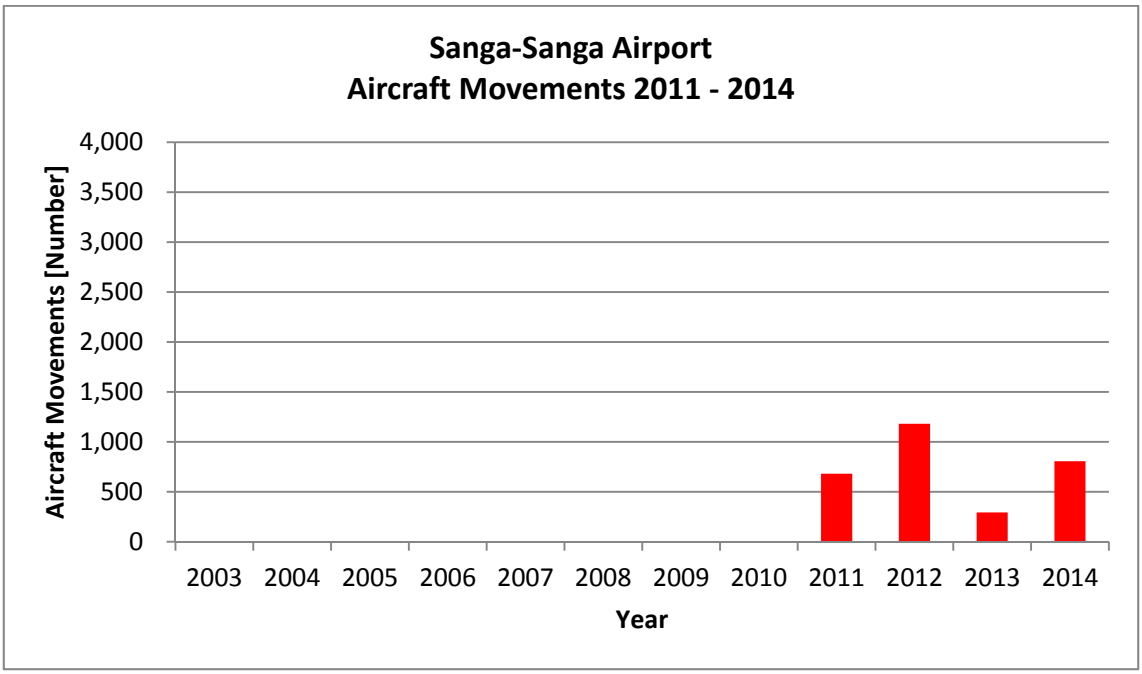
Year	Passenger (n)			Aircraft (n)			Cargo (ton)		
	In	Out	Total	In	Out	Total	In	Out	Total
2003									
2004									
2005									
2006									
2007									
2008									
2009									
2010									
2011	22,275	23,697	45,972	341	341	682	49	32	81
2012	58,539	59,797	118,336	591	591	1,182	180	412	592
2013	15,046	15,696	30,742	147	147	294	45	97	142
2014	48,548	49,821	98,369	403	403	806	171	464	635

Source: CAAP-ZAM.



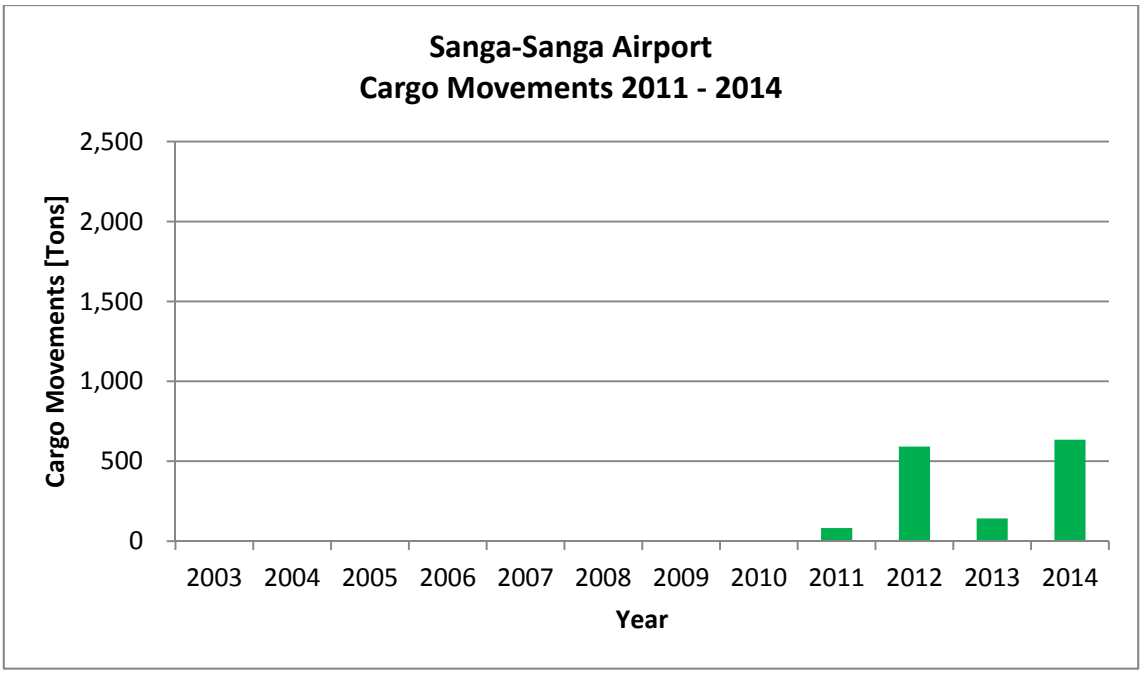
Source: CAAP-ZAM.

Figure 2.9 Air Passenger Movement at Sanga-Sanga Airport (2011–2014)



Source: CAAP-ZAM.

Figure 2.10 Air Traffic Movement at Sanga-Sanga Airport (2011–2014)



Source: CAAP-ZAM.

Figure 2.11 Air Cargo Movement at Sanga-Sanga Airport (2011–2014)

2.2.4 General aviation (GA)

Currently, there is no operation by the General Aviation which departs Bangsamoro airports as the origin. There are only a few flights from other airports in Mindanao to Bangsamoro airports.

2.3 Alternative Transportation Other than Aircraft

Alternative transportation means between Cotabato City and the other major cities in Mindanao, and between Zamboanga City and the other major islands in the Sulu archipelago are summarized in Table 2.4. These transportation services are widely utilized as an affordable transportation for the citizens.

Table 2.4 Summary of Alternative Transportation Means

Mode	Route		Seats	Fare (PHP)	Time (hours)	Frequency	Note
	Origin	Destination					
Bus	Cotabato	Davao	45	350	6	Daily	
		Gen. San.	45	322	5	Daily	
		Cgyn. De Oro	45	400	8	Daily	Via Kabacan
		Zamboanga	-	-	-	-	*
Van	Cotabato	Davao	12	270–350	4	Daily	
		Gen. San.	12	220	3	Daily	
		Cgyn. De Oro	12	250	6	Daily	Via Marawi
		Zamboanga	12	1,500	10	We/Th/Fr/Sn	
Ro-Ro vessel	Zamboanga	Sulu	200	1,000	10	Daily	
		Tawi-Tawi	200	1,500	17	Every other day	
		Cgyn. De Sulu	-	-	-	-	*
High speed vessel	Zamboanga	Sulu	200	800	4	Daily	†
		Tawi-Tawi	200	2,500	8	Daily	‡
		Cgyn. De Sulu	-	-	-	-	*

*No regular service; †Fare as of August 2015 (higher in March 2015); ‡Out of service due to vessel malfunction.

Source: JICA Study Team.

2.3.1 Road transportation service

The bus service is regularly operated at an every 30 minutes interval from 5AM to 3PM. The van service is regularly operated once the passenger reaches the capacity.

2.3.2 Sea transportation service

Vessel service is regularly operated daily or every other day. It takes relatively longer than air transport but its cost is considerably lower. Also, it is second to none on the frequency of operation.

2.4 Demand for Tourism

2.4.1 Tourist arrivals in ARMM

Changes in tourist arrivals in ARMM from 2008 to 2014 are presented in Table 2.5 and Figures 2.12 through 2.14, referring to the statistical data obtained from the Department of Tourism (DOT)-ARMM.

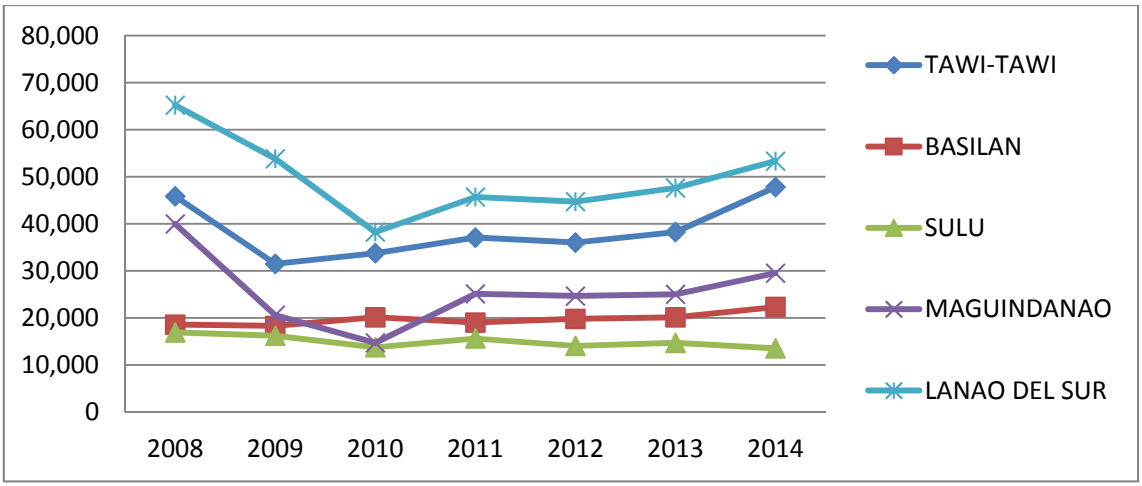
The tourist arrival data were collated with the documents furnished by LGU Provincial Tourism Offices in the ARMM, and hotel/hostel/inns records. Marawi City tourism arrival data are included in Lanao del Sur province.

The incident of Maguindanao massacre in 2009 is considered to be related to the decreases during 2008 to 2010. Tourist arrivals in Lanao del Sur, Maguindanao and Tawi-Tawi tend to increase in recent years. On the other hand, the numbers in Basilan and Sulu trend to decrease or remain unchanged. The ratio of the foreign tourists to the total tourists still remains around only 1% although increased drastically in Maguindanao.

Table 2.5 Tourist Arrivals in ARMM (as of November 15, 2014)

Particulars		Province					ARMM (n)
		Tawi-Tawi (n)	Basilan (n)	Sulu (n)	Maguinda-nao (n)	Lanao del Sur (n)	
Domestic	2008	45,840	18,570	16,900	39,970	65,210	186,490
	2009	31,500	18,300	16,200	20,600	53,830	140,430
	2010	33,755	20,130	13,763	14,720	38,240	120,608
	2011	37,067	19,019	15,636	25,117	45,693	142,532
	2012	36,025	19,799	14,067	24,663	44,700	139,254
	2013	38,244	20,117	14,690	25,014	47,619	145,684
	2014	47,805	22,330	13,515	29,517	53,333	166,500
Foreign	2008	15	20	14	34	2,343	2,426
	2009	10	4	3	18	14	49
	2010	215	21	11	280	14	541
	2011	280	16	8	110	27	441
	2012	380	17	14	233	32	676
	2013	185	25	17	1,091	35	1,353
	2014	384	28	16	1,189	61	1,678
Total	2008	45,855	18,590	16,914	40,004	67,553	188,916
	2009	31,510	18,304	16,203	20,618	53,844	140,479
	2010	33,970	20,151	13,774	15,000	38,254	121,149
	2011	37,347	19,035	15,644	25,227	45,720	142,973
	2012	36,405	19,816	14,081	24,896	44,732	139,923
	2013	38,429	20,142	14,707	26,105	47,654	147,037
	2014	48,189	22,358	13,531	41,506	53,394	168,178

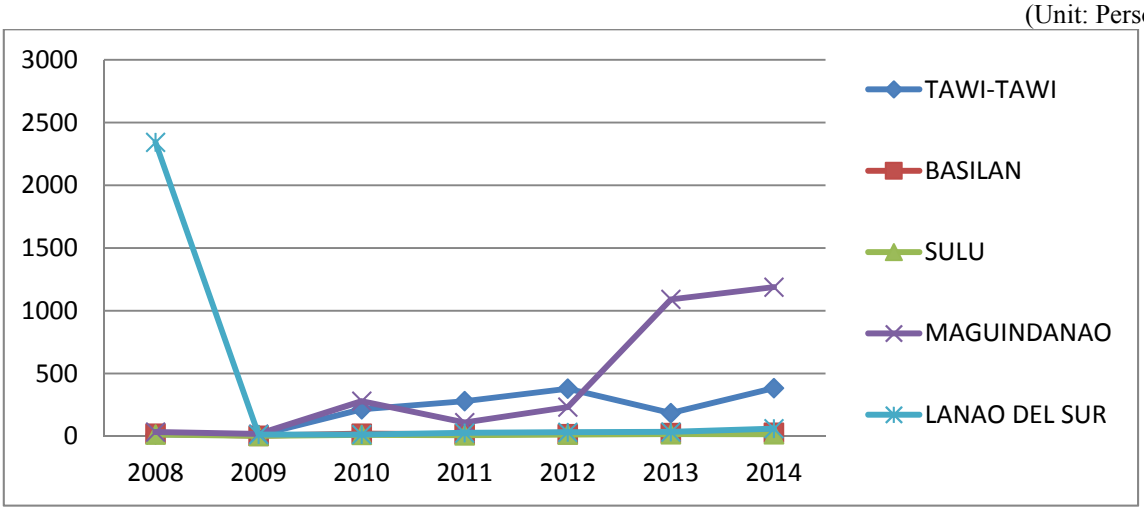
Source: DOT.



Source: DOT-ARMM.

Figure 2.12 Domestic Tourist Arrivals in ARMM (2008–2014)

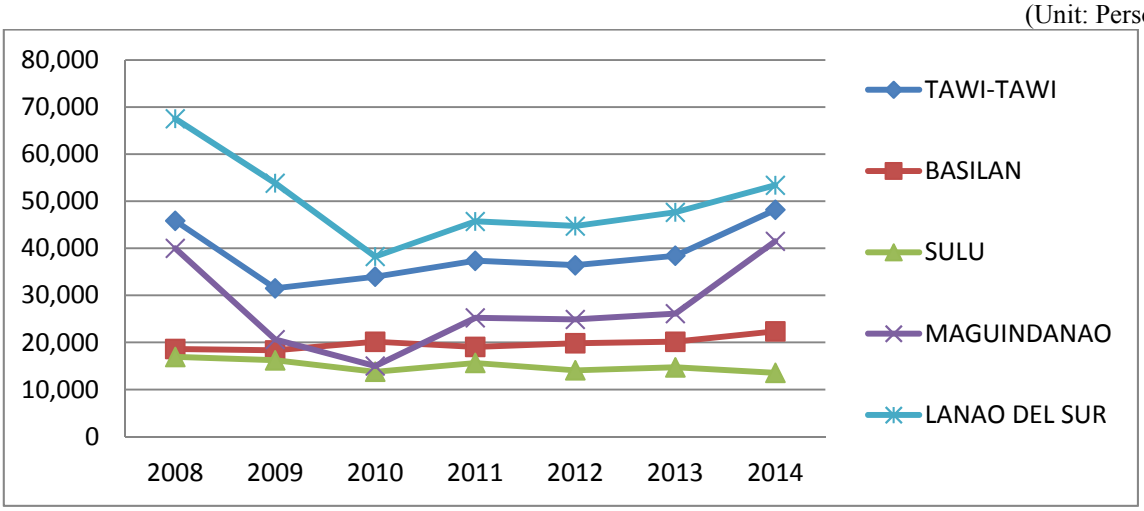
(Unit: Person)



Source: DOT-ARMM.

Figure 2.13 Foreign Tourist Arrivals in ARMM (2008–2014)

(Unit: Person)



Source: DOT-ARMM.

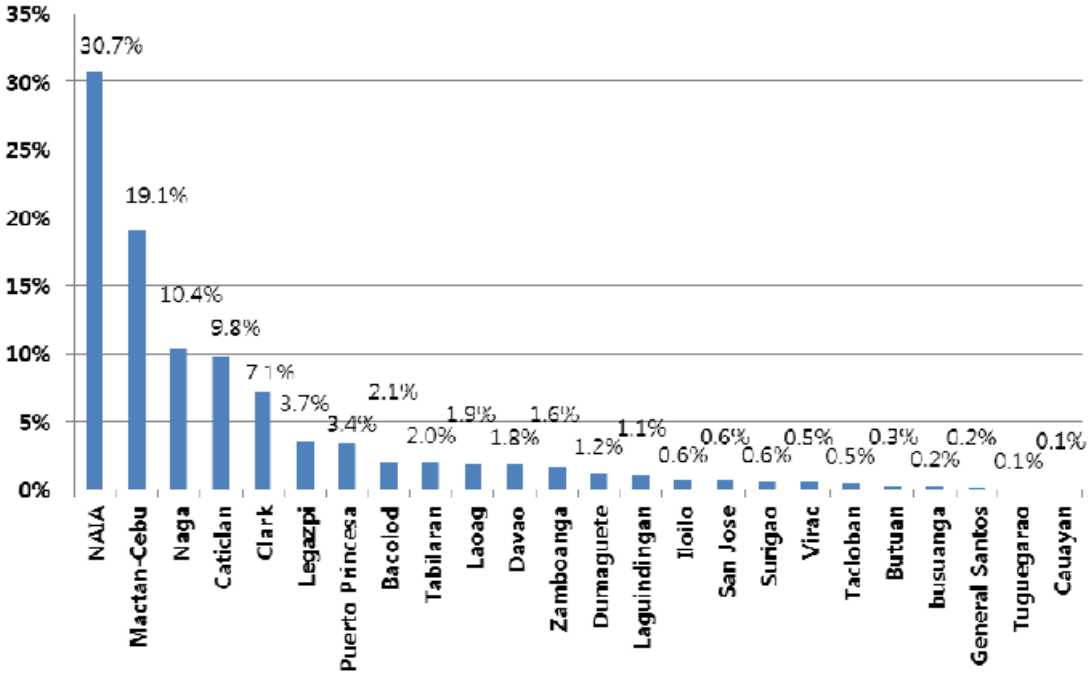
Figure 2.14 Total Tourist Arrivals in ARMM (2008–2014)

2.4.2 Transfer demand

In general, it is assumed that foreign travelers enter the Philippines through international flights, and then transit to other regions through domestic flights. Figure 2.15 based on the data by region on accommodations used by foreign travelers, collected by DOT, describes the registration status of foreigners traveling in each region. The statistics suggest that the potential for internationalization of the Cotabato airport currently still remains low.

(1) Location to stay in the Philippines

About 30.7% of foreign tourists tend to stay in Manila, followed by Mactan-Cebu with 19.1%, Naga with 10.4% and Caticlan with 9.8%. With regard to Mindanao, only 1.8% tends to stay in Davao, followed by Zamboanga with 1.6%, Laguindingan with 1.1%, Butuan with 0.3% and General Santos with 0.2%.

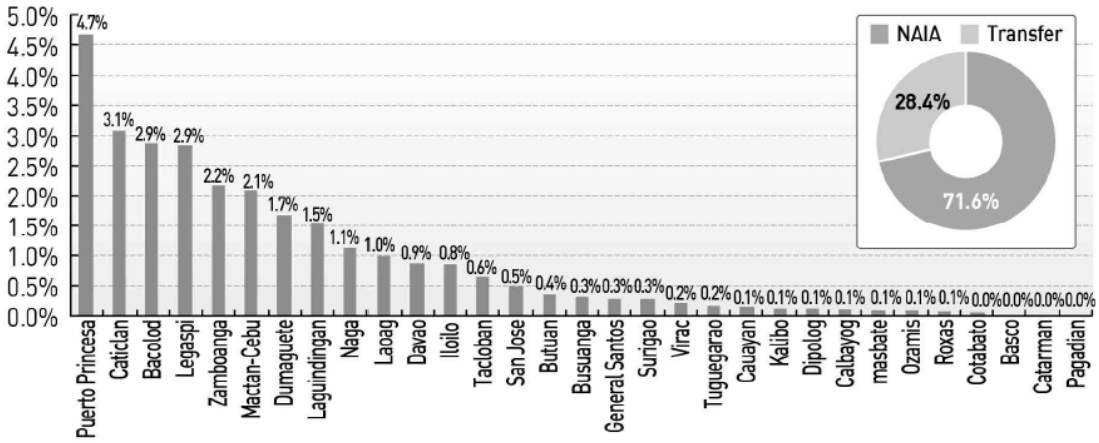


Source: KOICA Master Plan Study Report (Data from DOT).

Figure 2.15 Foreign Travelers Staying at Hotels (2012)

(2) Transfer at NAIA

Areas traveled by tourists were reviewed to predict a travel path from major international airports using domestic flights. Of the international passengers coming through NAIA, 71.6% stay in Manila while 28.4% connect to domestic flights bound for other regions (Figure 2.16). In the case of NAIA, the transfer demand is the highest for the domestic flights bound for the Puerto Princesa airport, followed by Caticlan and Bacolod airports. When the Puerto Princesa international airport opens as scheduled in 2017, much of the transfer demand via NAIA is expected to fall greatly. With regard to Mindanao, only 2.2% transfers to Zamboanga, followed by Laguindingan with 1.5%, Davao with 0.9%, Cotabato with less than 0.1%.

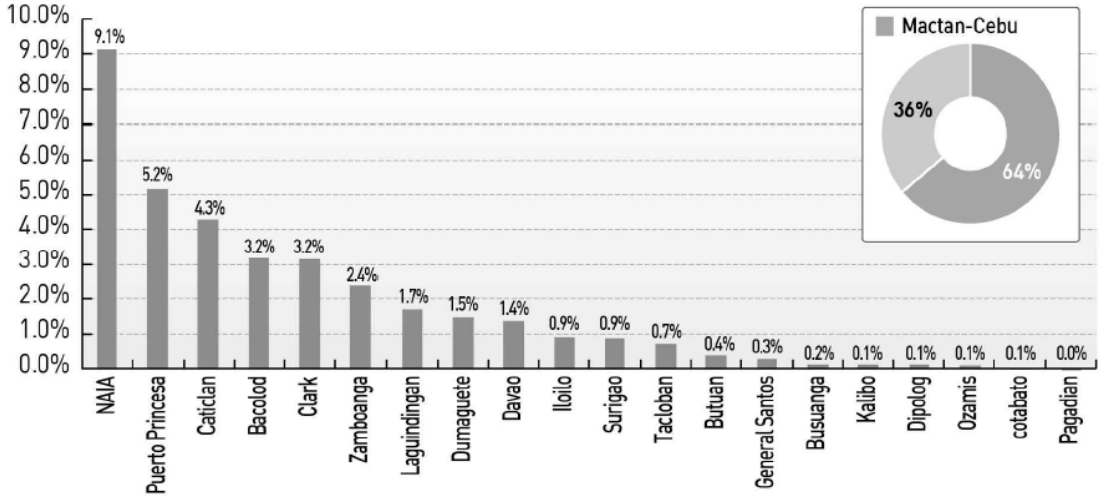


Source: KOICA Master Plan Study Report (Data from DOT).

Figure 2.16 NAIA Airport Transfer Rate (2012)

(3) Transfer at Mactan-Cebu airport

Of passengers entering the Mactan-Cebu airport, 64.1% stay in Cebu while 35.9% of them are presumed to transfer to domestic flights bound for other regions (Figure 2.17). Of the total transfers, there are most transits made to the NAIA airport, followed by Puerto Princesa, Caticlan and Bacolod airports in this order. In Mindanao, only 2.4% transfers to Zamboanga, followed by Laguindingan with 1.7%, Davao with 1.4%, Cotabato with 0.1%.

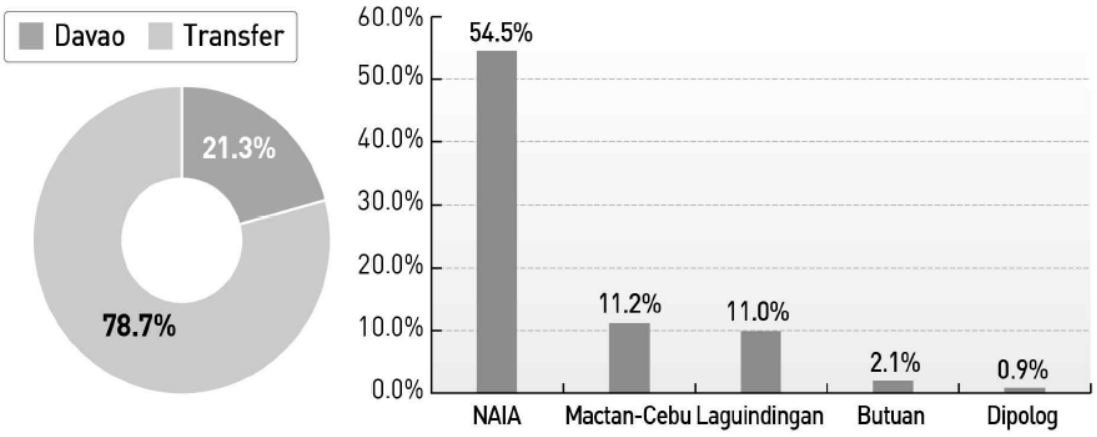


Source: KOICA Master Plan Study Report (Data from DOT).

Figure 2.17 Mactan-Cebu Airport Transfer Rate (2012)

(4) Transfer at Davao airport

An analysis shows that the Davao airport has relatively less pulling power than the airports situated in Manila and Cebu, and thus the transfer rate to adjacent regions is thought to be slightly high at 78.7% (Figure 2.18). The NAIA received most of the transfers made.



Source: KOICA Master Plan Study Report (Data from DOT).

Figure 2.18 Davao Airport Transfer Rate (2012)

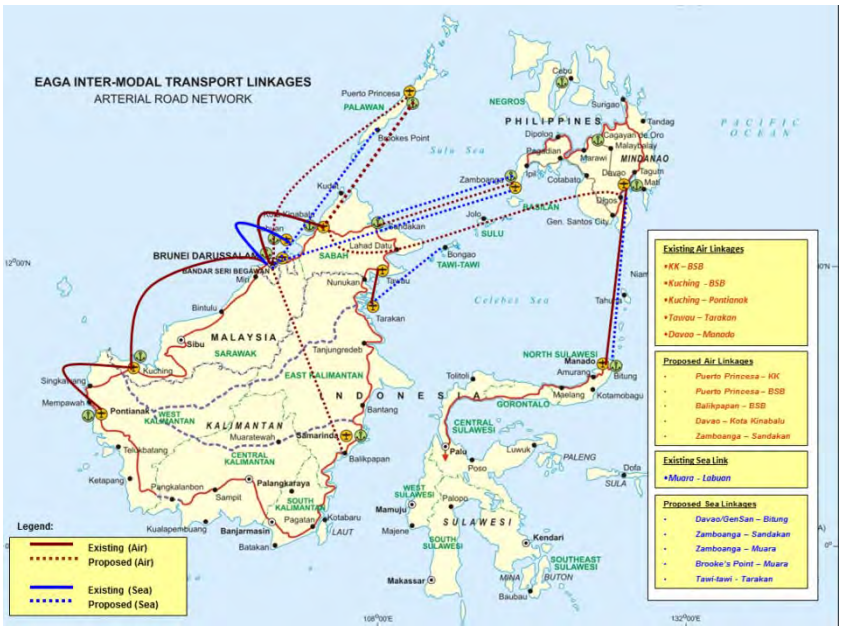
2.5 Air Linkage Program of BIMP-EAGA

Currently, there is no operation for the BIMP-EAGA air linkage from/to Bangsamoro airports, although the Sanga-Sanga airport is part of the air linkage program for possible international flights. There is an only air linkage between Davao and Manado, Indonesia by charter flights operated by Sriwijaya Air of Indonesian airline.

According to the Mindanao Development Authority (MinDA), a multi-stakeholder group from Mindanao and Indonesia is poised to revive the air connectivity between Mindanao and North Sulawesi starting off with a market development strategy for the Davao-Manado route. In a meeting recently convened by MinDA, key players from tourism, trade, academe, and government line agencies agreed to take more proactive and aggressive steps in re-establishing the connectivity between the two BIMP-EAGA cities (Figure 2.19).

Reviving air links between the Philippines and its EAGA counterparts is currently one of the priorities of MinDA in order to maximize the travel tax exemption approved by the Philippine Government for travelers from Mindanao and Palawan heading to any of the BIMP-EAGA destinations. MinDA serves as the Philippine National Secretariat for BIMP-EAGA and coordinates with DOT and the Manado Transport and Tourism Ministry in developing the market for the Davao-Manado linkages.

Among the strategies to be pursued to promote the Davao-Manado route are the development of tour packages, business matching, trade sessions, and student exchange programs. The direct flight from Davao to Manado offers a shorter route for travelers and will allow the faster movement of goods and products. Currently, passengers bound for Manado take the circuitous and costly Davao-Manila-Jakarta-Manado route.



Source: MinDA.

Figure 2.19 Air and Sea Transport Linkage Program of BIMP-EAGA

CHAPTER 3 EXISTING AIRPORT FACILITY PROFILE

The existing airport facilities and the operational status in the Bangsamoro airports are shown in Tables 3.1 through 3.6. The data are initially compiled from the Philippine Airport Profile provided by CAAP-HQ and updated to the latest conditions through the site survey by the JICA Study Team.

3.1 Cotabato Airport

Existing facilities at the Cotabato airport are summarized in Table 3.1.

Table 3.1 Existing Facilities at Cotabato Airport

	Classification	Item	Airport facilities	Status*
1	Technical Information	Name of airport	Cotabato (Awang) Airport	
		Airport codes	ICAO Code: RPMC	
			IATA Code: CBO	
		Location	Town/City, Province: Awang, Datu odin Sinsuat, Cotabato City	
			Region: ARMM XI	
			Aerodrome Area Cluster: XI	
		Classification	Principal Class 1	
		Land area	36.1 ha	
		Threshold 10	Latitude: 07° 10’ 0.2496” N Longitude: 124° 12’ 6.89217” E Elevation: 54.6027 m	
		Threshold 28	Latitude: 07° 09’ 45.84695” N Longitude: 124° 13’ 7.57687” E Elevation: 46.9204 m	
		Airport reference point	Latitude: 07° 09’ 53.0483’ N Longitude: 124° 12’ 37.2345 E	
		Runway designation no.	10/28	
		Runway elevation	54.6027 m AMSL	
		Runway efficient grade	0.406% downhill towards threshold 28	
		Runway pavement strength	PCN 44 R/A/W/u	
		True bearing	THR10-THR28: 103° 21’ 58.0”	
			THR28-THR10: 283° 22’ 05.6”	
2	Aircraft Movement Area	Runway	1,913 m x 45 m (paved w/ concrete, overlaid w/ asphalt)	
		Apron	256 m x 100 m (concrete)	
		Taxiway	2–18 m x 83 m (asphalt overlay)	
		Stopway	43.9 m x 45.3 m/44.7 m x 44.3 m	
		Clearway	60 m x 45 m both ends	
		Runway shoulder	Macadam	
		Strip	2,100 m x 130 m	
3	Airport Facility	PTB	72.00 m x 16.00 m	
		Staff house	10.00 m x 8.00 m (proposed)	
		Fire station building	22.00 m x 13.00 m	
		Administration building	19.00 m x 16.00 m	
		Parking area	72 m x 110 m	
4	Airport Equipment	Service vehicle	L-300	Not in use (repairs needed)
		Tractor mower		
		Runway sweeper	None	
		Airlines in service	Philippine Airlines, Cebu Pacific	
		Critical aircraft	A 320	

	Classification	Item	Airport facilities	Status*
		Airport category	Actual CAT. 4, required CAT. 6	
5	Aerodrome Rescue and Firefighting (ARFF)	Actual capacity	Water (L): 4,300; AFFF (L): 420; DCP (kg): -	
		Minimum ICAO requirements	Water (L): 7,900; AFFF (L): 474; DCP (kg): 225	
		Existing workforce	11 firefighters (9 permanent, 0 casual, 2 on job order)	
		Required	22 firefighters	
6	ANS and ATS Facilities	Radio NAVAID equipment	VOR (conventional, Wilcox 585B)	N (both systems)
			DME (ASI 1119)	Sys #1: Y Sys #2: N
		Communications equipment	VHF AM transmitter (main), 123.3 freq.: Aerocom 310	N
			VHF AM transmitter (standby), 123.3 freq.: Aerocom 310	N
			VHF AM receiver (main), 123.3 freq.; Aerocom 320	N
			VHF AM receiver (standby), 123.3 freq.: Aerocom 320	N
			VHF AM transceiver, 118.7 freq.: PAE T6TR, 50W	Y
			VHF AM transceiver, 123.3 freq.: Mentor MB, 50W	Y
			VHF AM transceiver, 123.3 freq.: PAE T6M, 10W	Y
			VHF AM transceiver, 121.5 freq.: PAE 1660, 10W	Y
			HF transceiver (M), 6.795 freq.: Yaesu FT-180A	Y
			Voice logging system (VLS): Stancil E-Series	Deck #1: N Deck #2: Y
			Integrated communication Switching System (ICSS): Denro ICSS-466	N
			CADAS: Comsoft	Y
		Meteorological equipment	WSI, WDI, and PTH: Vaisala	Y
		Airfield lighting equipment	PAPI 10 (pilot side)	Y
			PAPI 28 (pilot side)	Y
			Wind cones 10 (WDIL)	Y
			Wind cones 28 (WDIL)	Y
			RTIL 10	Y
			RTIL 28	Y
			TWY edge light	Y
			RWY edge light	Y
			Threshold light 10 (elevated type)	Y
			Threshold light 28 (inset type)	Y
			Rotating beacon	Y

*Y = operational; N = non-operational

Source: CAAP, updated by JICA Study Team.

3.2 Jolo Airport

Existing facilities at the Jolo airport are summarized in Table 3.2.

Table 3.2 Existing Facilities at Jolo Airport

	Classification	Item	Airport facilities	Status*
1	Technical Information	Name of airport	Jolo Airport	
		Airport codes	ICAO Code: RPMJ	
			IATA Code: JOL	
		Location	Town/City, Province: Barangay Bus-Bus, Jolo, Sulu	
			Region: Region IX	
			Aerodrome Area Cluster: AACIX	
		Classification	Principal Class 2	
		Land area	22.837 ha	
		Threshold		
		Airport reference point	Latitude: 6° 03'15"N Longitude: 121° 00'30"E	
		Runway designation number	9/27	
		Runway elevation	36 m. AMSL	
		Runway efficient grade	Eff. 2.02% uphill to E (AIP data)	
		Runway pavement strength	PCN 41 R/A/W/T	
		True bearing	N 16° 14' E	
2	Aircraft Movement Area	Runway	1,845 m total length (concrete), (1,535 m x 30 m @ RWY09, 310 m x 45 m @ RWY27)	
		Apron	150 m x 60 m (concrete)	
		Taxiway	2–22.5 m x 45 m (concrete)	
		Stopway	0 m/60 m	
		Clearway	0 m/100 m	
		Runway shoulder	Macadam	
		Strip	Approx. 1,900 m x 150 m	
3	Airport Facility	Passenger terminal building	20 m x 10 m	
		Staff house		
		Fire station building	25 m x 12 m	
		Administration building	None	
		Parking area	70 m x 47 m (concrete)	
4	Airport Equipment	Service vehicle	None	
		Tractor mower	None	
		Runway sweeper	None	
5	Aerodrome Rescue and Firefighting	Airlines in service	PAL Express, GEN AV	
		Critical aircraft	Q400 & D328	
		Airport category	Actual CAT. 4, required CAT. 6	
		Actual capacity	Water (L): 4,800; AFFF (L): 600; DCP (kg) 270	
		Minimum ICAO requirements	Water (L): 7,900; AFFF (L): 474; DCP (kg): 225	
		Existing workforce	43 (9 permanent, 18 casual, 16 on job-order)	
		Required	16 firefighters	
6	ANS and ATS Facilities	Radio NAVAID equipment	NDB	Y
		Communications equipment	VHF AM transceiver, 122.2 freq.	Y
			VHF AM transceiver (M), 122.2 freq.	Y
			VHF AM transceiver (S), 122.2 freq.	Y
			HF transceiver (M), 6.795 freq.	Y
			HF transceiver (S), 6.795 freq.	Y
		Airfield lighting equipment		n/a

*Y = operational; N = non-operational

Source: ibid.

3.3 Sanga-Sanga Airport

Existing facilities at the Sanga-Sanga airport are summarized in Table 3.3.

Table 3.3 Existing Facilities at Sanga-Sanga Airport

	Classification	Item	Airport facilities	Status*
1	Technical Information	Name of airport	Sanga-Sanga Airport	
		Airport codes	ICAO Code: RPMN	
			IATA Code: SGS	
		Location	Town/City/Province: Tubig Sallang, Bongao, Tawi-Tawi, Sulu	
			Region: ARMM	
			Aerodrome Area Cluster: IX	
		Classification	Principal Class 2	
		Land area	32 ha	
		Threshold 02	Latitude: 5° 02' 26.48129" Longitude: 119° 44' 27.26439" Elevation: 4.545 m	
		Threshold 20	Latitude: 5° 03'23.94805" Longitude: 119° 44'46.29439" 6.635 m	
		Airport reference point	Latitude: 5° 02' 55.21467" Longitude: 119° 44' 36.77939"	
		Runway designation number	02/20	
		Runway elevation	8.536 m AMSL	
		Runway efficient grade	0.442% uphill towards threshold 20	
		Runway pavement strength	PCN 39 R/A/W/T	
		True bearing	THR02-THR20: 18° 22' 9.5"	
			THR20-THR02: 198° 22' 10.3"	
2	Aircraft Movement Area	Runway	1,920 m x 30 m w/ turnaround pad @ rwy 20 (Concrete)	
		Apron	156m x 50m (Concrete)	
		Taxiway	None	
		Stopway	0/60m x 30m	
		Clearway	0/60m x 30m	
		Runway shoulder	(7.50 m min. both sides, macadam)	
		Strip	2,395 m x 200 m	
3	Airport Facility	PTB	10 m x 30 m	
		Staff house		
		Fire station building	11.00 m x 20.00 m	
		Administration building	None	
		Parking area	Under construction by DOTC	
4	Airport Equipment	Service vehicle	None	
		Tractor mower	None	
		Runway sweeper	None	
5	Aerodrome Rescue and Firefighting	Airlines in service	Cebu Pacific	
		Critical aircraft	A319	
		Airport category	Actual CAT. 4, required CAT. 6	
		Actual capacity	Water (L): 2,400; AFFF (L): 300; DCP (kg): 360	
		Minimum ICAO requirements	Water (L): 7,900; AFFF (L): 474; DCP (kg): 225	
		Existing workforce	8 firefighters	
		Required	8 firefighters	
6	ANS and ATS Facilities	Radio NAVAID equipment		n/a
		Communications equipment	VHF AM transceiver (M), 122.1 freq.	N
			VHF AM transceiver, 122.1 freq.	Y

	Classification	Item	Airport facilities	Status*
			HF transceiver, 6.795 freq.	Y
		Airfield lighting equipment		n/a

*Y = operational; N = non-operational

Source: ibid.

3.4 Cagayan De Sulu Airport

Existing facilities at the Cagayan de Sulu airport are summarized in Table 3.4.

Table 3.4 Existing Facilities at Cagayan De Sulu Airport

	Classification	Item	Airport facilities
1	Technical Information	Name of airport	Cagayan de Sulu (Mapun) Airport
		Airport codes	ICAO Code: RPMU
			IATA Code: CDY
		Location	Town/City/Province: Mapun, Cagayan de Sulu, Zamboanga del Sur
			Region: IX
			Aerodrome Area Cluster: IX
		Classification	Community
		Land area	No data
		Threshold	
		Airport reference point	Latitude: 7° 00' 45" Longitude: 118° 29' 43"
		Runway designation number	13/31
		Runway elevation	30 m. AMSL
		Runway efficient grade	Nil
		Runway pavement strength	17,010 kg/0.50 MPa
		True bearing	N 134° 00' E
2	Aircraft Movement Area	Runway	1,300 m x 30 m (macadam)
		Apron	60 m x 50 m (macadam)
		Taxiway	None
		Stopway	None
		Clearway	None
		Runway shoulder	Macadam
		Strip	1,410 m x 100 m
3	Airport Facility	PTB	Repair needed: terminal shed (not std.)
		Staff house	None
		Fire station building	None
		Administration building	None
		Parking area	None
4	Airport Equipment	Service vehicle	None
		Tractor mower	None
		Runway sweeper	None
5	Aerodrome Rescue and Firefighting	Airlines in service	GEN. AV
		Critical aircraft	Cessna & Islander
		Airport category	Actual CAT. 2, required CAT. 2
		Actual capacity	
		Minimum ICAO requirements	DCP (kg): 90
		Existing workforce	8 firefighters
		Required	8 firefighters
6	ANS and ATS Facilities	Radio NAVAID equipment	None
		Communications equipment	None
		Airfield lighting equipment	None

Source: ibid.

3.5 Malabang Airport

Existing facilities at the Malabang airport are summarized in Table 3.5.

Table 3.5 Existing Facilities at Malabang Airport

	Classification	Item	Airport facilities
1	Technical Information	Name of airport	Malabang Airport
		Airport codes	ICAO Code: RPMN
			IATA Code: MLP
		Location	Town/City/Province: Malabang, Lanao del Sur
			Region: Region X-ARMM
			Aerodrome Area Cluster: X
		Classification	Community
		Land area	16.05 ha
		Threshold	
		Airport reference point	Latitude: 7° 37' 6.83" Longitude: 124° 3' 15.51"
		Runway designation number	06/24
		Runway elevation	3.23 m AMSL (AIP data)
		Runway efficient grade	-/+0.578 %l
		Runway pavement strength	PCN 11 F/C/ZT
		True bearing	THR06-THR24: 061° 06' GEO, 061° 11' MAG
			THR24-THR06: 241° 06' GEO, 241° 11' MAG
2	Aircraft Movement Area	Runway	1,360 m x 18 m (concrete)
		Apron	100.00 m x 150.00 m (asphalt)
		Taxiway	None
		Stopway	100 m/35 m (macadam)
		Clearway	100 m/35 m (macadam)
		Runway shoulder	Macadam
		Strip	1,662 m x 100 m
3	Airport Facility	PTB	8.00 m x 30.00 m (old)
		Staff house	None
		Fire station building	None
		Administration building	None
		Parking area	None
4	Airport Equipment	Service vehicle	None
		Tractor mower	None
		Runway sweeper	None
5	Aerodrome Rescue and Fire Fighting	Airlines in service	GEN. AV
		Critical aircraft	Cessna & Islander
		Airport category	Actual CAT. 2, required CAT. 2
		Actual capacity	
		Minimum ICAO requirements	DCP (kg): 90
		Existing workforce	
		Required	
6	ANS and ATS Facilities	Radio NAVAID equipment	None
		Communications equipment	None
		Airfield lighting equipment	None

Source: ibid.

3.6 Wao Airport

Existing facilities at the Wao airport are summarized in Table 3.6.

Table 3.6 Existing Facilities at Wao Airport

	Classification	Item	Airport facilities
1	Technical Information	Name of airport	Wao Airport
		Airport Codes	ICAO Code: None
			IATA Code: WAO
		Location	Town/City/Province: Wao, Lanao del Sur
			Region: X-ARMM
			Aerodrome Area Cluster: AAC X
		Classification	Community
		Land area	To be verified
		Threshold	
		Airport reference point	Latitude: 7° 38' 19" N Longitude: 124° 43' 57" E
		Runway designation number	18/36
		Runway elevation	536 m. AMSL
		Runway efficient grade	-/+ 0.70 %
		Runway pavement strength	To be verified
		True bearing	To be verified
2	Aircraft Movement Area	Runway	1,000.00 m x 30.00 m (macadam)
		Apron	80.00 m x 50.00 m (macadam)
		Taxiway	None
		Stopway	50.00 m/50.00 m (macadam)
		Clearway	50.00 m/50.00 m
		Runway shoulder	Macadam
		Strip	To be verified
3	Airport Facility	PTB	To be verified (Nipa Hut)
		Staff house	None
		Fire station building	None
		Administration building	None
		Parking area	None
4	Airport Equipment	Service vehicle	None
		Tractor mower	None
		Runway sweeper	None
5	Aerodrome Rescue and Firefighting	Airlines in service	GEN. AV
		Critical aircraft	Cessna & Islander
		Airport category	Actual CAT. 2, required CAT. 2
		Actual capacity	
		Minimum ICAO requirements	DCP (kg): 90
		Existing workforce	
		Required	
6	ANS and ATS Facilities	Radio NAVAID equipment	None
		Communications equipment	None
		Airfield lighting equipment	None

Source: ibid.

CHAPTER 4 EXISTING AIRPORT DEVELOPMENT PLAN

4.1 Airport Infrastructure Program

Airport Infrastructure Programs from 2015 to 2018 are supposed to be undertaken by the Philippine national budget as shown in Table 4.1. The budget for the 2015 program was already approved by the Government in 2014. The budget for the 2016 program is still in process to finalize for submission for the approval procedures as of October 2015. The budget for CY 2017 and CY 2018 will be revised depending on the progress of the other programs by the previous years. These programs may be taken as priority projects, but particular attention shall be paid to other interventions by other donors and investors.

Table 4.1 Airport Infrastructure Program for Bangsamoro Airports

(Unit: PHP 1,000)

Airport	Project	Program			
		2015	2016	2017	2018
		Approved	Proposed	Proposed	Proposed
	Total	263,250	826,600	281,005	20,000
Cotabato		5,000	51,540	0	0
1	Rehabilitation of terminal bldg.	5,000			
2	Expansion of terminal bldg. from 1,150 to 2,870 m^2 (1,718 m^2)		51,540		
Jolo		0	36,250	20,000	0
1	Payment of lot rental		19,600		
2	Runway strip grade correction		10,000		
3	Construction of VPA[1] (650m^2)		1,650		
4	Construction of temporary terminal shed (700m^2)		5,000		
5	Site development at land side area			20,000	
Sanga-Sanga		248,250	648,760	261,005	20,000
1	Site acquisition of runway extension, strip width correction, land side area and provision of RESA[2]	62,250			
2	Removal of trees/ structures/ improvement at the affected site	32,000			
3	Widening of runway from 30 m to 45 m (1,920m x 7.5m, both ends) including runway shoulder	154,000			
4	Provision of filling/embankment materials, slope protection for runway extension, apron, taxiway and land side area		371,700		
5	Asphalt overlay of existing runway		181,440		
6	Construction of CHB[3] perimeter fence		44,000		
7	Runway strip grade correction		21,650		
8	Runway extension to 2,100m (180m x 45m)		28,350		
9	Construction of stopway (60m x 45m)		1,620		
10	Construction of new apron (240m x 125m)			105,000	
11	Construction of new 2-taxiways (105m x 23m)			16,905	
12	Construction of new PTB[4] including utilities (2,100m^2)			80,000	
13	Construction of fire station bldg.			14,400	
14	Construction of administration bldg. (350m^2)			10,500	
15	Construction of control tower bldg.			25,000	
16	Construction of vehicle parking area (3,675m^2)			9,200	
17	Replacement of military camps/facilities				
18	Site development at land side area				20,000
Cagayan de Sulu		10,000	90,050	0	0

Airport	Project	Program			
		2015	2016	2017	2018
		Approved	Proposed	Proposed	Proposed
1	Construction of perimeter fence 3,020m with 1,208 bays of barbed wire with concrete posts	10,000			
2	Completion of construction of perimeter fence		9,000		
3	Concrete paving of existing runway (1,300m x 18m) with runway shoulder and clearing of runway strip		75,600		
4	Rehabilitation of terminal bldg. (280m^2) including airport utilities		5,000		
5	Payment of old obligation (improvement on public land)		450		

[1]vehicle parking area; [2] concrete hollow block; [3] runway end safety area; [4] passenger terminal building

Source: DOTC.

