

THE REPUBLIC OF IRAQ  
MINISTRY OF ELECTRICITY

**SPECIAL ASSISTANCE FOR PROJECT IMPLEMENTATION (SAPI)  
FOR  
ELECTRICITY SECTOR RECONSTRUCTION PROJECT  
IN  
THE REPUBLIC OF IRAQ**

**FINAL REPORT**

DECEMBER 2017

**Japan International Cooperation Agency**

**NIPPON KOEI CO., LTD.**

<b>7R</b>
<b>CR(5)</b>
<b>17-025</b>

THE REPUBLIC OF IRAQ  
MINISTRY OF ELECTRICITY

**SPECIAL ASSISTANCE FOR PROJECT IMPLEMENTATION (SAPI)  
FOR  
ELECTRICITY SECTOR RECONSTRUCTION PROJECT  
IN  
THE REPUBLIC OF IRAQ**

**FINAL REPORT**

DECEMBER 2017

**Japan International Cooperation Agency**

**NIPPON KOEI CO., LTD.**



(Source: Prepared by the Study Team)

**132 kV Substations (FTK)**

- 1 Al Amel (GIS)
- 2 Al Mahmodiya (GIS)
- 3 Al Tajjiyat (GIS)
- 4 Abo Ghreeb (GIS)
- 5 Al Boaytha (GIS)
- 6 Al Latyfer (AIS)

**132 kV Mobile Substations (Supply)**

- 1 Falluja Cement (132/33 kV x 2)
- 2 Old Ramadi (132/33 kV x 3)
- 3 -
- 4 Falluja (132/33 kV x 2)
- 5 Kubaisah (132/33 kV x 3)
- 6 New Ramadi (132/33 kV x 2)
- 7 Old Ramadi (132/11 kV x 2)
- 8 Falluja Cement (132/11 kV x 2)
- 9 -
- 10 New Ramadi (132/11 kV x 2)
- 11 Falluja (132/11 kV x 2)

**33/11 kV Mobile Substations (Supply)**

- 1 Al Mashtal (33/11 kV x 2)
- 2 Al Qadisiyah (33/11 kV x 2)
- 3 Al Hussain (33/11 kV x 2)
- 4 Al Khaldiyah (33/11 kV x 2)
- 5 -
- 6 Al Karma (2) (33/11 kV x 2)
- 7 Al Nasr (33/11 kV x 2)
- 8 Al Hathra (33/11 kV x 2)
- 9 Al Karma (1) (33/11 kV x 2)
- 10 Al Sharqiyah (33/11 kV x 2)
- 11 Al Janobiyah (33/11 kV x 2)
- 12 Al Saqlawiyah (33/11 kV x 2)
- 13 Al Nasaaf (33/11 kV x 2)
- 14 Al Taawin (33/11 kV x 1)
- 15 Al Therthar (33/11 kV x 1)

**Project Site Location  
(Urgent Reconstruction Needs)**

**FINAL REPORT**  
for  
Special Assistance for Project Implementation (SAPI)  
for  
Electricity Sector Reconstruction Project  
in  
the Republic of Iraq

---

**CONTENTS**

---

*Location Map*

**Chapter 1 Introduction**

1.1	Background and Objective .....	1 - 1
1.2	Scope of the Study .....	1 - 2
1.3	Study Schedule .....	1 - 2
1.4	Study Team .....	1 - 3

**Chapter 2 Electric Power Sector in Iraq**

2.1	Introduction .....	2 - 1
2.2	General Information .....	2 - 1
2.3	Current Situations .....	2 - 4
2.3.1	Electricity Power Demand and Supply .....	2 - 4
2.3.2	Electric Power Generation .....	2 - 9
2.3.3	High Voltage Transmission Lines .....	2 - 12
2.3.4	High Voltage Substations .....	2 - 15
2.3.5	Distribution Network .....	2 - 16
2.4	Development Plans .....	2 - 18
2.4.1	Demand Forecast .....	2 - 18
2.4.2	Planned Power System Network in 2020 .....	2 - 19
2.4.3	Power Plants Development Plan .....	2 - 20
2.4.4	Planned Transmission Lines .....	2 - 22
2.4.5	Planned Substations .....	2 - 24
2.5	Cooperation from Other Donners .....	2 - 28
	Attachment 2-1: Existing 132 kV Substations	
	Attachment 2-2: Planned 132 kV Transmission Lines to cover the 2020 Loads	