4.2 Cotabato Airport Development Plan

4.2.1 Consolidated improvement plan

According to the document of the Airport Infrastructure programs mentioned above, the expansion of the passenger terminal building (PTB) at the Cotabato airport is requested by the Airport Manager through Executive Secretary, the Office of Regional Governor, ARMM in August 2014. The PTB expansion will improve the capacity of the airport to serve passengers and airlines operations. In relation with the development, the JICA Study Team obtained the drawing of the Cotabato Airport Consolidated Improvement Plan from CAAP-CBO. The layout of the proposed plan is shown in Figure 4.1.

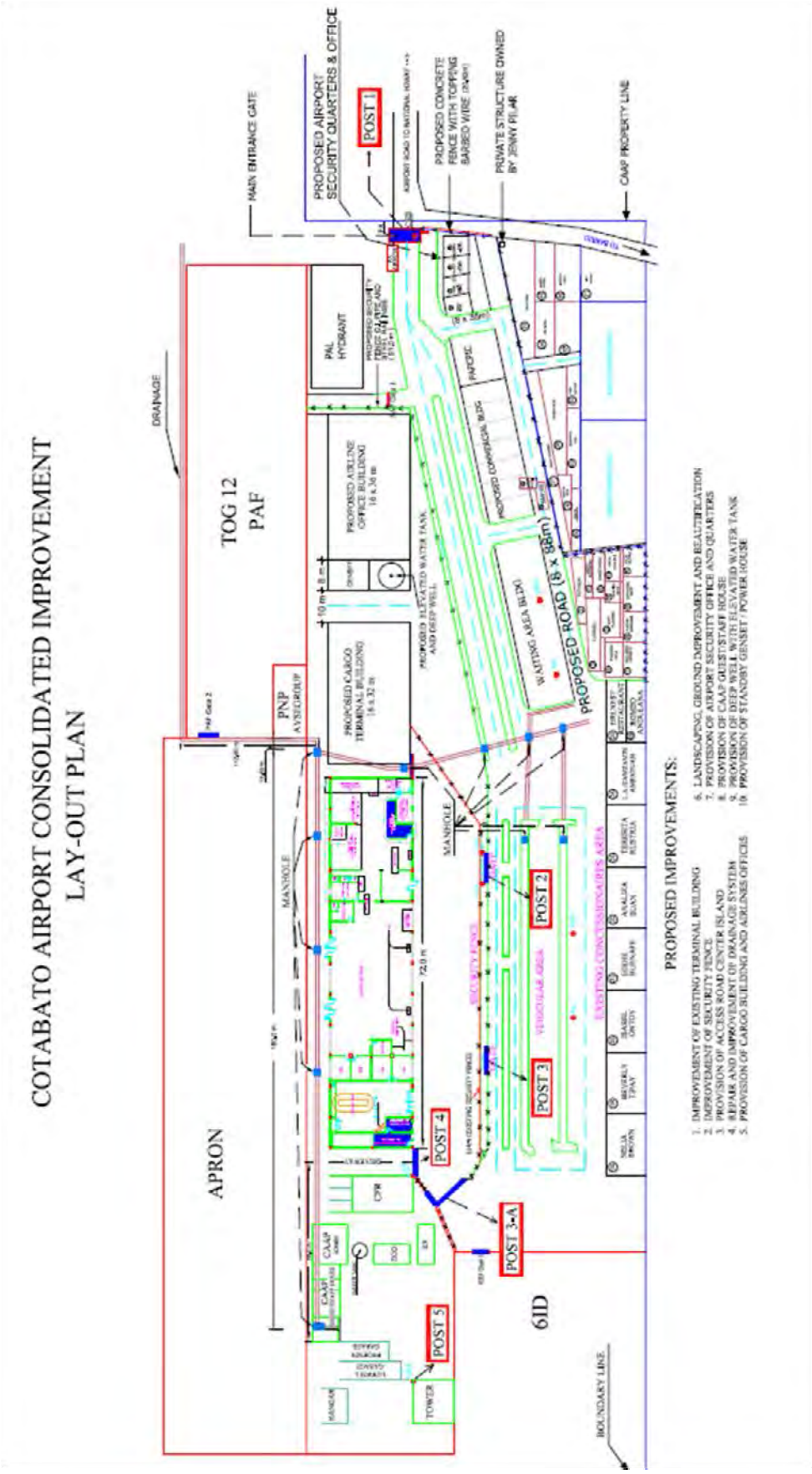
The proposed plan includes:

(1) Improvement of existing terminal building,
(2) Improvement of security fence,
(3) Provision of cargo building and airlines offices,
(4) Provision of airport security office and quarters,
(5) Provision of CAAP guest/staff house,
(6) Provision of deep well with elevated water tank,
(7) Provision of access road center island,
(8) Provision of standby generation set/power house,
(9) Repair and improvement of drainage system, and
(10) Landscaping, ground improvement and beautification.

Especially, it can be expected that the conditions of the PTB will be improved since the cargo building and airlines offices will be newly established and the activities will be undertaken in the new building instead of the existing passenger building. The evaluation regarding the facility requirements are discussed in the following section.

4.2.2 Other proposed improvement plans

Improvement programs were proposed for the Cotabato airport in the previous JICA study of the Master Plan Study on the Strategy for the Improvement of National Airports in the Republic of the Philippines, 2006. The JICA Study Team has clarified the status of the update on the programs with CAA-CBO and also summarized its recommendations, which can be proposed as a priority project in this study. The summary of the update is presented in Table 4.2.



Source: CAAP-CBO.

Figure 4.1 Cotabato Airport Consolidated Improvement Plan

Table 4.2 Update on Cotabato Airport Improvement in Accordance with Previous JICA Study and Other Recommendations from CAAP-CBO

Classification	Item	Airport facilities	Operation status*	Proposed development plan by previous JICA study	Update in accordance with previous study	Recommendations from CAAP-CBO
Aircraft movement area	Runway	1,913 m x 45 m		Widening of the runway to 45 m to comply with ICAO Code C	Completed.	
				Extension of the runway by 135 m to the east and at the same time shifting the runway some 80 m to the east (1,970 m x 45 m), which requires extensive embankment in the western end	Not carried out.	
				Runway rehabilitation and overlay on the exiting part of the runway	Not carried out.	
	Apron	256 m x 100 m (concrete)				
	Taxiway	2 - 18 m x 83 m (asphalt overlay)				
	Stopway	43.9 m x 45.3 m / 44.7 m x 44.3 m		Provision of paved blast pads in the extension of runway ends	Not completed.	
	Clearway	60m x 45m both ends		Construction of runway end safety area (RESA)	Not completed.	
	Runway shoulder	Macadam				
	Strip	2,100 m x 130 m		Provision of a 2,090 x 150 m runway strip, including grading and landscaping	Not completed.	
				Perimeter fencing along the airside/landside border	Not completed. (On going)	
Airport facility	PTB	72.00 m x 16.00 m		Refurbishment of the existing passenger terminal (for traffic in 2029)	To be improved by the above mentioned renovation plan (still waiting budget allocation)	
				X-ray machines and metal detectors	Already installed	
	Staff house	10.00 m x 8.00 m (proposed)				
	Fire station building	22.00 m x 13.00 m				
	Administration building	19.00 m x 16.00 m				
	VPA	72 m x 110 m				
Airport equipment	Service vehicle	L-300 (not-in-use; need of repair)		1 utility vehicle	Already installed but not in use any more	Recommendations: provision 1 unit service vehicle for ANS use
				1 tractor	Already installed	
	Tractor mower			1 lawn mower	Already installed	
	Runway sweeper	None				
	Airline operator	Philippine Airlines, Cebu Pacific				
	Critical aircraft	A 320				
	Airport category	Actual CAT. 4, required CAT. 6				
Aerodrome rescue and fire-fighting	Actual capacity	Water (L): 4,300 AFFF (L): 420 DCP (kg): -		1 new main fire vehicle	Already installed	
	Minimum	Water (L): 7,900 AFFF (L): 474				

Classification	Item	Airport facilities	Operation status*	Proposed development plan by previous JICA study	Update in accordance with previous study	Recommendations from CAAP-CBO
	ICAO requirements	DCP (kg): 225				
	Existing workforce	11 firefighters				
	Required	22 firefighters				
ANS and ATS facilities	Radio NAVAID equipment	VOR (conventional; Wilcox 585B)	N (both systems)			Recommendations: Installation of new VOR/DME equipment stipulated on the Manual of Standards (MOS); Doppler type VOR
		DME (ASI 1119)	Sys #1: Y Sys #2: N			
	Communications equipment	VHF AM transmitter (main) – 123.3 freq.: AEROCOM 310	N	Communication system including VHF, Digital voice recording system, HF, etc.	To be improved based on approved CAAP APP† 2015	Recommendations: Installation of 6 new units of 50 W VHF transceiver with new antenna system; provision of test instruments for communication equipment; installation of new communication console.
		VHF AM transmitter (standby) – 123.3 freq.: AEROCOM 310	N			
		VHF AM receiver (main) – 123.3 freq.: AEROCOM 320	N			
		VHF AM receiver (standby) – 123.3 freq.: AEROCOM 320	N			
		VHF AM transceiver – 118.7 freq.: PAE T6TR; 50W	N			
		VHF AM transceiver – 123.3 freq.: Mentor MB, 50W	Y			
		VHF AM transceiver – 123.3 freq.: PAE T6M, 10W	Y			
		VHF AM transceiver – 121.5 freq.: PAE 1660, 10W	Y			
		HF transceiver (M) – 6.795 freq.: Yaesu FT-180A	Y			
		Voice logging system (VLS): Stancil E-Series	Deck #1: N Deck #2: Y			Recommendations: Installation of new voice recording system
		Integrated communication switching system (ICSS): Denro ICSS-466	N			
		CADAS: Comsoft	Y			
	Meteorological equipment	WSI, WDI, and PTH: Vaisala	Y	Meteorological equipment including meteorological stations	Already installed	Recommendations: Relocation of existing MET equipment on site
	Airfield lighting equipment	PAPI 10 (pilot side)	Y	PAPI lights	Already installed	
		PAPI 28 (pilot side)	Y			
		Wind cones 10 (WDIL)	Y			
		Wind cones 28 (WDIL)	Y			
		RTIL 10	Y	Threshold identity lights	Already installed	
		RTIL 28	Y	Ditto	Already installed	
		TWY edge light	Y	Taxiway and apron edge lights	Already installed	
		RWY edge light	Y	Runway edge lights	Already installed	
		Threshold light 10 (elevated type)	Y	Runway threshold lights	Already installed	
		Threshold light 28 (inset type)	Y	Ditto	Already installed	
		Rotating beacon	Y			
				Apron flood lighting	Not yet installed.	
				Obstacle lights for all	Not yet installed.	

Classification	Item	Airport facilities	Operation status*	Proposed development plan by previous JICA study	Update in accordance with previous study	Recommendations from CAAP-CBO
				relevant obstacles not removed		
				Simple approach lighting system (SALS) for both runway approaches	Not yet installed.	
	Control tower			Refurbishment of the existing control tower, and other buildings	To be rehabilitated based on the approved CAAP APP* 2014	Recommendations: Relocation of control tower building; provision of multi-function building for ANS/ATS technical personnel; provision of 1 unit service vehicle for ANS use

*Y=operational, N=non-operational; †Annual Procurement Plan

Source: CAAP-CBO.

4.3 Jolo Airport Development Plan

Recently, the runway improvement project was implemented for the Jolo airport with assistance from the Growth with Equity in Mindanao (GEM) Program by USAID (United States Agency for International Development). The runway upgrade is a partnership project of DOTC, CAAP, and USAID's GEM Program, through its Regional Impact Project component. GEM is implemented under the oversight of the Mindanao Economic Development Council.

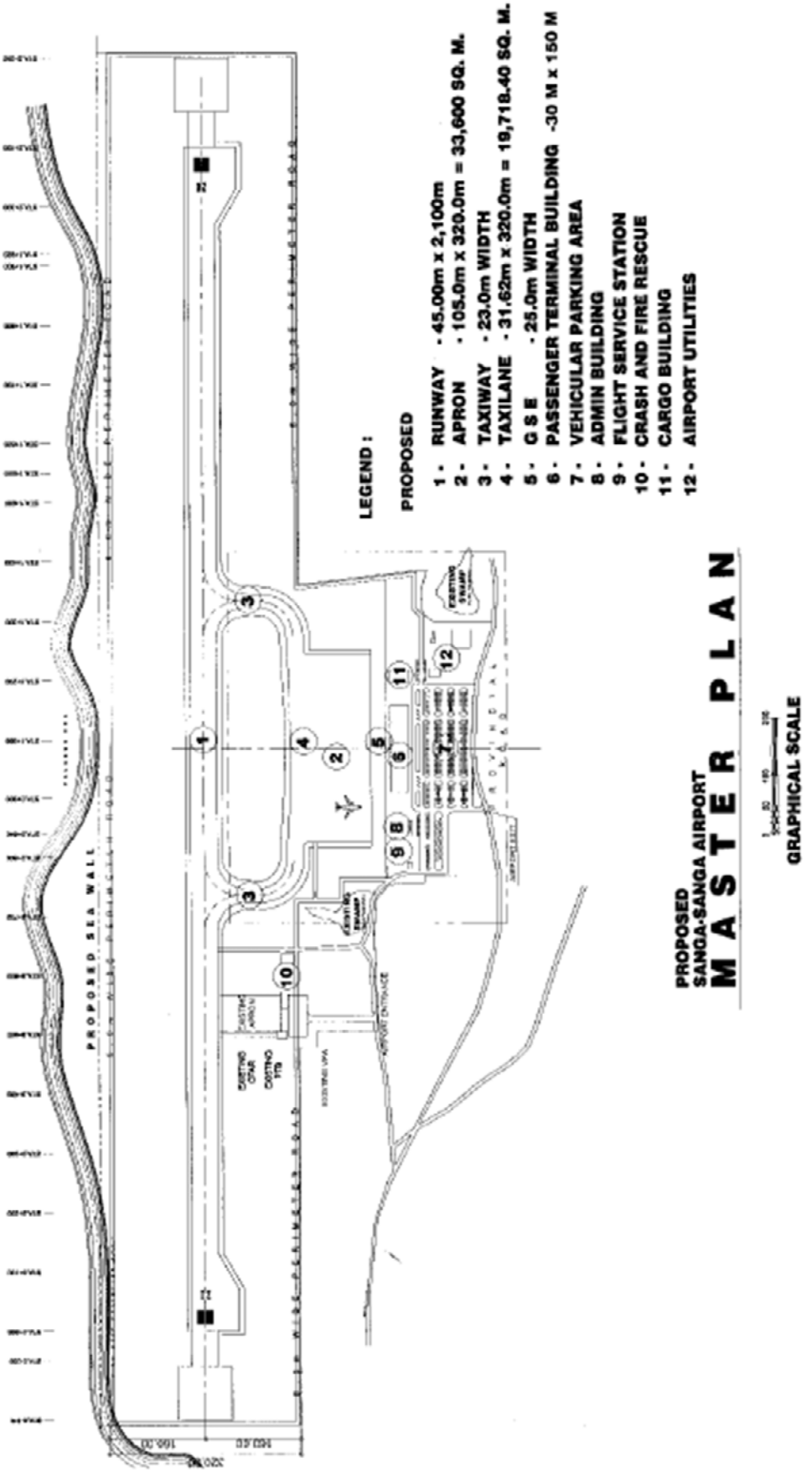
According to the site survey, civilians often intrude the runway since the perimeter fencing has not completed yet in the airport. Currently, the clearance of the runway when the aircraft take-off and landing is secured by military guards. Accordingly, the fence shall be established as high priority to ensure the security and safety of the airport in addition to the above mentioned national budget programs. Furthermore, X-ray baggage screening equipment shall be installed along with metal detector to ensure the security in accordance with the relevant regulations since the passenger baggage is currently screened one by one by manually in the airport.

4.4 Sanga-Sanga Airport Development Plan

Currently, the airport runway is being extended to 1,930 m at the Sanga-Sanga airport through partnerships between DOTC, CAAP, USAID, the ARMM government, and the Tawi-Tawi provincial government. The Sanga-Sanga airport is part of the BIMP-EAGA linkage program for possible international flights.

The JICA Study Team obtained the drawing of Sanga-Sanga Airport Master Plan from DOTC. The proposed plan is shown in Figure 4.2. Same as the Jolo airport, X-ray baggage screening equipment shall be installed along with metal detector to ensure the security in accordance with the relevant regulations in addition to the above mentioned national budget programs since the passenger baggage is screened one by one by manually in the airport.

According to the site survey, the land acquisition for the runway extension to the eastern side is still ongoing under negotiation with the land owners. It can be expected that the negotiation will be settled without any trouble relatively since the land owners are willing to sell the land where it cannot be utilized for the farm or the other purposes effectively.



Source: DOTC.

Figure 4.2 Sanga-Sanga Airport Master Plan

4.5 Cagayan De Sulu Airport Development Plan

The perimeter fencing is the first priority development for the Cagayan de Sulu airport to ensure the safety and security. Then the runway shall be paved to accommodate scheduled commercial aircrafts safely.

4.6 National Airports Master Plan

In 2006, JICA conducted the Master Plan Study on the Strategy for the Improvement of National Airports (hereinafter referred to as the JICA Master Plan Study), presenting various action plans to deliver rational improvements for the Philippines' aviation industry. However, much time has passed since then and now a new master plan for airport development is needed that suits the changes in the aviation market home and abroad, as well as economic situations.

To this end, the Philippine Government sent a request to the Korean Government to establish a new master plan in line with changed conditions based on which the Korea International Cooperation Agency (KOICA), on behalf of the Korean government, has commenced the Master Plan Study on the Strategy for the Development of National Airports (hereinafter referred to as the KOICA Master Plan Study) since December 2013 and completed in May 2015. The KOICA Master Plan Study carried out a review of the existing master plan, air traffic demand forecast, requirements analysis for future airport facilities, and establishment of airport development plan by stage (Short-Term by 2020, Mid-Term by 2025 and Long-Term by 2030).

With regard to priority of expanding nighttime operation at regional airports, among the airports where airlines have raised the need for nighttime flights, those with a non-instrument runway (Butuan, Basco, Catarman, Masbate, Clabayog, and Dumaguete) will be suggested to provide aeronautical lighting to enable nighttime flights. In addition, improvement plans are deemed necessary for the existing aeronautical lighting system under operation in consideration of its operation period after the installation.

CHAPTER 5 INITIAL EVALUATION OF TERMINAL BUILDING FACILITIES

5.1 Cotabato Airport

Currently, the Cotabato (Awang) airport has sufficient runway capacity to accommodate A320 aircraft as the maximum aircraft size. Although the airport still maintains essential capacity of terminal facilities to accommodate a single A320 aircraft at a time, it is desirable to improve the facilities. The capacity of the airport terminal facilities are evaluated, based on the Federal Aviation Administration's advisory circular, FAA AC 1505360-9 - Planning and Design of Airport Terminal Facilities at Non-Hub Locations (Table 5.1).

5.1.1 Capacity of the existing terminal building facilities

The capacity of the existing airport terminal facilities is evaluated based on the advisory circular mentioned above as shown in Table 5.2. According to the evaluation, the conditions of the lobby and waiting area and the arrival area (e.g., baggage claim public space and baggage claim counter lengths) are suitable for the existing passenger movements. On the other hand, the conditions of public automobile parking spaces, concession space and the departure area (e.g., ticket counter queuing space, airline ticket counter lengths, airline office, and operational space) are not suitable for the existing passenger movements.

Table 5.1 Proposed Terminal Facility Requirements for Cotabato Airport

No.	Item	Unit	Recommendation
1	Public parking spaces	n	200–270
2	Lobby and waiting area	m^2	190–240
3	Ticket counter queuing space	m^2	130–150
4	Airline ticket counter lengths	m	19–22
5	Airline office and operational space	m^2	550–650
6	Baggage claim public space	m^2	100–115
7	Baggage claim counter lengths	m	10–13
8	Concession space	m^2	170–230

Source: JICA Study Team.

Table 5.2 Capacity of Existing Terminal Facilities at Cotabato Airport

No.	Item	Unit	Value	Evaluation
1	Public parking spaces	n	150	Insufficient
2	Lobby and waiting area	m^2	400	Sufficient
3	Ticket counter queuing space	m^2	100	Insufficient
4	Airline ticket counter lengths	m	15	Insufficient
5	Airline office and operational space	m^2	170	Insufficient
6	Baggage claim public space	m^2	100	Fair
7	Baggage claim counter lengths	m	19	Sufficient
8	Concession space	m^2	80	Insufficient

Source: ibid.

5.1.2 Capacity of the upgraded terminal building facilities

The capacity of the airport terminal facilities upgraded by the consolidated improvement plan of the airport, presented in Section 4 is shown in Table 5.3. According to the evaluation, the conditions of the ticket counter queuing space, airline office and operation space will be improved by the renovation plan although the conditions of the public automobile parking spaces and concession space still remain unimproved.

Besides, the arrival area (e.g., baggage claim public space and baggage claim counter lengths) still remains the existing capacity which can accommodate only one A320 aircraft arrival at one time. It

should be expanded to the adequate capacity to accommodate at least two A320 aircraft arrivals simultaneously to deal with the various styles of the scheduled flight operation in a flexibly manner in the future.

Table 5.3 Capacity of Terminal Facilities Upgraded by Consolidated Improvement Plan of Cotabato Airport

No.	Item	Unit	Value	Evaluation
1	Public parking spaces	n	150	Insufficient
2	Lobby and waiting area	m^2	400	Sufficient
3	Ticket counter queuing space	m^2	160*	Sufficient
4	Airline ticket counter lengths	m	20*	Fair
5	Airline office and operational space	m^2	700*	Sufficient
6	Baggage claim public space	m^2	100	Fair
7	Baggage claim counter lengths	m	19	Sufficient
8	Concession space	m^2	80	Insufficient

*Assumed value

Source: ibid.

5.2 Jolo Airport

According to the advisory circular, the proposed terminal facility requirements in accordance with the current traffic movement at the Jolo airport are recommended as shown in Table 5.4. It can be evaluated in detail once the detail of the terminal development layout drawing is confirmed.

Table 5.4 Proposed Terminal Facility Requirements for Jolo Airport

No.	Item	Unit	Recommendation
1	Public parking spaces	n	50
2	Lobby and waiting area	m^2	100–140
3	Ticket counter queuing space	m^2	40–50
4	Airline ticket counter lengths	m	5–7
5	Airline office and operational space	m^2	200–250
6	Baggage claim public space	m^2	70–80
7	Baggage claim counter lengths	m	7–9
8	Concession space	m^2	100–130

Source: ibid.

5.3 Sanga-Sanga Airport

According to the advisory circular, the proposed terminal facility requirements in accordance with the current traffic movement at the airport are recommended as shown in Table 5.5. It can be evaluated in detail once detail of the terminal development layout drawing is confirmed.

Table 5.5 Proposed Terminal Facility Requirements for Sanga-Sanga Airport

No.	Item	Unit	Recommendation
1	Public parking spaces	n	75–100
2	Lobby and waiting area	m^2	200–240
3	Ticket counter queuing space	m^2	70–80
4	Airline ticket counter lengths	m	10–13
5	Airline office and operational space	m^2	320–380
6	Baggage claim public space	m^2	100–110
7	Baggage claim counter lengths	m	10–13
8	Concession space	m^2	170–230

Source: ibid.

CHAPTER 6 REVIEW OF FLAGSHIP PROJECTS ON BANGSAMORO DEVELOPMENT PLAN PHASE I

6.1 Flagship Programs for Air Transportation

According to the Bangsamoro Development Plan Phase I, the flagship programs are proposed for the airport development in Bangsamoro as shown in Table 6.1 and Figure 6.1.

Table 6.1 BDP Flagship Programs for Air Transportation According to BDP I

Projects	Cost (PHP million)
Airport Improvement: Cotabato Airport	95
Airport Improvement: Baloi Airport	48
Study on the creation of an international airport in the Bangsamoro	50
Total	193

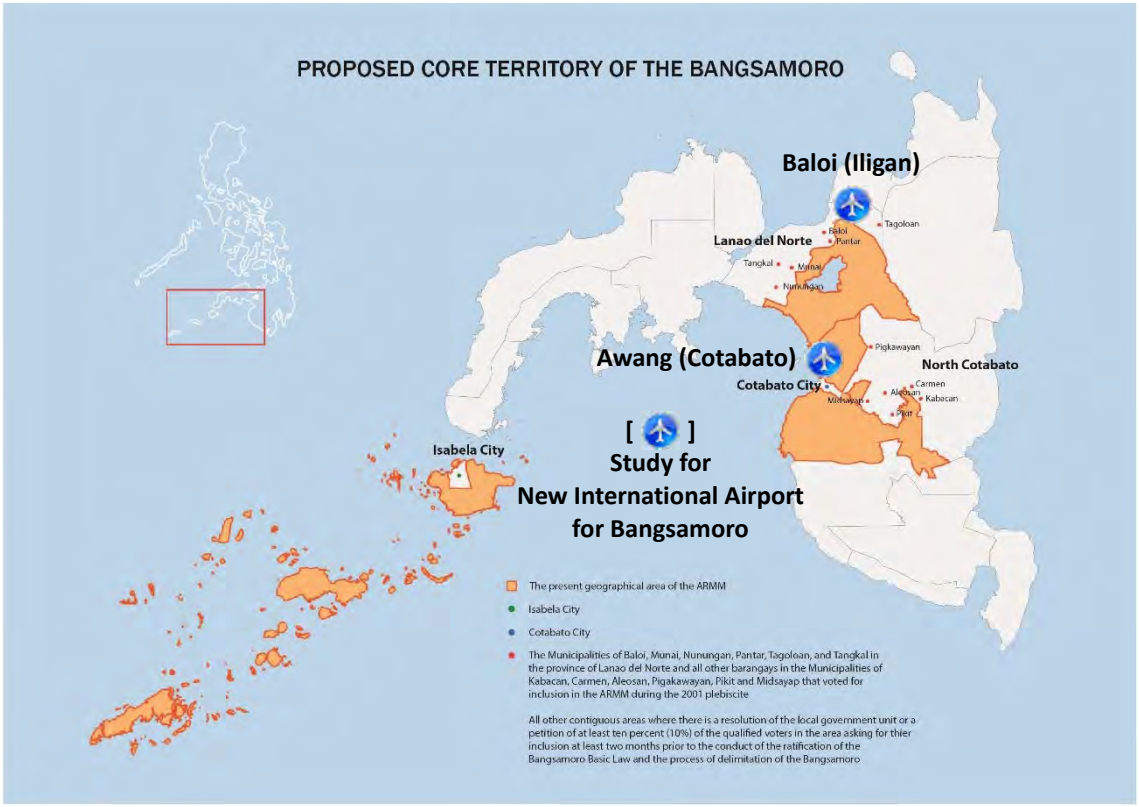
Source: BDP1 (draft).

Table 6.2 was presented at the meeting of Bangsamoro Development Plan - Infrastructure Cluster on 3rd of December 2014 at DOF with relevant authorities. The budget is supposed to be allocated for the programs which are undertaken by DOTC but not for the programs which are undertaken by ARMM. The remaining costs are indicated as a financing gap. The flagship programs in Table 6.1 are considered to be quoted from the programs undertaken by ARMM shown in Table 6.2.

Table 6.2 Bangsamoro Development Plan on Airport Infrastructure

Project	Agency	Total cost of BDA proposed projects	2014	2015	2016	Total Cost of NG & ARMM projects	Financing gap
			Funded	Funded	Funded		
1. Airport improvement: Cotabato Airport	ARMM	100.0	-	5.0	-	5.0	95.0
2. Airport improvement: Sanga-Sanga Airport	DOTC	248.3	-	248.3	-	248.3	-
3. Airport improvement: Jolo Airport	DOTC	54.7	54.7	-	-	54.7	-
4. Airport improvement: Baloi Airport	ARMM	48.0	-	-	-	-	48.0
5. Study on the creation of international airport in Bangsamoro	ARMM	50.0	-	-	-	-	50.0
6. Cagayan de Sulu Airport	DOTC	10.0	-	10.0	-	10.0	-
Subtotal		511.0	54.7	263.3	-	318.0	193.0

Source: DOF.



Source: JICA Study Team.

Figure 6.1 Location of Airports Proposed for Flagship Projects

6.2 Cotabato Airport Improvement

A feasibility study on the Cotabato airport was undertaken by ADB in 2006, which proposed to establish the new terminal area at the opposite side of the existing terminal area. The development plan presented above was proposed including the proposal of previous JICA study, the Master Plan Study on the Strategy for the Improvement of National Airports in the Republic of the Philippines, 2006.

The proposed plan includes the following:

[1] Airside facilities and works

- Runway strip widening and grading works
- Rehabilitation of existing runway
- Widening of existing runway from 30 m to 45 m
- Runway shoulders, turning eave and blast pads at both ends
- Taxiway and apron
- Runway extension of 110 m
- Airside roads (rescue and firefighting, apron, maintenance, and air service roads)
- Perimeter fence and roads
- Demolition of various obstacles

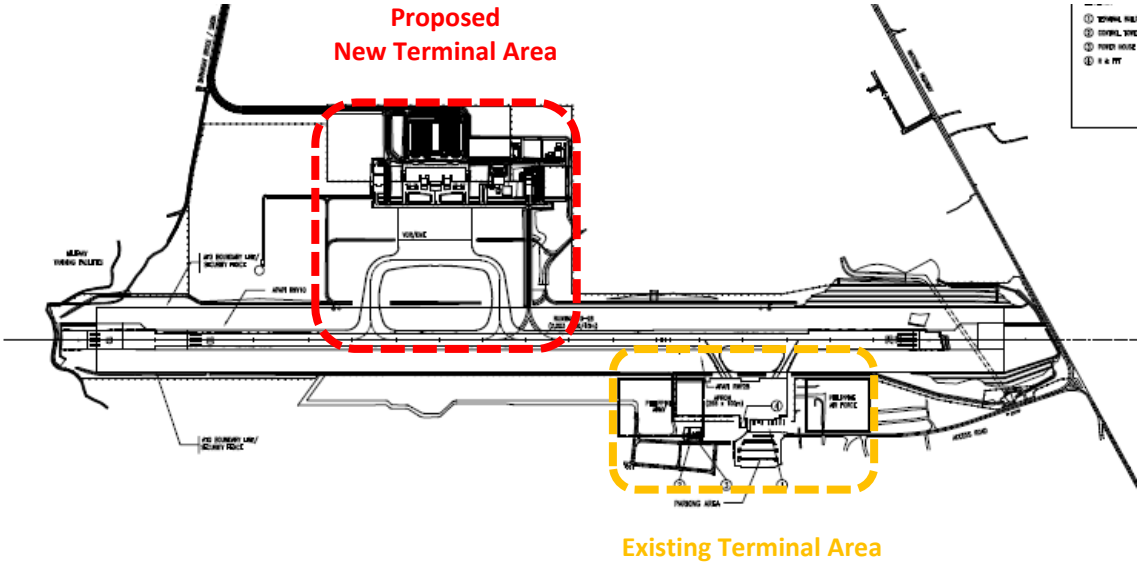
[2] Landside facilities and works

- New PTB
- New cargo terminal building
- Other new buildings (administration and operations, rescue and firefighting, power house, solid waste disposal, chiller pump house, and control tower.)
- New landside roads, security fence and parking facilities
- Drainage (runway strip, apron, road, and parking)

[3] Equipment

- Navigational aid (DVOR, DME, remote control, and power supply)
- Air traffic control (ATC) and communications (VHF system, voice switch control system, recording equipment, and UPS)
- Airfield ground lighting (high-intensity simple approach lighting system for RWY 30 and 12, high-intensity runway edge lighting, high-intensity runway end lighting, high-intensity runway threshold lighting, medium-intensity taxiway edge lighting, apron flood lighting, obstacle lighting, and illuminated wind cones)
- Airfield maintenance (tractor, grass mower, and utility vehicle)
- One firefighting vehicle

The layout of the proposed master plan for new terminal area development is shown in Figure 6.2.



Source: ADB.

Figure 6.2 New Terminal Area Development Plan of Cotabato Airport

The outstanding issues for the Cotabato airport development are presented as follows.

[1] Land acquisition

The formal compensation procedure had already been done properly but the settlement with unjustified claimers still remains. The development plan shall be commenced after completion of the settlement.

[2] Visibility of control tower

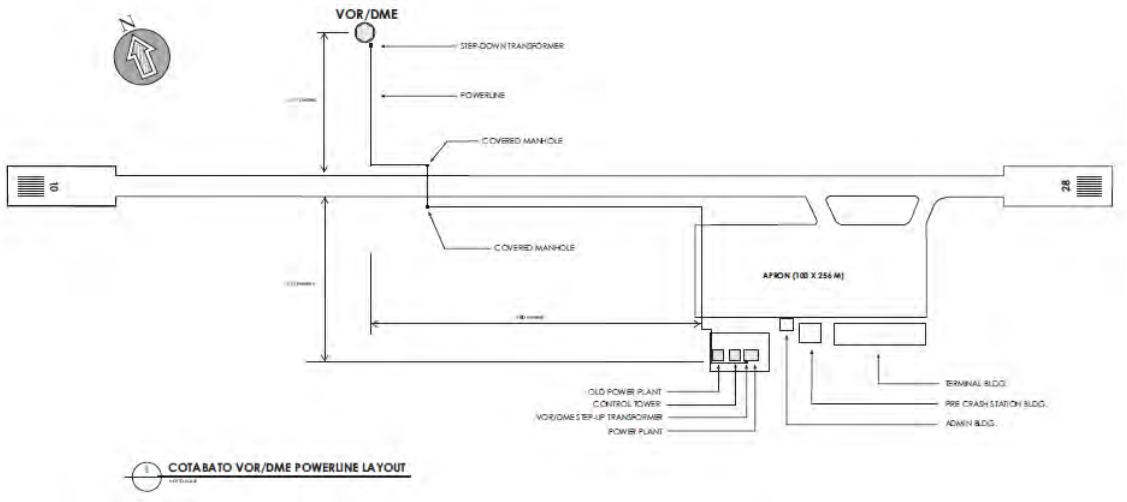
Currently both of the runway edges are not visible from the control tower, which violates the relevant regulations due to the obstacles by the military facilities. The inappropriate condition shall be improved in accordance with the relevant regulations.

[3] Constraints on runway expansion

The eastern edge of the existing runway is adjacent to the arterial road. Therefore, it is difficult to extend the runway in that direction. The western edge of the runway is located on the top side of the cliff. Therefore the massive embankment is required for the extension on this side. The development shall be undertaken including the alternatives of new airport development.

[4] Relocation of the existing VOR/DME facility

The existing VOR/DME facility is located in the proposed new terminal area (Figure 6.3). Therefore, the facility shall be relocated to the proper area in compliance with the relevant regulations as necessary.



Source: CAAP-CBO.

Figure 6.3 Location of Existing VOR/DME Facility at Cotabato Airport

6.3 Baloi Airport Improvement

The Baloi airport also known as the Iligan (Maria Christina) airport is an airport serving the general area of Iligan City, located in the province of Lanao del Norte. It is the only airport in the province.

The airport is classified by CAAP as a secondary airport, or a minor commercial domestic airport. Located some 400 m above the sea level, the Baloi airport has the distinction of being the highest airport in Mindanao and the second-highest in the Philippines, next to the Loakan airport in Baguio City.

The outstanding issues for the Baloi airport development are presented as follows.

The Laguindingan airport was constructed in Barangay Moog, Laguindingan, Misamis Oriental, and is located 46 km away from Cagayan de Oro City, Misamis Oriental. The airport is located only 65 km away or at most 35 to 40 minutes away from Iligan City. With the construction of the Laguindingan airport, designed to serve the Cagayan de Oro-Iligan corridor (CIC), the Baloi airport could be replaced by the new airport along with the Lumbia airport in Cagayan de Oro City. The Lumbia airport now serves as a military base for the Philippine Air Force (PAF). In consideration of the situation of the airport development in this region, it is necessary to examine how to ensure and expand the air traffic demand at the Baloi airport.

6.4 Study on Creation of an International Airport in Bangsamoro

The outstanding issues for the study on the creation of an international airport in the Bangsamoro are presented as follows.

The Cotabato airport still has sufficient capacity on runway to accommodate A320 aircraft as maximum size aircraft. Furthermore, the airport also still has essential capacity on terminal facilities for accommodating a single A320 aircraft at one time. It is considered, however, that increasing the frequency of flights between Manila and Cotabato is not easy to due to the congested slot coordination at the NAIA even if the traffic demand increases in the future. Given the situation, careful examination is necessary to ensure the viability of a new airport in advance starting from the discussion regarding the candidate sites.

CHAPTER 7 AIR TRAFFIC DEMAND FORECAST

Air traffic demand forecasts until 2030 of the Cotabato, Jolo and Sanga-Sanga airport were carried out in the KOICA Master Plan Study in consideration of socio-economic development projected for population, gross domestic product (GDP), and gross regional domestic product (GDRP). The results for each airport are summarized as shown in Tables 7.1 through 7.3, respectively.

7.1 Cotabato Airport

The demand forecast for the airport is summarized as shown Table 7.1. For the domestic passenger movement, the ratio of demand in 2030 to that in 2012 is 2.78 times with the compound annual growth rate (CAGR) in 2012-30 at 5.8%. For the domestic cargo movement, the ratio of demand in 2030 to that in 2012 is 2.48 times with the CAGR in 2012-30 at 5.2%.

7.2 Jolo Airport

The demand forecast of the airport is summarized as shown in Table 7.2. For the domestic passenger movement, the ratio of demand in 2030 to that in 2012 is 1.36 times with the CAGR in 2012–30 at 1.7%. For the domestic cargo movement, the ratio of demand in 2030 to that in 2012 is 1.41 times with the CAGR) in 2012–30 at 1.9%.

7.3 Sanga-Sanga Airport

The demand forecast of the airport is summarized as shown in Table 7.3. For the domestic passenger movement, the ratio of demand in 2030 to that in 2012 is 2.79 times with the CAGR in 2012–30 at 5.9%. For the domestic cargo movement, the ratio of demand in 2030 to that in 2012 and the CAGR in 20120–30 are not set due to the lack of cargo data in 2012 as the base year.

Table 7.1 Summary of Air Traffic Demand Forecast for Cotabato Airport (2015–30)

Item	Year				
	2012 (actual)	2015	2020	2025	2030
1. Passenger					
International		-	-	-	-
Domestic	240,484	329,158	442,920	556,216	669,139
General aviation		2,336	2,504	2,684	2,878
Subtotal		331,494	445,424	558,900	672,017
2. Cargo (ton)					
International		-	-	-	-
Domestic	1,748	2,276	2,960	3,645	4,329
General aviation	-	-	-	-	-
Subtotal	1,748	2,276	2,960	3,645	4,329
3. ATM* International					
4. ATM* Domestic					
Large jet		-	-	-	-
Medium size jet		-	-	-	-
Small jet	2,004	2,082	3,048	3,827	4,604
Turboprop	-	694	1,016	1,276	1,535
Short takeoff and landing		-	-	-	-
Subtotal	2,004	2,777	4,064	5,103	6,139
5. ATM* GA	405	417	446	479	513
Total	2,409	3,194	4,510	5,582	6,652

*ATM = air traffic movement

Source: KOICA Master Plan Study Report.

Table 7.2 Summary of Air Traffic Demand Forecast for Jolo Airport (2015–2030)

Item	Year				
	2012 (actual)	2015	2020	2025	2030
1. Passenger					
International		-	-	-	-
Domestic	16,912	18,259	20,009	21,605	23,077
General aviation		-	-	-	-
Subtotal	16,912	18,259	20,009	21,605	23,077
2. Cargo (ton)					
International		-	-	-	-
Domestic	40	30	38	47	56
General aviation	-	-	-	-	-
Subtotal	40	30	38	47	56
3. ATM International					
4. ATM Domestic					
Large jet		-	-	-	-
Medium size jet		-	-	-	-
Small jet		-	-	-	-
Turboprop	304	332	378	408	444
Short takeoff and landing	-	-	-	-	-
Subtotal	304	332	378	408	444
5. ATM GA	-	-	-	-	-
Total	304	332	378	408	444

Source: ibid.

Table 7.3 Summary of Air Traffic Demand Forecast for Sanga-Sanga Airport (2015–2030)

Item	Year				
	2012 (actual)	2015	2020	2025	2030
1. Passenger					
International		-	-	-	-
Domestic	16,295	23,550	31,193	38,460	45,427
General aviation		-	-	-	-
Subtotal	16,295	23,550	31,193	38,460	45,427
2. Cargo (ton)					
International		-	-	-	-
Domestic	-	31	41	50	59
General aviation	-	-	-	-	-
Subtotal	-	31	41	50	59
3. ATM International					
4. ATM Domestic	-	-	-	-	-
Large jet					
Medium size jet	-	-	-	-	-
Small jet	-	-	-	-	-
Turboprop	-	453	600	740	874
Short takeoff and landing	-	-	-	-	-
Subtotal	-	453	600	740	874
5. ATM GA	-	-	-	-	-
Total	-	453	600	740	874

Source: ibid.

CHAPTER 8 PROPOSED PRIORITY PROJECTS

The airport development plan by phase up to 2030 for the Cotabato, Jolo and Sanga-Sanga airports were prepared in the KOICA Master Plan Study based on the demand forecast mentioned above. The JICA Study Team has revised the plan in consideration of the latest information gathered through site survey (Table 8.1).

Table 8.1 Development Plan by Phase for Cotabato Airport (up to 2030)

Phase	Contents	Scale
Short-term plan (2016–20)	Securing width of runway strip	
	New stub taxiway (110 m x 23 m x 2)	5,060 m^2
	New apron	8,000 m^2
	Upgrading of aeronautical lighting facilities to Grade C	
	Expansion of rescue and firefighting station	170 m^2
	New PTB	5,500 m^2
	New vehicle parking area	8,960 m^2
	Installation of radio navigational aid (VOR/DME)	
	Installation of aeronautical information service (VHF)	
	Runway overlay (1,913 m x 45 m)	86,085 m^2
	Completion of fence connection	500 m
	New control tower	
Medium-term plan (2021–25)	None	
Long-term plan (2026–30)	Expansion of PTB	1,600 m^2

Source: KOICA Master Plan Study report (revised by JICA Study Team).

8.1 Cotabato Airport Development Project

The Cotabato airport is expected to be upgraded to a local leading airport after 2020, where more than 500,000 passengers are expected to be handled. The facility expansion is required in accordance with the expected air traffic demand. The expected demand in 2025 will exceed 500,000 passengers, and the runway approach category shall be upgraded from non-instrument to non-precision in accordance with facility requirements. The airport needs to ensure that its facilities meet safety standards while installing and operating approach light system and radio navigational aids.

In addition, the top priority in non-precision approach operation is securing of runway strip. The current 130 m wide runway strip shall be expanded to 300 m. Distance between runway and apron taxiway shall follow international standards for 4C, which is the airport classification category of A320 aircraft currently under operation. This calls for the expansion in the depth of the apron, which is impossible under the current situation as the apron is surrounded by PTB, vehicle parking area (VPA) and other buildings. Therefore, the apron should be relocated to the opposite side of the existing landside area. Such relocation will be accompanied by the construction of the passenger terminal, VPA, and access roads, and this needs to be reflected in the short-term plan.

The Cotabato airport has limited expandability since there is a significant height difference or faulting between both ends of the runway and surrounding areas. Accordingly, the conditions are unfavorable not only for securing 2,600 m runway required to service A321 planes in 2025 but also for meeting the facility requirement of 2,200 m runway to service A320. However, it is possible to service A320 aircraft flying domestic routes within Manila without separate load limit owing to the already secured stop-way and clear-way in both directions by 45 m and 60 m, respectively. Therefore, it seems feasible to operate A320 planes until 2030 without additional expansion. Realistically, however, it is challenging to secure a runway end safety area (RESA). Furthermore, additional widening was found to be unnecessary since there is a runway widening project by DOTC underway covering runway parts that are 30 m wide. Still, runway overlay has been included in the short-term plan in consideration of the asphalt pavement's service life of 20 years and of the growing air traffic demand.

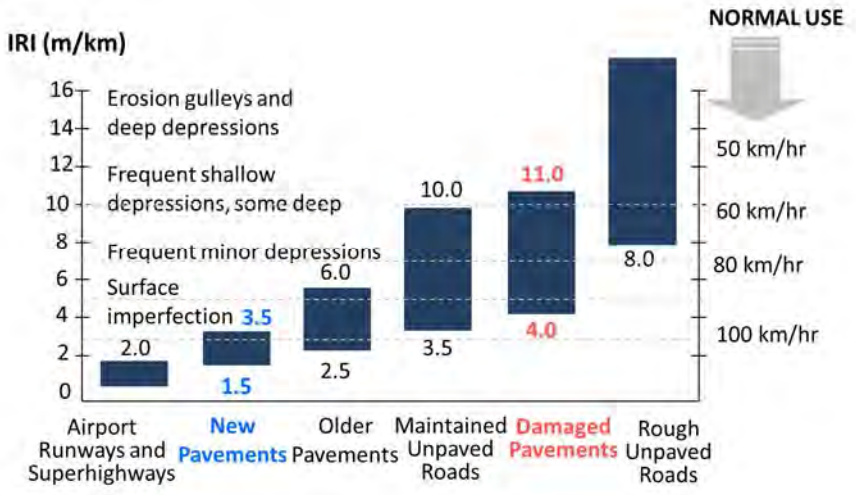
Table 8.2 Summary of Practical Development Targets for Cotabato Airport (up to 2030)

Demand/Main facility	Unit	Current	Future Requirements			Note
		2015	2020	2025	2030	
Traffic Demand						
Annual passengers	Pax.	-	445,424	558,900	672,017	
Annual AC movements		-	4,064	5,103	6,139	
Peak-hour passengers	Pax.	-	436	436	545	
Peak-hour AC movements		2	4	4	5	
Design Aircraft		A320	SJ	SJ	SJ	
Approach Category		Non-instrument	Non-precision	Non-precision	Non-precision	
Airside Facility						
Runway length	m	1,913	1,913	1,913	1,913	
Runway width	m	45	45	45	45	
Runway strip width	m	130	300	300	300	
Taxiway system		Stub	Stub	Stub	Stub	New construction
Apron area	m^2	25,600	8,000	8,000	8,000	New construction
Airfield lighting		B	C	C	C	
RFF (category)		6	6	6	6	
RESA length	m	0/0	0/0	0/0	0/0	
Landslide Facility						
Passenger terminal area	m^2	1,152	6,600	6,600	8,200	New construction
Cargo terminal area	m^2	n/a				
Vehicle parking area	m^2	7,920	8,960	8,960	8,960	New construction
R/W-T/W separation	m	86.6	168	168	168	
CNS/ATM						
RNA		Non-instrument	Non-precision	Non-precision	Non-precision	
AIS	CH	2/3/4	6/3/4	6/3/4	6/3/4	VHF/TRSC/HF
MET	Set	1/0/0	1/0/0	1/0/0	1/0/0	WIND/RVR/CCLM
Other Improvement						
Runway overlay			Overlay			1,913 m x 45 m*
Perimeter fences		Incomplete	Complete			500 m (250 bays)

Abbreviations: AC = aircraft, RFF = rescue and firefighting, RESA = runway end safety area, R/W = runway, T/W = taxiway, CNS/ATM = communication navigation and surveillance/air traffic management, RNA = radio navigational aid, AIS = aeronautical information service, VHF = very high frequency, TRSC = multi-transceiver, HF = high frequency, MET = meteorological facilities, WIND = anemometer, RVR = runway visual range, CCLM = COSMO climate limited-area model
*In the road condition survey using DRIMS, the Cotabato airport runway was calibrated in advance through real measurement of roads in Bangsamoro. The results indicated that the roughness of the existing runway pavement exceeds the international roughness index (IRI) for airport runways (Figure 8.1 and Figure 8.2).

Source: ibid.

It is suggested to include key facilities by a non-precision approach in the short-term plan such as runway strip securing, VOR/DME installation, and aeronautical lighting facility upgraded from B to C since the relocation of landside facilities should be carried out in the short-term plan. A new rescue and firefighting vehicle has already been installed but currently yet to be utilized due to the lack of personnel to operate it. The station shall be expanded in accordance with the number of vehicles.



Source: World Bank.

Figure 8.1 Rating of International Roughness Index (IRI)

Source: Road Condition Survey using Dynamic Response Intelligent Monitoring System (DRIMS).

Figure 8.2 Example of Runway Calibration at Cotabato Airport

8.2 Jolo Airport Development Project

As for geological features related to the Jolo airport, there exist rocky hills as high as a two-story building at the threshold of runway 27. This would make future expansion a challenge. However, there would not be an issue in terms of runway length as long as the airport services just turboprop (TP) aircrafts for the time being.

The runway is 45 m wide just over 310 m at the threshold of runway 27, while the remainder 1,535 m is only 30 m wide. Future design aircraft, however, would continue to be of the TP class in accordance with the air traffic demand. Accordingly, it seems unnecessary to implement separate runway widening for the 30 m section. No RESA is provided for runway 27. As the length of the existing runway can handle the service of TP aircrafts, the removal of the stop-way at the threshold of runway 27 and its replacement with the blast pad would create 60 m space, enabling the installation of a RESA.

A new PTB funded by DOTC is under preparation for the bidding to procure the contractor. Once completed, it is considered that additional expansion is not necessary until 2030. Furthermore, an area of 1,000 m^2 is being added to the car park, while 1,335 bays of airport perimeter fences and 80 bays of securing fences are being connected. Therefore, no additional facility improvement plan has been developed. Still, it is necessary to install PAPI and wind cone to secure safety during daytime operation. Runway overlay can be considered as the mid-term plan after taking into account air traffic demand since the pavement is in good conditions.

X-ray machine and metal detector shall be installed to ensure the security since the passenger baggage is currently screened manually one by one at the airport. A new rescue and fire fighting vehicle has been already allocated in the distribution plan but currently not installed yet. The station shall be expanded in accordance with the number of vehicles.

Table 8.3 Development Plan by Phase for Jolo Airport (up to 2030)

Phase	Contents	Scale
Short-term plan (2016–20)	Installation of airfield lighting facilities (PAPI & wind cones) Expansion of rescue and firefighting station Securing RESA (runway 27) Installation of aeronautical information equipment (VHF/TRSC) X-ray machine and metal detector	150 m^2
Medium-term plan (2021–25)	Runway overlay (1,845 m x 30 m)	55,350 m^2
Long-term plan (2026–30)	None	

Source: KOICA Master Plan Study report (revised by JICA Study Team).

8.3 Sanga-Sanga Airport Development Project

Even though the demand generated at the Sanga-Sanga airport is small, the airport is already accommodating small jet planes of A319. Therefore, a plan has been established to develop facilities that can service small jet aircrafts regardless of demand. Accordingly, its runway needs to be expanded

since it falls somewhat short of the standard runway length to service small jet aircrafts. Also, it is suggested to widen its runway to 45 m.

There is a plan to relocate the apron along with the PTB and VPA, and this should be reflected in the short-term plan. Furthermore, it is recommended that at least PAPI and wind cone be installed for daytime operation since there are no aeronautical lighting facilities at the moment.

Table 8.4 Summary of Practical Development Targets for Jolo Airport (up to 2030)

Demand/Main facility	Unit	Current	Future Requirements			Note
		2015	2020	2025	2030	
Traffic Demand						
Annual passengers	Pax.	-	20,009	21,605	23,077	
Annual AC movements		-	378	408	444	
Peak-hour passengers	Pax.	-	104	104	104	
Peak-hour AC movements		2	2	2	2	
Design Aircraft		Q400	TP	TP	TP	
Approach Category		Non-instrument	Non-instrument	Non-instrument	Non-instrument	
Airside Facility						
Runway length	m	1,845	1,845	1,845	1,845	
Runway width	m	30	30	30	30	
Runway strip width	m	150	150	150	150	
Taxiway system		Stub	Stub	Stub	Stub	
Apron area	m^2	9,000	9,000	9,000	9,000	
Airfield lighting		None	A	A	A	
RFF (category)		4	6	6	6	
RESA length	m	90/0	90/90	90/90	90/90	
Landslide Facilities						
Passenger terminal area	m^2	200	960	960	960	Ongoing
Cargo terminal area	m^2	N/A	-	-	-	
Vehicle parking area	m^2	3,290	4,290	4,290	4,290	Ongoing
R/W-T/W separation	m	71.5	71.5	71.5	71.5	
CNS/ATM						
RNA		Non-instrument	Non-instrument	Non-instrument	Non-instrument	
AIS	CH	1/0/2	6/2/2	6/2/2	6/2/2	VHF/TRSC/HF
MET	Set	1/0/0	1/0/0	1/0/0	1/0/0	WIND/RVR/CCLM
Other Improvement						
Runway overlay				Overlay		1,845 m x 30 m
Perimeter fences		Complete				Completed

Abbreviations: Same as Table 8.2

Source: ibid.

If the pavement conditions are found to be without any significant deficiency, runway overlay would be implemented as part of the long-term plan. X-ray machine and metal detector shall be installed to ensure the security since the passenger baggage is currently screened manually one by one at the airport. A new rescue and fire fighting vehicle has already been allocated in the distribution plan but currently not installed yet. The station shall be expanded in accordance with the number of vehicles.

Table 8.5 Development Plan by Phase for Sanga-Sanga Airport (up to 2030)

Phase	Contents	Scale
Short-term plan (2016–2020)	Runway extension (250 m x 45 m)	11,250 m^2
	Runway widening (1,860 m x 15 m)	11,250 m^2
	New apron	8,000 m^2
	New stub taxiway	
	Installation of airfield lighting facilities (PAPI & wind cone)	
	Expansion of rescue and firefighting station	230 m^2
	Securing RESA (both sides)	
	New PTB	1,110 m^2
	New vehicle parking area	5,100 m^2
	Installation of aeronautical information equipment (VHF)	
	Runway overlay (1,860 m x 30 m)	55,800 m^2
	Completion of fence connection	
	New control tower	
	X-ray machine and metal detector	

Phase	Contents	Scale
Medium-term plan (2021–2025)	Expansion of PTB	1,500 m^2
Long-term plan (2026–2030)	None	

Source: ibid.

Table 8.6 Summary of Practical Development Targets for Sanga-Sanga Airport (up to 2030)

Demand/Main facility	Unit	Current	Future Requirements			Note
		2015	2020	2025	2030	
Traffic Demand						
Annual passengers	Pax.	-	31,193	38,460	45,427	
Annual AC movements		-	287	353	417	
Peak-hour passengers	Pax.	-	218	218	218	
Peak-hour AC movements		2	2	2	2	
Design Aircraft		A319	SJ	SJ	SJ	
Approach Category		Non-instrument	Non-instrument	Non-instrument	Non-instrument	
Airside Facility						
Runway length	m	1,860	2,110	2,110	2,110	
Runway width	m	30	45	45	45	
Runway strip width	m	200	200	200	200	
Taxiway system		Stub	Stub	Stub	Stub	New construction
Apron area	m^2	5,500	8,000	8,000	8,000	New construction
Airfield lighting		N/A	A	A	A	
RFF (category)		4	6	6	6	
RESA length	m	0/0	90/90	90/90	90/90	
Landslide Facilities						
Passenger terminal area	m^2	240	1,110	2,600	2,600	New construction
Cargo terminal area	m^2	N/A	-	-	-	
Vehicle parking area	m^2	N/A	5,100	5,100	5,100	New construction
R/W-T/W separation	m	26.5	93	93	93	
CNS/ATM						
RNA		Non-instrument	Non-instrument	Non-instrument	Non-instrument	
AIS	CH	0/0/0	6/2/2	6/2/2	6/2/2	VHF/TRSC/HF
MET	Set	1/0/0	1/0/0	1/0/0	1/0/0	WIND/RVR/CCLM
Other Improvement						
Runway overlay			Overlay			1,860m x 30m
Perimeter fences		Incomplete	Complete			

Abbreviations: Same as Table 8.2

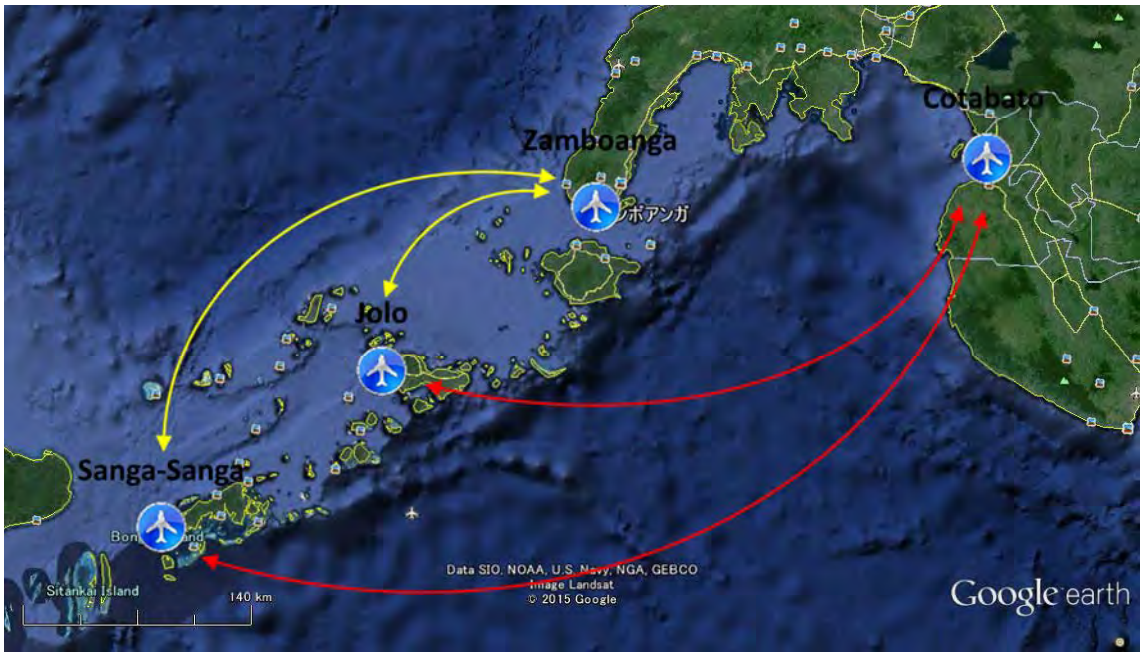
Source: ibid.

8.4 Other Viewpoints for Airport Development

8.4.1 Airport network development project

The existing air network is linked only between the Zamboanga airport and islands airports in BaSulTa such as the Jolo and Sanga-Sanga airports (Figure 8.3). There is no air connection between the Cotabato airport and islands airports. The direct air transportation between Cotabato and BaSulTa shall be established to promote comprehensive and integrative development of Bangsamoro although historically regional economy in BaSulTa has a strong tie with Zamboanga City. Such direct air connections can be expected once Cotabato City is expanded economically comparable to Zamboanga City.

Tourist related demand for air transport is expected in Tawi-Tawi not only from other parts of the Philippines but also from neighboring countries such as Brunei, Indonesia and Malaysia since Tawi-Tawi has enormous tourism potential with beautiful scenery, majestic nature and a variety of culture. Therefore customs, immigration and quarantine (CIQ) facilities shall be equipped at the Sanga-Sanga airport in Tawi-Tawi in the future to accommodate international passengers from these and other countries. Besides, Tawi-Tawi shall be properly considered as a safe region apart from the other islands in BaSulTa.



Legend: Yellow line = Existing route; Red line = Desired future route

Source: JICA Study Team.

Figure 8.3 Airport Network Development in the Bangsamoro

8.4.2 Bangsamoro corridor development project

Regarding air logistics along the Bangsamoro corridors (Figure 8.4), it is important to utilize not only airports located in the Bangsamoro area but also airports outside the Bangsamoro area. The direct and indirect air logistics routes mentioned above which support efficient export of locally grown products to urban areas such as Metro Manila or overseas will improve the profitability of economic activities in Bangsamoro.

(1) Northern corridor

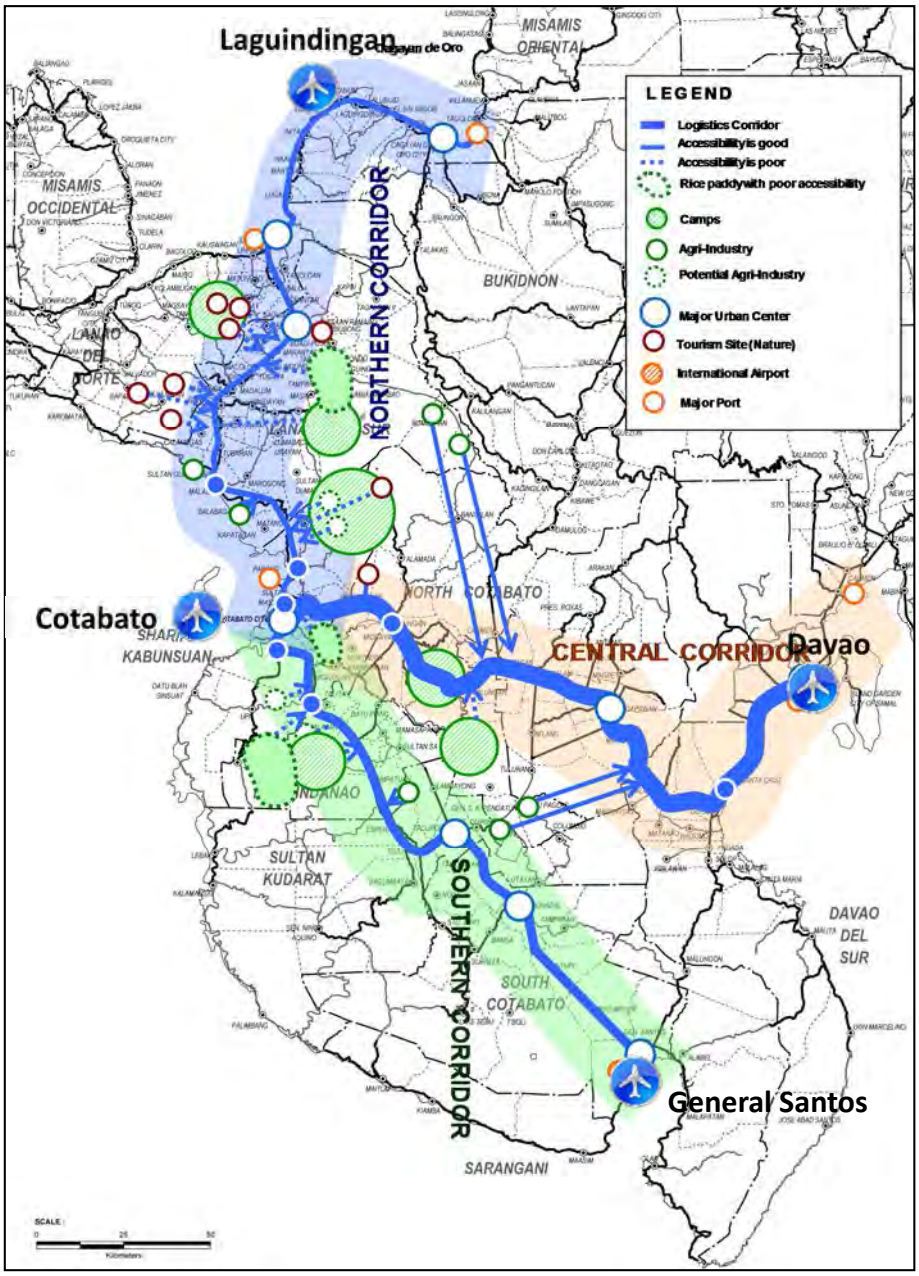
While enhancing direct air logistics routes through the Cotabato airport located in the Bangsamoro area, it is also desirable to enhance indirect air logistics routes through the Laguindingan airport outside the Bangsamoro area to revitalize the northern corridor. Agricultural products mainly from Lanao del Sur shall be considered as the prospective products for this corridor.

(2) Central corridor

While enhancing direct air logistics routes through the Cotabato airport located in the Bangsamoro area, it is also desirable to enhance indirect air logistics routes through the Davao international airport outside the Bangsamoro area to revitalize the central corridor. Agricultural products mainly from Maguindanao shall be considered as the prospective products for this corridor.

(3) Southern corridor

While enhancing direct air logistics routes through the Cotabato airport in the Bangsamoro area, it is also desirable to enhance indirect air logistics routes through the General Santos international airport outside the Bangsamoro area to revitalize the southern corridor. Marine products such as tuna caught in coastal areas of Moro Gulf shall be considered as the prospective products for this corridor.



Source: JICA Study Team.

Figure 8.4 Locations of Logistics Corridors and Some of Region's Resources

CHAPTER 9 PROJECT COST ESTIMATION

The project cost estimation by phase up to 2030 for the Cotabato, Jolo and Sanga-Sanga airports were prepared in the KOICA Master Plan Study based on the a airport development plan described above. The JICA Study Team revised the cost estimation in consideration of the latest information gathered through site surveys. The revised cost estimation is summarized in Table 9.1.

Table 9.1 Summary of Cost Estimate for Bangsamoro Airport Development Projects (up to 2030)

(Unit: PHP '000)

Airport	Future requirement			Total
	2020	2025	2030	
Cotabato	1,983,517	0	109,120	2,092,637
Jolo	74,282	108,900	0	183,182
Sanga-Sanga	845,118	68,750	0	913,868
Total	2,902,917	177,650	109,120	3,189,687

Source: JICA Study Team.

According to the previous JICA Master Plan study report in 2006, the economic internal rate of return (EIRR) of the Cotabato Airport Development Plan resulted in 11.6% while the social rate of returns in the Philippines is 15% according to NEDA. The reason for low EIRR is because of nature of the airport improvements focusing on safety. Among the improvement works, all works except the PTB are improvement in safety, which cannot be quantified in monetary terms.

The study team did not recommend the application of economic analysis for the evaluation of safety improvement project because the value of safety is not measurable. The safety improvement project of an airport should be justified with minimum safety standards, not with an economic analysis. These kinds of airport improvement projects cannot be measured by the EIRR, but should be justified and implemented from the viewpoint of maintaining minimum safety standards. The priority projects proposed in this report for Bangsamoro airports consist of similar component for safety. Therefore, these EIRR values of the priority projects will result in the same level as mentioned earlier.

The details of development costs are summarized in Tables 9.2 through 9.4 for the three airports, respectively.

9.1 Cotabato Airport Development Project

Table 9.2 Cost Estimation for Cotabato Airport Development Project (up to 2030)

(Unit: PHP '000)

Main Work	Future Requirements			Note
	2020	2025	2030	
Airside Facilities				
Runway extension				
Runway widening				
Taxiway system	25,300			
Apron expansion	40,000			
Strip expansion and site preparation	707,220			
Upgrading of AGL	144,000			
Upgrading of RFFS	6,560			
Subtotal	923,080	0	0	
Landslide Facilities				
PTB expansion	396,000		96,000	
CTB expansion				
VPA expansion	26,880			
Construction of control tower	120,000			1
Site preparation	31,120		3,200	
Subtotal	574,000	0	99,200	

Main Work	Future Requirements			Note
	2020	2025	2030	
CNS/ATM				
RNA	128,082			
AIS	34,247			
MET				
Subtotal	162,329	0	0	
Other Improvements				
Runway overlay	139,788			
Completion of fences	4,000			
X-ray machine and metal detector				
Subtotal	143,788	0	0	
Contingency (10%)	180,320	0	9,920	
Total Construction Cost	1,983,517	0	109,120	

Abbreviations: AGL = aeronautical ground lighting, RFFS = rescue and firefighting station, PTB = passenger terminal building, CTB = cargo terminal building, VPA = vehicle parking area, CNS/ATM = communication navigation and surveillance/air traffic management, RNA = radio navigational aid, AIS = aeronautical information service, MET = meteorological facilities
[1]To be carried out by Airport Infrastructure Program of DOTC

Source: KOICA Master Plan Study report (revised by JICA Study Team).

9.2 Jolo Airport Development Project

Table 9.3 Cost Estimation for Jolo Airport Development Project (up to 2030)

(Unit: '000 PHP)

Main Work	Future Requirements			Note
	2020	2025	2030	
Airside Facilities				
Runway extension				
Runway widening				
Taxiway system				
Apron expansion				
Strip expansion and site preparation	10,000			1
Upgrading of AGL	4,000			
Upgrading of RFFS	6,000			
Subtotal	20,000	0	0	
Landslide Facilities				
PTB expansion	5,000			1
CTB expansion				
VPA expansion	1,650			1
Construction of control tower				
Site preparation				
Subtotal	6,650	0	0	
CNS/ATM				
RNA				
AIS	36,879			
MET				
Subtotal	36,879	0	0	
Other Improvements				
Runway overlay		99,000		
Completion of fences				
X-ray machine and metal detector	4,000			2
Subtotal	4,000	99,000	0	
Contingency (10%)	6,753	9,900	0	
Total Construction Cost	74,282	108,900	0	

Abbreviations: Same as Table 9.2
[1]To be carried out by Airport Infrastructure Program of DOTC; [2]Cost estimated from similar projects in the Philippines

Source: ibid.

9.3 Sanga-Sanga Airport Development Project

Table 9.4 Cost Estimation for Sanga-Sanga Airport Development Project (up to 2030)

(Unit: '000 PHP)

Main Work	Future Requirements			Note
	2020	2025	2030	
Airside Facilities				
Runway extension	56,250			
Runway widening	111,600			1
Taxiway system	10,000			1
Apron expansion	32,000			1
Strip expansion and site preparation	93,020			1
Upgrading of AGL	16,625			
Upgrading of RFFS	9,200			
Subtotal	328,695	0	0	
Landslide Facilities				
PTB expansion	91,250	59,600		1 (2020)
CTB expansion				
VPA expansion	30,000			1
Construction of control tower	25,000			2
Site preparation	12,420	2,900		
Subtotal	158,670	62,500	0	
CNS/ATM				
RNA				
AIS	48,784			
MET				
Subtotal	48,784	0	0	
Other Improvements				
Runway overlay	184,140			
Completion of fences	44,000			2
X-ray machine and metal detector	4,000			3
Subtotal	232,140	0	0	
Contingency (10%)	76,829	6,250	0	
Total Construction Cost	845,118	68,750	0	

Abbreviations: Same as Table 9.2.

[1]To be carried out by Airport Infrastructure Program in 2015 of DOTC; [2]Based on the proposed Airport Infrastructure Program of DOTC; [3]Based on a similar project in the Philippines

Source: ibid.

Comprehensive Capacity Development Project for the Bangsamoro

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Final Report

Sector Report 2-4: River and Flood Control

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Abbreviations, Unit of Measurement, and Currency

(Refer to Sector Report 2-1: Road Transport, pp. 1-v through 1-x.)

CHAPTER 1 INTRODUCTION

1.1 Introduction

The Bangsamoro Core Territory (BCT) is susceptible to various disasters, such as flood, landslide, storm surge, earthquake, volcanic eruption, tsunami, and drought. Particularly, flood and landslide are perennial disasters that have hampered the development of the region. The river and flood control sector is to first clarify the present situation and then to propose strategies for the enhancement of disaster risk reduction and management (DRRM) for the region.

1.2 Objectives

The objectives of the survey on river and flood control sector are as follows:

- To identify the existing flood conditions;
- To identify the existing capacity of the BCT for DRRM, especially for flood control; and based on the above
- To propose strategies for developing the DRRM capacity of the BCT.

1.3 Photographs

Photographs taken during the field surveys are presented below to show key features of Bangsamoro related to rivers and flood control.

Rio Grande de Mindanao upstream of Delta Bridge
(May 30, 2015)

Rio Grande de Mindanao downstream of Delta Bridge
(May 30, 2015)

Tamontaka River upstream of Tamontaka Bridge
(January 27, 2015)

Tamontaka River downstream of Tamontaka Bridge
(January 27, 2015)

River mouth of Rio Grande de Mindanao (May 30, 2015)

Bifurcation point of Rio Grande de Mindanao and Tamontaka River (August 30, 2015)

Simuay River upstream of bridge on Pan-Philippine Highway (May 30, 2015)

Simuay River downstream of bridge on Pan-Philippine Highway (May 30, 2015)

Sand mining at Simuay River upstream of bridge on Pan-Philippine Highway (May 30, 2015)

Newly constructed closing dike on left bank of Simuay River (May 30, 2015)

Pulangi River upstream of Tunggol Bridge (September 7 , 2015)

Pulangi River downstream of Tunggol Bridge (September 7, 2015)

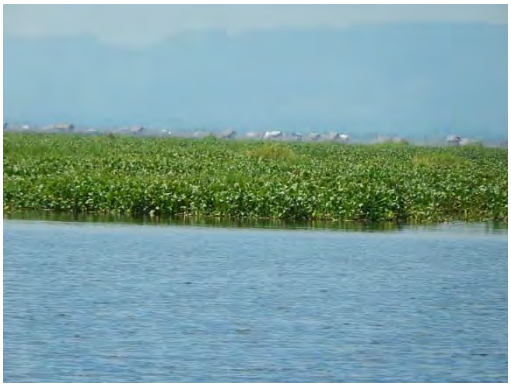
Telemetered water-level and rainfall censors of Project NOAH on Tunggol Bridge (September 7, 2015)

Tentative protection work of left abutment of Tunggol Bridge (September 7, 2015)

Buluan River upstream of bridge on Isulan–Tacurong City Road (September 7, 2015)

Buluan River downstream of bridge on Isulan–Tacurong City Road (September 7, 2015)

Lake Buluan (September 7, 2015)



Water hyacinth on Lake Buluan (September 7, 2015)

Destroyed Pan-Philippine Highway near Lambayong by course change on Ala River (September 7, 2015)

Banga River upstream of Kapingkong Bridge (September 7, 2015)

Banga River downstream of Kapingkong Bridge (September 7, 2015)

Ala River upstream of bridge on Isulan–Shariff Aguak Road (September 7, 2015)

Ala River downstream of bridge on Isulan–Shariff Aguak Road (September 7, 2015)

CHAPTER 2 DISASTERS IN BCT

2.1 Past Disasters

2.1.1 Disaster reports of OCD-ARMM

The Office of Civil Defense (OCD-ARMM) prepares disaster reports for every disaster event, and submits them to the OCD Central Office. However, historic statistic data have not been compiled yet as only in 2013 the report template was drafted by the OCD Central Office. OCD-ARMM started to prepare disaster reports of the main land provinces in 2014, following the draft template. Its satellite office in Zamboanga prepares disaster reports of the island provinces and submits them directly to the Central Office.

Table 2.1 is a summary of the disaster reports for three flood events in 2014. Unfortunately, there is no disaster event record of the island provinces in the reports for the reason mentioned above. According to staff of OCD-ARMM, main disasters in the region are flood and landslide, and the two mainland provinces, Maguindanao and Lanao del Sur are more susceptible to disasters than the three island provinces, Sulu, Balisan and Tawi Tawi.

Table 2.1 Summary of Disaster Reports of OCD-ARMM for Three Flood Events

Disaster Event	Affected Municipalities	Casualties	Affected people	Damage to houses and infrastructures	Agricultural loss	Note
Flood in Maguindanao Province (June 13 to July 9, 2014)	Mamasapano, Datu Salibo, Shariff Saydona1, Datu Piang1, Sultan sa Barongis, Rajah Buayan1, Datu Abdulah Sangki, Mother Kabuntalan, Northern Kabuntalan, Ampatuan, Datu Montawal, Pagalungan, Datu Odin Sinsuat, Sultan Kudarat, General Salipada K. Pendatun (GSKP), Sultan Mastura, Mangudadatu, Buluan, Pandag, Talitay, Buldon, Barira	1 dead, No missing, No injured	32,001 families/ 160,005 individuals	No damage reported	PHP 43 million 8,303 ha affected. No reported livestock or fishery damage	State of Calamity was declared for Maguindanao Province on June 19 and released on June 23
Flash Flood in North Upi of Maguindanao Province (6/13–7/9/ 2014)	North Upi of Maguindanao	No Casualties	95 families/ 137 individuals	3 houses totally and 7 houses partially damaged.	2 ha of corn farm	No Declaration of State of Calamity
Flood in Maguindanao Province (August 25 to September 9, 2014)	Ampatuan, Buldon, Datu Montawal, Mamasapano, Pagalungan, Paglat, Shariff Saydona Mustapha, Sultan Kudarat, Sultan Mastura, Sultan Sa Barongis, North Upi, South Upi, Northern Kabuntalan, Mother Kabuntalan, Datu Salibo, Rajah Buayan, Datu Abdullah Sangki, Talitay, Magudadatu, Pandag, Buluan, General Salipada K. Pendatun (GSKP), Datu Piang, Datu Odin Sinsuat, Datu Hoffer, Talayan*	5 dead and 4 injured by flash flood and landslide in North Upi	35,930 families/ 176,355 individuals	11 houses totally damaged and 3 houses partially damaged. A primary school destroyed by landslide A number of properties were damaged due to tornado incident at Barangay Magsaysay, Parang Maguindanao	PHP 45 million 8,784 ha affected	A state of Calamity was declared for Kudarat Municipality on Sep. 9, for Kabuntalan Municipality on Sep. 8 and for Pagalungan Municipality on Aug. 29

Source: OCD-ARMM.

2.1.2 Historical floods

Flooding in the BCT is usually associated with the occurrence of typhoons, thunderstorms and/or monsoon rains. In particular, Typhoon Frank in 2008 triggered massive inundations in the provinces of Cotabato, South Cotabato and Sultan Kudarat (all in Region XII) and in the provinces of Lanao del Sur and Maguindanao (both in ARMM). Table 2.2 shows flood damages in the BCT according to the National Disaster Coordinating Council (NDCC), the forerunner of the National Disaster Risk Reduction and Management Council (NDRRMC). A total of 46 people were killed, and 554,262 people in 490 barangays were affected.

According to officials of DPWH, the Simuay River changed its main course from west to south, namely to the Rio Grande de Mindanao (the Mindanao River) during the flood. This course change not only caused flooding over the Sultan Kudarat municipality of Maguindanao province but also brought about

siltation of sediments in the river channel of the Rio Grande de Mindanao. Moreover, water hyacinth flowing from the upstream was caught and accumulated at the new Delta Bridge and clogged the river channel. The siltation and the clogging raised the river water level, resulting in overflow into Cotabato City and Sultan Kudarat.

Table 2.2 Flood Damages in ARMM and Cotabato City by Typhoon Frank in 2008

Province/City	Population (as of August 2007)	No. of affected Barangays	Affected population (% of population)	No. of dead/missing
Maguindanao	1,273,725	279	311,379 (24.4%)	43
Lanao del Sur	1,138,544	176	138,693 (12.2%)	0
Tawi-Tawi	450,346	5	450 (0.1%)	0
Basilan	408,520	5	1,475 (0.4%)	0
Sulu	849,670	0	0 (0%)	0
Cotabato City	259,153	25	102,265 (39.5)	3
Total	4,379,948	490	554,262 (12.6%)	46

Source: NDDC-OCD.

In 2009, Typhoon Jolina displaced 15,000 families and inundated nearly all the barangays in Cotabato City (36 out of 37 barangays). For weeks, large tract of farmlands were submerged causing massive losses in agricultural productivity and income.

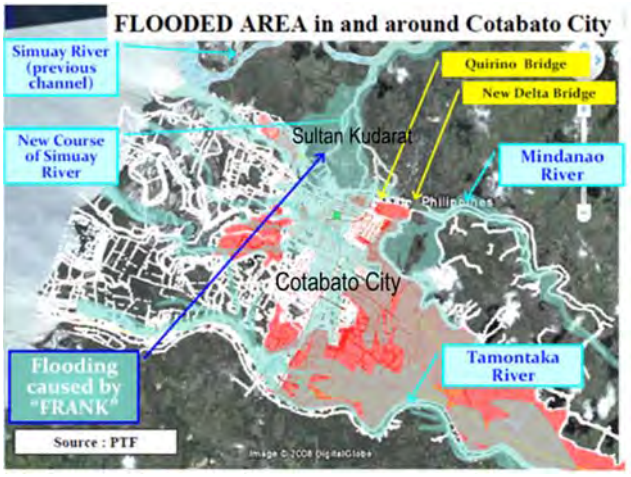


Figure 2.1 Flood Areas around Cotabato City Caused by Typhoon Frank in 2008

From May to June 2011, moderately heavy rain caused massive flooding in 31 of the 37 barangays in Cotabato City, and seven municipalities of Maguindanao were under 5-feet of flood. In Lanao del Sur, inundation reached knee-deep in six municipalities. The Regional Disaster and Risk Reduction Management Council (RDRRMC) reported that about 75% of the houses and farmlands in Cotabato City and nearby environs were submerged for several weeks. Among those greatly affected were those in low-lying areas (floodplains) and near the major rivers of the Mindanao River Basin.

Photo 1: Accumulation of water hyacinth under Delta Bridge on Rio de Grande River in June 2011

During the 2011 flood, water hyacinth became one of the most troublesome issue again. Accumulation of water hyacinth under the Delta Bridge and on the Tamontaka River contributed to the flood. The one under the Delta Bridge reached an estimated area of 16 ha, which was double its size three years before during the onslaught of Typhoon Frank in 2008. As a solution to the water hyacinth problem, its utilization as materials for handicraft, feed, fertilizer, bio-energy, and other purposes is being promoted by the private sector in cooperation with DPWH and local government units (LGUs).

Major natural disasters that hit the region in 2010–2011and their damages are summarized in Table 2.3.

Table 2.3 Natural Disaster Damages in ARMM, 2010–2011

Type of disaster	Date	Affected population	Affected areas
Flash flood	June 2010	9,388 families 40,000 persons	Maguindanao Province (10 barangays)
Flash flood	January 2011	11,816 families 59,080 persons	Maguindanao Province (26 barangays)
Flash flood	February 2011	553 families	Sulu Province (4 coastal barangays)
Flood	May–June 2011	53,188 families 324,261 persons	Maguindanao Province (168 barangays)
Flood	May–June 2011	10,263 families 51,315 persons	Sulu (9 barangays)
Typhoon Sendong	December 15–16, 2011	27,357 families 138,504 persons	Maguindanao Province (15 barangays)

Source NDRRMC.

2.2 Flood Hazard Maps

There are available susceptibility maps of flood and landslide by the Mining and Geo-science Bureau (MGB) of DENR, as shown in Figure 2.2. From the map, it can be observed that there is a huge extensive flood area along the Rio Grande de Mindanao (the lowest part of the Mindanao River) and in the marsh areas, and landside areas are also extensive in the south-western areas of Maguindanao and the western and south-western areas of the Lake Lanao. It is also seen that the island provinces are less disaster-prone than the mainland provinces except for flood areas around the coast of Sulu and landslide areas in Basilan.

This map, based on the 1/50,000 NAMRIA maps, is useful to generally understand potential disasters in the region, but it might be too coarse to be used for practical disaster risk reduction and management such as preparation of evacuation plan, land-use planning, etc.

Figure 2.3 is a flood area map of the 100-year return period prepared under the Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP). Under the master plan study, flood area maps of 5, 10, 25 and 50-year return periods were also prepared.

Recently more detailed flood hazard maps are being prepared by MGB and the Project NOAH (Nationwide Operational Assessment of Hazards) as presented in Table 2.4. They are all based on high-resolution maps, and are expected to be more practically used for the disaster risk reduction and management.

Table 2.4 Flood Hazard Maps

Map	Target area	Produced by	Base map resolution	Present status
Flood Susceptibility Map	Whole Country	MGB, DENR	1/50,000	Published
Landslide Susceptibility Map	Whole Country	MGB, DENR	1/10,000 (IFSAR)	Published
Potential flood Area Map	Mindanao River Basin	MRBIMDMP	GDEM (global digital elevation model) by NASA in 2007	Published
Flood Susceptibility Map	Whole Country	MGB, DENR	1/10,000 (IFSAR)	Under preparation
Landslide Susceptibility Map	Whole Country	MGB, DENR	1/10,000 (IFSAR)	Under preparation
Flood Hazard Map	Mindanao River Basin	Project NOAH	1/10,000 (IFSAR) and additional LiDAR survey data	Under preparation
Landslide Hazard Map	Whole Country	Project NOAH	1/10,000 (IFSAR)	Under preparation
Storm Surge Hazard Map	Whole Country	Project NOAH	1/10,000 (IFSAR)	Under preparation

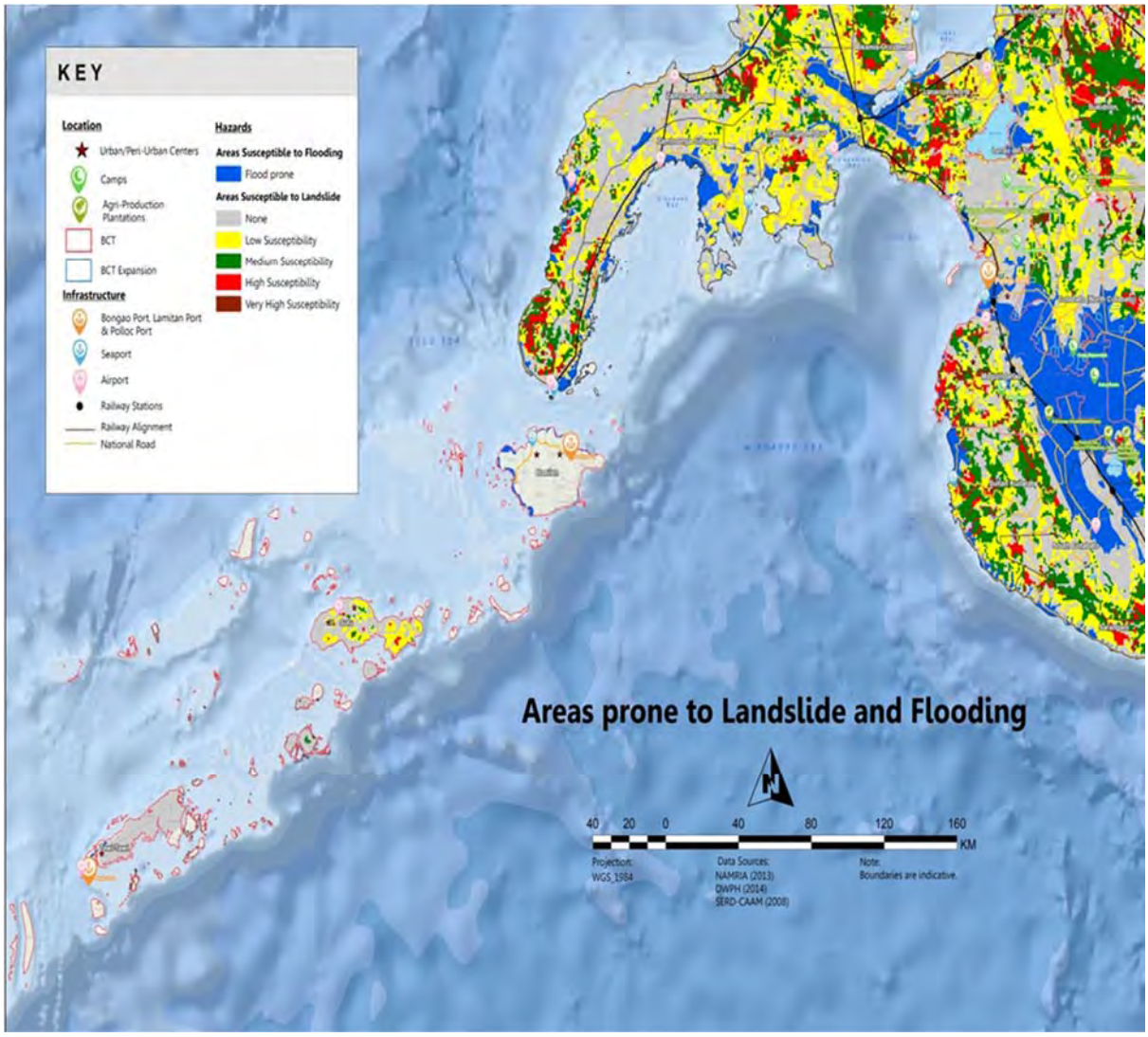


Figure 2.2 Flood and Landslide Susceptibility Map by MGB

Susceptibility of provinces and cities to various disasters including floods is summarized in Table 2.5.

Table 2.5 Susceptibility of Municipalities/Cities in MRB to Various Disasters

Province/City	No of Municipalities	No. of Municipalities/Cities Susceptible to Hazard										
		2-yr flooding	5-yr flooding	10-yr flooding	25-yr flooding	50-yr flooding	Rain-induced landslide	Earthquake	Earthquake-induced landslide	Liquefaction	Tsunami	Volcanic
Bukidnon	18	0	0	0	0	0	16	18	14	3	0	11
D. Del Sur	1	0	0	0	0	0	0	3	3	0	0	2
L. Del Sur	6	0	0	0	0	0	0	6	6	0	0	6
Maguindanao	19	14	14	14	14	14	3	11	11	13	3	2
Cotabato	18	12	12	12	12	12	0	16	16	12	0	7
Sarangani	2	2	2	2	2	2	1	2	2	1	1	2
S. Cotabato	11	0	0	0	0	0	0	7	7	7	0	7
S. Kudarat	10	3	3	3	3	3	3	7	7	7	0	2
Cotabato City	1	1	1	1	1	1	1	0	0	1	1	0
General Santos City	1	1	1	1	1	1	1	1	1	1	1	1

Source: MRBIMDMP.

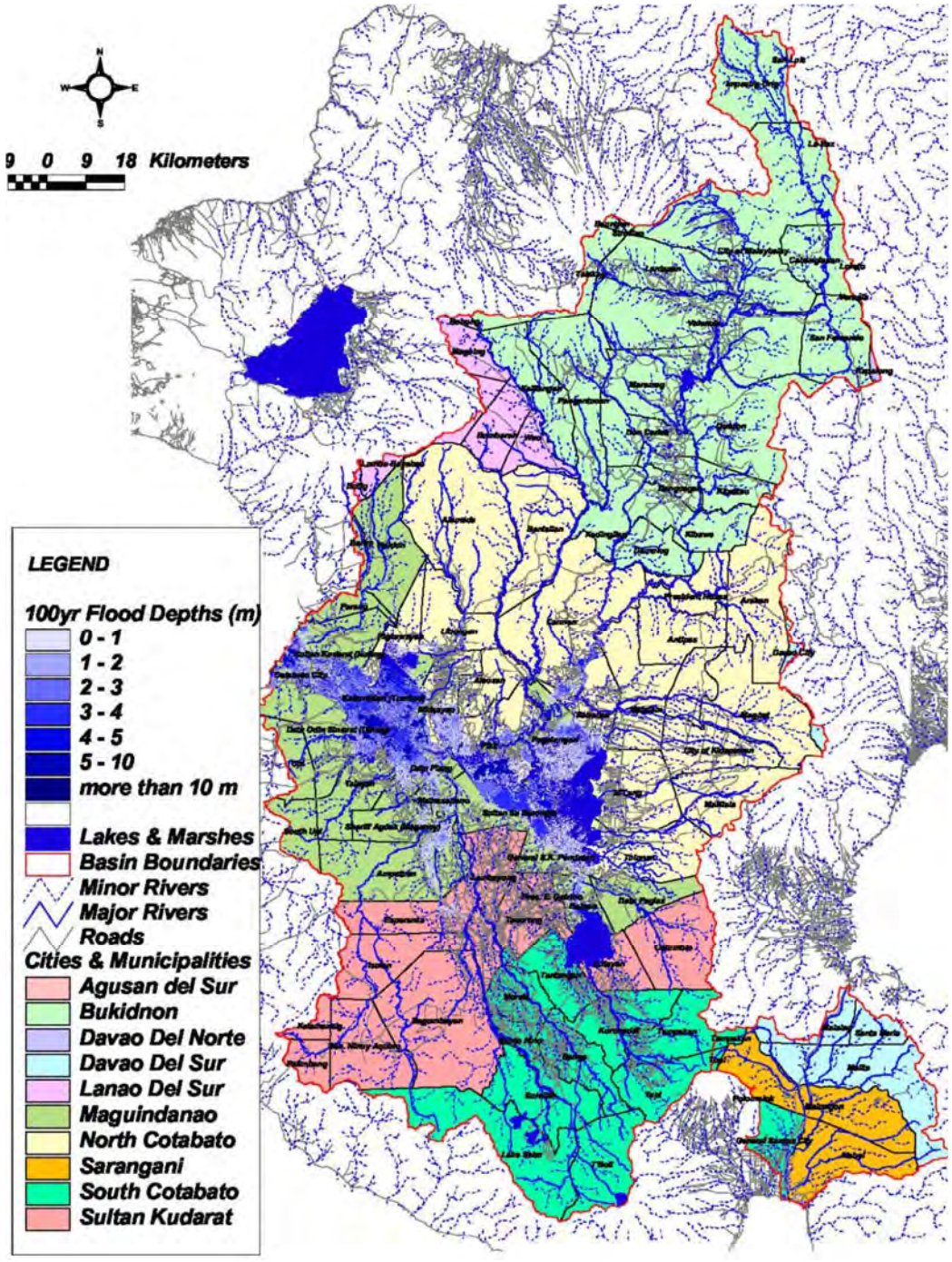


Figure 2.3 Flood Area Map by MRBIMDMP (100-year Return Period)

Possible causes of flood in the Mindanao River Basin (MRB), based on the findings of previous studies are summarized in Table 2.6.

Table 2.6 Possible Causes of Floods in Mindanao River Basin (MRB)

Cause of Floods	Description
Poor flow capacity	Poor flow capacities of shallow, gentle and meandering river channels of the Mindanao River and its tributaries are one of the major cause of flooding.
Heavy erosion and siltation	Erosion is likely to occur due to the steep slope, no vegetation, and poorly consolidated or compacted sediments in the MRB. Eroded sediment is transported downstream and makes shallow the river beds.
River course change	Heavy erosion and siltation can even change river courses in the BCT as the case of the Simuay River. Another example of the Allah River is as follows.

Cause of Floods	Description
	The denuded upper mountains and hills in the Allah River basin, the pyroclastic materials from previous eruptions of Mt. Parker and the rich farmlands of Banga, Isulan, Tacurong and Koronadal contribute to the major problem of siltation that has caused the perennial inundation of its flood plains where most of the populated centers and agricultural fields are located. The major storms of 2008 and 2009 have caused the river to change its course five times. In May 2011, the entire river diverted towards Barangay Tinumiguez at Lambayong, Sultan Kudarat and destroyed over 2,000 hectares of rice field and flowed through a 4 km stretch of the Lambayong-Marbel road. In 2009, the diversion of the river course to the populated area of Lambayong imperiled the residents. (see Figure 4)
Water Hyacinth	The presence of water hyacinth (an indication of the poor water quality) which had been carried downstream from the Ligawasan Marsh caused the clogging of the Tamontaka River and the Rio Grande de Mindanao and consequently caused the great flood disaster in June 2011. The water hyacinth stretched nearly 8 km and had an estimated depth of nearly 5 m.

2.3 Impact of Climate Change

The impact of climate change is a common concern of all mankind, but the situation is more serious for the Philippine people, who have been hit so often recently by extreme flood catastrophes, Tropical Strom Ondoy in 2009, Typhoon Pablo and Tropical Storm Sendong in 2012, and Typhoon Yolanda in 2013, etc.

Box 1 presents climate projections in 2020 and 2050 for the mainland provinces of ARMM by PAGASA. Box 2 is an extract on Asia Region from the Chapter 24 of *Impact, Adaptation and Vulnerability: Climate Change 2014* by the Working Group II of IPCC. According to them, the frequency of extremely heavy rainfall will increase, and precipitation will likely be more extreme near the centers of tropical cyclones causing landslides and future increases in precipitation extremes related to the monsoon are also very likely. Therefore, rain-induced hazards such as flood and landslide will likely increase in the future.

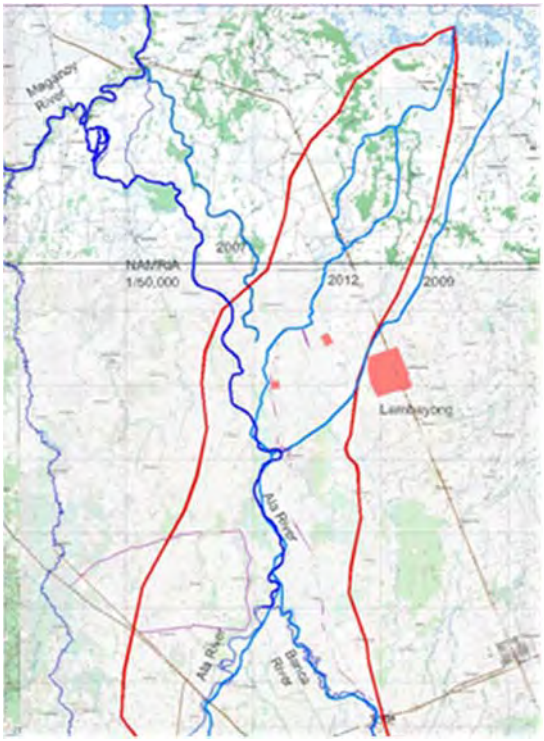


Figure 2.4 River Course Change of Allah River

Box 1: Climate Projections in 2020 and 2050 in Provinces in ARMM by PAGASA

The projected seasonal temperature increase, seasonal rainfall change and frequency of extreme events in 2020 and 2050 under the medium-range emission scenario in the provinces in ARMM are presented in Table a, Table b and Table c, respectively.