**Chapter 3 Power System Analysis**

3.1	Power System Analysis for 2015 .....	3 - 1
3.1.1	Power Network System in 2015 .....	3 - 1
3.1.2	Allowable Variations .....	3 - 2
3.1.3	Power Flow Analysis.....	3 - 2
3.1.4	Fault Current Analysis .....	3 - 5
3.1.5	N-1 Analysis .....	3 - 7
3.2	Power System Analysis for 2020 .....	3 - 10
3.2.1	Power Network System in 2020 .....	3 - 10
3.2.2	Power System Analysis .....	3 - 12

3.2.3	Fault Current Analysis .....	3 - 14
3.2.4	N-1 Analysis .....	3 - 16
<b>Chapter 4 Electricity Sector Reconstruction Project (IQ-P8)</b>		
4.1	General .....	4 - 1
4.2	Scope of the Project .....	4 - 1
4.3	Progress of the Project .....	4 - 7
<b>Chapter 5 Lessons Learned from IQ-P8</b>		
5.1	Lessons Learned from IQ-P8 Lot-4 and Lot-5 .....	5 - 1
5.2	Lessons Learned from IQ-P8 Lot-1 to Lot-6 .....	5 - 2
<b>Chapter 6 Reconstruction Needs for Power Sector</b>		
6.1	Substation Projects under Construction .....	6 - 1
6.2	Reconstruction Needs .....	6 - 16
6.3	Urgent Reconstruction Needs.....	6 - 21
<b>Chapter 7 Site Survey for Urgent Reconstruction Projects</b>		
7.1	General .....	7 - 1
7.2	Candidate Projects .....	7 - 1
	Attachment 7-1: Planned Construction Site 132 kV Al Amel Substation	
	Attachment 7-2: Planned Construction Site 132 kV Al Mahmodiya Substation	
	Attachment 7-3: Planned Construction Site 132 kV Al Tajiyat Substation	
	Attachment 7-4: Planned Construction Site 132 kV Abo Ghreeb Substation	
	Attachment 7-5: Planned Construction Site 132 kV Al Boaittha Substation	
	Attachment 7-6: Planned Construction Site 132 kV Al Latifiya Substation	
<b>Chapter 8 Conclusions and Recommendations</b>		
8.1	Lessons Learned from IQ-P8.....	8 - 1
8.2	Possibility of Japan's Support for Electricity Sector in Iraq .....	8 - 4

## TABLES

Table 1.3-1	Study Schedule .....	1 - 3
Table 1.4-1	Study Team Member .....	1 - 3
Table 2.2-1	Areas and Governorate in Iraq.....	2 - 3
Table 2.2-2	Seasons and its Corresponding Months in Iraq .....	2 - 4
Table 2.3-1	Average Load Records in 2015.....	2 - 5
Table 2.3-2	Calculated Peak Demand in 2015.....	2 - 6
Table 2.3-3	Required Energy of Each Governorate in 2015 .....	2 - 7
Table 2.3-4	Supplied Energy of Each Governorate in 2015 .....	2 - 8
Table 2.3-5	Existing Power Plants in April 2016.....	2 - 9
Table 2.3-6	Existing Generating Plants in 2014 .....	2 - 9
Table 2.3-7	Existing Steam Power Plants .....	2 - 10
Table 2.3-8	Existing Gas Power Plants.....	2 - 10
Table 2.3-9	Existing Diesel Power Plants .....	2 - 11
Table 2.3-10	Existing Hydro Power Plants.....	2 - 11
Table 2.3-11	Electric Power Imports .....	2 - 11
Table 2.3-12	Existing 400 kV Substations.....	2 - 15
Table 2.3-13	Summary of Existing 132 kV Substations .....	2 - 16
Table 2.3-14	Operating 33 kV and 11 kV Transformer Stations .....	2 - 16
Table 2.3-15	Operating 33 kV and 11 kV Distribution Lines and LV Transformers.....	2 - 17
Table 2.4-1	Peak Demand Forecast by Governorates .....	2 - 19
Table 2.4-2	Power Plants Development Plan.....	2 - 21
Table 2.4-3	Planned 400 kV Transmission Lines to cover the 2020 Demand.....	2 - 22
Table 2.4-4	Planned 400 kV Substations to cover the 2020 Demand.....	2 - 25
Table 2.4-5	Planned 132 kV Substations to cover the 2020 Demand.....	2 - 27
Table 3.1-1	Allowable Frequency Variation.....	3 - 2
Table 3.1-2	Allowable Voltage Variation.....	3 - 2
Table 3.1-3	Allowable Fault Current .....	3 - 2
Table 3.1-4	Result of Fault Current Analysis for 400 kV System .....	3 - 5
Table 3.1-5	Result of Fault Current Analysis for 132 kV System .....	3 - 5
Table 3.1-6	Overloaded 400 kV Transformers under N-1 Condition in 2015 .....	3 - 7
Table 3.1-7	Overloaded 400 kV Transmission Lines under N-1 Condition in 2015 .....	3 - 7
Table 3.1-8	Overloaded 132 kV Transmission Lines under N-1 Condition in 2015 .....	3 - 7
Table 3.2-1	Overloaded 132 kV Transmission Lines .....	3 - 14
Table 3.2-2	Overloaded 132 kV Transformers .....	3 - 14
Table 3.2-3	Result of Fault Current Analysis for 400 kV System .....	3 - 14
Table 3.2-4	Result of Fault Current Analysis for 132 kV System .....	3 - 14
Table 3.2-5	Overloaded 132 kV Transmission Lines under N-1 Condition in 2020 .....	3 - 16
Table 4.3-1	Milestones of the Project.....	4 - 9
Table 6.1-1	Substation Projects under Construction (1) .....	6 - 3
Table 6.1-2	Substation Projects under Construction (2) .....	6 - 11
Table 6.2-1	Reconstruction Needs for Liberated Area and Conflict Affected Area (1) .....	6 - 16
Table 6.2-2	Reconstruction Needs for Liberated Area and Conflict Affected Area (2) .....	6 - 17
Table 6.2-3	Planned 400 kV Substations .....	6 - 18
Table 6.2-4	Planned 132 kV Substations .....	6 - 18

Table 6.2-5	Planned Procurement of 400 kV Auto-Transformers .....	6 - 21
Table 6.2-6	Planned Procurement of 132 kV Mobile Substations .....	6 - 21