Table a: Seasonal temperature increases (in °C) in 2020 and 2050 under medium-range emission scenario in provinces in ARMM

	OBSERVED BASELINE (1971-2000)				CHANGE in 2020 (2006-2035)				CHANGE in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
ARMM												
LANAO DEL SUR	24.3	25.4	25.0	24.9	1.0	1.2	1.1	1.0	2.0	2.3	2.2	2.0
MAGUINDANAO	27.6	28.3	27.5	27.6	1.0	1.2	1.2	1.1	2.1	2.3	2.4	2.1

Table b: Seasonal rainfall change (in %) in 2020 and 2050 under medium-range emission scenario in provinces in ARMM

	OBSERVED BASELINE (1971-2000)				CHANGE in 2020 (2006-2035)				CHANGE in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
ARMM												
LANAO DEL SUR	293.8	369.4	661.5	562.2	7.2	-6.3	-7.2	0.3	-1.1	-4.6	-7.4	-3.6
MAGUINDANAO	225.3	399.1	635.3	553.6	6.3	1.4	-7.4	3.5	5.3	-1.4	-12.6	-1.2

Table c: Frequency of extreme events in 2020 and 2050 under medium-range emission scenario in provinces in ARMM

Provinces	Stations	No. of Days w/ Tmax >35 °C			No. of Dry Days			No. of Days w/ Rainfall >300mm		
		OBS	2020	2050	OBS	2020	2050	OBS	2020	2050
MAGUINDANAO	Cotabato	384	3382	5994	3516	5471	5788	0	3	1

Source: http://pagasa.dost.gov.ph/index.php/component/content/category/116-climate-change-in-the-philippines

Box 2: Projected Climate Change for Asia Region quoted from IPCC 5th Assessment Report

24.3.2. Projected Climate Change

24.3.2.1. Tropical and Extra-tropical Cyclones

The future influence of climate change on tropical cyclones is likely to vary by region, but there is low confidence in region-specific projections of frequency and intensity. However, better process understanding and model agreement in specific regions indicate that precipitation will likely be more extreme near the centers of tropical cyclones making landfall in West, East, South, and Southeast Asia (see WGI AR5 Sections 14.6, 14.8.9-12). There is medium confidence that a projected poleward shift

in the North Pacific storm track of extra-tropical cyclones is more likely than not. There is low confidence in the magnitude of regional storm track changes and the impact of such changes on regional surface climate (see WGI AR5 Section 14.6).

24.3.2.2. Monsoons

Future increases in precipitation extremes related to the monsoon are very likely in East, South, and Southeast Asia (see WGI AR5 Sections 14.2.1, 14.8.9, 14.8.11-12). More than 85% of CMIP5 models show an increase in mean precipitation in the East Asian summer monsoons, while more than 95% of models project an increase in heavy precipitation events (see WGI AR5 Section 14.2.2, Figure 14.4). All models and all scenarios project an increase in both the mean and extreme precipitation in the Indian summer monsoon (see WGI AR5 Section 14.2.2 and Southern Asia (SAS) in Figure 14.4). In these two regions, the inter-annual standard deviation of seasonal mean precipitation also increases (see WGI AR5 Section 14.2.2).

Source: Chapter 24, *Impact, Adaptation and Vulnerability: Climate Change 2014*, by IPCC Working Group II.

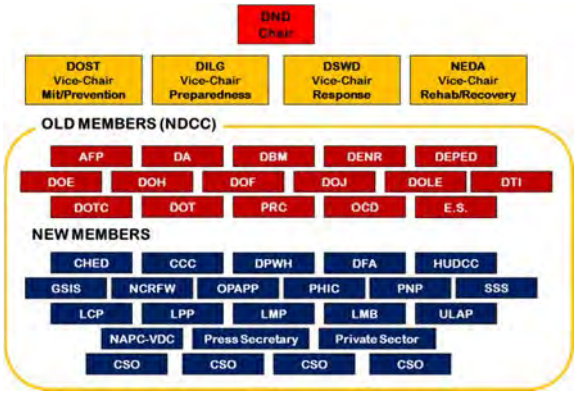
CHAPTER 3 DISASTER RISK REDUCTION AND MANAGEMENT

3.1 Disaster Risk Reduction System

3.1.1 Republic ACT 10121

In response to the phenomena of disasters and extreme events, the Philippine Government passed a major legislation: Philippine Disaster Risk Reduction and Management Act of 2010 or RA 10121. This act aims to transform the Philippines' disaster management system from disaster relief and response towards disaster risk reduction and management (DRRM). The National Disaster Risk Reduction and Management Council (NDRRMC) has been given the mandate to craft and implement the National DRRM Framework and Plan which utilizes the multi-hazard approach in managing the impact of natural and human-induced disasters.

RA 10121 supersedes the three-decade old Presidential Decree (PD) 1566, which established the National Disaster Coordinating Council (NDCC) and previous disaster risk management system in the Country, which was primarily focused on post-disaster response. In adherence to the Philippine Constitution and to international commitments, RA 10121 calls for the development of a National DRRM Framework that provides for a "comprehensive, all-hazards, multi-sectoral, inter-agency, and community-based approach to disaster risk reduction and management."



National DRRM Council (NDRRMC)

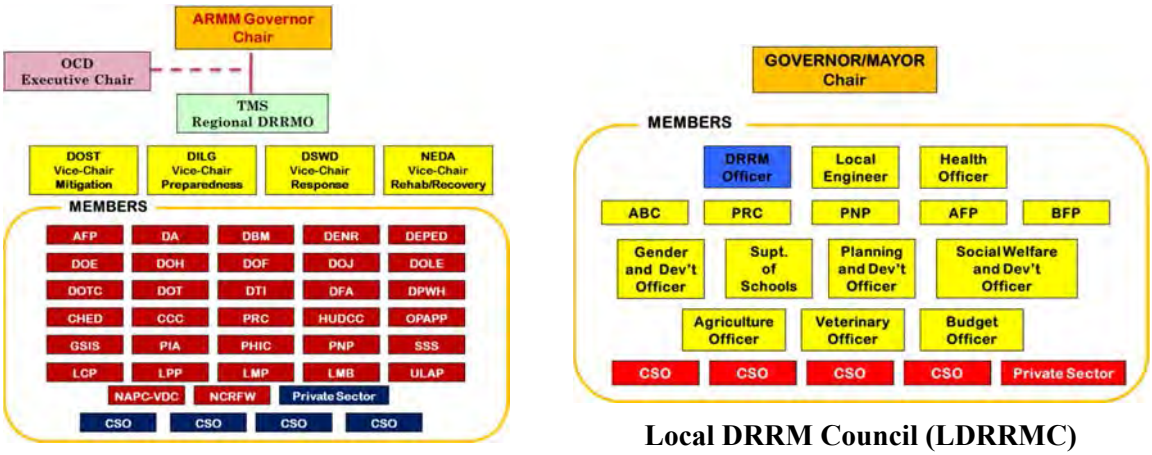
Figure 3.1 Organizational Chart of National DRRM Council

RA 10121 promotes a holistic approach to minimize the socio-economic and environmental impacts of disasters and to mainstream DRRM and climate change adaptation (CCA) into development processes. It encourages the involvement and participation of local communities, civil society organizations (CSOs), private sector, and volunteers to utilize their resources and facilities for the protection of life and preservation of properties.

RA 10121 has several salient provisions that underpin the long-term resilience of the Philippines to natural hazards. In terms of participation of stakeholders, the law expanded the membership of NDRRMC from the former NDCC set-up which was mainly composed of the government's line departments. NDRRMC is now composed of a Chairperson, four Vice- Chairpersons, and 39 members including representatives of four CSOs and one from the private sector as shown Figure 3.1. Corresponding to NDRRMC at the national level, DRRMCs were also organized at the Regional, Provincial, City and Municipal levels. Figure 3.2 presents the organizations of Regional and Local (City and Municipal) DRRMCs.

Another salient provision is the establishment of permanent Local DRRM Offices in every province, city, and municipality. The primary mandate of the Local DRRM Offices is to set the direction, development, implementation, and coordination of DRRM programs within their territorial jurisdictions.

Under RA 10121, the former Local Calamity Fund under PD 1566 is now known as the Local DRRM Fund (LDRRMF). Not less than 5% of the estimated revenues from regular sources will be set aside as the LDRRMF to support DRRM activities such as pre-disaster preparedness programs including training, purchasing life-saving rescue equipment, supplies, and medicines; post-disaster activities; and payment of premiums on calamity insurance. Of the amount appropriated for the LDRRMF, 30% will be allocated as quick response fund (QRF) or stand-by fund for relief and recovery programs in calamities, epidemics, or complex emergencies, which may be normalized as quickly as possible.



Regional DRRM Council, ARMM

Local DRRM Council (LDRRMC)

Figure 3.2 Organizational Structure of Regional and Local DRRM Councils

3.1.2 National DRRM Plan (NDRRMP) 2011–2028

NDRRMP fulfills the requirement of RA 10121 of 2010, which provides the legal basis for policies, plans and programs to deal with disasters. The plan covers four thematic areas (Figure 3.3), namely, 1) Disaster Prevention and Mitigation; 2) Disaster Preparedness; 3) Disaster Response; and 4) Disaster Rehabilitation and Recovery, which correspond to the structure of the National Disaster Risk Reduction and Management Council (NDRRMC). For each thematic area, a lead agency is designated as shown in Table 3.1. OCD is responsible for not only implementing NDRRMP but also ensuring that the physical framework and social, economic, and environmental plans for communities, cities, municipalities, and provinces are consistent with the plan.

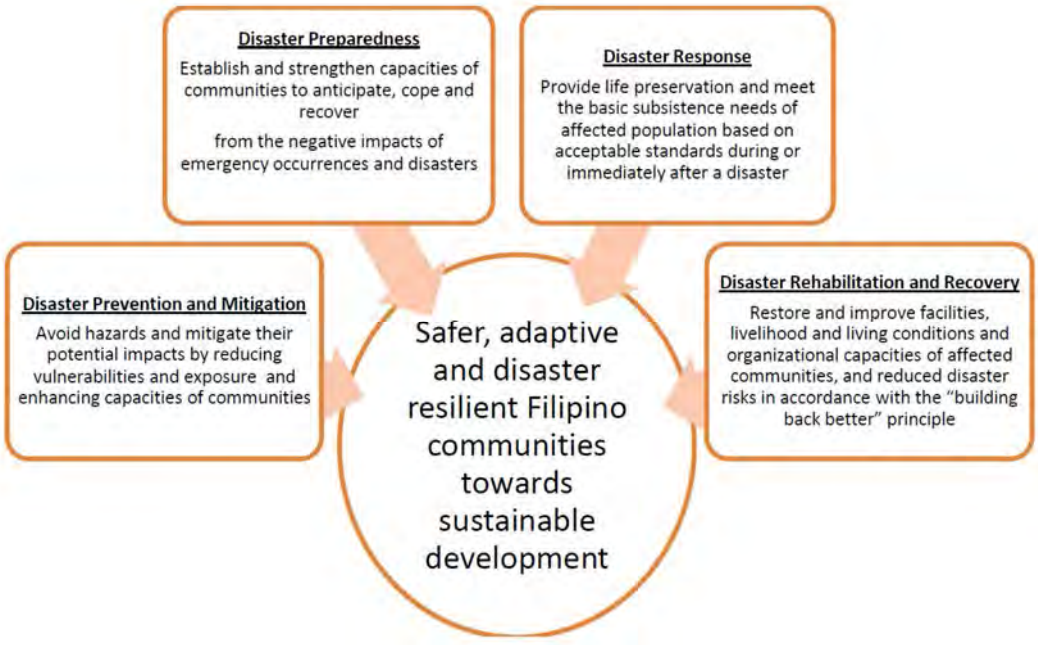


Figure 3.3 Four Thematic Areas of Philippine DRRM System

Table 3.1 Lead Agency, Outcome and Key Result Areas of Each Area of DRRM System

Area	Lead agency	Outcome	Key result area
Prevention and Mitigation	DOST	Avoid hazards and mitigate their potential impacts by reducing vulnerabilities and exposure and enhancing capacities of communities	- Mainstreamed and integrated DRR & CCA in national, sectoral, regional and local development, policies, plans, and budget. - DRRM & CCA-sensitive environmental management. - Increased disaster resiliency of infrastructure systems. - Community-based and scientific DRR & CCA assessment, mapping, analysis, and monitoring. - Risk transfer mechanisms
Preparedness	DILG	Establish and strengthen capacities of communities to anticipate, cope and recover from the negative impacts of emergency occurrences & disasters	- Community awareness and understanding of risk factors - Contingency planning at the local level (including incident command system, early warning systems, preemptive evacuation, stockpiling, and equipping) - Local drills and simulation exercises - National disaster response planning
Response	DSWD	Provide life preservation and meet the basic subsistence needs of affected population based on acceptable standards during or immediately after a disaster	- Damage and needs assessment - Relief operations - Search, rescue, and retrieval - Dissemination & sharing of disaster-related information - Water, sanitation, and health - Development & provision of temporary shelter - Mental & social support - Early recovery mechanism - Management of dead and missing - Evacuation management - Social protection intervention - Civil & uniformed services coordination
Rehabilitation & Recovery	NEDA	Restore and improve facilities, livelihood and living conditions and organizational capacities of affected communities, and reduced disaster risks in accordance with the *building back better* principle	- Livelihood - Shelter - Infrastructure

Source: NDRRMP 2011–2028.

3.1.3 Regional DRRM Plan 2012–2028

In accordance with NDRRMP, RDRRMP 2012–2018 was prepared to provide local authorities with ready options and priorities for actions. Disaster risk reduction and management can be highly effective when local authorities integrate DRRM measures and objectives in various aspects of local governance functions, responsibilities, and practices. This includes the systematic consideration of risk and risk reduction strategies and plans in ARMM such as regional development plans, food security and related human security strategies, environmental management strategies, integrated water resource management plans, and integrated coastal zone management plans.

ARMM RDRRMP intends to provide local LGUs with the knowledge and capacity necessary to effectively comply with the RA 10121, which requires the establishment of an LDRRM Office in every province, city, and municipality. Each LDRRM plan is implemented together with local partners and stakeholders.

The outline of ARMM RDRRMP is summarized in Table 3.2. For the four thematic areas, 24 outputs are proposed. According to the implementation timeline of RDRRMP, all the activities of the 24 outputs will be 100% completed by 2028. OCD-ARMM and ORG/TMS-ARMM are to submit to the Office of the ARMM Regional Governor through the Executive Secretary and the ARMM Regional Legislative Assembly (RLA), within the first quarter of the succeeding year, an annual report relating to the progress of the implementation of RDRRMP as part of the monitoring and evaluation system.

Table 3.2 ARMM Regional DRRM Plan

Area	Lead agency	Goal	Objectives	Outcomes	Lead agency
Prevention and Mitigation	DOST-ARMM	Avoid hazards and mitigate their potential impacts by reducing vulnerabilities and exposure and enhancing capacities of communities in the ARMM	Reduce vulnerability and exposure of communities to all hazards Enhance capacities of communities to reduce their own risks and cope with the impacts of all hazards	DRRM and CCA mainstreamed and integrated in regional, sectoral and local development policies, plans and budget	OCD-ARMM and ORG/TMS-ARMM
				DRRM and CCA-sensitive environmental management	DENR-ARMM
				Increased disaster resilience of infrastructure systems	DPWH-ARMM
				Community based and scientific DRRM and CCA assessment, mapping, analysis and monitoring are conducted and/or improved	OCD-ARMM & ORG/TMS-ARMM
				Communities have access to effective and applicable disaster risk financing and insurance	FBMS/ ORT-ARMM
				End-to-End monitoring system (monitoring and response), forecasting and early warning are established and/or improved	DOST-ARMM
Preparedness	DILG-ARMM	Establish and strengthen capacities of communities to anticipate, cope and recover from the negative impacts of emergency occurrences & disasters in the ARMM	Increase the level of awareness of the community to the threats and impacts of all hazards, risks and vulnerabilities Equip the community with the necessary skills to cope with the negative impacts of a disaster Increase the capacity of institutions Develop and implement comprehensive regional and local disaster preparedness policies, plans and systems Strengthen partnership among all key players and stakeholders Optimize utilization of capacity-building resources and match with the needs of the LGUs	Increased level of awareness and enhanced capacity of the community to the threats and impacts of all hazards	BPI-ARMM
				Communities are equipped with necessary skills and capability to cope with the impacts of disasters	DILG-ARMM /& OCD-ARMM
				Increased DRRM and CCA capacity of Local DRRM Councils and Offices	DILG-ARMM
				Developed and implemented comprehensive regional and local preparedness and response policies, plans, and systems	DILG-ARMM and OCD-ARMM
				Strengthened partnership and coordination among all key players and stakeholders	DILG-ARMM
Response	DSWD-ARMM	Provide life preservation and meet the basic subsistence needs of affected population based on acceptable standards during or immediately after a disaster in the ARMM	Decrease the number of preventable deaths and injuries Provide basic subsistence needs of affected population Immediately restore basic social service	Well-established disaster response operations	DSWD-ARMM
				Adequate and prompt assessment of needs and damages	OCD-ARMM and DSWD-ARMM
				Integrated and coordinated search, rescue, and retrieval (SRR) capacity	OCD-ARMM, DILG-ARMM, and DOH-ARMM
				Evacuated safely and on time affected communities	LGUs
				Temporary shelter needs are adequately addressed	DSWD-ARMM
				Basic health services provided to affected population whether inside or outside ECs	DOH-ARMM
				Mental and social wellbeing promoted and mental health problems and risks reduced	DOH-ARMM
				Coordinated, integrated system for early recovery implemented at the regional and local levels	DSWD-ARMM
Rehabilitation & Recovery	RPDO-ARMM	Restore and improve facilities, livelihood and living conditions and organizational capacities of affected communities, and reduced disaster risks in accordance with the building-back-better principle	Restore people's means of livelihood and continuity of economic activities and business Restore shelter and other buildings/installation Reconstruct infrastructure and other public utilities Assist in the physical and psychological rehabilitation of persons who suffered from the effects of disaster	Damages, losses, and needs Assessed	OCD-ARMM and ORG/TMS-ARMM
				Economic activities restored and, if possible, strengthened or expanded	PRDO
				DRRM/CCA elements incorporated in human settlement	HLURB-ARMM
				Disaster and climate change-resilient and infrastructure reconstructed	DPWH-ARMM
				A psychologically sound, safe, and secured citizenry that is protected from the effects of disasters able to restore to normal functioning after each disaster	DOH-ARMM and DSWD-ARMM

Source: ARMM Regional DRRM Plan.

3.1.4 DRRM practices

Since the RA 10121 was promulgated in January 2010, the DRRM system has been developed nationwide. Notwithstanding, the level of implementation and enforcement of the new system seems to still remain at its infantile stage.

Under the Mindanao River Basin Integrated Management and Development Master Plan study, key informant interviews were conducted with local heads from July to August of 2010. The results disclosed that risk information had been hardly available at the local level, and early warning systems and protocols on response were not clearly established. Only twelve of the forty municipalities (30%)

interviewed were able to provide copies of their respective preparedness and contingency plans. These, however, were either outdated or at the proposal stage. None had been approved by their respective local councils for appropriation. Table 3.3 provides a summary checklist of selected LGU disaster management plans.

Table 3.3 Summary of Checklist of Selected LGUs in MRB

Indicator No.	Province/City	Maguindanao	Maguindanao	S. Cotabato	S. Cotabato	S. Cotabato	Sultan Kudarat	Sarangani	General Santos City	Sarangani	Buukidon	Bukidon	Sultan Kudarat
	Municipality/City	Buluan*	Datu Paglas*	Koronadal City	Tampakan	Tupi	Bagumbayan	Alabel		Malungon	Maramag	Malaybalay City	Esperanza
1	Preparedness												
1.1	Vulnerability Assessment			++	++	++	++				+	++	
1.2	Planning	+	+	++	++	++	+	++		++	++	++	
1.3	Institutional framework		+	++	++	++	++	++	++			++	+
1.4	Information System				++								
1.5	Resource base		+	++	++	++		++			++		
1.6	Warning systems			++			++		++		++		
1.7	Response mechanism		+	++		++		++					
1,8	Public education training			++	++	++		++	++		++	++	
1.9	Rehearsals												
2	Mitigation												
2.1	Engineering			++									
2.2	Spatial Planning	+											
2.3	Economic												
2.4	Management and institution			++			++						
2.5	Societal												
2.6	Conflict resolution					++		++					
2.7	Timing												
2.8	Political												
2.9	Long-term development efforts			++			++					++	
3	Reconstruction and rehabilitation												
3.1	Damage assessment			++	++	++					+		
3.2	Capacities assessment			+	++		++	++					
3.3	Institutional arrangement			+					++				
3.4	Income generation activities												
3.5	Community organization	+		++	++	++	++	++					
3.6	Capital resources										++		
3.7	Planning/phasing of activities					++		++					
3.8	Timing												
3.9	Emergency settlement	+		++				++					
4.	Response												
4.1	Protocol			++									
4.2	Quick response mechanism								++				
4.3	Relief resources	+									++		

Note: + Mentioned in general term; ++ Specific activities identified; +++ with concrete programs/projects with funding/approved by Sanggunian; ++++ Links risk assessment to planning and with approved budget; Not present if not indicated; * located in BCT.

Source: MRBIMDMP.

The above-mentioned information might be already too old as the interviews were made in 2010, five years ago. A JICA capacity development project, the Autonomous Region in Muslim Mindanao (ARMM) Human Resource Development Project was implemented between May 19, 2008 and March 31, 2011. DPWH-ARMM staff were trained in skills of flood control study under the infrastructure development course of the project. Therefore, some improvement might have been made in this aspect at least.

As described in the Final Report of the Disaster Risk Reduction and Management Capacity Enhancement Project (DRRMCEP) of JICA (March 2015), however, the percentage of LGUs that have submitted their Local DRRM Plans was only 50% for ARMM as of December 2014, the lowest among the 16 regions of which average was 90%. As for the establishment of the Regional DRRM Office (RDRRMO) and the Humanitarian Emergency Action Response Team (HEART), there may be still

some lacking in the capacity building efforts aside from the numerous training workshops and drills that are being implemented by the OCD-ARMM.

Officials of OCD-ARMM were interviewed by the JICA Study Team about issues toward the improvement of the present DRRM system. The OCD-ARMM officials pointed out following three issues that should be tackled urgently:

1) Poor knowledge of local people on disasters (for example most of local people do not understand storm surge),
2) Poor consideration of disaster risk in land use planning, and
3) Dependence of DRRM activities at local levels upon the awareness of the municipal mayor.

3.2 Ongoing and Proposed Flood Control Projects

3.2.1 General

To cope with flood problems described in the previous chapter, the Government of Philippines has been making efforts by implementing flood control and DRRM projects/programs. Following are ongoing, and proposed ones in the Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP) and the Integrated River Basin Management and Development Master Plan for Lanao (Agus) River Basin (IRBMDMPR):

3.2.2 Ongoing flood control projects in BCT

This is a challenging plan for the BCT, of which total cost is more than PHP 9 billion, to implement several flood control projects/programs starting from 2014. Most of them are national projects by DPWH, of which prefeasibility and/or feasibility studies were conducted as high-impact projects in the MRBIMDMP study except for the Baloi Plains Flood Control Projects, as shown in Table 3.4. The others are small shore protection, flood control and drainage projects to be implemented by DPWH-ARMM, of which project costs are PHP 5 to 10 million. These national projects are supposed to be implemented through the DPWH Regional Office XII.

According to the DPWH Central Office, detailed engineering design (DED) of the Baloi Plains Flood Control Project was already completed, and the DED for other major projects in the Mindanao River basin will start very soon. According to an official of DPWH, the major national projects are supposed to be funded by national funds, but there is still a room for ODA as the total necessary budget as much as PHP 9 billion has not be secured yet. In case of ODA application, however, the project implementation will be considerably delayed.

Table 3.4 Major Flood Control Projects for BDP Phase 1

No.	River (Province)	Project	Project component	Cost (PHP mil.)
1	Rio Grande de Mindanao and Tamontaka River (Maguindanao/Cotabato City)	Rio Grande de Mindanao Flood Control System	- Dredging with land reclamation/spoil-banking: 2,227,000 m^3 for Rio Grande de Mindanao - Repair and construction of Rio Grande de Mindanao, Tamontaka protective pocket dike	3,151
2	Buluan River (Maguindanao)	Buluan River Flood Control System	Clearing of water hyacinth and river improvement works	1,288
3	Pulangi River (Maguindanao)	Pulangi River Flood Control System	Repair of Tunggol Bridge, construction of cut-off channel, parallel dikes, Tunggol Bridge extension, repair of other bridges	673
4	Ambal-Symuay River (Maguindanao)	Ambal-Symuay River Flood Control System	River improvement works (widening of cut-off channel, construction of multi-purpose structure and 6 km dike)	1,634
5	Allah River (Maguindanao)	Allah River Flood Control System	Delineation of Allah River following its original course (construction of 3km dike and evacuation centers)	743
6	Agus River (Lanao del Sur)	Balo-i Plains Flood Control Project	Construction of 14.3 km dike, bank protection works, and dredging, etc.	1,900
			Total	9,389

Although pre-feasibility and feasibility studies have been conducted on these projects, they are at a rudimentary level by international standards in terms of the following:

- The pre-feasibility and feasibility studies are based on topographic information of coarse resolution;
- Hydrological and hydraulic analysis models were not validated with actual observation data;
- A basin-wide point of view including effects of the marsh areas and sediment supply from the upstream was lacking; and
- The contents of the projects were already considerably modified but review studies have not been conducted yet.

Therefore, they still remain pre-mature, and need to be reviewed. It is strongly recommended that the long-term and overall projects be reviewed with a basin-wide point of view.

3.2.3 Flood forecasting and warning system by PAGASA

PAGASA is the duly mandated agency to operate 98% of all hydro-meteorological observation networks in the Country. It issues all official forecast, warnings, advisories, outlooks, and press releases on severe weather and extreme events such as tropical cyclones, floods, droughts/dry spell, and El Niño/La Niña. Currently PAGASA is operating flood forecasting and warning system in five river basins out of the 18 major river basins in the Philippines, and has an intention to expand the system over the remaining 13 major river basins including the Mindanao River Basin.

In the MRBIMDMP a pre-feasibility study on the development of early warning and flood forecasting project, which is to be undertaken by PAGASA, was conducted. The study proposed a flood forecasting and warning system consisting of three zones, namely, (1) Data Collection Zone, (2) Command Zone, and (3) Warning Recipient Zone (Table 3.5). The project is planned to be implemented in two phases, taking into account constraints of finance and capacity of operators. In the first phase data collection and warning dissemination will be made manually through a short message system (SMS) by cellular phone, and full automation by introducing telemeter system and warning dissemination through Internet will be in the second phase. The total cost was estimated at about PHP 2.0 million.

Table 3.5 Proposed Flood Forecasting and Warning System

Component	Contents
1. Data Collection Zone	A total of 13 stations are proposed in the Mindanao River Basin. Rainfall heights are measured and transmitted manually during Phase I while they will be converted into telemetered stations in Phase II.
2. Command Zone	One comand center is proposed at CDRRMC Cotabato City, and four sub-command cnters are proposed at PDRRMCs of Maguindanao, Sultan Kudarat, South Cotabato and Cotaboto Provinces. The command center center will receive the rainfall data tai are stord in the database of the flood simulation model. During high rainfall event, visualization module of the simulation model will be activated to forecast the probable areas to be flooded based on the rainfall data. If there are places found to be flooded, a warning bulletin will be sent to their respective sub- command centers. The sub-command centers then will transmit the text message to probable affected warning recipient zones.
3. Warning Recipient Zone.	As warning recipients, 17 municipalities in Maguindanao, 12 municipalities in North Cotabato, 1 city in South Cotabato and 5 municipalities in Sultan Kudarat are proposed.

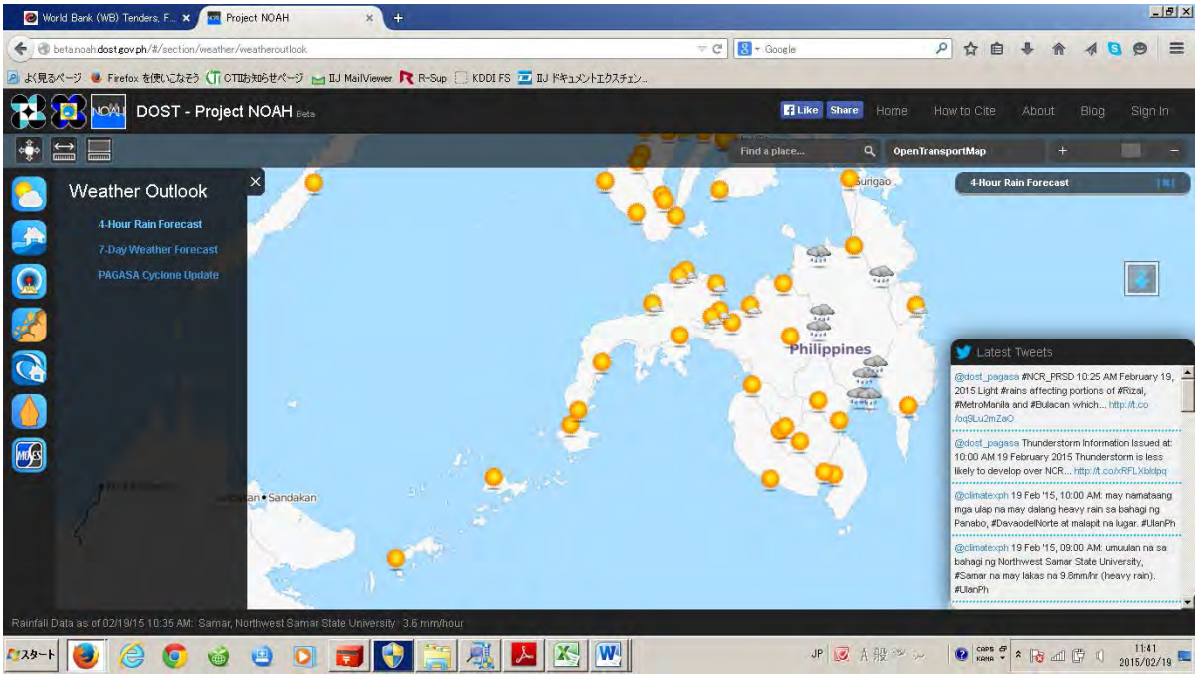
Source: MRBIMDMP.

On the other hand the Project NOAH has commenced in 2012 under the initiative of DOST- Advanced Science and Technology Institute (ASTI), and telemetry system based on SMS is being constructed in the Mindanao River Basin, too, as described in the following section. Coordination or integration with the Project-NOAH will be a challenge for the realization of the flood forecasting and warning system for the Mindanao River Basin to avoid duplication of investment.

3.2.4 Project NOAH

The Project NOAH, launched in July 2012, is a responsive disaster management program that makes use of advanced scientific research and cutting edge technology to reduce risks in highly vulnerable communities. This project has been executed by DOST with the participation of a variety of related

governmental and non-governmental organizations and donors including PAGASA, DOST, PHIVOLCS, the University of the Philippines, DILG, MMDA, DENR, DPWH, NDRRMC-OCD, Smart Communications, Inc., SUN Cellular, Google Crisis Response, Petron, Life So Mandane (www.lifesomundane.net), Rotary Club of Pinamalayan Central, World Bank, USAID, and GiZ.



Source: http://beta.noah.dost.gov.ph/

Figure 3.4 NOAH Website

The Project NOAH envisions a disaster-free Philippines where communities are empowered through open access to accurate, reliable and timely hazard and risk information, and has following missions:

- To develop high-resolution hazard maps for various types of natural hazards using frontier science and cutting-edge technology;
- To undertake investigations in meteorological and geological hazards to improve the Country's capability to prevent and mitigate the potentially disastrous impacts of natural hazards;
- To systematically simulate, validate, and improve geo-hazard maps;
- To integrate and assist other agencies in identifying meteorological and geological hazards with the ultimate objective of promoting safety in communities affected by natural hazards; and
- To collaborate with similar institutions or organizations, both national and international, in furtherance of the above purposes.

The Project NOAH has nine components, and the progress of each of the components related to the BCT is summarized as shown in Table 3.6.

One of the most important benefits of the Project NOAH is mapping of high resolution that is based on the LiDAR survey data with 50 cm horizontal and 20 cm vertical resolution for more important areas as well as the IFSAR survey data by NAMRIA with 5 m horizontal and 1m vertical resolution. These detailed maps will be practically useful for investigation of evacuation routes and places and land use planning that are difficult with the existing MGB susceptibility maps that are based on 1/50,000 NAMRIA maps. On the other hand, the NOAH maps have a weak point, too. They are not subject to validation with observed data during past disasters such as flood marks and landslide areas. Therefore, they still might include a certain error in terms of accuracy, and should be improved and updated at every disaster event through validation with observed information.

The next challenges might be maintenance of the equipment and systems, and dissemination of the project products to local governments and communities. Especially the maintenance problem is urgent. One third of the devices installed in ARMM in 2014 were already out of order. According to Dr.

Alfredo Mahar A. Lagmay, the director of the project, the NOAH systems have been developed by university researchers, and since these researchers are not able to be engaged in the maintenance work, the developed equipment and systems should be taken over to an agency such as PAGASA. However, it has not been decided yet.

Another problem is the dissemination of the project products. If they are not practically used by the local governments and communities, the technically advanced project might fail finally. The Project should be integrated in the DRRM activities of the local governments and communities.

Table 3.6 Progress of Project NOAH for BCT as of February 2015

No.	Component	Present status	Remarks
1	Distribution of hydro-meteorological devices: installation of automated rain gauges and water level monitoring station	45 devices (automated rainfall gauges, weather censors, water level censors, etc.) were installed in 2014, However, 14 of the 45 devices are inactive already. Observed data by the devices can be monitored on the web-site. DOST-ARMM has requested another 76 devices for 2015.	SMS (Short Message Services) is used for data transmission
2	Disaster Risk Exposure Assessment for Mitigation – Light Detection and Ranging (DREAM-LiDAR) Project: generation of accurate flood inundation and hazard maps;	LiDAR (light detection and ranging) survey of some 700 km^2 and bathymetry survey for some 50 km stretch of the most downstream area of the Mindanao River Basin were conducted. Flood inundation and hazard maps are being prepared for Mindanao River Basin	These hazard maps by this component are being developed by applying numerical models over precise IFSAR (Interferometric Synthetic Aperture Radar) survey data by NAMRIA in addition to the LiDAR and the bathymetry survey data, and are different from flood, and landslide susceptibility maps by MGB that were based on topographical analyses of 1/50,000 and filed investigation.
3	Enhancing Geohazards Mapping through LIDAR: identification of areas prone to landslides	Maps of landslide areas can be accessed on the NOAH web-site.	Analysis was based on results of IFSAR (Interferometric Synthetic Aperture Radar) survey by NAMRIA These maps by the NOAH project and landslide susceptibility maps by MGB are being separately prepared.
4	Coastal Hazards and Storm Surge Assessment and Mitigation (CHASSAM): establishment of wave surge, wave refraction, and coastal circulation models	Modelling of storm surge were finished. Validation is being done.	Analysis was based on results of IFSAR (Interferometric Synthetic Aperture Radar) survey by NAMRIA
5	Flood Information Network (FloodNET) Project: formulation of flood early warning systems	Forecasted rainfall can be accessed on the NOAH web-site. Flood forecasting models for main rivers have been established, but have not been in use for operation yet due to insufficient computer capacity.	
6	Local Development of Doppler Radar Systems (LaDDeRS): development of local capacity to design, fabricate, and operate sub-systems of Doppler radars;	Rainfall of Tampakan Doppler radar that covers the mainland of BCT can be seen on the NOAH website. This information is used for weather and rain forecasting.	
7	Landslide Sensors Development Project: development of early monitoring and warning system for landslides	BTC is out of the target areas. (No censor has been installed in BCT.	
8	Hazards Information Media: Strategic communication intervention and disaster managing using WebGIS	Weather hazard information can be accessed on the NOAH Website.	
9	Weather Information Integration for System Enhancement(WISE): Enhancement of the weather predicting capabilities of the country by using High-Performance Computing (HPC) and smart analytics,	Weather prediction can be accessed on the NOAH web-site.	

Sources: DOST-ARMM, PAGASA, and UP.

3.2.5 Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP)

The Mindanao River basin is the second largest river basin in the Philippines with the catchment area of 21,503 km^2 which pours to the Illana Bay through Central and Southern Mindanao. Major rivers within the basin include the Allah River, traversing the Allah Valley in the south, the Pulangi River with headwater from Bukidnon; the Ambal-Simuay River System originating from Lanao del Sur, and the Mindanao and Tamontaka Rivers in the lowest part of the river basin. There are three huge marshes, Ligawasan, Ebpanan and Libungan, in the central and lower parts of the basin, which act as natural storages to attenuate large flows including several lakes. Before entering Cotabato City, the Mindanao River bifurcates into the Rio Grande de Mindanao and the Tamontaka Rivers. The river basin extends over two Provinces of Maguindanao and Lanao del Sur of ARMM, a province of Bukidnon of Region X, a province of Davao del Norte of Region XI, and three provinces of Sultan Kudarat, Cotabato and South Cotabato, and Cotabato City of Region XII.

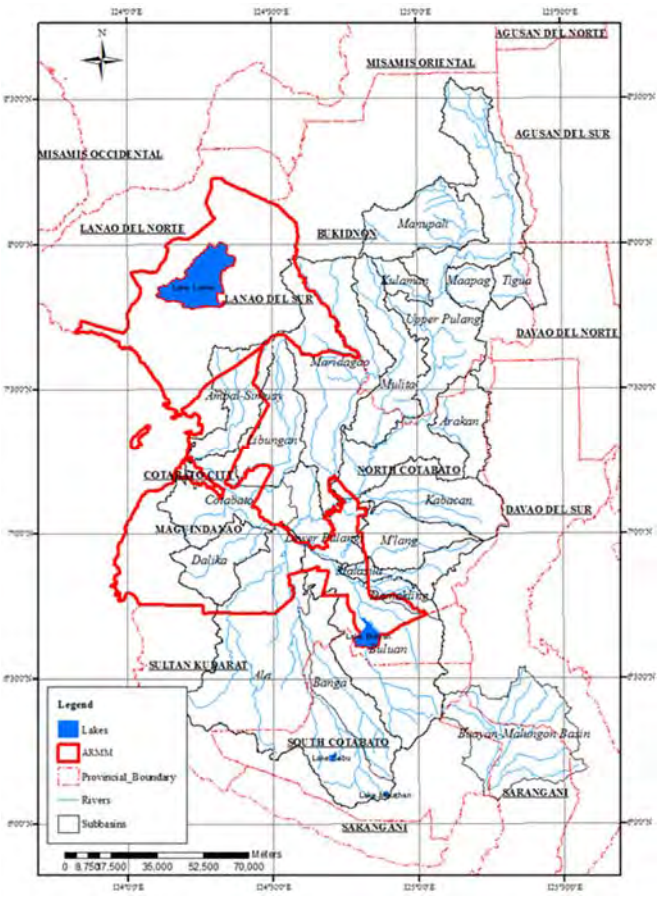


Figure 3.5 Mindanao River Basin

The Mindanao River Basin Integrated Management and Development Project Master Plan (MRBIMDMP) was prepared by a local consultant firm, Woodfields Consultants, Inc. in 2012. The plan aimed to determine the specific causes of the physical deterioration of the basin, and to formulate a master plan that would provide the blue print for a balanced development approach for the basin area through sound water resources development and management practices, although specific contents of the project components were considerably modified from the original ones in the MRBIMDMP.

As part of outputs of the master plan study, a variety of flood control and DRRM projects/programs were proposed as shown in Table 3.7. They cover non-structural measures as well as structural ones. As mentioned in the previous section, the first seven projects in the table have already entered into their preparation process, although the contents of the project components were considerably modified.

In addition, long-term, overall flood control projects were also proposed for the Rio Grande de Mindanao, Allah, Pulangi River systems. However, neither pre-feasibility study nor feasibility has been conducted yet. Only conceptual illustrations are presented.

Table 3.7 MRBIMDMP Development Matrix for Flood and Disaster Risk Management

Development Vision	A Mindanao River Basin that is a sustainable area of peace and development where all stakeholders, striving as active collaborators and competent stewards of the Almighty Creator, adhere to the judicious use of its natural resources to enjoy nondiscriminatory socio-economic growth, human development and ecological balance that is inclusive for all and without aggression to anyone or anything.
Development Goal	Ensure a focused, comprehensive and integrated development and management of the Mindanao River Basin that would prevent, mitigate and protect its stakeholders from any calamities and disaster risks, and facilitate the attainment of sustainable development.
Development Issues & Challenges	Increasing occurrence and worsening effects of floods, and risks from other natural hazards.

Goals	Objectives	Strategies	Program/Project/Activity	Status (as of Feb. 2015)
Strengthened flood and other disaster risk management through increased cooperation and partnership with local government units and other stakeholders towards building safe and resilient communities.	To develop, implement and maintain a flood control management system in active collaboration with concerned national and local stakeholders	Adoption of an integrated flood management approach	Integrated Flood Control, River Bank Protection and Rehabilitation of Ambal-Simuay River System	FS completed. DED to start soon
			Siltation Control and Management for Rio Grande de Mindanao System	FS completed. DED to start soon
			Siltation Control and Management for Allah River System	FS completed. DED to start soon
			Siltation Control and Management for Buayan-Malungon River System*	FS completed. DED to start soon
			Integrated Flood Control, River Bank Protection and Rehabilitation of Rio Grande de Mindanao System	Pre-FS completed. DED to start soon
			Integrated Flood Control, River Bank Protection and Rehabilitation of Allah River System	Pre-FS completed. DED to start soon
			Integrated Flood Control, River Bank Protection and Rehabilitation of Pulangi System	Pre-FS completed. DED to start soon
			Integrated Flood Control, River Bank Protection and Rehabilitation of Buayan-Malungon River System*	Pre-FS completed.
			Early Warning and Flood Forecasting System for the MRB and BMRB*	Pre-FS completed.
			Dendro-Thermal Power	Pre-FS completed.
			Implementation of thematic development plans and projects for watershed management, wetland management, water resource management & development, human development and creation of the MRBA*	
			Establishment of a technical coordinating sub-unit within the proposed MRB-DRRM Technical Committee focusing on Integrated Flood Management.	
		Basin-wide risk assessment and monitoring	Establishment of a basin-wide multi-hazard early warning and forecasting system	
			Establishment of a basin-wide knowledge management center on disaster risk management	
		Strengthen disaster preparedness	Establishment of an MRBA*-DRRM Technical Committee	
			Acquire necessary equipment and facilities on rescue/response to support LGUs in managing disaster emergency situations	
			Design and conduct series of training-workshops on preparedness and contingency planning	
			Preparation and implementation of a basin-wide community-oriented	
			IEC campaign on climate change and disaster risk reduction	
		Capacity development for LGUs and other basin stakeholders	Creation/organization of instructors and trainers on disaster risk assessment (hazard characterization, frequency analysis, consequence analysis, risk estimation, risk evaluation and GIS) to support/augment local initiatives	
			Creation of a pool of experts from the academe/industry for scientific research on hazards and risks that will provide specialized advice to LGUs and other basin stakeholders	
		Mainstream DRRM	Preparation and implementation of an	

Goals	Objectives	Strategies	Program/Project/Activity	Status (as of Feb. 2015)
		and CCA in all development policies, programs and plans of sub-national government agencies, LGUs and other basin stakeholders	MRB disaster risk management comprehensive resource development plan	
			Monitoring and evaluation system on DRRM and CCA mainstreaming efficacy by the MRBA	

*Buayan-Malungon River Basin (BMRB), allied river basin of MRB, located in Regions XI and XII.

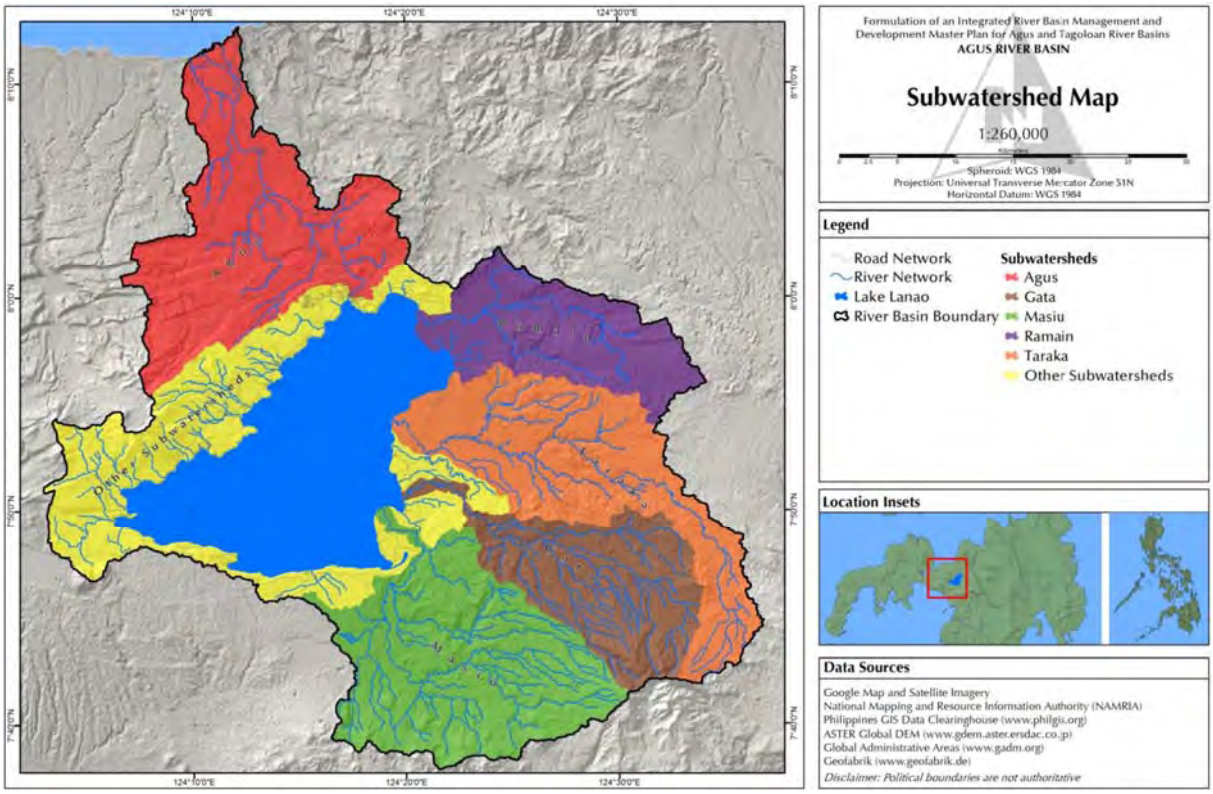
3.2.6 Integrated River Basin Management and Development Master Plan for Lanao (Agus) River Basin (IRBMPRRB)

The Lanao (Agus) River basin is one of the 18 major river basins in the Philippines. The total catchment area is 1,987 km^2 consisting of five major sub-basins namely, Agus, Gata, Masiu, Ramain, and Taraka (Figure 3.6). All the major sub-basins except for the Agus River supply water to the Lake Lanao. The Agus River serves as the drainage of the Lake Lanao, and is famous for a cascade hydropower generation system where water from the Lake Lanao is regulated and released to the Agus River through the Agus I regulation dam in Marawi City. Of the Lanao (Agus) River basin catchment area, 89% is under the administrative jurisdiction of Lanao del Sur Province of ARMM, while 11% is part of Lanao del Norte of Region X.

The Integrated River Basin Management and Development Master Plan for Lanao (Agus) River Basin (IRBMPRRB) was completed by the College of Forestry and Natural Resources of the University of the Philippines Los Banos in January 2015. The master plan study aimed to formulate an Integrated River Basin Management and Development Master Plan for the Lanao (Agus) River basin, which addresses concerns on 1) water resources management, 2) watershed management, 3) flood control/mitigation and disaster risk reduction management and hazard management, 4) river and river delta management, 5) coastal and fresh water resources management, 6) biodiversity conservation, 7) climate change adaptation and mitigation, 8) mineral resources management, 9) sustainable management through community participation, 10) economic development, and 12) institutional linkages and organizational structure for river basin management.