## FIGURES

Figure 2.2-1	MOE Organization as of April 2016.....	2 - 2
Figure 2.2-2	Governorates in Iraq .....	2 - 3
Figure 2.3-1	Daily Load Curves.....	2 - 4
Figure 2.3-2	Record of Power Supply Hour Rates in 2015.....	2 - 7
Figure 2.3-3	Power Supply Rates in 2015.....	2 - 8
Figure 2.3-4	Energy Production in 2014.....	2 - 12
Figure 2.3-5	Imported Energy in 2014.....	2 - 12
Figure 2.3-6	Location of Existing 400 kV Transmission Lines .....	2 - 13
Figure 2.3-7	Existing 400 kV and 132 kV Network Diagram.....	2 - 14
Figure 2.4-1	Demand Forecast 2015 – 2030.....	2 - 18
Figure 2.4-2	Planned 400 kV Network in 2020.....	2 - 20
Figure 3.1-1	Power Network System in 2015 .....	3 - 1
Figure 3.1-2	Substation Busbar Voltage Profile in 400 kV Network in 2015 .....	3 - 3
Figure 3.1-3	Power Flow on 400 kV Network in 2015 .....	3 - 4
Figure 3.1-4	Maximum Fault Currents on 400kV Network in 2015 .....	3 - 6
Figure 3.2-1	Planned Power Network System in 2020 .....	3 - 10
Figure 3.2-2	Planned 400 kV Transmission Line Length and Capacity in 2020 .....	3 - 11
Figure 3.2-3	Substation Busbar Voltage Profile in 400 kV Network in 2020 .....	3 - 12
Figure 3.2-4	Power Flow on 400 kV Network in 2020 .....	3 - 13
Figure 3.2-5	Maximum Fault Currents on 400 kV Network in 2020 .....	3 - 15
Figure 4.2-1	Location of the Project Sites .....	4 - 6
Figure 7.2-1	132 kV Al Amel Substation Location .....	7 - 1
Figure 7.2-2	132 kV Al Amel Substation: Single Line Diagram.....	7 - 3
Figure 7.2-3	132 kV Al Mahmodiya Substation Location.....	7 - 5
Figure 7.2-4	132 kV Al Mahmodiya Substation: Single Line Diagram .....	7 - 6
Figure 7.2-5	132 kV Al Tajiyat Substation Location .....	7 - 8
Figure 7.2-6	132 kV Al Tajiyat Substation: Single Line Diagram.....	7 - 9
Figure 7.2-7	132 kV Abo Ghreeb Substation Location .....	7 - 10
Figure 7.2-8	132 kV Abo Ghreeb Substation: Single Line Diagram .....	7 - 11
Figure 7.2-9	132 kV Al Boaita Substation Location .....	7 - 13
Figure 7.2-10	132 kV Al Boaita Substation: Single Line Diagram .....	7 - 14
Figure 7.2-11	132 kV Al Latifiya Substation Location.....	7 - 16
Figure 7.2-12	132 kV Al Latifiya Substation: Single Line Diagram .....	7 - 17

## Abbreviations

AIS	:	Air Insulated Switchgear
AMR	:	Automatic Meter Reading
CB	:	Circuit Breaker
EN	:	Exchange of Notes
FAC	:	Final Acceptance Certificate
FIDIC	:	International Federation of Consulting Engineers
FIT	:	Feed-in Tariff
GEF	:	Global Environment Facility
GIS	:	Gas Insulated Switchgear
HV	:	High Voltage
IBRD	:	International Bank for Reconstruction and Development
ICB	:	International Competitive Bidding
IDA	:	International Development Association
IPP	:	Independent Power Producer
ISIL	:	Islamic State in Iraq and the Levant
JICA	:	Japan International Cooperation Agency
JPY	:	Japanese Yen
IQD	:	Iraqi Dinar
KfW	:	Kreditanstalt für Wiederaufbau
KOICA	:	Korea International Cooperation Agency
L/C	:	Letter of Credit
LV	:	Low Voltage
MOE	:	Ministry of Electricity
MOF	:	Ministry of Finance
MOP	:	Ministry of Planning
MS	:	Mobile Substation
MV	:	Medium Voltage
ODA	:	Official Development Assistance
PMT	:	Project Management Team
PQ	:	Pre-qualification
PSS/E	:	Power System Simulator for Engineering
PV	:	Photo-Voltaic
SAPI	:	Special Assistance for Project Implementation
SCS	:	Substation Control System
SS	:	Substation
TEPSCO	:	Tokyo Electric Power Services Co., Ltd.
TL	:	Transmission Line
TOAC	:	Taking Over Acceptance Certificate
UNDP	:	United Nations Development Programme
USAID	:	United States Agency for International Development



USD	:	United States Dollar
WB	:	World Bank
YDY	:	Star-Delta-Star Connection
YYD	:	Star-Star-Delta Connection

### **Exchange Rate**

(as of December 4, 2017)

1 US dollar = 112.91 Japanese Yen

1 US dollar = 1,196.43 Iraqi Dinar

1 Iraqi Dinar = 0.0963 Japanese Yen

## ***CHAPTER 1 INTRODUCTION***

## **CHAPTER 1 INTRODUCTION**

### **1.1 Background and Objective**

Since the electric power facilities in the Republic of Iraq (Iraq) such as power plants, transmission lines, substations, and distribution lines were devastated and deteriorated because of repeated conflicts and economic sanctions, their functions have been significantly decreased. Although reconstruction of the facilities has been gradually progressed since the end of the Iraq War, power supply capacity against the demand is still about 67-75% and long power outages are frequent. Since the electric power demand is projected to be increased along with the instauration progress and population increase, restoration and improvement of the electricity sector has become one of the most vital issues for the Iraqi reconstruction.

The Japan International Cooperation Agency (JICA) has been assisting the Iraqi electricity sector through many grant-aid and loan projects. Rehabilitation and expansion works of substation facilities has commenced under the “Electricity Sector Reconstruction Project (Phase 1)” of which the loan agreement was signed between the Government of Iraq and the Government of Japan in January 2008. JICA also conducted the Preparatory Survey on Electricity Sector Reconstruction Project II (Phase 2 Study) in 2013 to formulate further assistance projects that aims to improve the power transmission and distribution networks. The loan agreement of the Phase 2 project was signed in June 2015 based on the result of the survey.

However, because the construction sites under the Phase 1 project are spread all over the country, it is difficult to say that the appropriate construction supervision by experienced electrical experts has been made. To carry forward the next phase of the project hereafter, it is necessary to strengthen the project implementation structure. In addition, the electric power facilities have been destroyed by the invasion of the Islamic State in Iraq and the Levant (ISIL). This forces to change some construction sites under the Phase 1 project and creates new reconstruction needs. Upon the site change, it is necessary to consider security situation, reconstruction needs, and current situation of the electric power facilities.

Under such circumstances, JICA decided to conduct this study on Special Assistance for Project Implementation (SAPI) on Electricity Sector Reconstruction Project. The main objectives of the study are to:

- 1) Collect and identify issues and lessons learned based on the actual implementation

status of construction sites under the Phase 1 project,

- 2) Collect and analyze information on current power supply and demand situation and the reconstruction needs in Iraq, and
- 3) Seek out possibilities for further cooperation of Japan for reconstruction and new development of electric power facilities in the future.

This study covers the area throughout Iraq, especially in the Middle and Southern Regions, except the Kurdistan Region.

## 1.2 Scope of the Study

The scope of this study is as follows:

- 1) Confirmation of current situation of the electric power facilities including power flow calculations;
- 2) Confirmation of damage situation and reconstruction needs of the facilities including the reconstruction plan prepared by the Ministry of Electricity (MOE), priority, etc.;
- 3) Confirmation of implementation structure of the electric power development projects including organization, staff assignment, measures for safety, etc.;
- 4) Collection of information on assistance to power sector by other international donors;
- 5) Confirmation of status of each construction site under the Phase 1 project and identification of issues and lessons learned for the next phase of the project;
- 6) Collection of information on possibility of cooperation for the power sector in the future; and
- 7) Preparation of several reports.

## 1.3 Study Schedule

The planned entire survey period was about six months: from September 2015 to February 2016. However, JICA and the Study Team mutually agreed to extend the schedule up to the end of December 2017 because of several reasons.

The first field study in Amman, Jordan was conducted from September 15 to 25, 2015 in order to discuss about the reconstruction needs of the electricity sector in Iraq.

The second field study in Amman was conducted from April 16 to 22, 2016 in order to collect data and discuss about the current situation and development plans of the Iraqi Electricity Sector.