According to the flood and landslide susceptibility map by MGB (Figure 2.2), flood-prone areas cover about 10% of the total catchment area. The Ramain and Taraka sub-basins and the other sub-basins surrounding the Lake Lanao are more susceptible to flooding. The Gata sub-basin is the most susceptible to landslide.

With a development objective to establish a flood-free Lanao (Agus) River basin, several structural and non-structural flood control, disaster risk reduction and management, and climate change adaptation projects and programs were proposed as shown in Table 3.8. It is considered that these projects and programs were elaborated mainly through various stakeholders during a series of consultations and meetings. However, engineering studies have not been conducted to formulate such projects or programs. Thus, the proposed projects/programs should be regarded as conceptual ones.



Source: IRBMPRRB.

Figure 3.6 Lanao (Agus) River Basin

Table 3.8 Proposed Projects for Disaster Risk Reduction and Climate Change Adaptation Program

Programs/Projects	Location	Implementing Agency	Total Estimated Cost (PHP mil.)	Expected Source of Fund
Installation, Operation and Maintenance of Weather Monitoring Stations	Marawi city, Iligan City	RBCO, DOST, DENR	35	ODA, GOP
Establishment of early flood warning system	IliganC ity, Ramain, Taraka, Gata and Malaig	RBCO, DOST, DENR	25	GOP, ODA
Construction, operation and maintenance of smart flood control structure	Iligan City, Ramain, Taraka, Gata and Malaig	DPWH	300	GOP, ODA, PPP
River Channelization	Ramain, Taraka, Gata and Malaig	DPWH	150	GOP, ODA, PPP
Development of high resolution flood model and flood Hazard Maps of Lanao River Basin	Lanao River Basin	DREAM, DENR	10	ODA, DOST, DENR
Capacity Development of LGUs on DRR and CCA	39 cities and municipalities inside the Lanao River Basin	LGUs, DILG, CCC, DENR, DA, DOH, DOST, DPWH, DOE	642	Grant, Loan, Presidential Support Fund (PSF)
Rapid Visual Vulnerability Assessment of Structures	Iligan City, Marawi City	DOST, DPWH	15	GOP, ODA
Seismic Hazard and Risk Mitigation Planning	Iligan City, Ramain, Taraka, Gata and Malaig	DOST, DPWH	20	GOP, ODA
		Total	1,197	

CHAPTER 4 PROPOSED PROJECTS FOR BDP

4.1 Proposed Projects

As projects under the Enhanced Resources Management Initiative, the following two projects are proposed for the river and flood control sector:

1) Mindanao River Basin Integrated Flood Management Project (MRBIFMP), and
2) Bangsamoro Disaster Risk Reduction and Management Project (Bangsamoro DRRMP)

4.2 Mindanao River Basin Integrated Flood Management Project

As part of output of the Mindanao River Basin Integrated Management and Development Master Plan (MRBIMDMP), a variety of flood control and DRRM projects and programs were proposed. They cover structural measures as well as non-structural ones. Five of these flood control projects, which correspond to the five sub-projects (SP-2 to SP-6) in Table 4.1, are now about to be subjected to DED.

However, the master plan has to be regarded as a conceptual plan, especially on the flood control aspect, for the following reasons:

- Hydrological and hydraulic analysis models were not validated with actual observation data;
- The study was based on coarse geo- and topo-graphic information; and
- A basin-wide point of view including effects of the marsh areas and sediment supply from the upstream was lacking.

Under these circumstances, the Mindanao River Basin Integrated Flood Management Project (MRBIFMP) aims to comprehensively deal with the flood problems in the Mindanao River Basin, composed of the eight sub-projects listed in Table 4.1.

Table 4.1 Eight Sub-Projects of Mindanao River Basin Integrated Flood Management

No.	Sub-project	Status
SP-1	Comprehensive Study on Flood Control for Mindanao River Basin	
SP-2	Rio Grande de Mindanao and Tamontaka Rivers Flood Control Systems	Ongoing
SP-3	Buluan River Flood Control System	Ongoing
SP-4	Pulangi River Flood Control System including Repair of Tunggol Bridge	Ongoing
SP-5	Ambal-Simuay River Flood Control	Ongoing
SP-6	Ala River Flood Control System	Ongoing
SP-7	Mindanao River Basin Flood Forecasting and Warning System	Pre-feasibility study
SP-8	Mindanao River Basin Urgent Flood and Sediment Control Project	

The most important sub-project is SP-1: Comprehensive Study on Flood Control for Mindanao River Basin. The comprehensive study aims to formulate an overall flood control plan including flood forecasting and warning system, paying special attentions to validation of hydrological and hydraulic models with observed data, river morphology, sediment balance, retarding effects of the marsh areas, utilization of products of recent related projects, climate change adaptation, etc. The five ongoing sub-projects (SP-2 to SP-6), which is supposed to be implemented soon, will be reviewed under the comprehensive study. If these projects are found insufficient or inappropriate for the expected effects, supplemental/additional works for filling in the gaps will be planned under the study, and further might be implemented as high-priority projects under SP-8.

The project profiles are presented in the Project Report, and the terms of reference for SP-1 are also presented in the Project Report.

4.3 Bangsamoro Disaster Risk Reduction and Management Project

The proposed Bangsamoro Core Territory or the Bangsamoro region comprises the present Autonomous Region of Muslim Mindanao's five component provinces of Maguindanao, Lanao de Sur, Basilan, Sulu and Tawi-Tawi alongside two cities and the expansion areas of at least six municipalities in Lanao de Norte Province, 39 barangays in North Cotabato Province, together with the chartered city of Cotabato and Isabela City, located in Central and Western Mindanao. The total land area is approximately 15,000 km^2 with a population of about 4 million as of 2010.

Similar to other regions in the Philippines, the Bangsamoro region is exposed to many types of hazards. Floods and storm surges have been most frequently occurring. Due to its geography and geology, there is a high level of exposure to earthquake, tsunami and landslide. The periodic El Nino southern oscillation is likely to bring drought in the vast agricultural lands in Maguindanao Province. A number of active volcanoes that can be found in Sulu, Lanao de Sur, Bukidnon, and South Cotabato Provinces likewise trigger constant threats to its communities.

Meanwhile, the DRRM Act of 2010 (RA 10121) has shifted its DRRM policies from a reactive to a proactive approach. The ARMM Regional DRRM Plan 2012–2028 (RDRRMP) has been prepared to guide local authorities to effectively comply with the DRRM Act, in which one of the prioritized DRRM activities described in the NDRRMP and the RDRRMP, the capacity development of LGUs, has been strongly emphasized. Further, to implement the DRRM activities efficiently under the new approach, the needs for preparing various plans as well as establishing and strengthening the capabilities of related agencies have been rapidly increasing.

Following the current undertakings, the ongoing DRRM efforts in the ARMM territory may 'have not' been progressed well, and are still far behind the time frame proposed in the RDRRMP. As described in the Final Report of the Disaster Risk Reduction and Management Capacity Enhancement Project (DRRMCEP) of JICA dated March 2015, the percentage of LGUs that have submitted their Local DRRM Plans was only 50% for ARMM as of December 2014, the lowest among the 16 regions of which average was 90%. As for the establishment of the Regional DRRM Office (RDRRMO) and the Humanitarian Emergency Action Response Team (HEART), there may still be some deficiencies in the capacity building efforts despite numerous training workshops and drills that are being implemented by the OCD-ARMM.

DRRM efforts at the national level have been progressed gradually on the other hand. JICA implemented the DRRMCEP between 2012 and 2015 to further strengthen the capacity for DRRM of OCD. The JICA project developed a variety of training modules, regional and local DDRM plans of selected regions and LGUs, monitoring and evaluation tools, National Disaster Response Plans for hydro-meteorological, earthquake and tsunami which are definitely useful as references, guides or prototypes for the DRRM activities at all levels.

The Bangsamoro Disaster Risk Reduction and Management Project (Bangsamoro DRRMP) aims to improve the DRRM activities at the regional to the barangay levels in the new Bangsamoro by utilizing fruits of the above-mentioned recent efforts at the maximum so that substantial DRRM activities could be launched as soon as possible. The project features are summarized in Table 4.2, and the detailed project profile with the project design matrix is presented in the Project Report.

Table 4.2 Features of Bangsamoro Disaster Risk Reduction and Management Project

Project Title	Bangsamoro Disaster Risk Reduction And Management Project (Bangsamoro DRRM Project)
Goal	To improved DRRM activities in Bangsamoro
Project Purpose	Substantial DRRM activities are launched in the Bangsamoro region
Expected Outputs	Output 1: DRRM activities at the Bangsamoro region level are improved. Output 2: DRRM activities at the LGU level are improved. Output 3: DRRM training system and program for all levels from region to barangay is developed. Output 4: Model Early Warning Systems (EWSs) are developed in the pilot LGUs
Project Area	Bangsamoro Core Territory (Bangsamoro Region)
Executing Agencies	OCD, Bangsamoro Government, LGUs
Project Period	4 years
Project Cost	USD 3 million

Comprehensive Capacity Development Project for the Bangsamoro

Development Plan for the Bangsamoro

Final Report

Sector Report 2-5: Power Policy

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Abbreviations, Unit of Measurement, and Currency

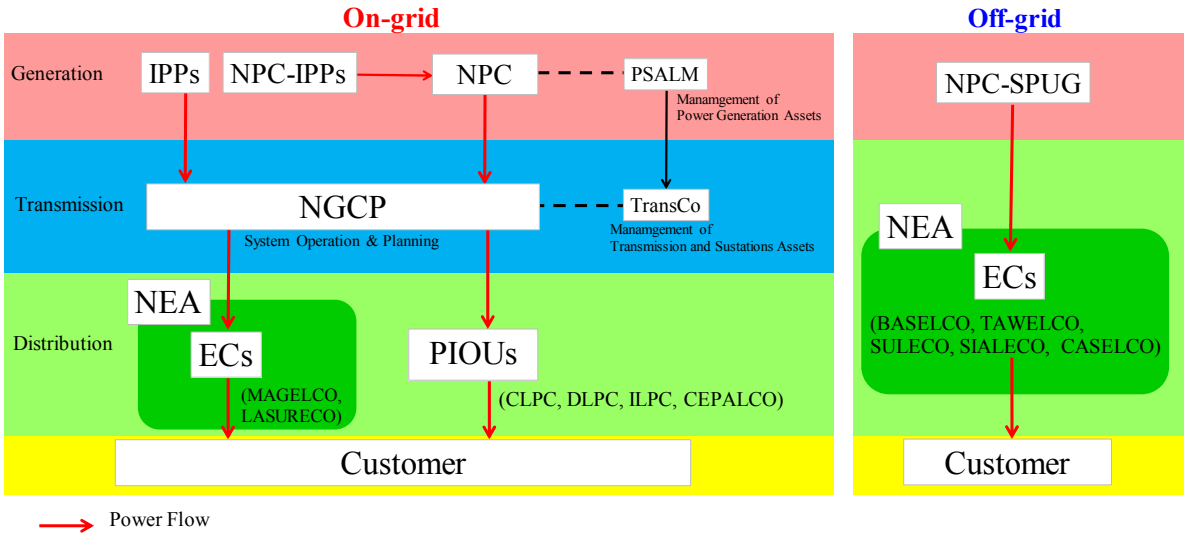
(Refer to Sector Report 2-1: Road Transport, pp. 1-v through 1-x.)

CHAPTER 1 CURRENT SITUATION OF MINDANAO POWER SECTOR

1.1 Structure of Power Sector

As of January 2015, the power sector in the Republic of the Philippines is divided into power generation, power transmission, and power distribution business fields respectively, where the national and private power operators are coexisting as power suppliers playing roles in supplying power. The conceptual diagram of the power business structure is shown in Figure 1.1.

In Mindanao, the contract of the electricity transaction between generation companies and distribution companies or customers is based mainly on a bilateral arrangement. On the other hand, the electricity transaction is conducted through wholesale power trading market with the exception of a bilateral contract in the Luzon and Visayas regions. In Mindanao, the Interim Mindanao Electric Market (IMEM), which is a mandatory program for all generation capacities, customers with embedded generation, and distribution utilities, was officially launched in September 2013. However, it is requiring further improvement in terms of system design, contract rule, etc. and the Department of Energy (DOE) is presently making its effort to address those issues in order to allow it to properly function. In the future, the IMEM is to be transferred to the wholesale power trading market as well as the one in Luzon and Visayas.



Source: Power Industry in Overseas Countries (JEPIC), MEP 2014–2030 (DOE).

Figure 1.1 Concept of Power Business Structure in Mindanao

1.2 Regulations and Laws in Power Sector

In 2001, the Electric Power Industry Restructuring Act (EPIRA) was enacted in the power sector of the Philippines and its restructuring process is still ongoing. The purposes of the EPIRA are as follows:

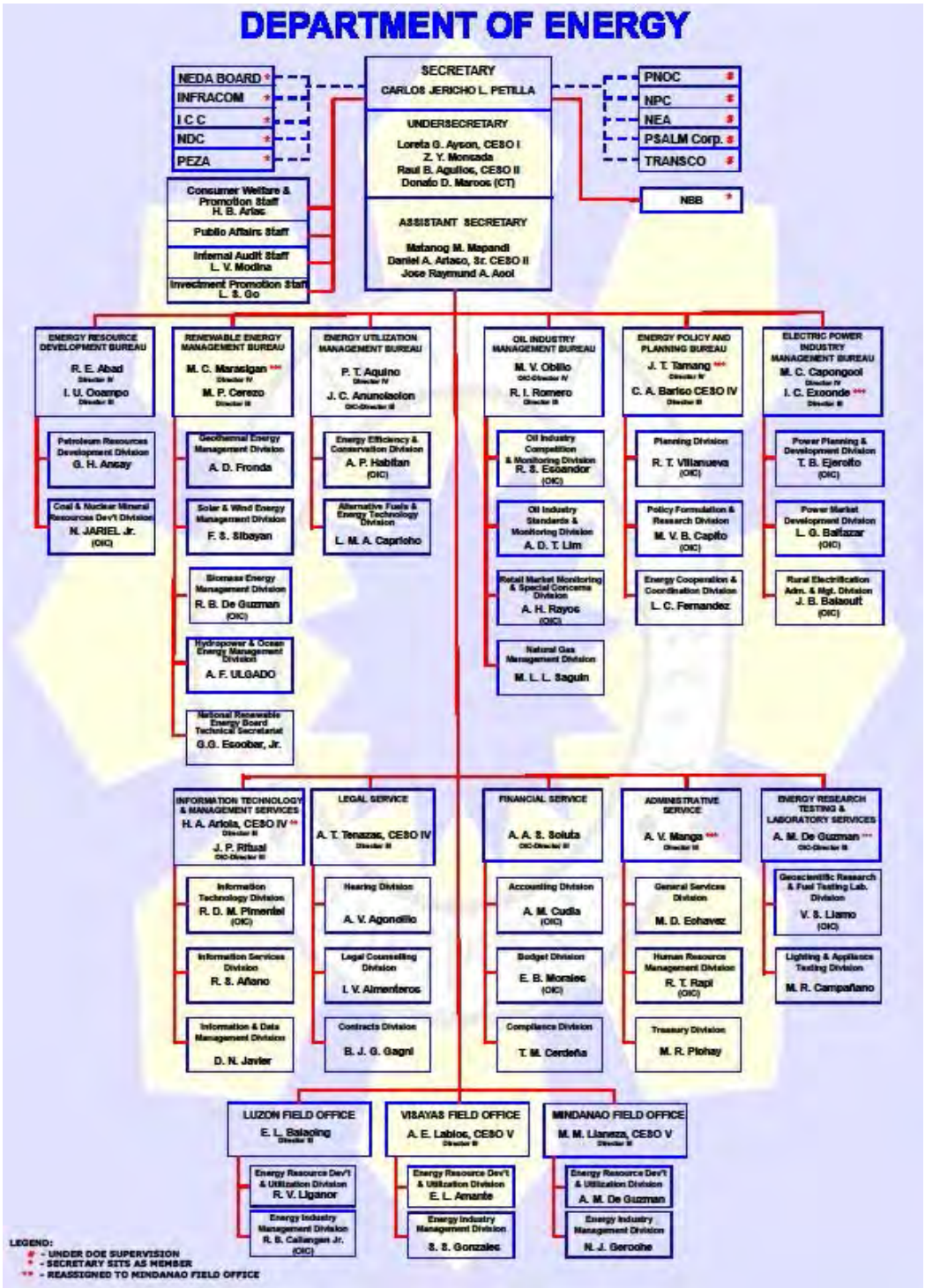
1) Sale of NPC assets,
2) Introduction of market mechanism by establishing wholesale power market, and
3) Introduction of competition principle by liberalization of power retail market.

1.3 Governmental Organizations in Power Sector

1.3.1 Department of Energy

The Department of Energy (DOE) is one of the central governmental administrative authorities that has a jurisdiction in the energy sector in the Philippines and plays a role of formulating basic policies and

energy program related to the development and utilization of energy resources. The organization chart of DOE is shown in Figure 1.2.



Source: DOE website.

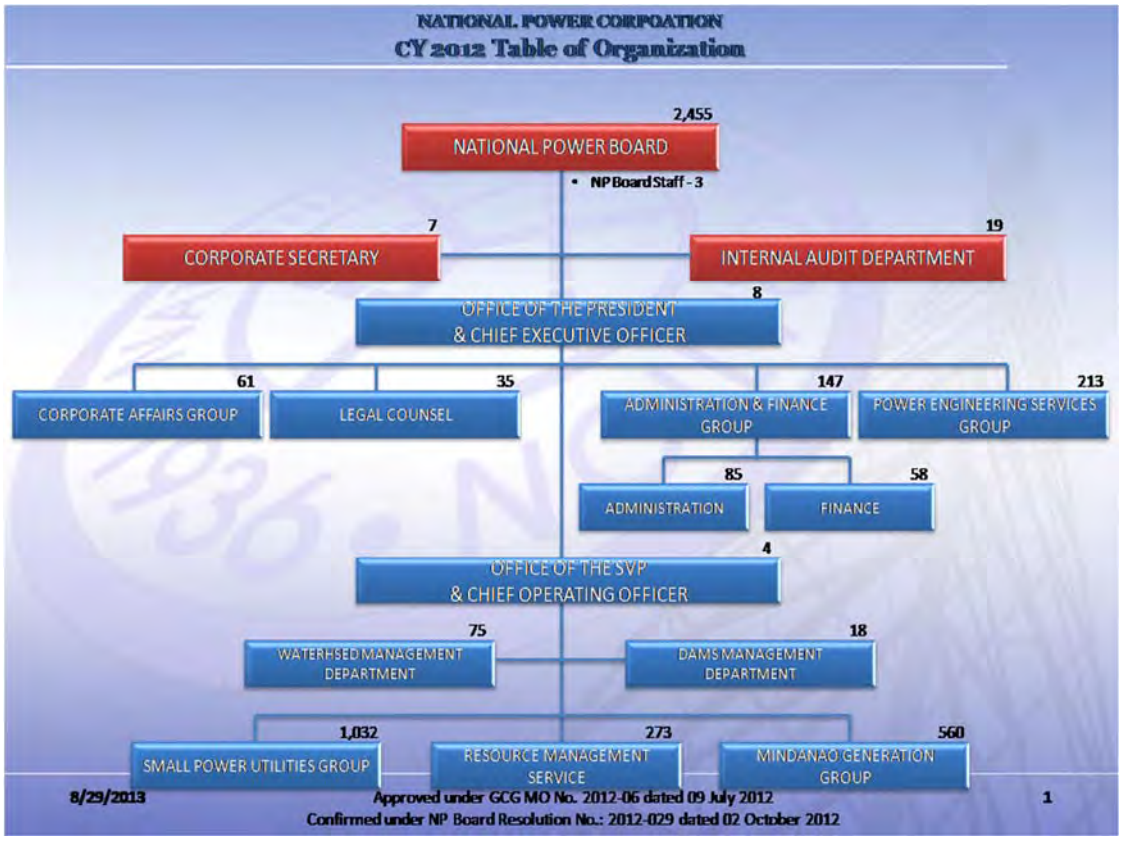
Figure 1.2 Organizational Chart of DOE

1.3.2 National Power Corporation

The National Power Corporation (NPC) was established as a national power company fully capitalized by the Philippine Government in 1936. It used to own the majority of power plants and transmission lines and be the principal power provider in the Philippines. After independent power producers (IPPs) were approved to enter the power market in 1993, the financial status of NPC was seriously aggravated

because power purchase from IPPs at a high rate, responsibility for fuel supply, and exchange rate risk became a burden on NPC. Furthermore, a depreciation of Peso caused by the Asian currency crisis compounded its management condition, and the financial deficit of the government, consequently, was viewed with suspicion.

In response to this situation, the Philippine Government enacted the EPIRA to restructure the power sector. Since the EPIRA enforcement, the assets owned by NPC are being sold and privatized in order. As of January 2015, the power supply by the power plants (PB104 and Agus-Pulangi complex) operated by NPC accounts for 41% (828 MW) of the total power output 1,794 MW generated by all power plants connected to the Mindanao on-grid. According to *24th Electric Power Industry Reform Act Implementation Status Report* periodically issued by ERC, the ownership of the Agus-Pulangi hydro complex, which is the largest hydro power plant in Mindanao, shall be subject to the consultation with the Congress and it is going to be discussed whether the water resource tapped from the Lanao Lake should attribute to the Bangsamoro autonomous equity or the Government of the Philippines.



Source: NPC website.

Figure 1.3 NPC Organizational Chart

1.3.3 National Power Corporation-Small Power Utility Group

The National Power Corporation-Small Power Utility Group (NPC-SPUG) is an organization established inside NPC and has a responsibility for supplying the power for islands such as Basilan, Sulu, and Tawi-Tawi, and missionary areas (remote areas) which have no connection with on-grid. NPC-SPUG is in charge of maintaining and operating small-scale generators and planning the power development plan in the missionary areas. The power generated by NPC-SPUG is supplied for distribution utilities such as electric cooperatives (ECs).

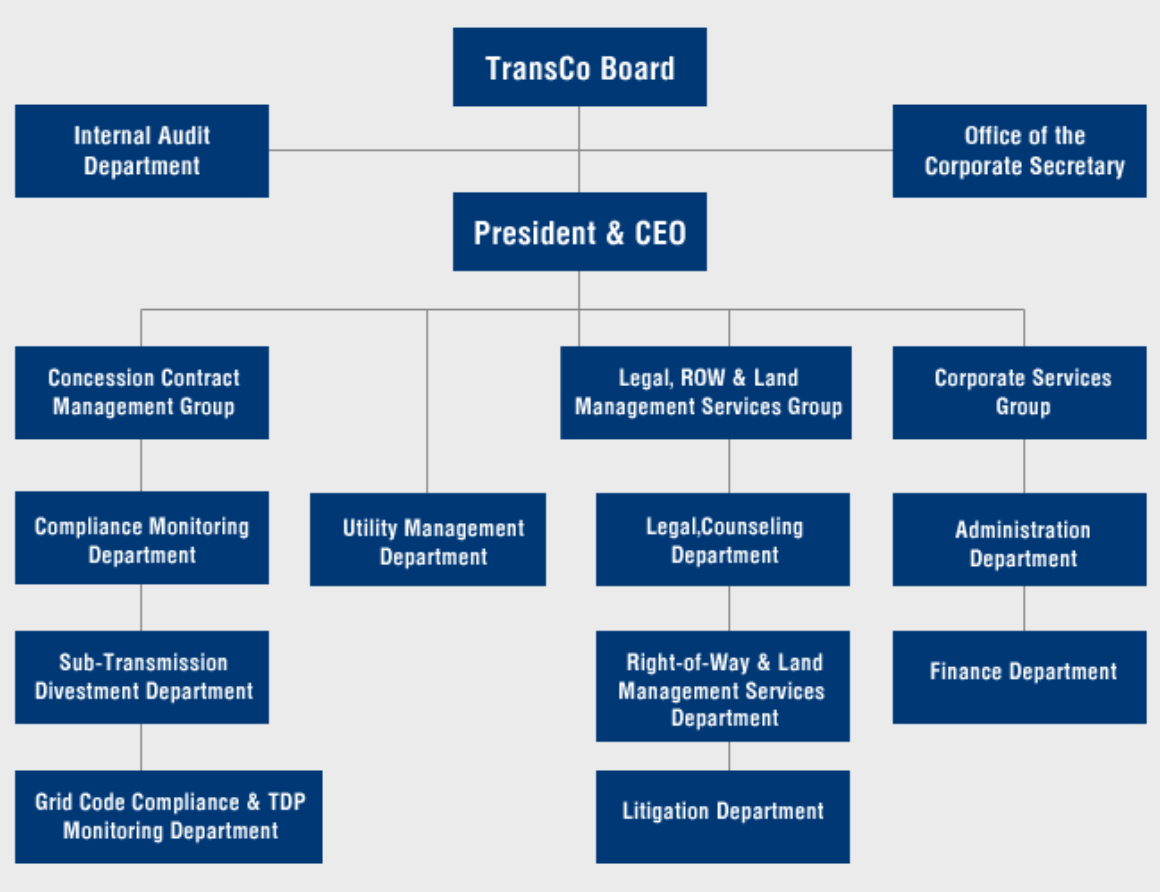
1.3.4 Power Sector Assets and Liabilities

The Power Sector Assets and Liabilities (PSALM) was established based on the EPIRA aiming to proceed with the sale of available assets owned by NPC for the repayment of a debt of NPC. Two

power plants in Mindanao, namely, PB104 and the Agus-Pulangi hydro complex are now owned by PSALM.

1.3.5 National Transmission Corporation

The National Transmission Corporation (TransCo) was originally the transmission department of NPC. Based on the EPIRA enforcement, it was spun off from NPC and established as TransCo that owns the assets of the transmission facilities ever owned by NPC. TransCo has a responsibility for managing and supervising the transmission business operated by NGCP.



Source: TransCo website.

Figure 1.4 Organizational Chart of TransCo

1.3.6 National Grid Corporation of the Philippines

The National Grid Corporation of the Philippines (NGCP) is a private company that maintains, operates, plans, and constructs 138 kV and 69 kV power transmission network in the Philippines. NGCP took over the system operation business of TransCo that spun off from the transmission department of NPC through bidding. The corporation was established on the basis of joint finance of two domestic companies in the Philippines and State of the Grid in China (SGCP) in 2008. The former companies are Monte Oro Grid Resources Corporation and Calaca High Power Corporation International that are wholly owned subsidiaries of International Container Terminal Services, Inc. (ICTSI), one of the large companies doing port and harbor business.

Each company is equally making 30% investment to NGCP and on the other hand, the investment ratio of SGCP is 40%. As for dispatching control centers in Mindanao, the Mindanao Regional Control Center (MRCC) is conducting power demand and supply operation and five Area Control Centers (ACCs) are conducting system operation allocated to each ACC in Mindanao. Also, back-up function of MRCC is installed in the Iligan ACC. RCC and each ACC have been updated since the mid-2000s

and a new SCADA/EMS system manufactured by SIMENS has just installed in 2012.

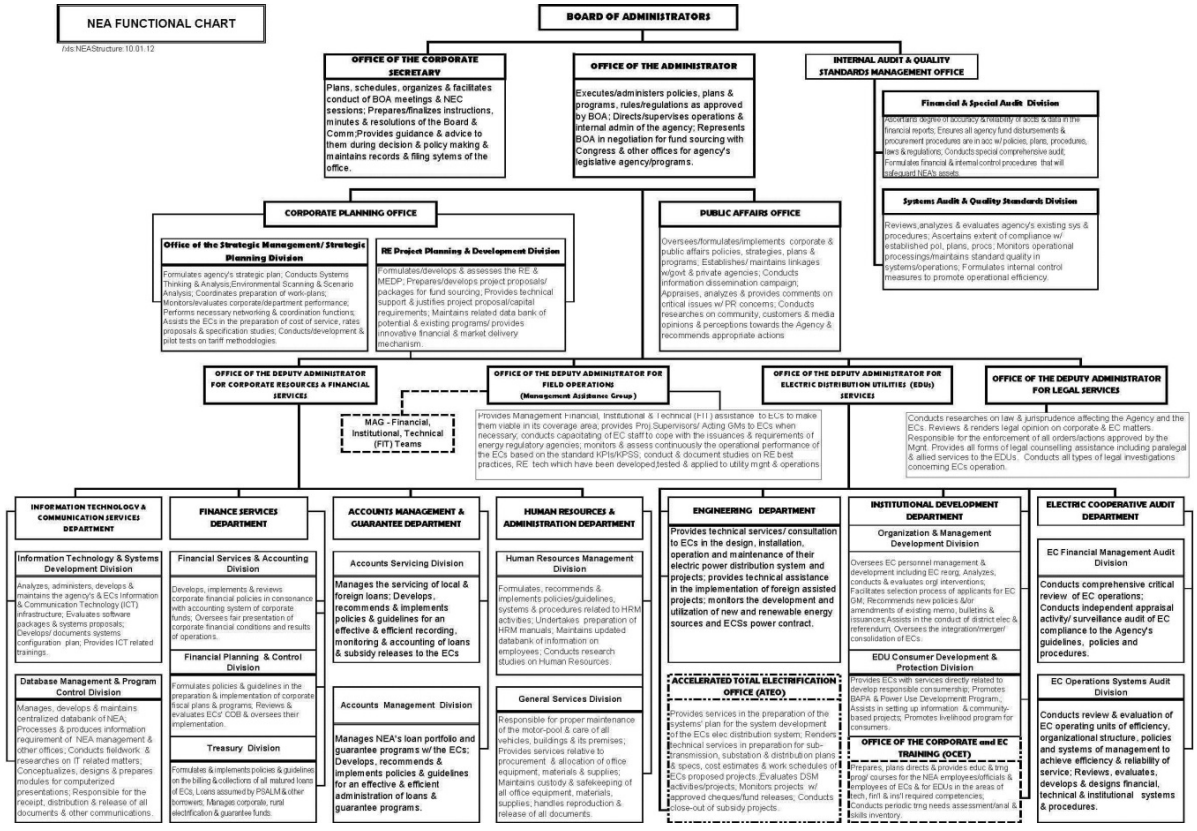
Table 1.1 List of Dispatching Control Centers in Mindanao

Dispatching control center	Location	Date commissioned
Mindanao RCC	Cagayan de Oro City	April 2012
Butuan ACC	Butuan City	February 2006
Davao ACC	Davao City	December 2005
General Santos ACC	General Santos City	November 2006
Zamboanga ACC	Zamboanga City	February 2005
Iligan ACC (with backup function of MRCC)	Iligan City	October 2010

Source: TDP 2013 Volume II (Part1).

1.3.7 National Electrification Administration

The National Electrification Energy (NEA), originally created as the Electrification Administration (EA) in 1960, was established in 1969 for the purpose of promotion of regional electrification as a national policy. NEA's role is not only to manage and supervise ECs in the Philippines but also to finance ECs as the financial support for regional electrification. NEA sets the goal of achieving the electrification of all regions by the end of 2020. The organization chart of NEA is shown in Figure 1.5.

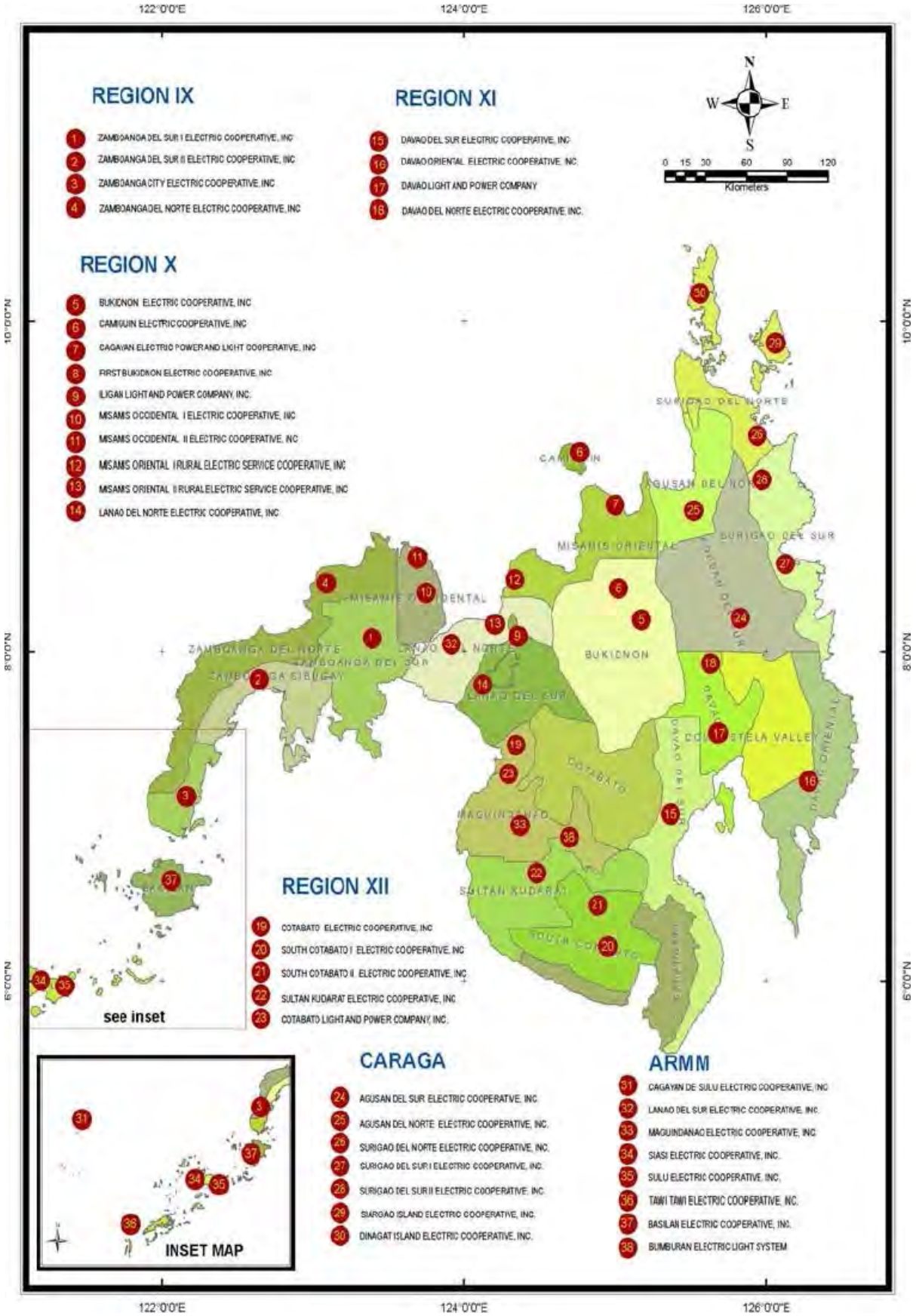


Source: NEA website.

Figure 1.5 Organizational Chart of NEA

1.3.8 Electric cooperatives

Electric cooperatives (ECs) are non-profit public distribution utilities. In Mindanao, 33 ECs exist including neighboring islands. The franchise of ECs in Mindanao is shown in Figure 1.6. Also, the list of ECs whose franchise could be included in Bangsamoro is shown in Table 1.2.



Source: DOE, DDP 2010–2019.

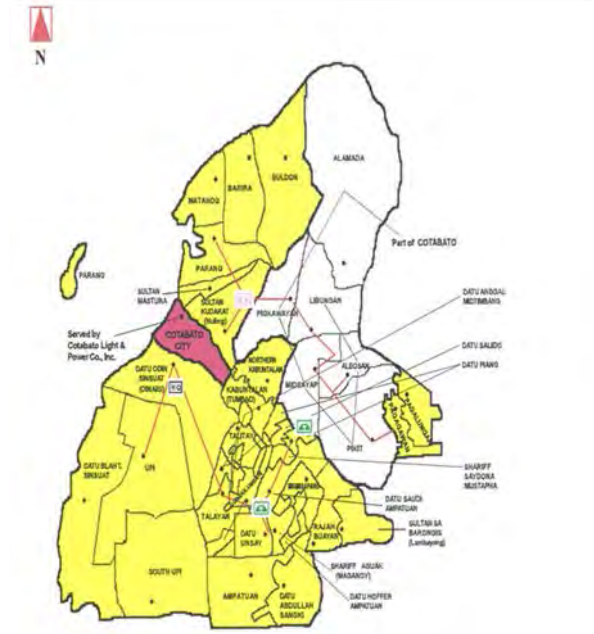
Figure 1.6 Franchise Areas of ECs in Mindanao

Table 1.2 List of Potential Franchise Areas of ECs in Bangsamoro

No.	Region	Name of ECs
Mindanao Island		
1	ARMM	Mindanao Electric Cooperative (MAGELCO)
2		Lanao Del Sur Electric Cooperative (LASURECO)
Neighboring Islands		
3	ARMM	Basilan Electric Cooperative (BASELCO)
4		Sulu Electric Cooperative (SULECO)
5		Siai Electric Cooperative (SIASELCO)
6		Tawi-Tawi Electric Cooperative (TAWELCO)
7		Cagayan De Sulu Electric Cooperative (CASELCO)

Source: JICA Study Team.

The detailed franchise map of each EC in Bangsamoro is shown Figure 1.7. The bold red lines on the map mean 13.2 kV distribution lines and is called as a back-bone line.

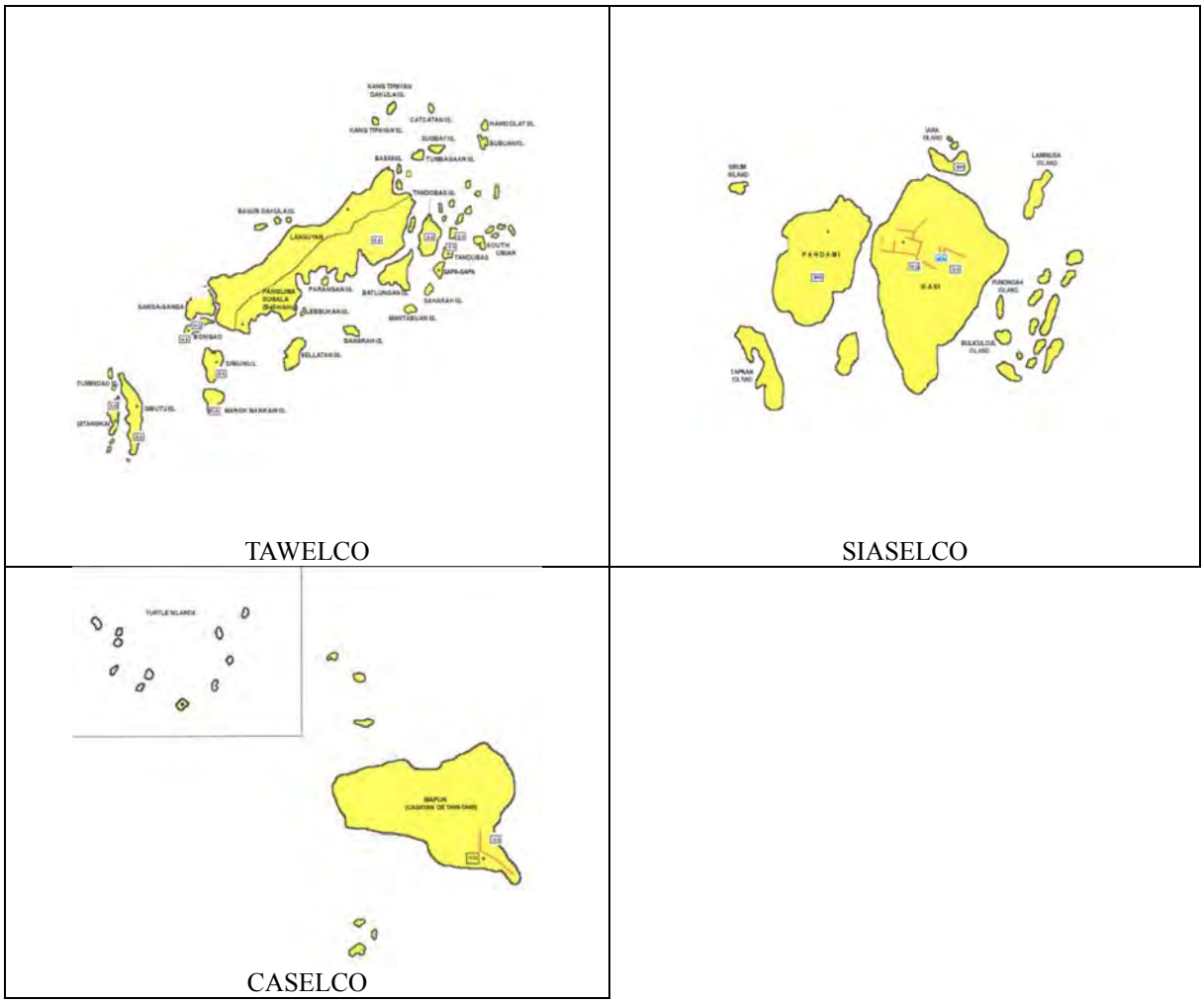


MAGELCO & CLPC

LASURECO

BASELCO

SULECO



Source: Documents provided by NEA.

Figure 1.7 Franchise Areas of ECs in Bangsamoro

ECs provide the power for their customers through their owned distribution network and maintain, plan and construct the distribution lines including 69 kV sub-transmission lines. In the first quarter of 2014, the performance assessment targeting for ECs was conducted by NEA and all the ECs were classified into *Green*, *Yellow (b-1)*, *Yellow (b-2)* and *Red* in terms of its operation and financial status. As a result of the assessment, most ECs in the ARMM are categorized into Red group. "Red" means that the performance improvement is strongly required. Especially, the Mindanao Electric Cooperative (MAGELCO) was evaluated as the worst rate (11th of 11 ECs included in the Red group). With regard to other ECs in the ARMM, Lanao del Sur Electric Cooperative (LASURECO) was 10th, Sulu Electric Cooperative (SULECO) was 9th, Basilan Electric Cooperative (BASELCO) was 8th, Tawi-Tawi Electric Cooperative (TAWELCO) was 7th in the Red group. The assessment report shows that most ECs in the region are facing the severe condition from an operational and financial point of view. The excerpt from the assessment report by NEA is shown in Table 1.3.

Table 1.3 Excerpt from Compliance Report by NEA (1st Quarter, 2014)

AILING ELECTRIC COOPERATIVE	INDICATORS										
	Cash-Generated Fund	One Mo. Working Capital	Debt SFF	CERCC As of March 2014	RSEP As of March 2014	Profitability	Retained Earnings 12/31/2014	Retained Earnings 2013	Retained Earnings 2012	Retained Earnings 2011	System Loss
1	PELCO III	53,272	80,174	64.98	Res-With Arrears	Current	(21,396)	(913,819)	(885,533)	(1,001,348)	(813,487)	15.25
2	ALECO	0	0	NDA	With Arrears	With Arrears	NDA	(1,925,569)	(1,925,569)	(1,925,569)	(1,704,089)	NDA
3	CASURECO III	19,003	51,409	90.31	Res-With Arrears	With Arrears	7,194	(322,613)	(324,715)	(358,391)	(285,093)	16.81
4	MASELCO	(10,808)	34,509	88.64	Res-With Arrears	N/A	3,052	225,914	315,492	248,892	256,093	15.83
5	TISELCO	(329)	2,950	65.07	Res-With Arrears	N/A	3,322	23,025	18,955	8,923	84	14.62
6	NORSAMELCO	(5,877)	32,004	78.17	Res-With Arrears	With Arrears	20,229	(121,354)	(148,451)	(49,113)	64,142	22.28
7	TAWELCO	11,415	11,162	41.13	With-Arrears	N/A	(16,571)	(535,866)	(526,708)	(443,900)	(374,338)	29.43
8	BASELCO	4,574	19,596	77.07	With-Arrears	N/A	(5,623)	(889,281)	(883,660)	(844,772)	(608,687)	40.74
9	SULECO	(5,120)	18,217	32.72	With-Arrears	N/A	185	(559,970)	(559,225)	(518,870)	(429,884)	31.99
10	LASURECO	NDA	NDA	NDA	With-Arrears	With-Arrears	(5,381)	(1,589,260)	(1,589,260)	(1,569,037)	(1,568,551)	17.93
11	MAGELCO	NDA	NDA	NDA	With-Arrears	Current	(23,288)	(159,439)	(159,439)	(98,989)	(34,793)	42.88

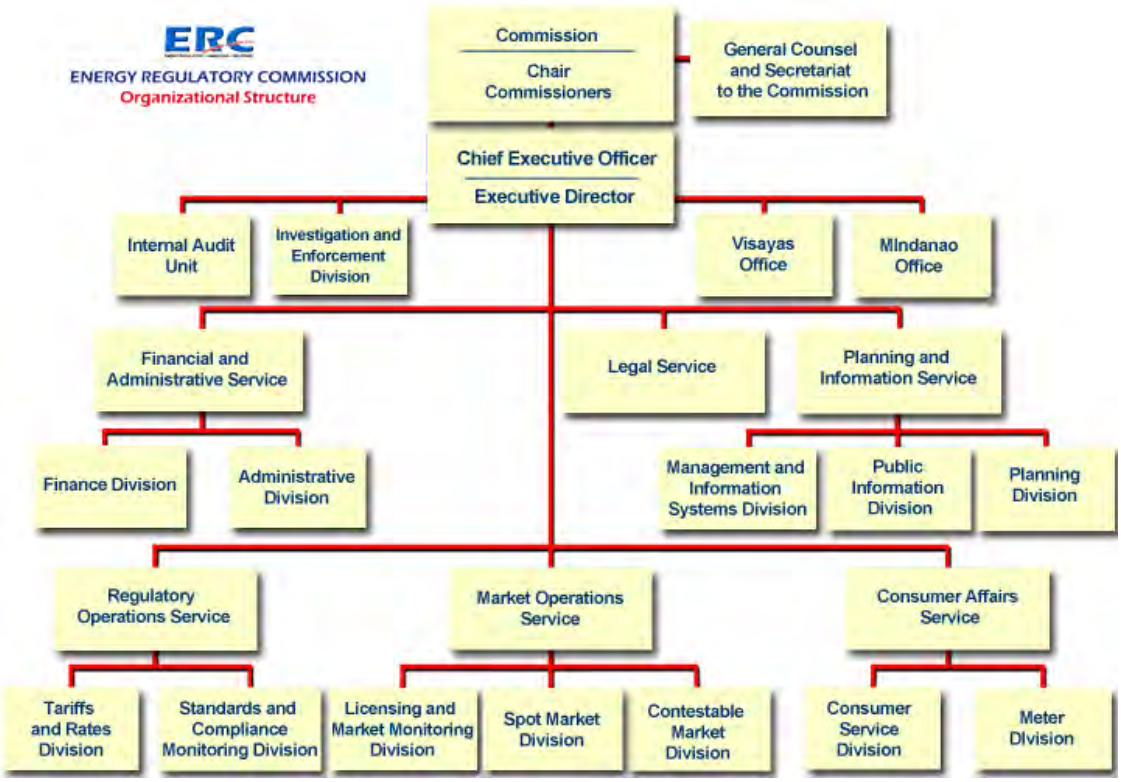
Source: NEA, Compliance Report on Performance of ECs 1st Quarter, 2014.

1.3.9 Private investor-owned utilities and local government unit-owned utilities

Aside from ECs, private investor-owned utilities (PIOUs) and LGU-owned utilities (LGUOUs) operated by local governments are existing in the Philippines. In Mindanao, two major private distribution utilities (DUs), Davao Light and Power Company (DLPC) and Cotabato Light and Power Company (CLPC), both of which are owned by one of major holding companies representing the Philippines, the Avoitiz group, and Illigan Light and Power Company (ILPC), and Cagayan Electric Power and Light Company (CEPALCO) are doing their business as PIOUs. Of those DUs, CLPC is supplying power for Cotabato City in the ARMM.

1.3.10 Energy Regulatory Commission

The Energy Regulatory Committee (ERC) was established on the basis of the EPIRA and has the authority of regulating and supervising generation, transmission, and distribution business fields. Also, ERC has a role for streamlining regulatory rules of the power supply and acceleration of competition in the power market. The organization chart of ERC is shown in Figure 1.8.



Source: ERC website.

Figure 1.8 Organizational Chart of ERC

1.4 Generation

1.4.1 Ratio of generation fuel types

As of March 2014, the total installed capacity of all generation facilities in Mindanao (Table 1.4) is 2,150.9 MW and the total dependable power output is 1,811.7 MW. Figure 1.9 shows the generation shares by source: diesel 33.1%, hydro 49.3%, coal 10.8%, geothermal 5.0%, and biomass 1.7%. The share of solar generation is almost nil. Close to a half of the power supply depends on hydro generation. New IPPs using coal, however, are planned to be constructed in the near future, and the dependence on hydro power generation is projected to decrease. The generation shares by owner in Mindanao is shown in Figure 1.10. According to this figure, the generation share of NPC accounts for 50% and that of PSALM is 25% of all. From this point of view, it is found that the generation power still depends on the power plants owned by the Government.

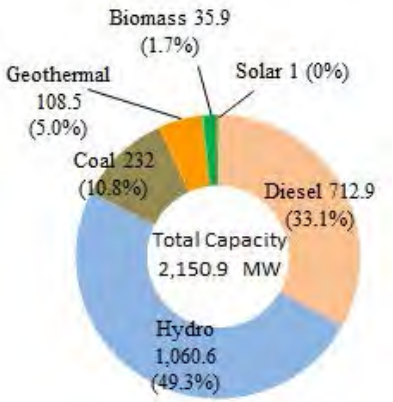
Table 1.4 List of Power Generation Facilities in Mindanao

Facility Name	Installed Capacity	Dependable Capacity	Number of Unit	Location	Owner	Year Commissioned
【Diesel】	712.9	653.6				
MINDANAO ENERGY SYSTEM 1	18.9	18.0	1	Cagayan de Oro City	Mindanao Energy Systems	25-Aug-1995
MINDANAO ENERGY SYSTEM 2	27.5	27.0	2	Cagayan de Oro City	Mindanao Energy Systems	March 2012
COTABATO LIGHT	10.0	9.9	6	Cotabato	Cotabato Light	1963
BAJADA DPP	58.7	48.0	12	Davao City	Davao Light	05-Jun-1995
KING ENERGY	3.2	3.1		Valencia City, Bukidnon	King Energy Generation Inc	26-Aug-2012
SPPC	59.0	50.0	6	Alabel, Sarangani	Southern Philippines Power	26-Mar-1998
PB 104	32.0	16.0	4	Brgy Ilang,Davao	PSALM	September 2005
TM1 2	100.0	99.0	2	Nasipit, Agusan del Norte	Therma Mobile Inc.	26-Feb-1994
TM1 1	100.0	99.0	2	Maco, Davao del Norte	Therma Marine Inc.	20-Jul-1994
WMPC	113.0	100.0	10	Sangali, Zamboanga City	Western Mindanao Power	12-Dec-1997
MPC - IDPP	103.0	98.0	18	Dalipuga, Iligan City	Mapalad Power Corporation	May 2014
KEGI - Misamis Or.	10.6	10.0		Gingoong, Misamis Oriental	King Energy Generating Inc.	25-Sep-2013
MPC-Koronadal	13.0	13.0		Koronadal City, South Cotabato	Mapalad Power Corporation	01-Oct-2013
EEI Power	15.0	15.0		Davao del Norte	EEI Power	26-Dec-2013
SoEnergy	19.0	19.0		Bgry. Apopong, Gen. Santos City, South Cotabato	SoEnergy Int'l Philippines, Inc.	March 2014
MPC-Digos	15.0	15.0		Digos, Davao del sur	Mapalad Power Corporation	28 March 2014
KEGI - Panaon	15.0	13.6		Panaon, Ozamis City, Misamis Occ.	King Energy Generation Inc	May 2014
【Geothermal】	108.5	98.0				
MT APO	108.5	98.0	2	Kidapawan, North Cotabato	Energy Development Corp.	15-Dec-1996
【Hydro】	1,060.6	839.7				
Large Hydroelectric Plants	1,024.7	812.0				
AGUS 1	80.0	50.0	2	Marawi City,Lanao Sur	PSALM	23-Jun-1992
AGUS 2	180.0	122.0	3	Saguiaran, Lanao Sur	PSALM	6-June-1979, 27-Nov-1979
AGUS 4	158.1	136.0	3	Baloi, Lanao del Norte	PSALM	16-Mar-1985, 16-Apr-1985
AGUS 5	55.0	52.0	2	Buru-un, Iligan City	PSALM	9-Feb-1985, 8-Mar-1985
AGUS 6	200.0	151.0	5	Buru-un, Iligan City	PSALM	1-Jul-1953, 28-Apr-1971
AGUS 7	54.0	40.0	2	Buru-un, Iligan City	PSALM	5-Mar-1983, 17-Dec-1983
PULANGI 4	255.0	225.0	3	Maramag, Bukidnon	PSALM	21-Dec-1985, 21-Jun-1986
SIBULAN HEP	42.6	36.0	4	Santa cruz, Davao del Sur	HEDCOR Sibulan Inc.	March 2010
Small Hydroelectric Plants	35.9	27.7				
AGUSAN	1.6	1.6	2	M. Fortich, Bukidnon	FG Bukidnon Power Corp.	28-Dec-1957
BUBUNAWAN	7.0	0.0	1	Baungon,Bukidnon	BPC Inc.	22-Sep-2001
CABULIG HEP	9.2	8.0	1	Claveria, Misamis Oriental	Mindanao Energy Systems	24-Sep-2012
TALOMO HEP	4.5	4.5	5	Mintal, Davao City	HEDCOR Inc.	01-Oct-1998
TUDAYA 1	6.6	6.6		Sta. Cruz, Davao del Sur	HEDCOR Inc.	2014/5/1
TUDAYA 2	7.0	7.0		Sta. Cruz, Davao del Sur	HEDCOR Inc.	2014/5/1
【Solar】	1.0	0.3				
SOLAR PV	1.0	0.3	1	Sitio Lomboy,Cagayan de Oro	CEPALCO	September 2004
【Coal】	232.0	210				
MINDANAO COAL	232.0	210.0	2	PHIVIDEC,Villanueva,Misamis	STEAG State Power Inc.	16-Sep-2006
【Biomass】	35.9	10.0				
CRYSTAL SUGAR	35.9	10.0	4	Maramag, Bukidnon	Crystal Sugar Co., Inc.	
Total Mindanao	**2,150.9**	**1,811.7**				

Note: Excluding off-grid generators, parts in red mean
Release Date, Oct 2014

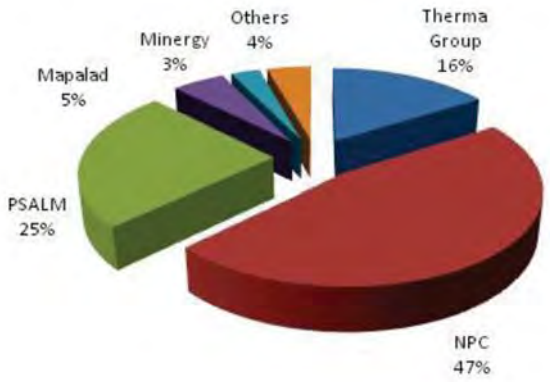
Source: DOE, List of Existing Plants 2014

The Agus-Pulangi hydro complex, tapped from the largest lake in Mindanao, Lanao Lake, is included in the government-owned power plants and it is highly controversial whether or not these power plants should be attributed to the Bangsamoro autonomous equity. According to Mindanao Development Authority (MinDA), it seems that there is an opinion that the generation facility itself should be owned by the Central Government and the water resource tapped from the Lanao Lake as a fuel should be attributed to the new Bangsamoro government. In the 24th Electric Power Industry Reform Act Implementation Status Report, there is a description that the ownership of Agus-Pulangi hydro complex would be decided based on the discussion in the Congress in 2017.



Source: Created by DOE, List of Existing Plants 2014.

Figure 1.9 Generation Capacity by Source



Source: DOE, 24th EPIRA Implementation Status Report (covering Nov. 2013 to Apr. 2014).

Figure 1.10 Generation Shares by Organization in Mindanao (as of April 2014)

1.4.2 Off-grid generators

Generators connected to the off-grid system exist in the islands in the ARMM and are operated by NPC-SPUG. All generators are diesel generators and the one in Basilan is the largest-scale unit with a capacity of approximately 20 MW. The second largest unit is installed in Sulu and its capacity is 15 MW. In Tawi-Tawi, the generator with a capacity of approximately 6 MW is installed and the remaining smaller-scale units are dispersedly installed in the island. Since these generators are run by diesel fuel oil, the burden on the environment is large and can be operated only for 6–8 hours per day due to the mechanical limitation. Accordingly, it is necessary and meaningful to introduce generation that can be operated during 24 hours and eco-friendly generations utilizing renewable energy in order to achieve the stable power supply and revitalization of the local economic activities. Table 1.5 shows the list of generators connected to the off-grid in the ARMM (islands).

Table 1.5 List of Generators Connected to Off-grid in ARMM

NPC-SPUG Power Plants	ECs	Existing Capacity		Operating hours	Location
		Installed (MW)	Dependable (MW)		
Sulu	SULECO	15.54	10.40	24	Sulu
Luuk	SULECO	0.33	0.29	8	Sulu
Siasi	SIASELCO	2.08	1.65	20	Sulu
Tawi-Tawi	TAWELCO	6.49	4.16	24	Tawi-Tawi
Cagayan de Tawi-Tawi	CASELCO	1.02	0.80	8	Tawi-Tawi
Balimbing	TAWELCO	0.73	0.65	8	Tawi-Tawi
Manuk-Mangkaw	TAWELCO	0.16	0.15	6	Tawi-Tawi
Sibutu	TAWELCO	0.33	0.28	6	Tawi-Tawi
Sitangkay	TAWELCO	1.16	0.99	6	Tawi-Tawi
Tandubanak	TAWELCO	0.44	0.38	6	Tawi-Tawi
Tandubas	TAWELCO	0.26	0.22	6	Tawi-Tawi
West Simunul	TAWELCO	0.73	0.63	6	Tawi-Tawi
Basilan	BASELCO	20.05	14.40	24	Basilan
Total		49.32	35		

Source: DOE, Mindanao Energy Plan 2014.

According to Table 1.5, the dependable capacity of all the generators in the islands provinces is a bit smaller than the installed capacity. This is because the actual output is set to be 80% of the installed capacity. However, due to the shortage of spare parts and aging of facilities and equipment, some units cannot produce the power at 60% to 70% of the installed capacity.

1.4.3 Independent power producers

In the 1990s, independent power producers (IPPs) were approved to enter the power market in the Philippines to eliminate serious shortages of power sources. Since then, IPPs became a major part of power generation share in the power market of the Philippines due to the development of new power generation financed by conglomerates and the promotion of sales of generation assets owned by NPC. However, the ratio of IPPs facilities in all the generation facilities in Mindanao still remains to be approximately 25%. IPPs are classified into NPC/IPPs that sell the power to NPC based on a supply-demand contract with NPC and Non-NPC/IPPs that supply the power for customers through the transmission network based on the bilateral contract.

The typical major conglomerate managing IPPs in Mindanao is the Avoitiz group and approximate 19% of all the power plants in Mindanao are operated by subsidiary companies under the umbrella of the Avoitiz group. Not only Therma Mobile Inc. and Therma Marine Inc. that have generators with a capacity of 100 MW respectively but also local distribution company, CLPC with diesel generators that supplies the power for Cotabato City and DLPC that supplies the power for Davao City are wholly owned subsidiary companies of the Avoitis group. As a second typical conglomerate, the Alson Power group is well-known group operating several IPPs. The power plants owned by the Alson group account for approximately 14% of all the power plants in Mindanao. Mapalad Power Corporation that have generators with a capacity of 103 MW is also a subsidiary under the Alson power group.

1.5 Transmission System

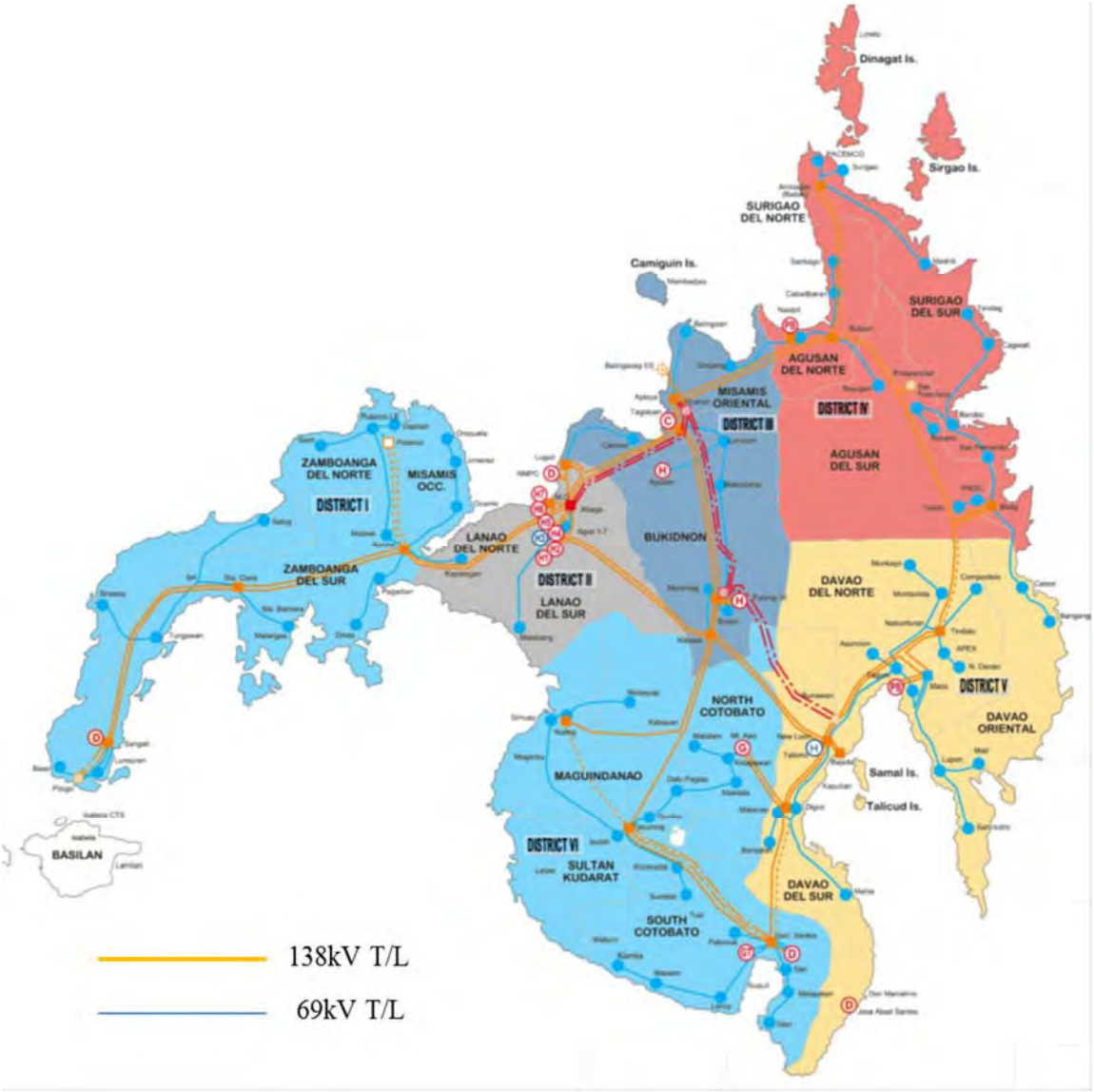
The transmission system in Mindanao is divided broadly into on-grid and off-grid. The off-grid means the small-scale and independent power network that is not connected to the on-grid. The transmission network is operated at the voltage class of 138 kV and 69 kV. The transmission system including substations is operated and maintained by the private company, NGCP, based on the grid-code under supervision of TransCo that manages the transmission and substation assets. The on-grids in Luzon and Visayas are connected by a submarine cable. The on-grid in Mindanao, however, unconnected to the Luzon-Visayas power system, is an independent system in Mindanao. The system diagram in Mindanao is shown in Figure 1.11.

To ensure the consistency and standardization in naming of substations, some substations described above is renamed as shown in Table 1.6.

Table 1.6 Comparison of Substation Names

NEW NAME	OLD NAME	TYPE
Balo-i	Abaga	138 kV Substation
Cagayan de Oro	Carmen Mindanao	69 kV Substation
Gen. Santos	Klinan	138 kV Substation
Iligan	Overton	69 kV Substation
Ipil	Pangi	69 kV Line Breaker
Jasaan	Aplaya	138 kV Substation
Malaybalay	Aglayan	69 kV Capacitor Bank Station
Nabunturan	Tindalo	138 kV Substation
Naga	Sta. Clara	138 kV Substation
Oroquieta	Villaflor	69 kV Capacitor Bank Station
Placer	Anislagan	138 kV Substation
Sultan Kudarat	Nuling	138 kV Substation
Tumaga	Lunzuran	69 kV Capacitor Bank Station
Villanueva	Kirahon	138 kV Substation
Zamboanga	Sangali	138 kV Substation

Source: NGCP, Transmission Development Plan 2013.



Source: NGCP, Transmission Development Plan 2013.

Figure 1.11 Mindanao Power Supply System Diagram

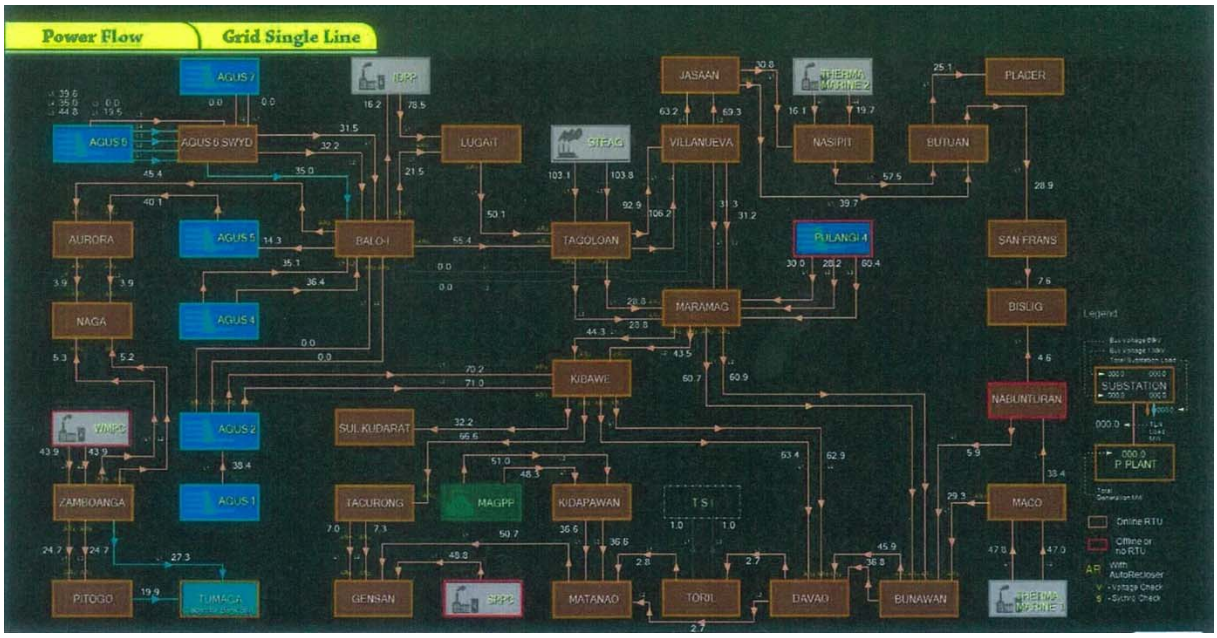
Figure 1.12 presents actual power flow in the Mindanao main grid. This was recorded at 16:59 on December 2, 2014. From this power flow, it is found that the power was being transmitted largely from the north to the south. It is because many power plants with a large capacity such as the Agus hydro power plants are intensively situated in the northern part of Mindanao and the regions consuming much load such as the Davao City are situated in the southern part of Mindanao. On the other hand, focusing on the ARMM, which will be incorporated into the Bangsamoro region, the power flow for each transmission line from Kibawe to Sultan Kudarat and Tacuronge located in the province of Maguindanao and Sultan Kudarat is 32.2 MW and 66.6 MW, respectively.

Table1.7 shows the scales of transmission and substation facilities in the Mindanao main grid.

Table 1.7 Transmission and Substation Facilities

Voltage class	Transmission lies (ckt-km)	Sub-transmission Lines (ckt-km)	Substation capacity (MVA)
138 kV	3,268.09	33.84	3,240
69 kV ≥	4	1,839.71	77.5
Total	3,272.09	1,839.71	3,317.5

Source: NGCP, Transmission Development Plan 2013.



Source: NGCP.

Figure 1.12 Power Flow in the Mindanao Main Grid (December 2, 2014)

1.6 Distribution System

1.6.1 System profile

The distribution system in Mindanao is operated by ECs or PIOUs. Table 1.8 shows distribution voltage applied to the distribution network in Mindanao. The applied voltage and number of power lines are determined based on the conditions of power demand scale and power contract with customers.

Table 1.8 Distribution Voltage

Classification	Voltage	Type of neutral grounding point
High voltage	13.2 kV (3-phase 3-line, 3 phase 3-line), 7.62 kV (1-phase)	Solidly grounded
Low voltage	240V (1-phase 2-line), 3-phase 3-line	—

Source: NEA.

In the ARMM, the jointly used poles shared by transmission lines and distribution lines are observed. Figure 1.13 shows the picture of transmission lines and distribution lines passing through Cotabato City.

Both transmission lines and distribution lines are owned and maintained by CLPC that supplies the power for Cotabato City. According to CLPC, the upper transmission lines are power facilities that were constructed to link points receiving the power from NGCP to improve the reliability of power supply. Figure 1.14 illustrates the image of CLPC transmission and distribution facility configurations.

Under the normal condition, the power is supplied for Cotabato City by the distribution line of CLPC via the Sultan Kudarat substation managed by NGCP. If the power supply is interrupted due to the system fault occurred at the upper transmission system of NGCP, the power failure can be restored in supplying the power from the extra power source, the Tacurong substation. CLPC accomplished the high supply reliability by introducing this system configuration.

1.6.2 Utilities rates

Utilities rates including electricity in the Philippines are relatively high compared to other Asian countries.

Figure 1.13 Transmission and Distribution Lines in Cotabato City

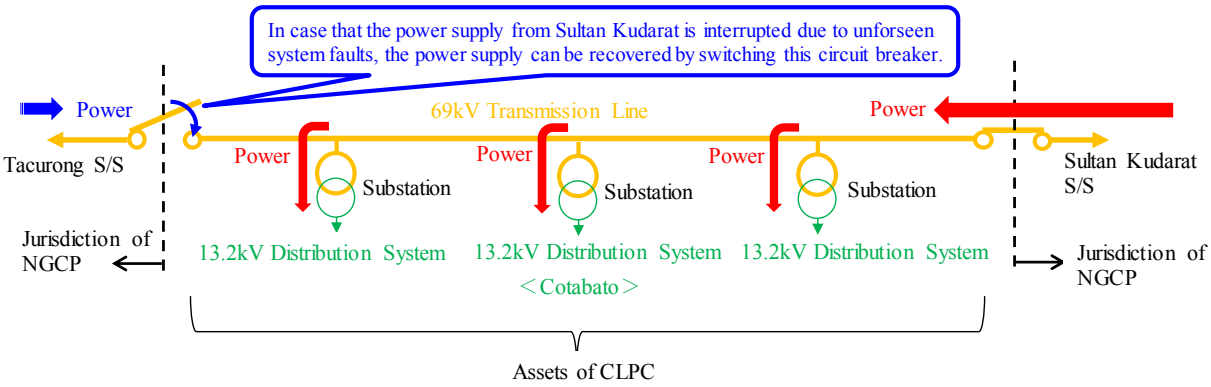


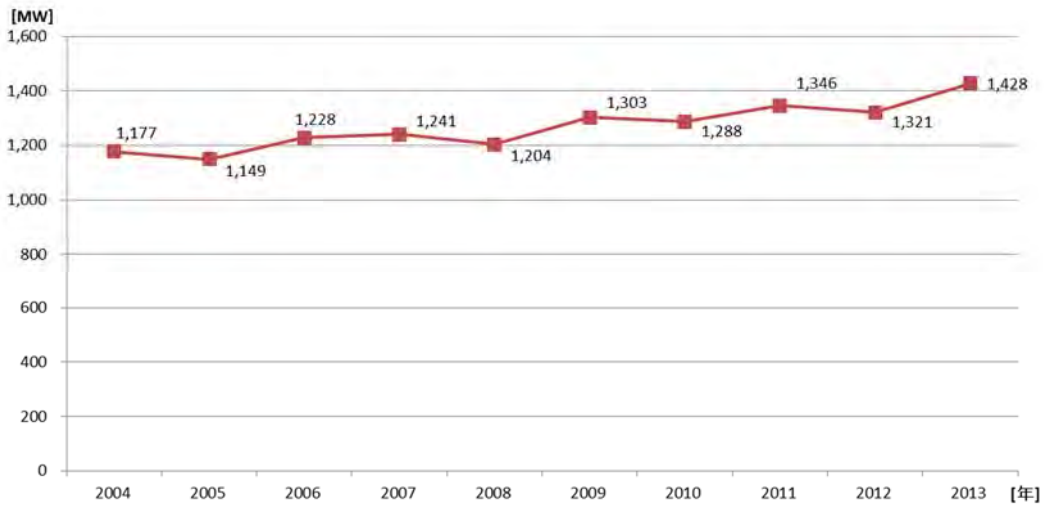
Figure 1.14 Image of CLPC Transmission and Distribution Facility Configurations

1.7 Power Demand

The power demand in Mindanao is on a strong upward trend and the average growth rate of power demand is approximately 3.8% over the past decade. Figure 1.15 shows the actual demand in Mindanao from 2004 to 2013 over the past decade.

In a certain year, negative growth was found but the peak demand is growing at the average rate of approximately 2.45%. In accordance with this growing trend of the peak demand, the energy consumption is also growing as shown in Figure 1.16. As of the fiscal year (FY) 2013, the energy consumption by the residential use is the leading primary use representing 41.5% (249 kTOE) of the total power consumption. Also, the energy consumption in the industrial and commercial use combined accounts for 38.9% (233 kTOE) and 19.7% (118 kTOE) respectively. The energy consumption in the agriculture is relatively small compared to the one in other sectors.

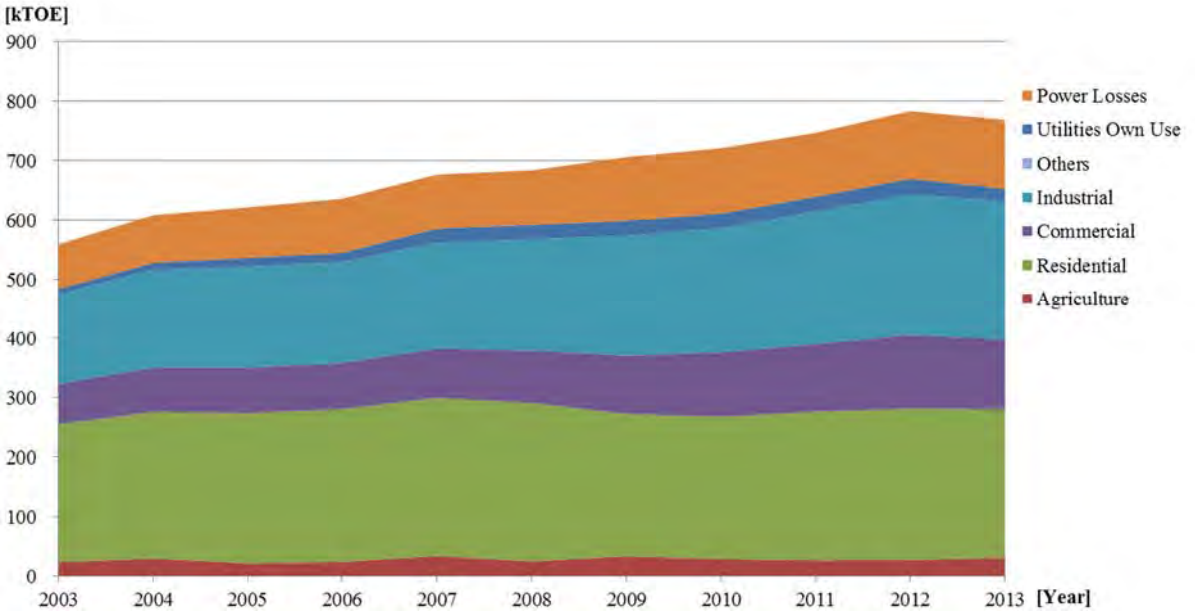
Figure 1.17 presents the daily load curve showing the power demand changing from hour to hour in the Mindanao main grid. The power load tends to reach the peak from 18:00 to 20:00 in the evening and the maximum power demand to be recorded till the end of 2013 is 1,420 MW recorded on December12, 2013. On the other hand, the minimum power demand is 1,027 MW recorded on January1, 2013. However, this load duration curve is superficial because this is formed with a result of load curtailment during the daytime caused by the shortage of power supply. It might become the different shape if this is formed without an effect of load curtailment. As a trend, the power consumption in the dry season is a bit larger than the one in the wet season.



Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Peak Demand [MW]	1,177	1,149	1,228	1,241	1,204	1,303	1,288	1,346	1,321	1,428
Growth Rate	4.07%	-2.38%	6.88%	1.06%	-2.98%	8.22%	-1.15%	4.50%	-1.86%	8.10%

Source: DOE, Philippine Power Statistics 2013 & Mindanao Energy Outlook 2014–2030.

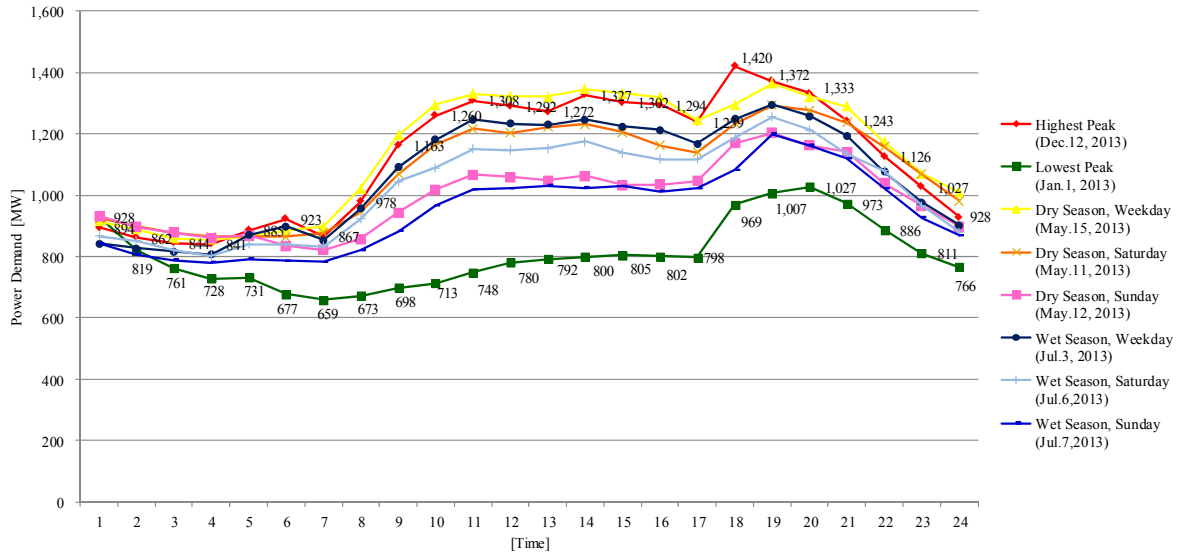
Figure 1.15 Peak Power Demand in Mindanao



Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Agriculture	23	29	21	24	34	25	33	28	26	27	31
Residential	231	246	252	257	265	266	239	239	250	254	249
Commercial	68	74	76	78	83	88	98	109	114	124	118
Industrial	153	166	172	171	180	189	203	210	224	238	233
Others	0	0	0	0	0	0	0	0	0	0	0
Electricity Sales	**452**	**487**	**500**	**506**	**528**	**543**	**540**	**558**	**588**	**616**	**600**
Utilities Own Use	9	12	15	15	24	24	25	24	25	26	21
Power Losses	75	80	85	91	91	92	107	110	107	114	116
Total	**536**	**579**	**600**	**612**	**643**	**659**	**672**	**692**	**720**	**756**	**737**

Source: DOE, Mindanao Energy Outlook 2014–2030.

Figure 1.16 Energy Consumption by Sector



Source: Provided by NGCP.

Figure 1.17 Daily Load Curves in Mindanao Main Grid

1.8 Conventional Energy Sources

The present JICA Study focusses on power supply policies for Bangsamoro instead of covering the broader energy sector as a whole. The Philippine Government promotes use of renewable energy for power supply in general. In Mindanao, a large coal-fired thermal plant will be commissioned in 2016, followed by small hydropower plants to resolve power shortages by the main grid power supply. Also, oil-fired thermal power and gas turbine plants make the unit cost of electricity higher than the existing hydropower derived electricity. In view also of adverse environmental effects, conventional power supply based of fossil fuel resources is not dealt with in the Study.

There exist potentials for natural gas in the Ligawasan Marsh area of Maguindanao, which may deserve investigation. A pre-feasibility level study may be undertaken to examine this possibility for power supply.

1.9 Renewable Energy

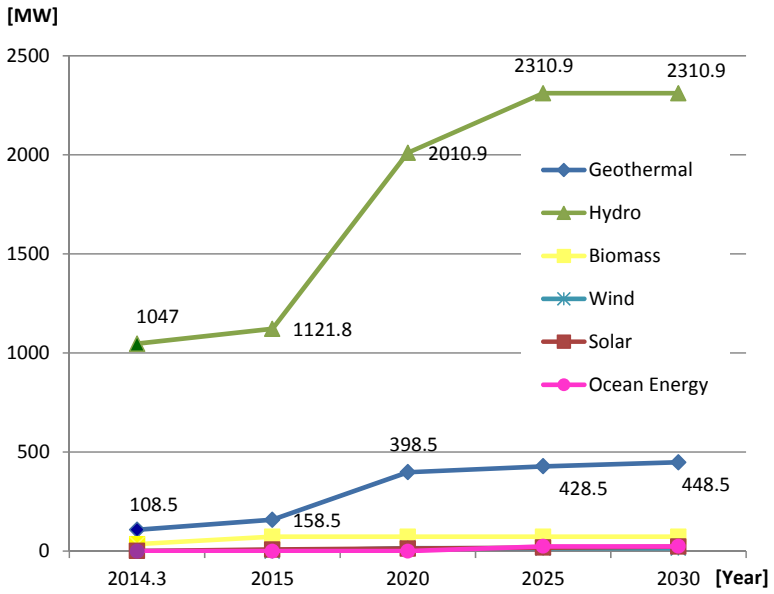
In the Philippines, the renewable energy (RE) is being gradually introduced since the promulgation of the Renewable Energy Laws enacted in 2008, which aims to protect the environment and ensure the national energy security. In the National Renewable Energy Program (NREP), DOE formulated the development plan for introducing RE such as geothermal, hydro, biomass, wind, solar and ocean energy to set targets for the whole area of the Philippines and each regional area, Luzon, Visayas and Mindanao. Table 1.9 shows the target allocated by accumulated annual goal set for each type of renewable energy on the capacity of the existing units (Figure 1.18).

By the end of 2030, the hydro power capacity will be most developed as the largest target, 1,263.9 MW, followed by the development of the geothermal, 340 MW. The development of biomass, wind, solar and ocean energy are relatively small compared to the hydro and geothermal. In order to achieve this goal, it is required that the comprehensive system is developed to tackle and cope with a gap impeding popularization of RE and the essential features of action plan is formulated to promote the investment by the private sector. On the other hand, the proper setting of fee-in-tariff (FIT) is required to stimulate the spread of RE. If not proper, it would be difficult to attract the investors, who try to secure their profit by harnessing RE, of which the generation cost is higher than the fossil fuel, to the power market. Table 1.10 shows the FIT rate approved by ERC on July 2012. Incidentally, this FIT rate is applied to the power generators with renewable energy resource which are connected to the main grid.

Table 1.9 Target Capacity Addition for Introducing Renewable Energy in Mindanao

Sector	Installed Capacity, (MW) as of 2010	Target Capacity Addition by				Total Capacity Addition (MW) 2011-2030	Total Installed Capacity by 2030
		2015	2020	2025	2030		
Geothermal	103.0	50.0	240.0	30.0	20.0	340.0	443.0
Hydro	1,040.0	74.8	889.1	300.0	0.0	1,263.9	2,303.9
Biomass	0.0	36.8	0.0	0.0	0.0	36.8	36.8
Wind	0.0	0.0	15.0	0.0	0.0	15.0	15.0
Solar	1.0	7.0	5.0	5.0	5.0	22.0	23.0
Ocean	0.0	0.0	0.0	24.0	0.0	24.0	24.0
TOTAL	1,144.0	168.6	1,149.1	359.0	25.0	1,701.7	2,845.7

Source: DOE, Renewable Energy Plans and Programs.



Source: DOE.

Figure 1.18 Targets for Introducing Renewable Energy in Mindanao

Table 1.10 FIT Rates

Types of RE	PHP/kWh
Wind	8.53
Biomass	6.63
Solar	9.68
Hydropower (run-of-river)	5.90

Source: DOE, Mindanao Energy Plan 2014.

1.9.1 Hydro power potential resources

According to the Mindanao Energy Plan (MEP) 2014–2030 prepared by DOE, it is estimated that the equivalent of 1,379.32 MW has hydro resource potential and the number of potential sites for its exploration and development is estimated to be 238 in Mindanao. Of the total potential resources, the hydro power potential with 17 identified sites which could provide a total aggregate capacity of 27.15 MW is estimated in the ARMM. The hydro power potential resources in Mindanao are shown in Table 1.11.

A ratio of hydro potential resources in the region accounts only for 2% of the total potential capacity in

the whole area of Mindanao and the number of hydro potential sites is the least in the ARMM compared to other regions. Table 1.12 shows hydro potential resources by province in Mindanao.

Although the number of hydro potential sites is eight, the largest number compared to other provinces, the potential capacity is only around 5 MW and smaller than in Lanao del Sur and Sulu. Nine commissioned projects, which are not in the ARMM but in Region X and Region XI, are ongoing and new hydro power plants with total capacity of 90.8 MW are scheduled to be commissioned by the end of 2017. Further, indicative six projects are expected in the northern part of Mindanao. No development project is planned in the ARMM (Table 1.13).

Table 1.11 Hydropower Potential Resources in Mindanao (as of December 2013)

Region	Location	No. of potential sites	Total estimated capacity (MW)
IX	Zamboanga Peninsula	28	80.06
X	Northern Mindanao	63	679.79
XI	Davao Region	41	151.58
XII	SOCCSKSARGEN	46	161.05
XIII	Caroga	43	279.69
ARMM	ARMM	17	27.15
Total		238	1,379.32

Source: DOE, Mindanao Energy Plan 2014.

Table 1.12 Hydropower Potential Resources by Province in Bangsamoro

Province	No. of sites	Potential capacity (MW)	Pre-development investment requirement (PHP 10^6)
Maguindanao	8	5.23	562.23
Lanao del Sur	7	11.29	1,213.68
Sulu	2	10.63	1,142.73
Total	17	27.15	2,918.64

Source: DOE, MEP 2014–2030.

1.9.2 Geothermal potential resources

The Philippines having active volcanic activities are endowed with rich geothermal resources and remains the second largest geothermal power producer in the world. In Mindanao, Mt. Apo geothermal power plant with a capacity of 108.5 MW is operated by a private company which sells the generated power to NPC based on the power purchase agreement. The geothermal power potential resources estimated as of December 2013 are 290 MW in Mindanao. Table 1.14 and Figure 1.19 show the geothermal power potential resources in Mindanao and map of the geothermal development in Mindanao respectively. As of January 2015, no addition of geothermal power plants is planned in the ARMM.

1.9.3 Biomass potential resources

Mindanao is endowed with rich biomass resources. According to the biomass potential map issued by DOE, the bagasse potential resources are nil, while rice potential resources are estimated to be 4.47 MW and coconuts are estimated to be 84.87 MW (Figure 1.20). As of January 2015, two construction projects of the biomass power plants in Maguindanao are ongoing and they were originally scheduled to be commissioned by the end of 2015. The output of each power plant is 1.6 MW and 10 MW, respectively. Table 1.15 shows the biomass capacity additions planned in Mindanao.

1.9.4 Solar potential resources

Solar energy is one of the promising RE resources in Mindanao. Studies conducted by the National Renewable Energy Laboratory (NREL) indicate that Mindanao has high solar power potential with an average amount of 5–5.5 kW/m^2/day (Figure 1.21).

Table 1.13 Hydropower Plant Construction Plan in Mindanao (as of December 2013)

Region	Plant	Location	Potential Capacity (MW)	Year Available	Pre-Development Investment Requirement* (Million PhP)
Committed					
X	Limbatangon Hydroelectric Power Project	Cagayan de Oro City, Misamis Oriental	9	2017	-
XI	Tudaya 1 Hydroelectric Power Project	Sta. Cruz, Davao del Sur	6.6	2014	-
	Tudaya 2 Hydroelectric Power Project	Sta. Cruz, Davao del Sur	7	2014	-
	Sabangan	Davao City	13.2	2015	-
	Puyo Hydroelectric Power Project	Jabonga, Agusan del Norte	30	2017	-
	Lake Mainit	Jabonga, Agusan del Norte	25	2016	-
Indicative					
IX	Pasonanca	Zamboanga City	0.05	March 2017	5.37
X	Tagoloan Hydropower Project	Impasigong, Bukidnon	39.00	January 2018	4,192.50
	Bubunawan Hydroelectric Power Project	Baungon and Libona, Bukidnon	23.00	January 2018	2,472.50
	Tumalaong Hydroelectric Power Project	Baungon, Bukidnon	9.00	July 2018	967.50
	Culaman Hydroelectric Power Project	ManoloFortich, Bukidnon	10.00	June 2018	1,750.00
CARAGA	Cabadbaran Hydroelectric Power Project	Cabadbaran, Agusan del Norte	9.75	July 2018	1,048.13
Total			**181.60**		**9,761.00**

* *On the assumption that investment cost would require 2.5 million USD per MW*
Foreign Exchange Rate 43 PhP per USD

Source: DOE, MEP 2014–2030.

Table 1.14 Geothermal Power Potential Resources in Mindanao

Region	Location	No. of potential sites	Total estimated capacity(MW)
IX	Zamboanga Peninsula	1	40
X	Northern Mindanao	3	80
XI	Davao Region	1	40
XII	SOCCSKSARGEN	3	100
XIII	Caroga	1	30
Total		9	290

Source: DOE, Mindanao Energy Plan 2014.

Source: DOE, Renewable Energy Plans and Programs (2011–2030).

Figure 1.19 Map of Potential Geothermal Development Sites in Mindanao

Table 1.15 Biomass Capacity Additions Planned in Mindanao (as of December 2013)

Region	Plant	Location	Potential Capacity (MW)	Year Available	Pre-Development Investment Requirement* (Million PhP)
Committed					
ARMM	Philippine Trade Center, Inc.	Maguindanao	1.60	2015	-
	15 MW LPC Biomass Power Plant Project	Maguindanao	10.00	2015	-
Indicative					
X	12 MW Biomass Power Plant Project	Misamis Oriental	10.80	2015	928.80
	10 MW Kalilangan Bio-Energy Corporation Multi-Feedstock Power Generating Facility	Bukidnon	9.00	2015	774.00
	10 MW Don Carlos Bio-Energy Corporation Multi-Feedstock Generating Facility	Bukidnon	9.00	2015	774.00
	10 MW Malaybalay Bio-Energy Corporation Multi-Feedstock Generating Facility	Bukidnon	9.00	2015	774.00
Total			**49.40**		**3,250.00**

* *On the assumption that investment cost would require 2 million USD per MW*
Foreign Exchange Rate 43 PhP per USD

Source: DOE, MEP 204–2030.

Rice

Baggasse

Coconuts

Source: DOE website.

Figure 1.20 Biomass Potential Resources in Mindanao

Source: NREL materials.

Figure 1.21 Solar Potential Map of Mindanao

Mindanao has 17 solar potential sites, of which two sites are located in the ARMM (Table 1.16). Their combined output is around 37 MW, accounting for 18% of total estimated capacity in Mindanao. Those pre-development projects entail estimated cost of approximately PHP 2,918.64 million. The breakdown of solar potential sites in the ARMM is shown in Table 1.17.

Table 1.16 Solar Potential Resources in Mindanao

Region	Location	No. of potential sites	Total estimated capacity (MW)
IX	Zamboanga Peninsula	3	21
X	Northern Mindanao	1	20
XI	Davao Region	2	45
XII	SOCCSKSARGEN	5	47
XIII	Caroga	4	31
ARMM	ARMM	2	37
Total		17	201

Source: DOE, Mindanao Energy Plan 2014.

Table 1.17 Solar Potential Resources in ARMM

Region	Location	Potential capacity (MW)	Pre-development investment requirement (PHP 10^6)
ARMM	Tawi-Tawi	2	172
	Marawi, Lanao Del Sur	35	3,010
Total		37	2,918.64

Source: ibid.

1.9.5 Ocean energy potential resources

Ocean energy power generation is a generating method harnessing RE such as ocean current, wave, tide, and a difference of sea water temperature. Mindanao has eight ocean energy potential sites identified with total capacity of 24 MW, of which the ARMM has five potential sites with a capacity of 8 MW (Table 1.18). Table 1.19 shows the ocean energy potential resources by location in the area. As shown in Figure 1.22, the ocean energy potential sites are studded with coastal areas of Mindanao and small neighboring islands.

Table 1.18 Ocean Energy Potential Resources in Mindanao

Region	Location	No. of potential sites	Total estimated capacity (MW)
XII	SOCCSKSARGEN	1	1
XIII	Caroga	2	15
ARMM	ARMM	5	8
Total		8	24

Source: ibid.

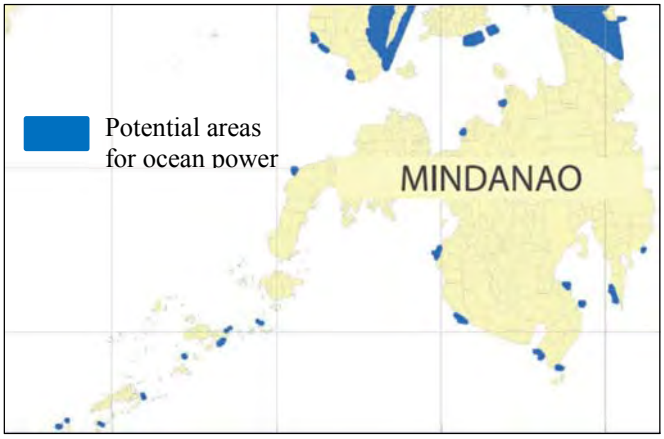
Table 1.19 Ocean Energy Potential Resources in ARMM

Region	Location	Potential capacity (MW)	Pre-development investment requirement (PHP 10^6)
ARMM	Tongkil, Sulu	1	7
	Sulu	2.5	17.5
	Tawi-Tawi	4.5	31.5
Total		8	168

Source: ibid.

1.9.6 Wind power potential resources

According to the investigation result by NREL, the wind power potential resources in Mindanao are lower than those in Luzon and Visayas (Figure 1.23). According to Figure 1.23, Mindanao has the highest wind power potentials with total capacity of 2,000 to 4,000 MW in the western coastal area of Mindanao Island. However, it is comparatively lower than in Luzon and Visayas. The ARMM has wind power potential resources with a capacity of 100 to 1,000 MW and it is also lower than in other regions. For the development of wind power, a small part of Region X and Region XIII in Mindanao is targeted.