The revised study schedule including the above field surveys is as follows:

Table 1.3-1 Study Schedule

	2015		2016				2017					
	9	10	-----	3	4	5	6	-----	3	-----	11	12
1st Home Work	□											
1st Field Study	■											
2nd Home Work	▲		///				Interim		Interim 2			
2nd Field Study	Inception				■		▼		▼		Draft Final	Final
3rd Home Work			///				///	///	///			▼ □ ▼

(Prepared by the Study Team)

The following reports were submitted during the study period:

- 1) Inception Report            September 2015
- 2) Interim Report             June 2016
- 3) Interim Report             June 2016
- 4) Draft Final Report        December 2017
- 5) Final Report                December 2017

#### 1.4 Study Team

The Study Team consists of the following experts:

Table 1.4-1 Study Team Members

Position	Name
1) Team Leader / Power Development Planning:	Junichi FUKUNAGA
2) Power System Planning:	Hidekazu TAKASE
3) Transmission Line and Substation Facilities / Construction Planning:	Hitoshi EGAWA
4) Procurement Planning:	Kazumasa YAZAWA (till March 2017) Yuya UEHARA (from April 2017)
5) Evaluation and Analysis:	Takaharu SONOYAMA (till March 2016) Masahiko TADA (from April 2016)
6) Coordinator / Safety Planning / Assistance of Construction and Procurement Planning:	Taro UENO

(Prepared by the Study Team)

## ***CHAPTER 2 ELECTRIC POWER SECTOR IN IRAQ***

## CHAPTER 2 ELECTRIC POWER SECTOR IN IRAQ

### 2.1 Introduction

Prior to the Gulf War, electricity system in Iraq was in proper condition with generation capacity exceeded the demand. The total installed generating capacity was 9,295 MW with a peak demand of about 5,100 MW. Approximately 87% of the population had access to electricity<sup>1</sup>.

During the Gulf War in 1991, the electricity system in Iraq suffered severe damage. Several generating plants and substations were damaged and the transmission lines were put out of service. After the war, although about 50% of the generation capacity was restored by the end of 2002, electric power supply remained insufficient and unreliable, and programmed load shedding and unplanned power outages were frequent.

In this chapter, current situation and development plans of electric power sector in Iraq are described.

### 2.2 General Information

#### (1) Ministry of Electricity

The Ministry of Electricity (MOE) in Iraq is an electric power utility in Iraq and is responsible for both the policymaking and electricity supply throughout the country including electric power generation, transmission, and distribution.

Figure 2.2-1 shows the organization structure of MOE, as of April 2016.

As shown in the figure, under the Minister of MOE, there are three deputy ministers, such as Deputy Minister for Generation, Deputy Minister for Distribution, and Deputy Minister for Projects, and there are Minister's Office, Internal Control Section, General Inspector Office, and Information Center. There are ten offices as headquarter functions and four Director Generals for 1) Electric Power Generation, 2) Electric Power Transmission, 3) Electric Power Distribution, and 4) Other (Projects).

---

<sup>1</sup> Source: "United Nations/World Bank Joint Iraq Needs Assessment: Electricity," p. 1, October 2003.