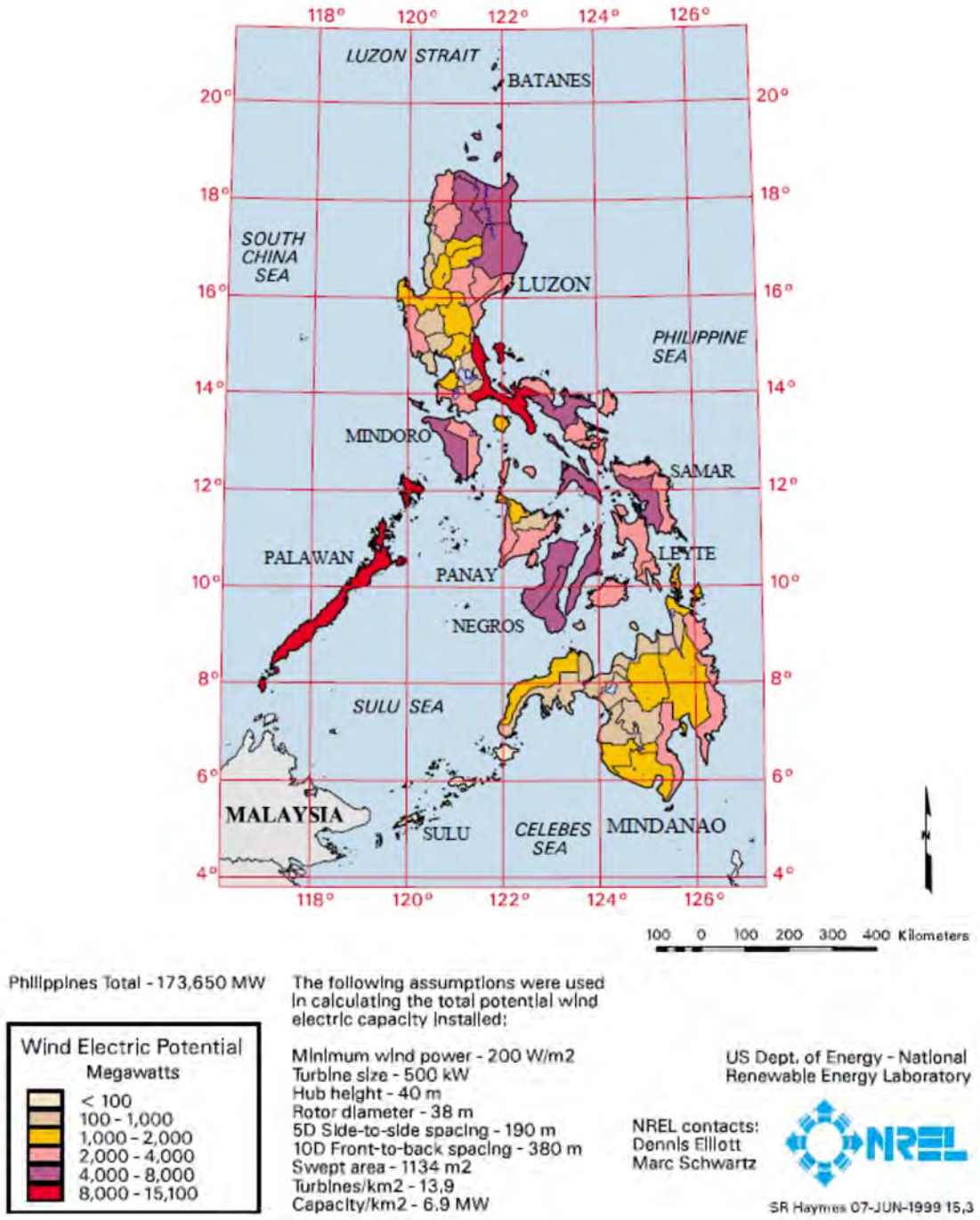
Source: DOE, Renewable Energy Plans and Programs (2011–2030).

Figure 1.22 Mindanao Ocean Energy Potential Map

1.10 Electricity Rate

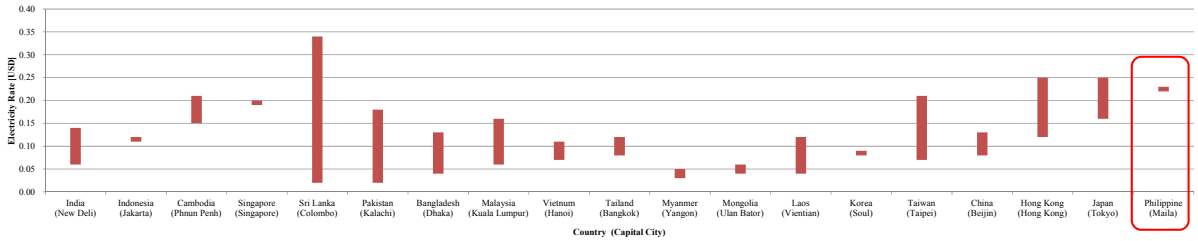
The electricity rate in the Philippines tends to be comparatively higher than other Asian countries. Figure 1.24 represents electricity rate of capital cities in the Asian countries based on the investigation conducted by Japan External Trade Organization (JETRO). The electricity rate in Sri Lanka is the highest, followed by Hong Kong and Japan. The electricity rate in the Philippines is the third highest and approximately US$0.22/kWh.

National average systems rate, private distribution utilities' average system rate, and electric cooperatives' as of September 2014 and March 2014 are shown in Figure 1.25. Regarding the national average system rate and the national average system rate of private DUs, Mindanao has the lowest rates as of both March and September in 2014 among three major grids. Meanwhile, Visayas has the lowest rate with regard to ECs average system rate. Table 1.20 shows ECs unbundled average effective residential electricity rates in June 2014. From the table, it is found that regarding ECs' average systems rate, Visayas has the lowest rate, while Mindanao has the lowest as to the residential rate. Generation costs comprised approximately 50% of ECs' national average effective residential electricity rates. The generation cost in Mindanao is PHP 3.9615/kWh, the lowest among all the grids. This is mainly attributable to the fact that about 50% of power demand in Mindanao is supplied by the Agus hydro power plants, which can generate the power at a lower cost.



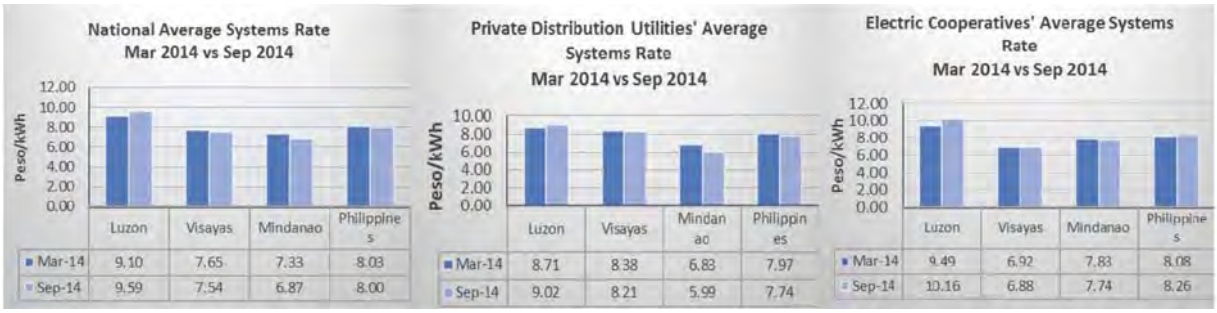
Source NREL, Wind Energy Resource Atlas of the Philippines.

Figure 1.23 Wind Power Potential Resources in Philippines



Source: JETRO website data.

Figure 1.24 Electric Tariff by Capital Cities in Asian Countries



Source: DOE, 25th EPIRA Implementation Status Report.

Figure 1.25 Average Electric System Rate

Table 1.20 EC's Unbundled Average Effective Residential Electricity Rates (PHP/kWh), June 2014

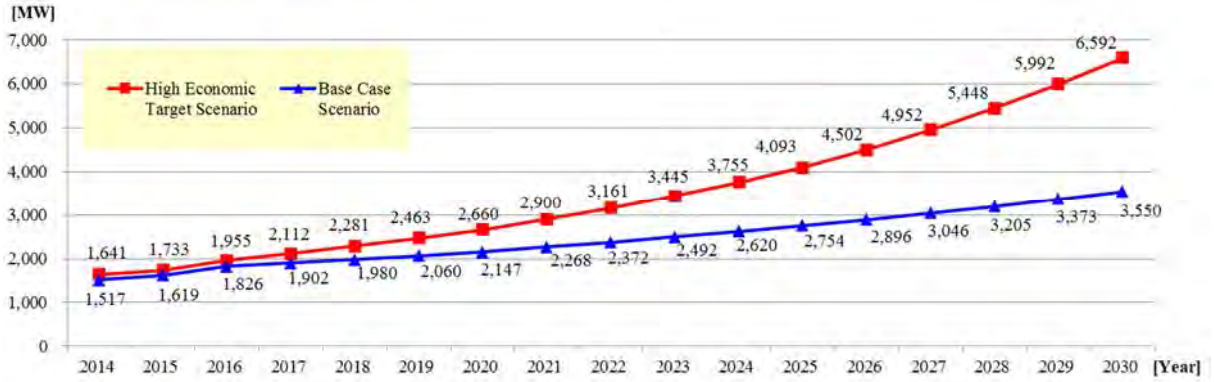
Bill Subgroup	LUZON		VISAYAS		MINDANAO		NATIONAL	
	PhP/kWh	Percent share	PhP/kWh	Percent share	PhP/kWh	Percent share	PhP/kWh	Percent share
Generation	5.0897	50.09	5.6504	53.19	3.9615	45.57	4.9005	49.87
Transmission	1.0787	10.62	0.8658	8.15	1.0020	11.53	0.9822	10.00
System Loss	0.8765	8.63	0.9050	8.52	0.7162	8.24	0.8326	8.47
DSM[1]	1.6931	16.66	1.8190	17.12	1.6805	19.33	1.7309	17.62
RFSC[2]	0.3251	3.20	0.3459	3.26	0.4552	5.24	0.3754	3.82
Other Charges[3]	(0.0712)	(0.70)	0.0674	0.63	(0.1434)	(1.65)	(0.0491)	(0.49)
Subsidy Charges[4]	0.0654	0.64	0.0671	0.63	0.0830	0.95	0.0718	0.73
Universal Charges[5]	0.3159	3.11	0.3142	2.96	0.3350	3.85	0.3217	3.27
Other Taxes[6]	0.0812	0.80	0.0205	0.19	0.0642	0.74	0.0553	0.56
VAT	0.7067	6.95	0.5685	5.35	0.5388	6.20	0.6047	6.15
Total	**10.1611**	100.00	**10.6238**	100.00	**8.6930**	100.00	**9.8260**	100.00

[1] Distribution, Supply and Metering Charges
[2] Reinvestment Fund for Sustainable CAPEX
[3] Loan Condonation & PEMC-SPA Charge
[4] Lifeline & Senior Citizen Subsidy/Discount
[5] Missionary Electrification, Environmental Charges, NPC Stranded Cost
[6] Local Franchise &Business Taxes, Real Property Tax
Source: NEA

CHAPTER 2 POWER SECTOR DEVELOPMENT PLAN

2.1 Demand Forecast

Two demand projections, namely, Base Case and High Economic Target, have been prepared by DOE. The base case demand forecast is obtained from the Distribution Development Plan (DDP) submitted by all distribution utilities in Mindanao, while the high economic target demand forecast is based on the gross regional domestic product (GRDP) target from the peace and development framework plan prepared by Mindanao Development Authority (MinDA). In the case of the high economic target scenario, the growth rate of peak demand is expected to be around 12-14% during 2014-16. From 2017 onward, the peak demand growth rate is expected to be 8-10%. On the other hand, in the case of base case scenario, the growth rate of peak demand is estimated to be around 6-12% and from 2017 onward, the growth rate of around 4-5% is expected. Figure 2.1 shows the peak demand projection for both the base case scenario and the high economic target scenario in Mindanao.

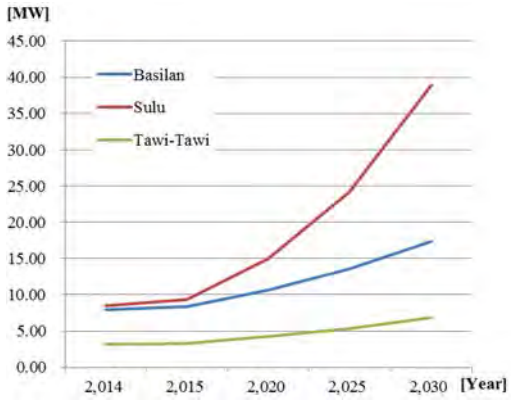


Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
High Economic Target Scenario	1,641	1,733	1,955	2,112	2,281	2,463	2,660	2,900	3,161	3,445	3,755	4,093	4,502	4,952	5,448	5,992	6,592
Growth Rate	14.95%	5.60%	12.80%	8.00%	8.00%	8.00%	8.00%	9.00%	9.00%	9.00%	9.00%	9.00%	10.00%	10.00%	10.00%	10.00%	10.00%
Base Case Scenario	1,517	1,619	1,826	1,902	1,980	2,060	2,147	2,268	2,372	2,492	2,620	2,754	2,896	3,046	3,205	3,373	3,550
Growth Rate	6.02%	6.72%	12.80%	4.20%	4.10%	4.03%	4.22%	5.65%	4.55%	5.08%	5.11%	5.14%	5.16%	5.18%	5.21%	5.23%	5.25%

Source: DOE, Mindanao Energy Outlook 2014–2030.

Figure 2.1 Projected Peak Demand in Mindanao

As for the demand forecast in missionary areas such as Basilan, Sulu, and Tawi-Tawi, the peak demand is expected to increase substantially by the end of 2030. The projected peak demand for Basilan and Tawi-Tawi in 2030 is estimated to be approximately twice as much as the demand in 2014. Also, it is expected that the peak demand for Sulu in 2030 will reach 38.92 MW, which is equivalent to about 4.6 times the demand in 2014. Figure 2.2 shows the demand forecast for Basilan, Sulu, and Tawi-Tawi.



[Unit: MW]

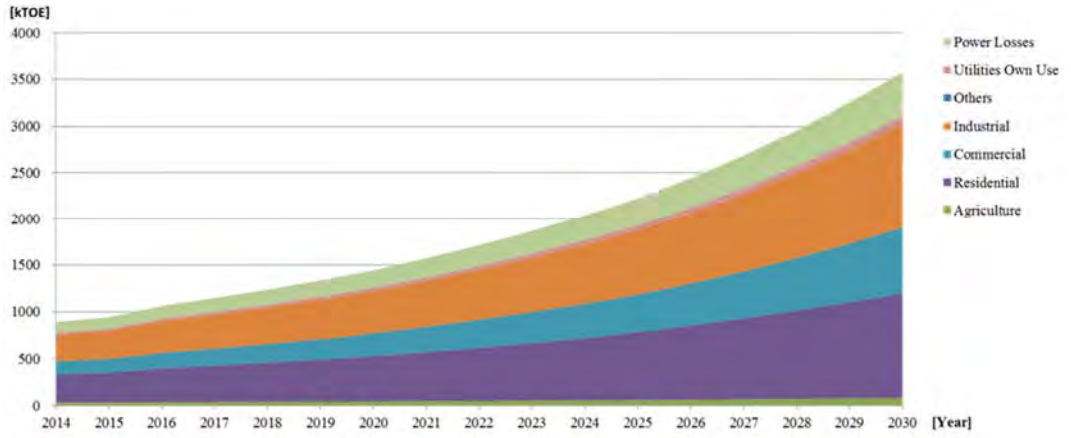
Islands \ Year	2014	2015	2020	2025	2030
Basilan	7.94	8.33	10.63	13.57	17.32
Sulu	8.47	9.32	15.01	24.17	38.92
Tawi-Tawi	3.15	3.30	4.22	5.38	6.87

Source: DOE, Mindanao Energy Plan 2014.

Figure 2.2 Demand Forecast for Basilan, Sulu, and Tawi-Tawi

2.2 Energy Outlook by Sector

For the energy outlook by sector in Mindanao, two scenarios, the high economic target scenario and base case scenario, have been prepared as well as the demand forecast by DOE. Figure 2.3 and 2.4 show the high economic target scenario and base case scenario of the energy outlook by sector in Mindanao respectively.

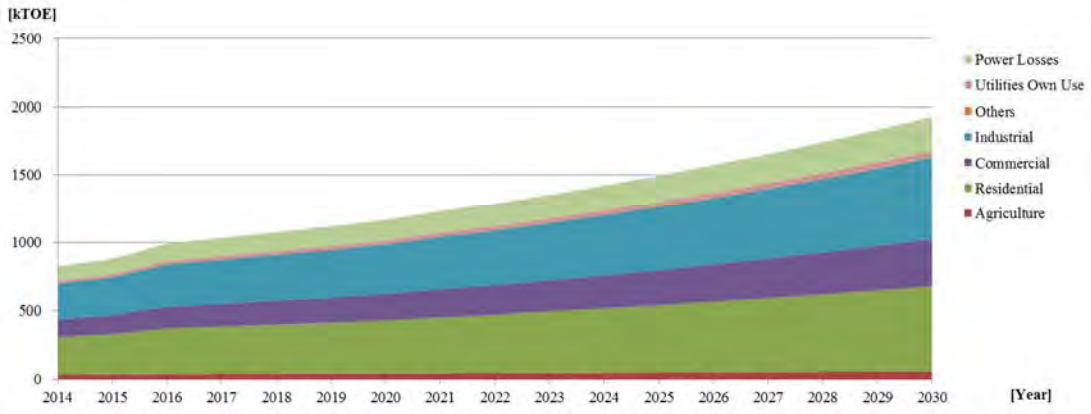


[Unit: kTOE]

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Agriculture	33	34	37	39	41	43	45	48	51	54	57	60	64	68	73	77	82
Residential	304	322	363	391	421	452	484	525	568	616	667	721	788	860	939	1024	1116
Commercial	138	145	165	180	197	217	239	265	294	326	361	401	449	502	562	630	706
Industrial	278	294	331	358	387	417	451	491	536	584	636	694	763	839	923	1016	1117
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity Sales	**720**	**760**	**860**	**929**	**1005**	**1086**	**1174**	**1281**	**1398**	**1525**	**1664**	**1816**	**2000**	**2202**	**2424**	**2669**	**2939**
Utilities Own Use	22	24	27	29	31	33	36	39	43	47	51	56	61	67	74	81	89
Power Losses	116	122	138	149	161	174	188	204	223	243	265	289	317	349	384	423	465
Total	**858**	**906**	**1024**	**1107**	**1196**	**1293**	**1398**	**1525**	**1664**	**1815**	**1980**	**2160**	**2378**	**2618**	**2882**	**3173**	**3493**

Source: DOE.

Figure 2.3 Energy Outlook by Sector in Mindanao: High Economic Target Scenario



[Unit: kTOE]

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Agriculture	32	34	37	38	39	40	41	42	44	45	47	48	50	52	53	55	57
Residential	277	297	335	348	362	375	389	410	427	447	468	491	514	539	564	591	619
Commercial	129	137	156	164	172	180	190	203	214	227	241	256	272	289	307	327	348
Industrial	257	274	309	322	336	349	364	385	402	423	444	467	491	517	544	573	603
Others	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity Sales	**663**	**708**	**800**	**834**	**869**	**904**	**943**	**997**	**1043**	**1097**	**1154**	**1214**	**1278**	**1345**	**1416**	**1491**	**1570**
Utilities Own Use	21	22	25	26	27	28	29	31	32	34	36	37	39	41	43	46	48
Power Losses	107	114	129	134	140	145	151	160	167	176	185	194	204	215	226	238	250
Total	**790**	**844**	**954**	**994**	**1035**	**1078**	**1124**	**1188**	**1243**	**1307**	**1374**	**1446**	**1521**	**1601**	**1685**	**1774**	**1868**

Source: ibid.

Figure 2.4 Energy Outlook by Sector in Mindanao: Base Case Scenario

In both cases, the energy required for the residential and industrial use is highly and almost equally

expected. The second largest is the commercial use and the agriculture use is the lowest. These scenarios are based on the current share and created by proportionally increasing energy consumption for each sector.

2.3 Power Development Plan

For the development of large-scale power plants connected to the on-grid, the investment by private capitalization is required since the Philippine Government cannot directly and strongly encourage private companies to install new power plants. This situation is due to the EPIRA designed for the introduction of competitive principal by private utilities that could consequently lead to electricity price reduction. As a matter of fact, after the EPIRA was enacted, the private investment has not been so activated as expected, and the Philippines are still being annoyed by chronic power shortages that the supply cannot meet the demand. However, as a recent trend, the development of power facilities by big holding companies is being promoted and committed. The outlook of improving the power supply shortages is expected. Table 2.1 shows the committed projects for new power plants in Mindanao.

Table 2.1 Committed Projects for New Power Plants in Mindanao

Year	Name of Plants	Fuel Type	Capacity [MW]	Location
2014	Tuday 1 Hydro	Hydro	6.6	Sta.Cruz, Davao del Sur
	Tuday 2 Hydro	Hydro	7	Sta.Cruz, Davao del Sur
	MEGC Diesel	Diesel	15	Dalipuga, Iligan City
	PSI Bunker-Fired Power Plant	Diesel	20.9	Brgy.Apopong, General Santos City
	PSFI Bunder-Fired Power Plant	Diesel	5.2	San Francisco, Agusan del Sur
2015	Therma South Coal	Coal	300	Toril, Davao City and Sta.Cruz, Davao del Sur
	Puyo Hydro	Hydro	30	Jabonga, Agusan del Norte
	Southern Mindanao Coal	Coal	200	Maasim, Sarangani
	Kalilangan Biomass	Biomass	10	Maramag, Bukidnon
	Malaybalay Biomass	Biomass	10	Maramag, Bukidnon
	Don Carlos Biomass	Biomass	10	Maramag, Bukidnon
	LPC Biomass	Biomass	10	Maguindanao
2016	Lake Mainit Hydro	Hydro	25	Jabonga, Agusan del Norte
	FDC Misamis Coal	Coal	405	Villanueva, Misamis Oriental
2017	Limbatangon Hydro	Hydro	9	Cagayan de Oro City, Misamis Oriental
Total			1063.7	

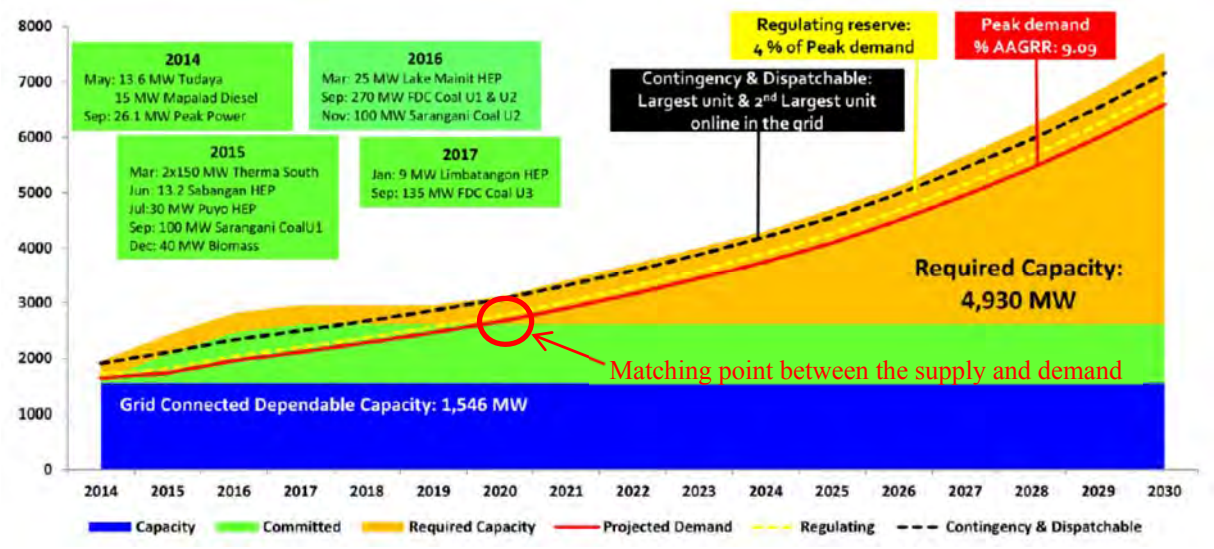
Source: DOE, Mindanao Energy Plan 2014.

Although, the improvement of the power supply will be realized by the end of 2015 owing to these capacity addition committed, there is a possibility that the power shortages could occur again as far as the peak demand continue to grow. If the high economic target scenario or base case scenario can be realized, such a severe situation would appear in 2020 at the earliest and at the latest in 2024, respectively. Figures 2.5 and 2.6 show the demand-supply balance for both case scenarios.

For the small-scale power plants installed in the off-grid, the addition by NPC-SPUG is permitted. The diesel generators that are easier to install in the off-grid and the initial installation cost is smaller. From a mechanical characteristic restriction, some of those units cannot be run for 24 hours. Accordingly, it is hard to say that the stable power is supplied on the off-grid. By the end of 2030, the addition of power generators, 10 MW in Sulu and 5 MW in Tawi-Tawi are scheduled to be installed (Table 2.2).

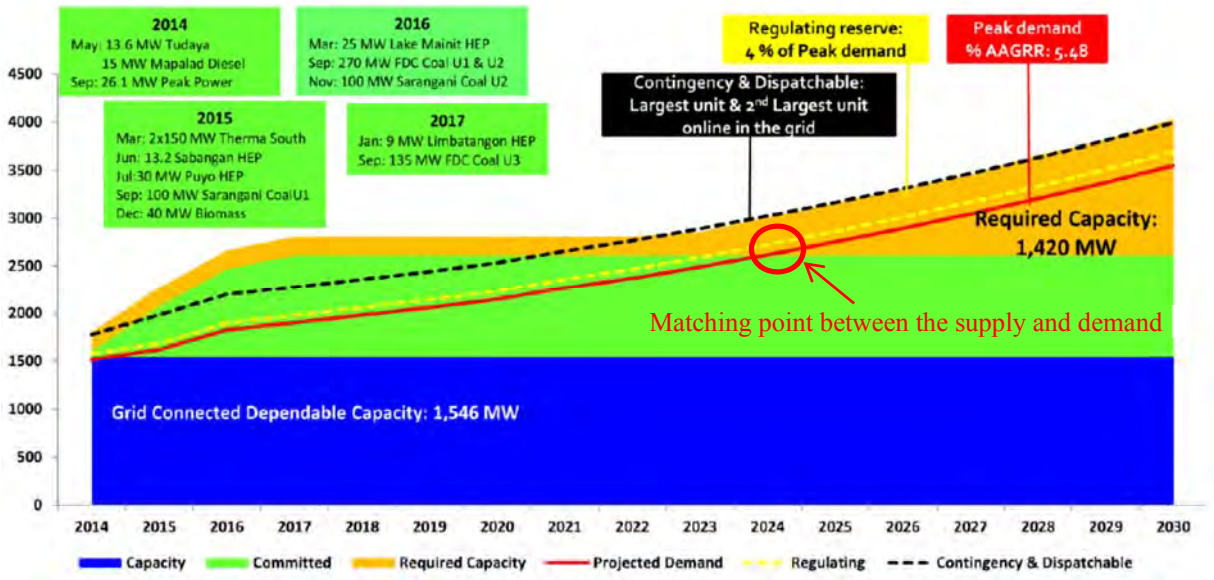
2.4 Transmission Development Plan

The transmission development plan (TDP) is prepared by NGCP and annually updated and published on their official website. All transmission development projects planned between 2016 and 2023 are shown in the TDP 2013. The projects that may have an impact on the ARMM are as follows.



Source: DOE, MEP 2014–2030.

Figure 2.5 Electricity Demand-Supply Balance 2014–2030: High Economic Target Scenario



Source: ibid.

Figure 2.6 Electricity Demand-Supply Balance 2014–2030: Base Case Scenario

Table 2.2 Added Capacity in Islands of ARMM

Year / Islands	2014	2015	2020	2025	2030	Estimated Investment Requirement [Million PhP]
Sulu	-	10	-	-	-	2,257.50
Tawi-Tawi	-	-	5	-	-	645
Basilan	-	-	-	-	-	967.5

Source: DOE, MEP 2014.

2.4.1 Tacurong–Sultan Kudarat 138 kV transmission lines construction project

This is the project that aims to improve the system reliability of supplying the power for the Tacurong substation (S/S) and the Sultan Kudarat S/S by newly constructing 138 kV T/L, one circuit. Under normal condition, the Sultan Kudarat S/S are served through the Kibawe S/S. However, when the 138 kV line between Kibawe and Tacurong S/S is faulted or in preventive maintenance, the Tacurong S/S can accommodate the loads of the Sultan Kudarat S/S via long 69 kV transmission line with limited capacity. Consequently, some of the electricity end users have experienced frequent low voltage due to relatively long transmission line. In order to avoid this situation, this project is planned and targeting the completion in 2018. Figure 2.7 shows the zoomed system diagram around the Tacurong S/S and the Sultan Kudarat S/S and Figure 2.8 shows the image of newly constructed 138 kV T/L between the Tacurong S/S and the Sultan Kudarat S/S.

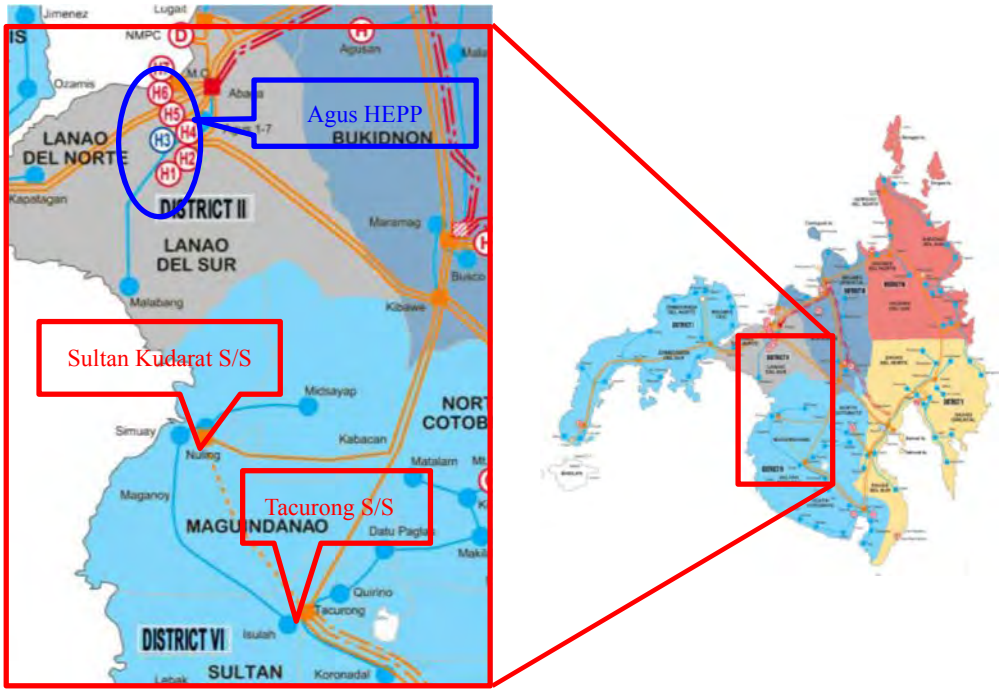


Figure 2.7 Zoomed System Diagram around Tacurong S/S and Sultan Kudarat S/S

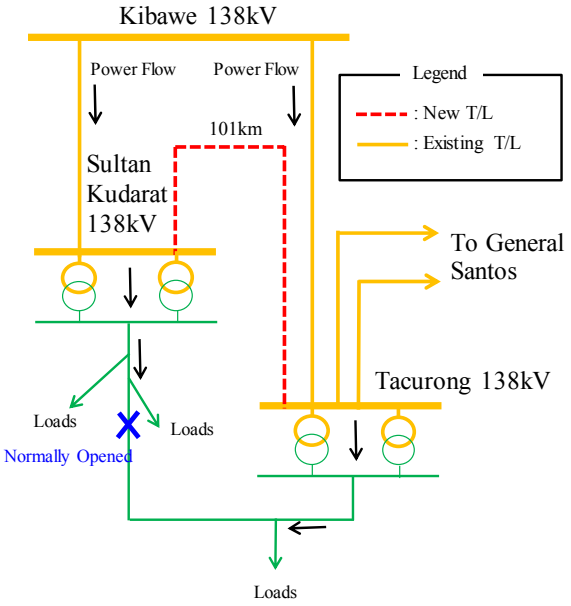


Figure 2.8 Image of Newly Constructed 138 kV T/L between Tacurong S/S and Sultan Kudarat S/S

2.4.2 Agus 1-2 switchyard upgrading and rehabilitation

Currently, the Agus 1 power station and the Agus 2 power station are mutually connected through a single circuit, 138 kV T/L with a length of 6 km. When this line is faulted, the generator in the Agus 1 power station is shut down and the power supply is interrupted. In order to avoid this situation, a new T/L between the Agus 1 and the Agus 2 is scheduled to be additionally constructed and completed in 2017 (Figure 2.9). Also, this project includes the rehabilitation of auxiliary equipment such as circuit breakers at the Agus switchyard as replacement of aged facilities.

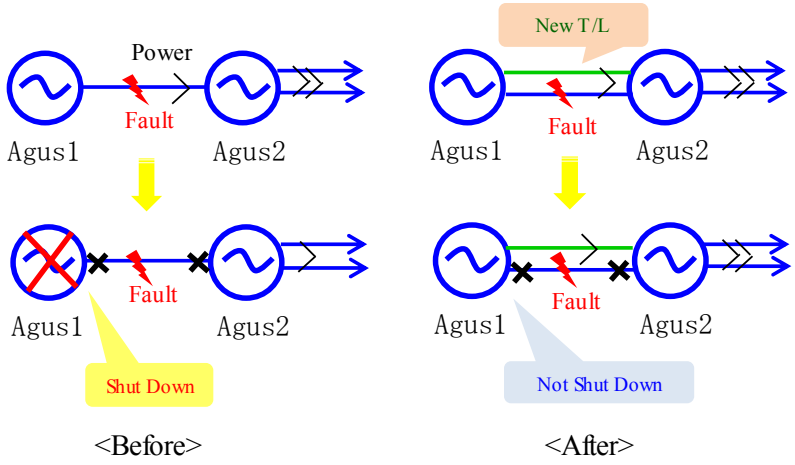


Figure 2.9 Image of System Condition before/after Agus1-2 Upgrading and Rehabilitation Project

2.4.3 Agus 5 switchyard upgrading and rehabilitation

The control devices and equipment of the switchyard connected to the Agus 5 power station can be controlled from the control room shared by the operation room of the Agus 5. In order to meet the unbundling policy regulated by the EPIRA and the NGCP internal regulation, a new control room is planned to be established separately from the NPC facilities. Simultaneously, the related aged facilities are also scheduled to be replaced by the end of 2020 (Table 2.3).

Table 2.3 Power Circuit Breaker Targeted for Replacement in ARMM

Substation/Switchyard	No. of 138 kV PCB and associated equipment	No. of 69 kV PCB and associated equipment
Agus 1 and 2 Switchyard	4	-
Agus 5 Switchyard	6	-
Sulatan Kudarat Substation	-	1
Tacurong Susbstation	1	8

Source: NGCP, TDP 2013.

2.4.4 Other projects

Large-scale system reinforcement projects, which could indirectly benefit the ARMM, are under consideration as described below.

(1) Balo-i–Villanueva–Maramag–Bunawan 230 kV energization project

- Expected completion year: 2017
- Project purpose: To improve the system stability and supply reliability by upgrading from 138 kV T/L to 230 kV T/L, which is called backbone line passing through the central part of Mindanao
- Estimated invest requirement: Around PHP 2.4 billion

(2) Leyte–Mindanao interconnection project (LMIP)

- Expected completion target: Under examination
- Project purpose: To improve the supply reliability and realize the power interchange by interconnecting Mindanao on-grid and Visayas on-gird, effective utilization of power reserves, and expansion of power wholesale market
- Estimated investment requirement: Around PHP 34 billion (only for the Mindanao side)

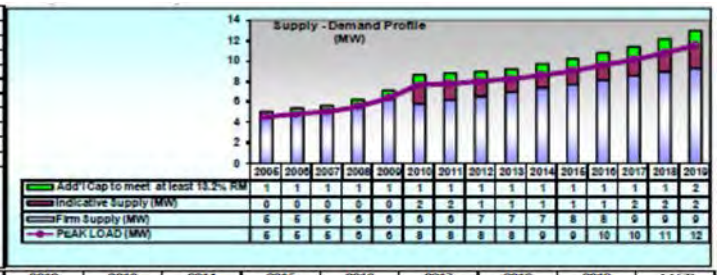
2.5 Distribution Plan

2.5.1 Distribution development plan

A set of expansion and rehabilitation plans for power distribution facilities, called the Distribution Development Plan (DDP), has been formulated by ECs and PIOUs. Those plans by ECs are submitted to DOE through NEA, and those by PIOUs to DOE directly. DOE compiles these expansion-and-rehabilitation plans and publishes these plans as DDP. The DDP 2010–2019 compiled by DOE shows peak demand forecast of the power supplied by ECs and yearly budget required for enforcement of power supply facilities (Table 2.4). However, it is hard to say whether these plans of ECs in the ARMM are properly formulated. Also, some of the ECs have not submitted development plans including long-term plans, and some have only short-term plans. In the DDP 2010–2019, no EC in the ARMM has an expansion plan for distribution facilities targeting 2015–2019.

Table 2.4 Excerpt from DDP 2010-2019 (SULECO)

General Information	
Location	Bus-Bus, Jolo, Sulu
Contact Person	Peraida T. Akajal
Position	General Manager
Tel. No.	09189795681 / 09196782007
Fax No.	
E-mail Address	
Coverage Area	1,600.40 sq. km.
No. of barangays	330
Franchise Population	
SUPPLY HIGHLIGHTS	
Power Contract with NPC-SPUG expired on December 2009. Power Supply Agreement (PSA) with NPC-SPUG was signed for CY 2010 onwards.	



No. of Customers	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	AAGR
Residential	15,068	15,900	16,770	17,843	18,976	20,180	21,355	22,612	23,933	25,345	6%
Commercial	1,127	1,169	1,222	1,290	1,360	1,433	1,502	1,575	1,651	1,731	5%
Industrial											
Others	345	352	360	362	364	366	368	370	373	376	1%
Total	16,541	17,421	18,352	19,495	20,699	21,979	23,226	24,557	25,957	27,452	6%
Energy Sales per Customer Type (MWh)	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**AAGR**
Residential	21,082	22,432	23,916	25,865	27,972	30,263	32,715	35,383	38,250	41,370	8%
Commercial	4,973	5,279	5,739	6,389	7,113	7,918	8,810	9,803	10,909	12,140	10%
Industrial											
Others	5,911	6,320	6,835	7,350	7,941	8,582	9,279	10,035	10,859	11,755	8%
Total	31,966	34,031	36,489	39,606	43,026	46,763	50,804	55,221	60,018	65,264	8%
Projected Infrastructure Requirements	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**TOTAL**
Distribution/Sub-transmission Facilities	29	32	14								75
Expansion(ckt-km)	22										22
Rehabilitation(ckt-km)	7	32	14								53
Substation Capacity (MVA)											
Reactive Power Compensation Plan (MVAr)											
Capital Investment Requirements(in Million PhP)	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**TOTAL**
Distribution/Subtransmission Facilities	29	27	18								69
Expansion	17										17
Rehabilitation	5	27	19								52
Substation Projects											
Electrification Projects	9	14	9	6	4	6	8	4	6	8	72
Total	32	42	28	6	4	6	8	4	6	8	141
Level of Electrification	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	
Barangay Level (%)	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
No of Barangays Electrified (On-Grid)	281	281	281	281	281	281	281	281	281	281	
No. of Barangays Electrified (Off-Grid)	49	49	49	49	49	49	49	49	49	49	
Total	330	330	330	330	330	330	330	330	330	330	
Household Level (%)	11%	12%	12%	13%	13%	14%	14%	16%	16%	16%	
No. of Households Electrified (On-Grid)	14,911	15,657	16,439	17,426	18,471	19,589	20,764	22,020	23,342	24,754	
No. of Households Electrified (Off-Grid)											
Total	14,911	15,657	16,439	17,426	18,471	19,589	20,764	22,020	23,342	24,764	
Franchise Coverage:											
6 small island with a total of 274 mainland barangays and 56 small island barangay.											

Unknown

Source: DOE, Distribution Development Plan 2010–2019.

Considering this situation, the JICA Study Team confirmed directly with MAGELCO if it has its own DDP for short and long terms. According to MAGELCO, the expansion and rehabilitation plans of distribution facilities for 2015-2017 were formulated as a short term plan as shown in Table 2.5

As stated earlier, MAGELCO was evaluated as the EC requiring drastic and prompt managerial improvement as “the worst rated EC” based on the performance assessment conducted by NEA. In

response to this assessment, MAGELCO is currently under a restructuring process, initiated in November 2014 and some of distribution facilities is expected to be rehabilitated and expanded by the end of 2015.

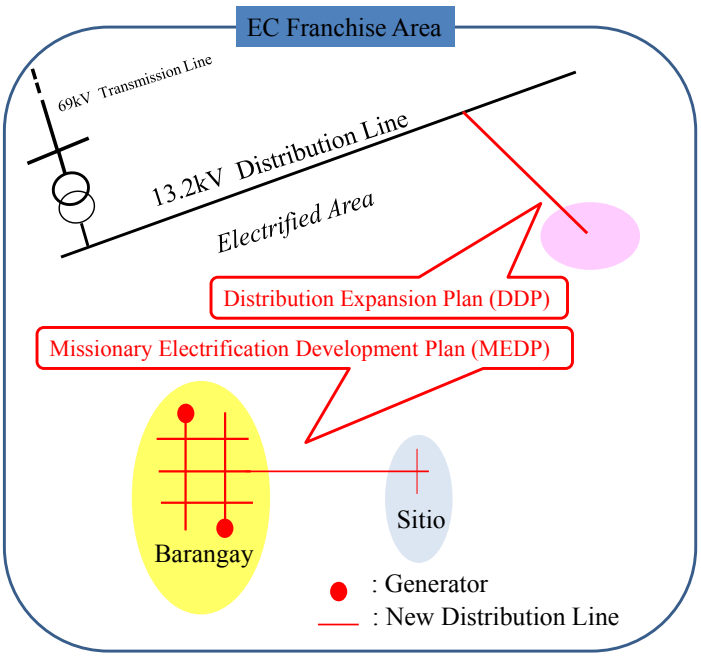
Table 2.5 MAGELCO Short Term Distribution Development Plan, 2015–2017

Power Distribution Facilities		2015	2016	2017
Sub-transmission Line 69 kV (km)	Expansion	32	40	30
	Replacement	1.4	0.5	-
Distribution Line13.2 kV (km)	Expansion (3-phase)	72	-	-
	Expansion (single phase)	275	-	-
	Replacement (3-phase)	147	-	-
Distribution Transformer (sets)	10 MVA	1	-	-
	5 MVA	1	1	-
	10 MVA Upgrading	1	-	-

Source: MAGELCO.

2.5.2 Missionary electrification development plan

In addition to the DDP, the Missionary Electrification Development Plan (MEDP) is disclosed by DOE. The MEDP is a plan to energize remote areas and islands for *barangay* and *sitio* or enclave villages far from the center of barangay, located far from existing distribution network, and targeting the area to which extension of distribution lines is difficult (Figure 2.10). The business operators to be responsible for implementing the energization are stipulated by the EPIRA and prioritized as (1) a distribution company with un-electrified areas in its franchise area, (2) a distribution company adjacent to the un-electrified area, (3) third business operator, and (4) NPC-SPUG.



Source: JICA Study Team.

Figure 2.10 Energization Image by DDP and MEDP for Remote Areas

2.5.3 Progress of energization plan

The energization rate of the DDP and the MEDP is managed by DOE and disclosed on the DOE website, and the progress of energization in the ARMM is shown in Table 2.6.

Table 2.6 Progress of Energization in ARMM (Disclosed on February 9, 2015)

Status	Year Approved	EC Franchise Area	Type of PJT	Province	No. of PJT Areas	Potential House Hold Benefeficiaries
Completed/For Inspection	2009	SIASELCO	Barangay & Sitio	Sulu	4	-
For Implementation/For Fund Release	2013	CASELCO	Barangay & Sitio	Tawi-Tawi	6	944
	2013	TAWELCO	Barangay & Sitio	Tawi-Tawi	13	750
	2011	TAWELCO	Barangay & Sitio	Tawi-Tawi	3	-
Ongoing Implementation	2012	LASURECO	Rehabilitation	Lanao Del Sur	3	-

Source: DOE website.

CHAPTER 3 ISSUES OF POWER SECTOR

3.1 Power Supply Shortages

In Mindanao, the power demand exceeds power supply capability even as of January 2015, and this is one of the factors which constrain economic growth. The information on the demand and supply balance such as forecasted peak demand, power supply capability and reserve capacity are disclosed on the NGCP website at 4:00 in the early morning on a daily basis. Table 3.1 shows the daily demand and supply balance forecast published from February 16 to 22, 2015 by NGCP.

Table 3.1 Demand and Supply Balance Forecast: Feb. 16–22, 2015

Date			LUZON	VISAYAS	MINDANAO
Feb.16	Mon.	System Capacity (MW)	8,536	1,571	1,320
		System Peak (MW)	7,282	1,457	1,338
		Reserve (MW)	1,254	114	-18
		Reserve Rate (%)	*17.2*	*7.8*	*-1.3*
Feb.17	Tue	System Capacity (MW)	8,473	1,608	1,351
		System Peak (MW)	7,500	1,468	1,348
		Reserve (MW)	973	140	3
		Reserve Rate (%)	*13.0*	*9.5*	*0.2*
Feb.18	Wed	System Capacity (MW)	8,566	1,608	1,371
		System Peak (MW)	7,430	1,428	1,362
		Reserve (MW)	1,136	180	9
		Reserve Rate (%)	15.3	12.6	0.7
Feb.19	Thu	System Capacity (MW)	8,448	0	1,271
		System Peak (MW)	6,709	0	1,374
		Reserve (MW)	1,734	0	-103
		Reserve Rate (%)	25.9	0.0	-7.5
Feb.20	Fri	System Capacity (MW)	8,473	1,473	1,271
		System Peak (MW)	7,430	1,389	1,362
		Reserve (MW)	1,043	84	-91
		Reserve Rate (%)	14.0	6.0	-6.7
Feb.21	Sat	System Capacity (MW)	8,473	1,473	1,271
		System Peak (MW)	7,430	1,389	1,362
		Reserve (MW)	1,043	84	-91
		Reserve Rate (%)	14.0	6.0	-6.7
Feb.22	Sun	System Capacity (MW)	8,146	1,404	1,213
		System Peak (MW)	6,307	1,329	1,312
		Reserve (MW)	1,839	75	-99
		Reserve Rate (%)	29.2	5.6	-7.5

Source: NGCP website.

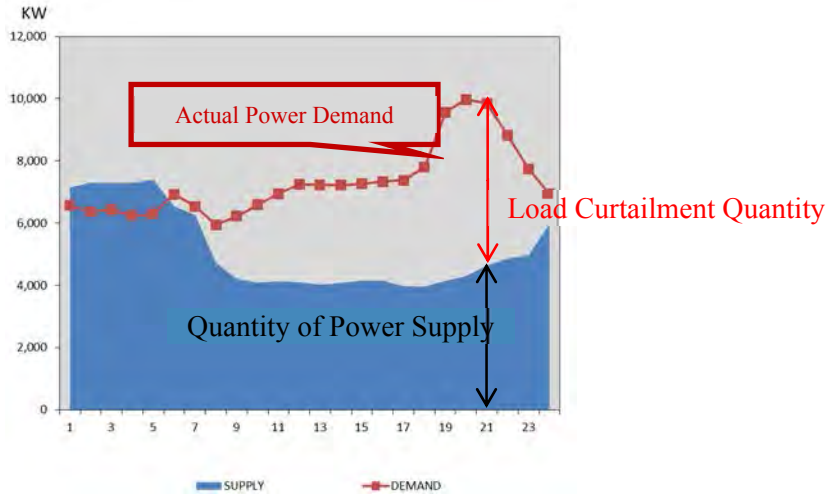
According to Table 3.1, it is found that the reserve capacity is secured at more than 13% in Luzon and 6% in Visayas through the week, while the reserve capacity in Mindanao indicates negative values or almost zero through the week. This means the condition that the demand exceeds supply capacity, i.e. power shortage condition. Under the power shortage condition, the load curtailment (scheduled power outage) is implemented to keep the demand and supply balance. NGCP is also disclosing forecasted demand and supply balance on an hourly basis on its website. Table 3.2 presents an example of hourly demand and supply balance in Mindanao, disclosed on February 13, 2015.

"Net Sys. Res." in the bottom row in Table 3.2 indicates reserve capability. The reserve capacity of -537 MW here means the shortage of 537 MW in reserve capacity and the load curtailment of 537 MW is required. According to MinDA, the distribution feeders of ECs supplying the power for the area and region where there are lots of residents who do not pay tariff are targeted for the load curtailment.

Table 3.2 Example of Power Demand and Supply Balance in Mindanao by Hour

Mindanao Net System Reserve (for Friday, February 13, 2015 - as of 10:20:00 AM Thursday, February 12, 2015)												
Time	1am	2am	3am	4am	5am	6am	7am	8am	9am	10am	11am	12nn
NPC Cap.	880	880	880	880	880	880	884	885	885	885	922	922
Sys. Load	939	908	891	886	930	966	898	987	1129	1232	1271	1266
Basic Op. Res.	70	70	70	70	70	70	70	70	70	70	70	70
Reg. Res.	38	36	36	35	37	39	36	39	45	49	51	51
Con. Res.	32	34	34	35	33	31	34	31	25	21	19	19
Net Sys. Res.	-129	-98	-81	-76	-120	-156	-84	-172	-315	-417	-420	-415
Time	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm	12mn
NPC Cap.	922	917	875	875	880	922	922	922	885	885	880	870
Sys. Load	1297	1334	1342	1321	1258	1324	1338	1295	1223	1117	1008	947
Basic Op. Res.	70	70	70	70	70	70	70	70	70	70	70	70
Reg. Res.	52	53	54	53	50	53	54	52	49	45	40	38
Con. Res.	18	17	16	17	20	17	16	18	21	25	30	32
Net Sys. Res.	-446	-488	-537	-517	-448	-472	-486	-443	-408	-303	-198	-147

Source: ibid.



Source: MAGELCO.

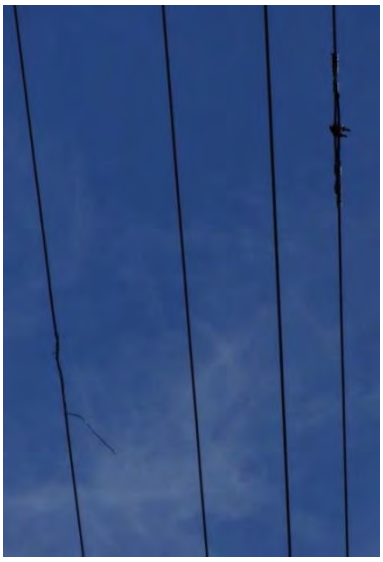
Figure 3.1 Electricity Demand and Supply Profile of MAGELCO

Figure 3.1 shows the demand and supply profile of MAGELCO on weekday in October, 2014. Actual power supply is only 4 MW for the peak demand of 10 MW at around 9:00PM. This means, remaining 6 MW supply was interrupted as load curtailment. It is found that the load curtailment quantity to be implemented was changing hour by hour and it was implemented from around 06:00 to 24:00. In other words, this is the situation where no power was supplied in more than half of the franchise area of MAGELCO during day time and even after sunset.

3.2 Aged Distribution Facilities

In the ARMM, the existence of aged power distribution facilities are outstanding (Figure 3.2). Especially, of distribution line facilities owned and operated by ECs, most poles of distribution lines of MAGELCO were constructed between 1970s and 1980s, and wooden poles with cracks on the surface and corrosion at the bottom are frequently observed. Furthermore, those wooden poles with supporting post and line conductors with strand cutting are also frequently observed. From the observation, it was found that improper maintenance and repair have been made and this condition involves the risk of reoccurrence of conductor cutting and collapse of poles, and is also causing the increase of distribution losses.

Very old and leaning wooden pole of distribution line with supporting post



Strand cutting of line conductor with improper repair

Power transformer without nameplate (year of manufacture, etc. are unknown)

Figure 3.2 Distribution Line Facilities of MAGELCO

Due to these aged distribution and substation facilities, the serious power outage, attributed to the system faults and equipment troubles might be caused. For the realization of stable power supply, urgent replacement of these facilities and establishment of proper operation and maintenance management system are required. ECs are non-profitable cooperatives and almost all ECs in the ARMM are not under a healthy condition in terms of the financial status. Therefore, they have difficulty in improving their distribution and substation facilities on their own and consequently, it leads to unhealthy conditions. In almost all ECs in the ARMM, the expense is surpassing the earning, and only SIASELCO is achieving a primary surplus in 2012 and 2013. Since the remaining ECs are in deficit, urgent administrative improvement for each EC is required. Table 3.3 shows financial statements of ECs in the area from 2011 to 2013.

3.3 High Distribution Loss Rates

High distribution loss rates constitute one of the issues to be solved in the ARMM. According to the performance assessment of ECs conducted by NEA, distribution loss rate for each EC is reported as shown in Table 3.4.

The loss rates of ECs in the region shown in Table 3.4 are classified as high rates compared to the rate in other Southeast Asian countries with the average rate of 12-15%, and it should be improved in consideration also of the level of loss rates in other areas of the Philippines. Distribution loss rates are classified into two categories. One is a technical loss and the other is a non-technical loss. The technical loss means an electric loss such as a heat loss which is generated by flowing current inside line conductors. The non-technical loss means a loss mainly due to the unaccounted use of electricity without paying the electric tariff.

The high loss rate in the ARMM is mainly due to the unaccounted use of electricity, which causes financial difficulty and deficit operation of ECs. The main causes of low tariff collection rate are as follows: (1) broken kWh meters, (2) utilization of used kWh meters with low accuracy, and (3) illegal connection of service wire (pilferage). As an example, power purchase by MAGLECO is 2,895,668 kWh, while its power sale is 1,626,863 kWh in October 2014 (Figure 3.3). Accordingly, the power loss and loss rate are calculated as 1,247,087 kWh and 43.07%, respectively.

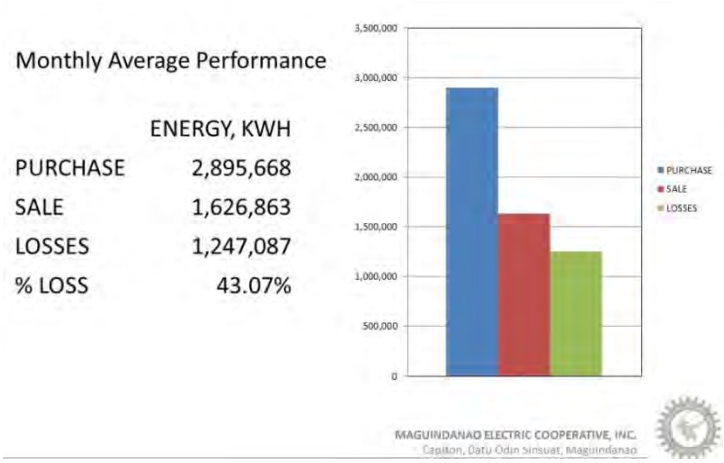
Table 3.3 Financial Conditions of ECs in ARMM

	Maguindanao Electric Cooperative (MAGELCO)			Lanao Del Sur Electric Cooperative (LASURECO)		
	2011	2012	2013	2011	2012	2013
Total Operating Revenue	167,639	159,192	168,100	583,244	690,575	649,847
Total Operating Expense	247,958	241,063	247,992	721,339	711,909	644,592
Operating Margin	-80,319	-81,871	-79,892	-138,095	-21,333	5,255
Depreciation&Amortiation Expense	7,772	8,608	9,172	4,046	4,043	4,049
Interest Expense	1,212	894	1,545	7,131	7,131	7,131
Net Operating Margine	-89,303	-91,373	-90,609	-149,272	-32,507	-5,925
Non-Operating Revenue	2,686	5,374	4,645	3,384	2,969	2,375
Non-Operating Expense	2,521	1,421	757			
Net Margin/Loss	-89,137	-87,420	-86,720	-145,888	-29,539	-3,550
	Basilan Electric Cooperative (BASELCO)			Sulu Electric Cooperative (SULECO)		
	2011	2012	2013	2011	2012	2013
Total Operating Revenue	212,467	245,175	220,762	223,749	310,887	316,977
Total Operating Expense	237,984	267,058	246,931	276,500	308,230	292,129
Operating Margin	-25,517	-21,883	-26,169	-52,751	2,657	24,848
Depreciation&Amortiation Expense	9,224	9,335	9,799	5,908	6,520	3,748
Interest Expense	325	312	321	92,443	107,764	62,842
Net Operating Margine	-35,066	-31,530	-36,289	-151,102	-111,627	-41,742
Non-Operating Revenue				740	1,149	1,032
Non-Operating Expense				154	200	122
Net Margin/Loss	-35,066	-31,530	-36,289	-150,516	-110,678	-40,832
	Tawi-Tawi Electric Cooperative (TAWELCO)			Siasi Electric Cooperative (SIASELCO)		
	2011	2012	2013	2011	2012	2013
Total Operating Revenue	119,314	134,406	122,809	19,002	24,142	22,650
Total Operating Expense	129,630	144,085	139,907	19,845	23,787	20,702
Operating Margin	-10,316	-9,679	-17,098	-843	355	1,948
Depreciation&Amortiation Expense	2,839	2,466	2,636	246	230	295
Interest Expense	55,572	61,302	66,936			
Net Operating Margine	-68,727	-73,447	-86,670	-1,089	125	1,653
Non-Operating Revenue	5,008	4,105	4,206	860	1,074	1,004
Non-Operating Expense	1,070	157	46			
Net Margin/Loss	-64,789	-69,501	-82,509	-229	1,199	2,657
	Cagayan De Sulu Electric Cooperative (CASELCO)					
	2011	2012	2013			
Total Operating Revenue	2,929	6,740	5,308			
Total Operating Expense	4,665	8,228	6,122			
Operating Margin	-1,736	-1,488	-814			
Depreciation&Amortiation Expense						
Interest Expense						
Net Operating Margine	-1,736	-1,488	-814			
Non-Operating Revenue	190	248	282			
Non-Operating Expense	200	166	657			
Net Margin/Loss	-1,746	-1,406	-1,189			

Source: NEA.

Table 3.4 ECs' Distribution Loss Rate

ECs	MAGELCO	BASELCO	SULECO	TAWELCO	LASURELCO	SIASELCO	CASELCO
Distribution loss rate (%)	42.88	40.74	31.99	29.43	17.93	9.84	n/a



Source: MAGELCO.

Figure 3.3 Record of Power Sales of MAGELCO for October 2014

Broken kWh Meter

Illegal connection (indicated by arrow)

Figure 3.4 KWh Meters Installed in Franchise Area of MAGELCO

3.4 Low Energization (Electrification) Rate

The energization rate in the ARMM stays at a quite low level. Table 3.5 shows energization rates by franchise area of ECs in the ARMM. According to Table 3.5, the almost 100% energization rate is achieved at the barangay level. However, the connection rates at the sitio level varies and relatively low on an average. One sitio indicates the connection rate of 0%. The connection rates of service wire as a whole are shown to be low between 24% and 53%. This is due to the definition of energization rate and because "the barangay where a distribution line is passing through it and ready to connect service wire to the customers" is regarded as being energized. Therefore, Table 3.5 shows that there is a house on which the distribution lines are passing through but it has no service wire, namely, no power supply.

Table 3.5 Electrification Rates in Franchise Area of ECs in ARMM (December 31, 2014)

ECs	MUNICIPALTIES/CITIES		BARANGAYS				SITIOS				CONNECTIONS		
	Coverage/ Energized	%	Potential	Energized/ Completed To Date	%	Unenergized	Potential	Energized/ Completed To Date	%	Unenergized	POTENTIAL	SERVED TO DATE	%
TAWELCO	9	100	186	186	100	0	344	200	58	144	47,000	12,498	27
SIASELCO	2	100	66	66	100	0	75	31	41	44	13,000	4,067	31
SULECO	16	100	330	330	100	0	81	62	77	19	85,000	25,295	30
BASELCO	14	100	269	269	100	0	220	105	48	115	75,000	39,964	53
CASELCO	2	100	17	17	100	0	26	0	0	26	5,000	1,961	39
LASURELCO	41	100	1,175	1,175	100	0	68	68	100	0	138,000	56,357	41
MAGELCO	30	100	404	398	99	9	1,245	497	40	748	116,000	27,485	24
Total	114	100	2,447	2,441	99	9	2,059	963	47	1,096	479,000	167,627	35

Source: NEA.

CHAPTER 4 PROPOSALS OF PRIORITY PROJECTS

Based on the findings reported in Chapters 1 through 3, the following projects are recommended.

4.1 Boom Truck Procurement Plan for Distribution Work

4.1.1 Background and issues

ECs in the ARMM generally suffer high distribution losses mainly due to low collection of electricity tariff and need to recover from deficit. Due to financial difficulties, they cannot secure sufficient funds to procure new heavy equipment such as boom trucks for distribution work (Figure 4.1). Accordingly, they have no choice but to continue to use second-hand vehicles for a long time. However, these vehicles frequently break down because of aged parts and need to be replaced as spare parts are often unavailable. Furthermore, some of the boom trucks owned by ECs are heavy in weight since their chassis is American made. Therefore, they are not desirable in terms of fuel consumption.

Fuel-efficient, medium-size Japanese auto-manufacturers' boom trucks are suitable for the road condition in the Philippines and thus strongly requested by MAGELCO. According to the performance assessment conducted by NEA, MAGELCO was ranked at the bottom of 120 ECs. Other six ECs in the ARMM are similarly ranked low: 119th for LASURECO, 118th for SULECO, 117th for BASELCO, 116th for TAWELCO, 108th for CASELCO and 107th for SIASELCO. Almost all the ECs in the ARMM are in face of severe financial problems. Procurement of Japanese- boom trucks for all the ECs will be meaningful and effective assistance.

Boom truck owned by MAGELCO

Boom truck owned by LASURECO
(with its original bucket on the boom top missing)

Figure 4.1 Boom Trucks Owned by MAGELCO and LASURECO

4.1.2 Scope of proposal

Japanese automakers' boom trucks with bucket or digger should be procured and distributed to all the ECs in the ARMM, and the number of vehicles for each EC shall be allocated based on the size of their franchise area and business scale in consultation with NEA. Table 4.1 presents a sample allocation of boom trucks to major ECs in the region.

Table 4.1 Example of Allocation of Boom Trucks with Bucket/Digger

EC	Boom truck w/ bucket	Boom truck w/ digger
MAGELCO	2	2
LASURECO	2	2
SURECO	2	2
BASELCO	2	2
TAWELCO	2	2
SIASELCO	1	1
CASELCO	1	1
Total	12	12

Note: Project cost ≈ JPY 500 million

4.1.3 Project purpose

This project aims to improve the capacity of ECs in the ARMM for construction and maintenance work.

4.1.4 Expected effects

The following effects are expected:

- High visibility of the assistance expected in the whole ARMM including islands;
- Contribution by small and medium-sized firms;
- Minimization of the risk that the delivered equipment is exposed for a long time at site in the process of procurement;
- Delivery to ECs in a short period of time, approximately two years, compared to infrastructure related projects; and
- The experience of the Philippine Government to receive the boom trucks procured through grant aid scheme, through the Yolanda relief project.

Therefore, it would be possible to smoothly implement the boom truck procurement plan for ECs in the ARMM.

4.1.5 Security consideration

There are many places where it is difficult to ensure security in Mindanao especially in the ARMM. Accordingly, it should be carefully considered to secure the security on transportation route and storage warehouse at the time of delivery of the boom trucks.

4.2 Rehabilitation Plan for MAGELCO's Distribution Facilities

4.2.1 Background and issues

MAGELCO was established on September 4, 1975 by NEC in accordance with Presidential Decree 269 as a non-stock, non-profit, non-political venture corporation owned by its members. As of today, it has three substations to supply power in the province of Maguindanao. However, MAGELCO is facing with serious issues in its power supply facilities which should be improved urgently to get out of the red. The following are the problems of the MAGELCO.

(1) Distribution system reliability

The distribution facilities in the MAGELCO's franchise area in the ARMM were constructed in the 1970s and the 1980s. In the site survey conducted by the JICA Study Team, it was observed that, of all the wooden poles and cross-arms of distribution facilities with an average span length of 100 m, approximately 60% were inclined. Over the years of operation, line conductors in many portions of the distribution lines have been damaged (cut) and not been properly jointed or terminated. The power distribution lines are now dilapidated and unreliable.

(2) Substation capacity and facilities

According to the substation load forecasts and loading analysis as shown in Table 4.2, the Salbu substation requires immediate capacity augmentation because it is scheduled to additionally supply the power through the DOS and Maganoy feeders newly connected to the system.

Also, existing substations are protected only by power fuses on the 69 kV line side. In order to improve the system reliability and shorten the duration of power outage, circuit breakers and instrument transformers should be installed on the primary side of substations.

Table 4.2 Substation Load Forecast and Loading Analysis

	SALBU SS		CAPITON SS (HQ)		SIMUAY SS	
Rated capacity (MVA)	5		5		10	
Power factor (%)	97.7		98.7		92.4	
Year	MW load	% loading	MW load	% loading	MW load	% loading
2008	3.33	68.25	2.13	43.26	3.5	37.87
2009	3.12	63.87	2.19	44.45	3.69	39.97
2010	3.02	61.72	2.37	48.03	3.86	41.80
2011	2.84	58.10	2.50	50.59	4.09	44.30
2012	3.38	69.19	2.58	52.29	4.37	47.30
2013	3.91	80.04	2.75	55.72	4.56	49.40
2014	3.93	80.53	2.88	58.45	4.80	51.92
2015	4.03	82.46	3.02	61.19	5.03	54.49
2016	4.15	84.93	3.15	63.92	5.28	57.11
2017	4.27	87.37	3.29	66.65	5.52	59.78

Source: MAGELCO.

(3) Primary line losses

The 13.2 kV distribution lines were constructed using #1/0 (54 mm^2), #2/0 (67 mm^2) and #4/0 (107 mm^2) AWG ACSR. The increase in customer demand and its present aging condition made the line capacities insufficient. Also it shall be noted that the existing backbone 13.2 kV lines are over-stretched using undersized conductors. This causes high primary line losses and voltage drops below 10% of nominal level in the distribution system. Table 4.3 shows results of power flow simulation carried out by MAGELCO showing primary line losses per feeder line for the Salbu and HQ substations.

From Table 4.3, the total line losses of 8% is too high, and lowest voltage level less than 0.9 PU is serious status to supply power for customers properly. In accordance with the NEA Engineering Bulletin, recommended percent losses on primary lines are 3%. The serious effort of loss reduction is required.

Table 4.3 Power Flow Simulation Results

Substation	Feeder	SS-end MW Load	SS-end MW Load	Line losses kWh	% line losses	Lowest voltage level, PU
CAPITON (HQ)	DOS	1.63	646,549	72,761	11	0.82
	UPI	1.03	408,118	41,158	10	0.80
SALBU	MAGANOY	2.61	1,033,560	54,482	5	0.87
Total		5.27	2,088,227	168,401	8	

Source: ibid.

(4) Metering defects and losses

Illegal connections of service wires and breaking of kWh meters are being done on a day-to-day basis in the franchise area. According to the sampling calibration of 251 sets of kWh-meter, 75% (187 sets) of kWh-meter were found to be of low accuracy or defective, which resulted in low tariff collection rate. Therefore, replacement or installation of properly functioning kWh-meters is urgently needed to improve financial and managing status of MAGELCO.

4.2.2 Rehabilitation program by MAGELCO

MAGELCO had prepared a rehabilitation program presented below before the JICA Study Team conducted its field survey at the beginning of December 2014:

(1) Sub-transmission projects

- Construction of 69 kV/13.2 kV UB line

- Installation of switchyard Kauran SS
- Installation of switchyard at HQ SS

(2) Substation projects

- Installation of new 5 MVA Kauran SS
- Installation of new 10 MVA Landasan SS
- Upgrading of Salbu SS to 10 MVA capacity
- Installation of 5 MVA Nuro SS

(3) Rehabilitation of 13.2 kV lines

- Total 115 km

(4) Metering project

- 30,000 sets of kWh-meters

(5) Construction vehicles

- Purchase of two boom trucks and five utility vehicles

4.2.3 Scope of proposal

The following project components extracted from the Rehabilitation Program of MAGELCO are recommended based on the criteria: 1) security during construction work, and 2) budget for Japanese grant aid projects:

- Power transformer and substation equipment for new construction and improvement of substations as follows: one lot of substation equipment for HQ substation and one unit of 5 MVA for NURO substation
- 69 kV/13.2 kV transmission and distribution facilities: 30 km total length; under-built; concrete poles)
- Digital-type kWh meter: 10,000sets
- Boom trucks with bucket and boom trucks with digger: two units each

The proposed priority project for the rehabilitation of the power facilities of MAGELCO is shown in Figure 4.2. Figure 4.3 is the single line diagram showing the current distribution system of MAGELCO.

4.2.4 Project purpose

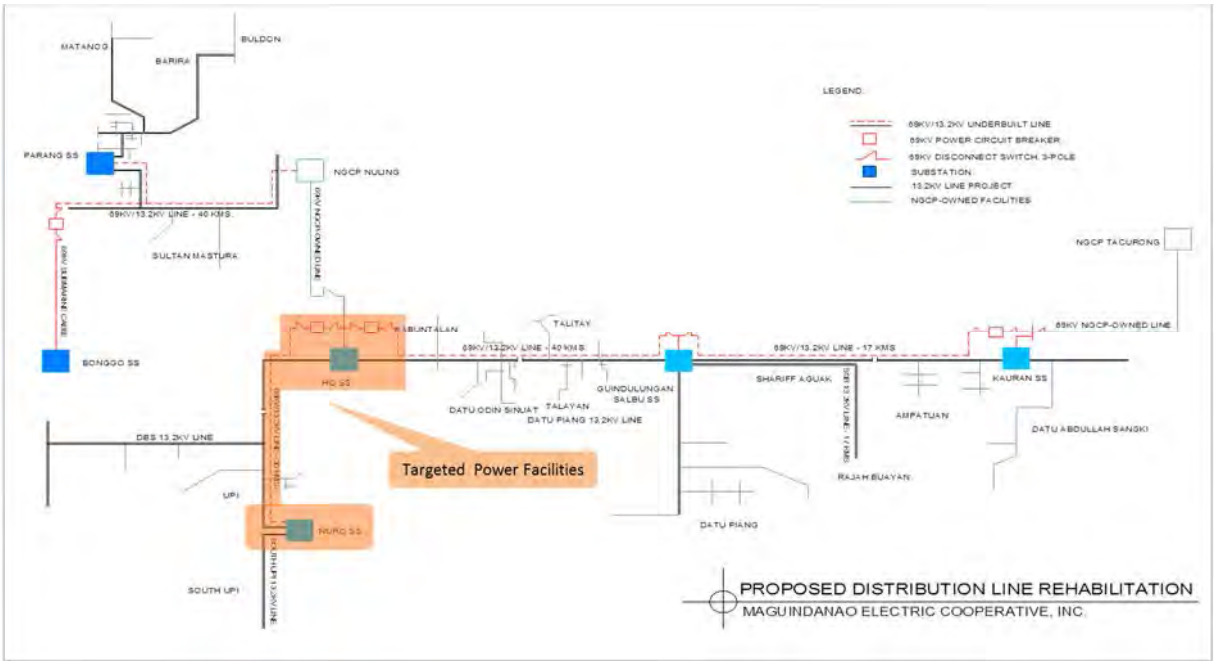
The project aims at

- Improvement of supply reliability of distribution network,
- Realization of quality power supply at the proper supply voltage,
- Distribution loss reduction and prevention and reduction of illegal connections,
- Upgrading of supply capacity to satisfy future increasing power demand, and
- Improvement of rate of tariff collection.

4.2.5 Expected effects

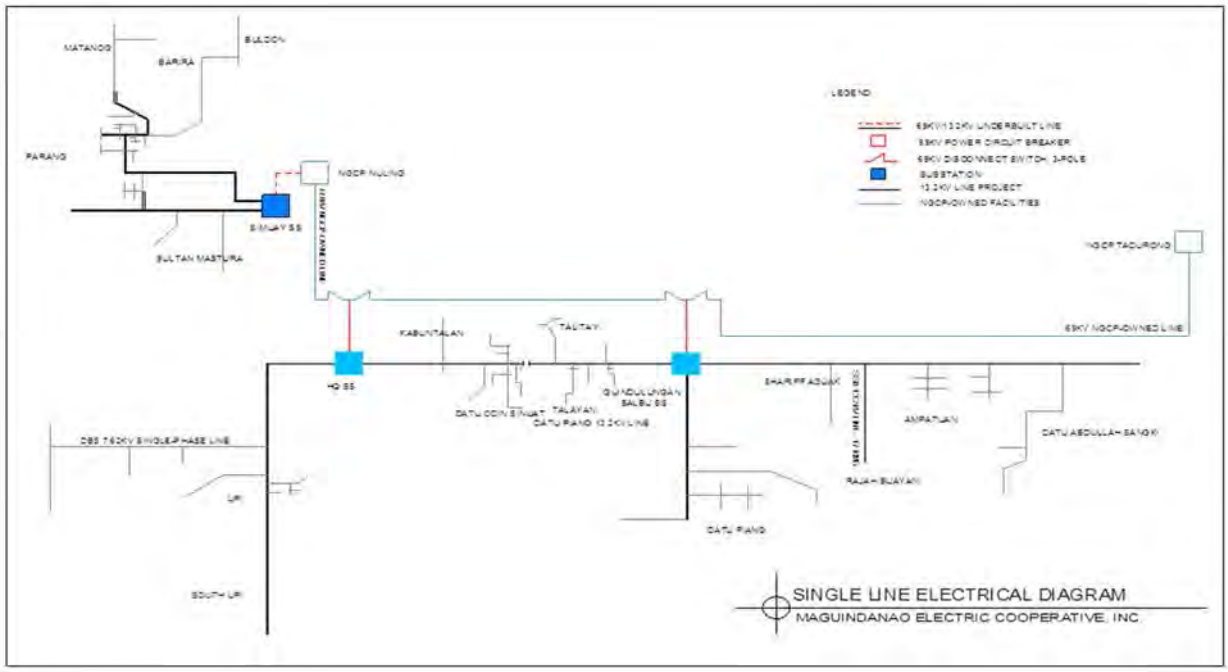
The following effects are expected:

- Since this type of project could be a role model of project implementation, the success of this project will lead to the continuous project formulation to supply equipment and materials to the ECs in the missionary areas and islands such as Lanao del Sur and Basilan. Consequently, this can contribute to the economic development of the Bangsamoro area.
- Improvement of quality of life of local residents



Source: MAGELCO.

Figure 4.2 Power Facilities for Priority Project in MAGLECO's Rehabilitation Plan



Source: ibid.

Figure 4.3 Single Line Diagram of Current Distribution System

4.2.6 Considerations for project implementation

The following should be considered during the implementation of the project.

(1) This proposal is formulated based on the rehabilitation program prepared by MAGELCO, and the area, where the rehabilitation and construction work will be done, covers from Guindulungan of middle Maguindanao to Datu Abdullah Sangki in the southern area of Maguindanao; the project will only include procurement of equipment and materials, and installation and construction work should be done by MAGELCO.

(2) It is necessary to confirm the ability of project management of MAGELCO and ability of contractors because the requirement of project implementation is conditioned to be done by MAGELCO.

(3) It is necessary to review the scope of the project and technical justification because this scope of project has been determined by MAGELCO.

(4) It is required to ensure the security during construction work.

4.3 Development of Low-head Hydro Power Plant in Tawi-Tawi

4.3.1 Background and issues

As stated in Sub-section 1.8.1, Mindanao is rich in hydro resources. Various types of surveys for development of hydro resources are ongoing in the main island of Mindanao, while in surrounding island provinces of Bangsamoro, development studies have not been promoted sufficiently due to the security and potential risk. However, Tawi-Tawi seems to be a comparatively less risky island than other islands judged from hearing surveys. In the Bangsamoro Development Agency (BDA) Transitional Development Plan, the development of a mini-hydro power plant (MHPP) at the Busay falls in Bohol Province and Bongao in Tawi-Tawi Province is designated as one of the prioritized projects. In order to grow out of dependency on diesel generation and facilitate the introduction of renewable energy sources on the islands, the development of a low-head hydro power plant in Tawi-Tawi is recommended.

4.3.2 Scope of proposal

The Malum River flows in the southern part of Tawi-Tawi island as shown in Figure 4.4. Figure 4.5 and Figure 4.6 present three candidate sites for the development of a hydro power plant along the river. As shown in the figure, there is a road crossing the upper stream of the Malum River. This road could be used for transporting materials required for the construction of the plant and even for the construction work downstream of the Malum River. Also, a temporary construction road may be built branching from the road to further facilitate the construction works.

Panglima Sugala, the third municipality of Tawi-Tawi Province, is close to the construction sites. This is an important factor for the workers and employees related to the construction of the power plant. Easy access to the construction sites is an advantage.

At these targeted points, a hydro-power plant should be developed based on the site survey. From the above diagram, the effective head can be expected to be approximately 5–10 m or slightly more. Accordingly, a low-head type of hydro power plant would be highly recommended.

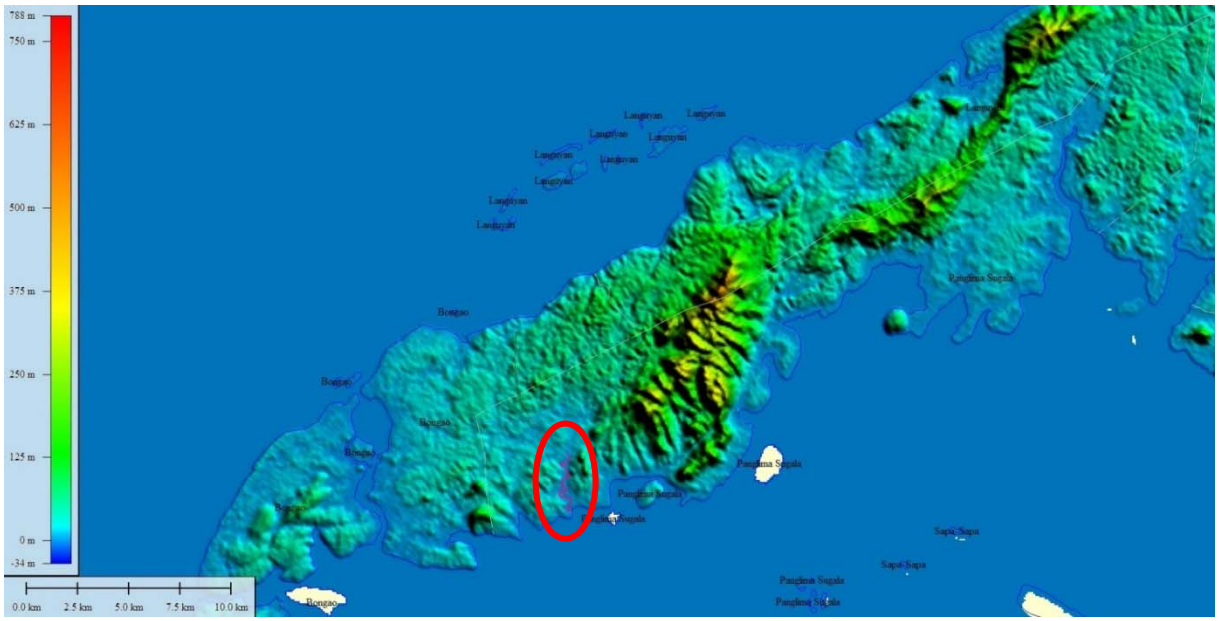
4.3.3 Project purpose

The purpose of this project is to harness the hydroelectric potential of the Malum River and the Busay falls to produce electricity and contribute to CO_2 emission reduction in using renewable energy instead of fossil fuel.

4.3.4 Expected effects

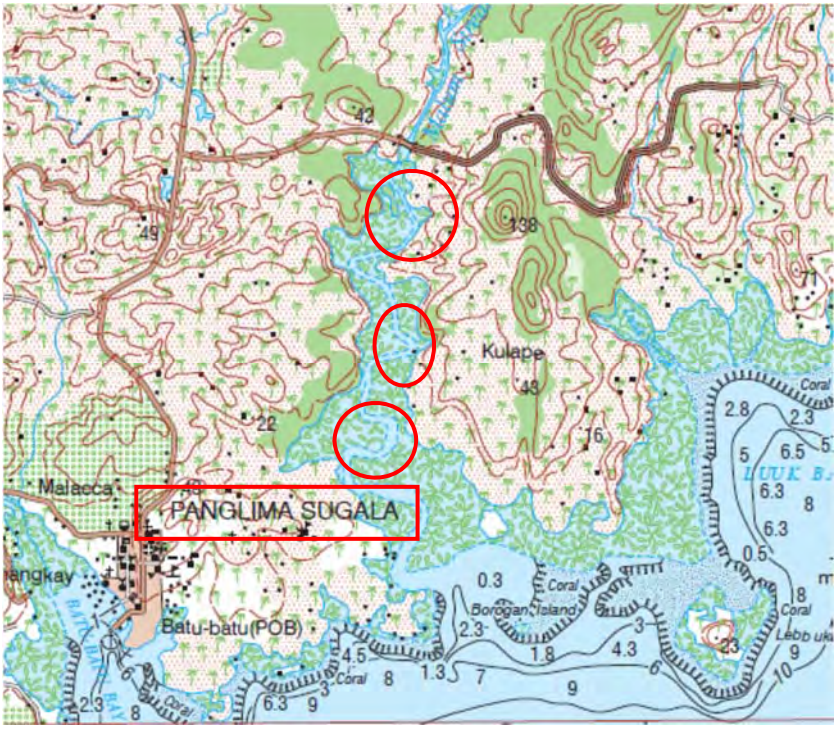
The following effects are expected:

- Contribution to the reduction of fuel procurement cost required for power supply with diesel generators and the promotion of renewable energy in the Philippines, and
- Demonstration of effectiveness of the renewable energy development in the island and provision of an incentive for further renewable energy development in other islands such as Sulu and Basilan.



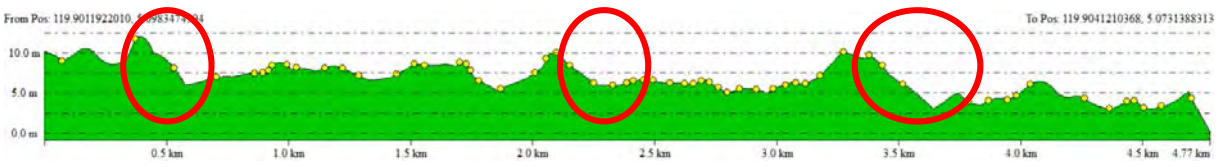
Source: JICA Study Team.

Figure 4.4 Location of Malum River in Tawi-Tawi



Source: JICA Study Team.

Figure 4.5 Potential Hydro Power Plant Development Sites on Malum River in Tawi-Tawi



Source: JICA Study Team.

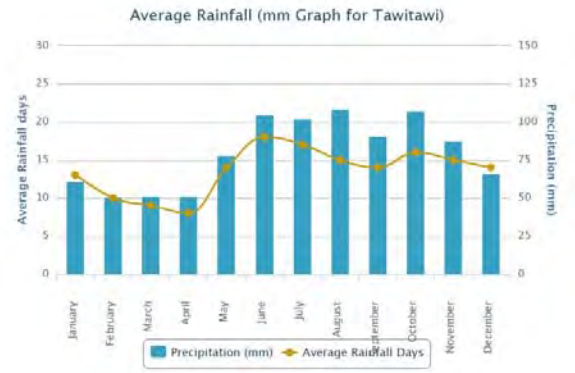
Figure 4.6 Cross Sections of Potential Hydro Power Plant Development Sites

4.3.5 Consideration for project implementation

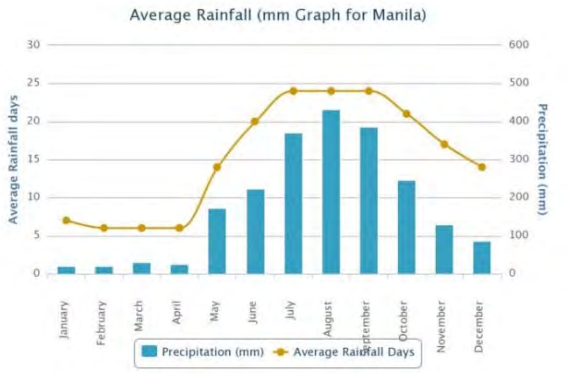
For rough estimate of the expected output of a hydro power plant, it is required to measure the flow rate of the river (m^3/sec) on a monthly and yearly basis. According to DPWH-ARMM, such data are not available at present. Therefore, prior to the implementation of this project, a pre-FS or FS is highly recommended with the following surveys:

- Water flow and geographic survey,
- System impact study,
- Environment impact assessment (EIA),
- Economic analysis, and
- Surveys on fishery and water rights.

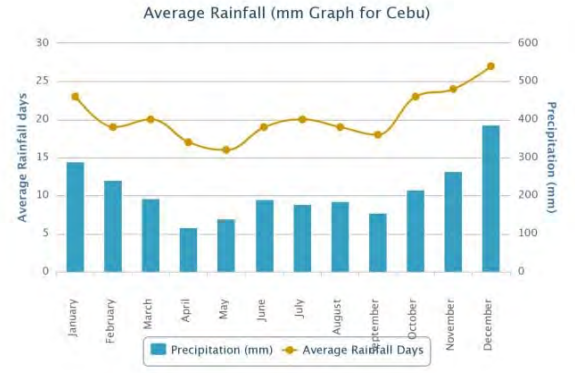
Rainfall is an important factor in designing the development plan. Figure 4.7 shows average rainfall for typical city of each region in the Philippines. It is found that Mindanao area has less rainfall relatively compared with other regions. The less rainfall could possibly lead to the lack of power output caused by drought. Therefore, the development of hydro power plant should be evaluated in a comprehensive manner.



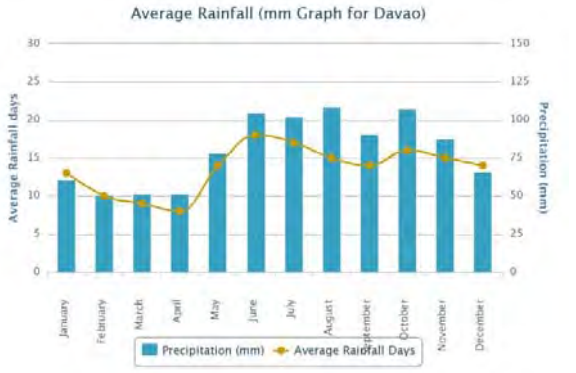
Tawi-Tawi (Mindanao [Small Island])



Manila (Luzon)



Cebu (Visayas)



Davao (Mindanao[Main Island])

Figure 4.7 Average Rainfall in Major Cities by Region in the Philippines, 2000–2012

CHAPTER 5 RECOMMENDATIONS FOR THE BANGSAMORO POWER SECTOR

As stated in Section 3, the critical issues in the Bangsamoro power sector are classified into (1) power supply shortages, (2) aged distribution facilities, (3) high distribution loss rate, and (4) low electrification rate. In order to effectively address these issues and accelerate the development of Bangsamoro area, the following action plans and power policy are recommended.

5.1 Recommended Action Plans

5.1.1 Specific action plans for power supply shortages

As stated in Section 3.1, the power shortage in Mindanao is one of critical issues in the power sector and the load curtailment is being conducted almost every day in accordance with the rule that the areas and regions where there are lots of residents not paying electric tariff are targeted for the load shedding. This means that ECs having a low rate of tariff collection and poor financial status are targeted for the load shedding. Therefore, it is required to improve ECs' financial status by improving this low rate of tariff collection so that ECs in Bangsamoro are excluded from the target of the load curtailment. In order to realize this situation, the following actions are effective measures to:

- Establish the strict rule of the tariff collection and strict disconnection and reconnection policy,
- Replace aged/broken kWh-meters to new ones with accuracy and implement accurate meter-reading,
- Promote awareness campaign to power consumers regarding tariff payment, and
- Prevent illegal connections by regular monitoring

One of ECs in the Bangsamoro area, MAGELCO has already been introducing and implementing some activities mentioned above. Similarly, it is desirable for other ECs to introduce these counter measures against the illegal connections.

In order to tackle with the power shortages, it is also effective to introduce the power facilities such as small power plants and power resources with renewable energy as well as connect to the distribution grid. Since ECs are not permitted to introduce and own generators due to the regulation of power sector, new power producers as IPPs, are required and it is essential to make an effort to attract investors into the power sector in Mindanao.

5.1.2 Specific action plans for aged distribution facilities

The rehabilitation and expansion program in the franchise area of MAGELCO, which has been well prepared, should be implemented immediately to improve its financial status. MAGELCO plays an important role for supplying the power for the central area of Bangsamoro. The rehabilitation and expansion of distribution lines and substations contribute to the improvement of technical losses, and replacement of kWh-meters can decrease non-technical losses. These measures combined will lead to the increase of billing amount.

The following actions can be recommended:

- To secure own budget by requesting NEA for financial assistance, and
- To request international donors for financial and technical assistance.

Furthermore, for the ECs in islands provinces, the following procedures are recommended:

- To study current status of existing facilities, and
- To prepare EC's own rehabilitation and expansion programs.

It is noted that MAGELCO has introduced computerized on-line receipting system of the member-consumers' payment on January 7, 2015 and it is achieving notable results as regards the improvement of the tariff collection rate.

5.1.3 Specific action plans for high distribution loss rates

Distribution losses include both technical and non-technical losses, and the technical losses can be improved by rehabilitation and expansion of distribution facilities using proper conductor size and proper line configuration and suitable transformer capacity. Non-technical losses are mainly due to 1) low accuracy of kWh-meters, 2) un-metering including illegal connection, and 3) bill collection method. Therefore, to reduce non-technical losses, the same measures as the action plans recommended for the power shortage should be undertaken.

5.1.4 Specific action plans for low electrification rate

As mentioned in Section 3.4, barangays of all the ECs have been recorded to be electrified. However, the connection rate to customers is as low as 24% to 53%. Therefore, ECs including MAGELCO have to enhance and expedite electrification programs. The following actions are recommended:

- To promote public relations activities,
- To secure own budget by requesting NEA for financial assistance, and
- To request international donors for financial and technical assistance.

The relationships among four issues of action plans, the expected results and actions to be done are shown in Figure 5.1.

5.2 Recommended Power Policies

The recommended power policies intended for the new Bangsamoro autonomous government are as follows.

5.2.1 Empowerment of Bangsamoro government to develop power sources

The power supply is requisite for the economic growth and various existing industries in the modern society. In Mindanao, and even in other regions of the Philippines, the frequent power shortages are annoying the public and enterprises. According to the EPIRA, the development of power source is entrusted mainly to the private sector and investors/developers.

However, in order to facilitate and achieve rapid economic growth in the Bangsamoro region, it would be necessary and effective not to rely too much on the private sector to avoid risk such as sudden termination of the construction work due to unforeseen situations, but to promote and develop it by the Bangsamoro autonomous government itself and/or the new governmental organization to be established in the Bangsamoro autonomous government that has a responsibility of power development. Therefore, the Bangsamoro government needs to have the authority of developing the power sources. At present, since the power sector in Bangsamoro is under an effect of the EPIRA, it can be recommended to coordinate with ERC to discuss the future structure of power sector in Bangsamoro and coverage of the EPIRA. The development of power sources should be undertaken by the initiative of the Bangsamoro governmental organization.

5.2.2 Establishment of proper FIT prices

The feed-in-tariff (FIT) system is known as an effective measure to expedite the introduction of renewable energy in the world. In the Philippines, this system has already been introduced and is functioning properly. However, a lower rate of the FIT has a possibility of becoming an obstacle to investors who try to invest and develop the renewable energy resources. In order to attract such kinds of investors and private companies to the Bangsamoro region, it is recommended to properly raise FIT rates for renewable energy in Mindanao. However, it may cause an increase in the burden of tariff payers as it may lead to a rise of electric tariff. The key is to adequately and strategically set up specific FIT prices in consideration of the economic level of Bangsamoro in cooperation with DOE, ERC and other related organizations.

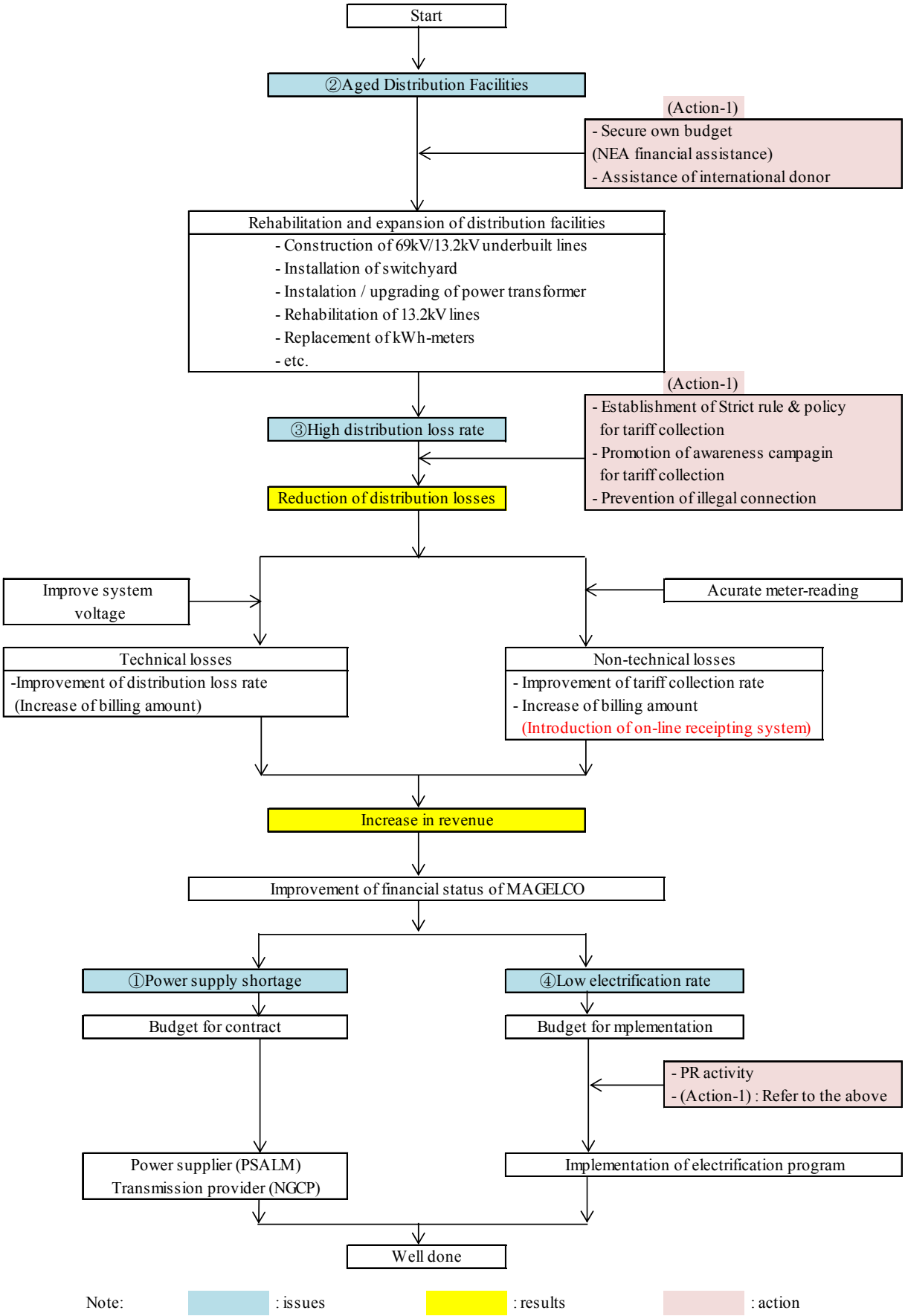


Figure 5.1 Procedure for Improvement of the Bangsamoro Power Sector

5.2.3 Integration of ECs into ARMM

As stated in Sub-section 1.3.8, there are seven ECs in the ARMM. For effective management, it would be worth considering the possibility of integration of those ECs as one distribution utility in the Bangsamoro region. It would be possible to effectively manage the power distribution business and comprehensively plan the development of the distribution network, considering the entire development of the Bangsamoro region.

5.2.4 Introduction of capacity development system to Bangsamoro government

Even if the organization or ministry that can handle the power sector is newly established in the Bangsamoro government, it would take some time for the Bangsamoro government itself to properly control the power sector. For a specified period of time, the management of the power sector in the Bangsamoro region may be undertaken effectively based on the cooperation and leadership of the Philippine Central Government, focusing on capacity development of the Bangsamoro power sector.