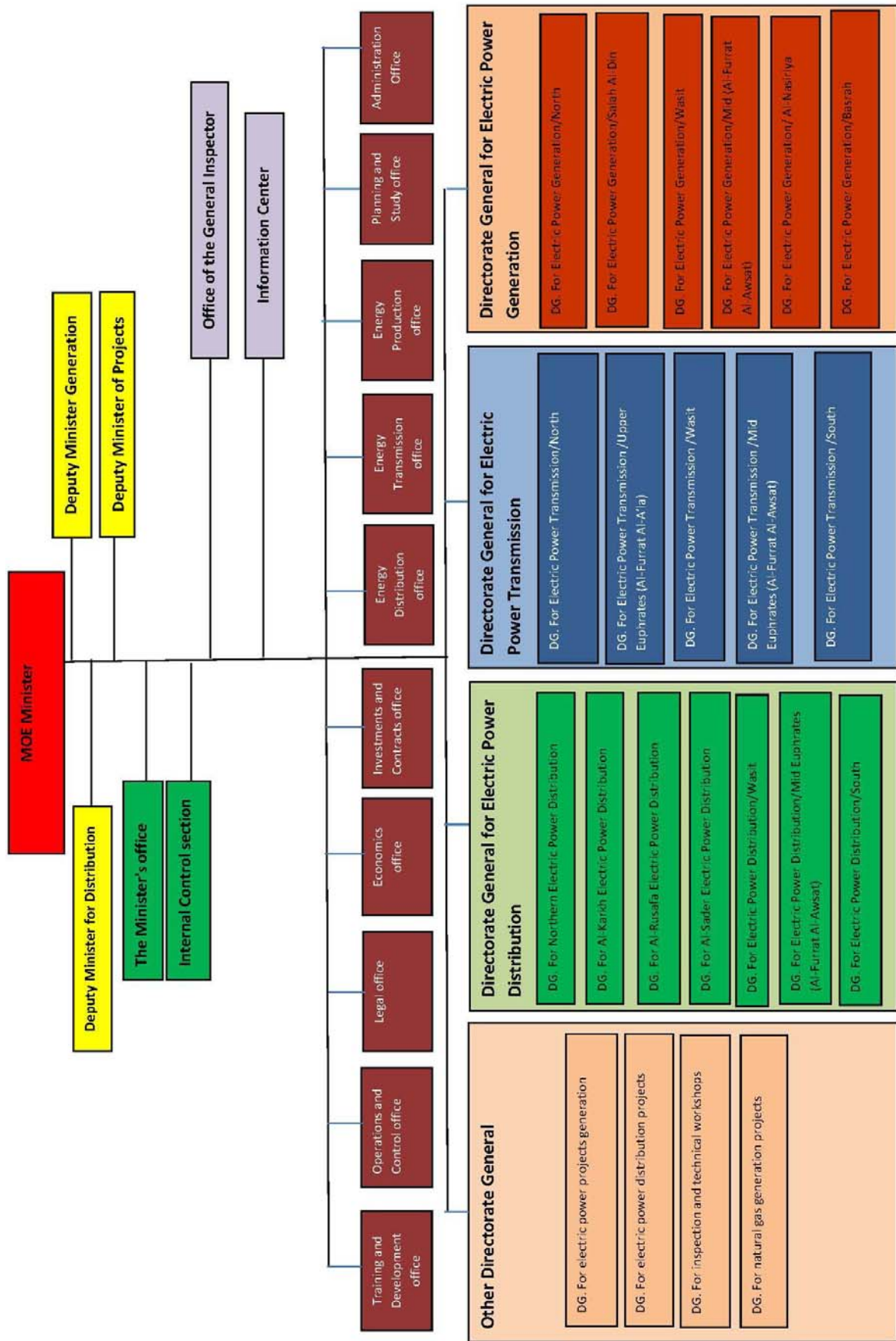


Figure 2.2-1 MOE Organization, as of April 2016 (Source: MOE)



(2) Areas and Governorates

Iraq is divided into six areas and 15 governorates as shown in Table 2-1. Figure 2.2-2 shows the map of the governorate in Iraq.

Table 2.2-1 Areas and Governorate in Iraq

Area	Governorate
1. North	1 Ninewa
	2 Salah al-Din
2. East	3 Kirkuk
3. Central	4 Baghdad
	5 Diyala
	6 Wassit
4. West	7 Al-Anbar
5. South-West	8 Babil
	9 Kerbala
	10 Najaf
	11 Qadissiya
6. South	12 Muthanna
	13 Thi-Qar
	14 Missan
	15 Basrah

(Source: MOE)



Figure 2.2-2 Governorates in Iraq (Source: MOE)

(3) Season in Iraq

The season of Iraq is divided into four seasons which is spring, summer, autumn, and winter, according to an MOE staff. Table 2.2-2 shows the season and its corresponding month/s.

Table 2.2-2 Seasons and its Corresponding Months in Iraq

Seasons	Months
Spring	February and March
Summer	April, May, June, July, August, and September
Autumn	October and November
Winter	December and January

(Source: MOE)

### 2.3 Current Situations

#### 2.3.1 Electricity Power Demand and Supply

(1) Daily Load Curves

Figure 2.3-1 shows the daily load curves of the whole Iraq in four months: January, March, July, and October in 2015.

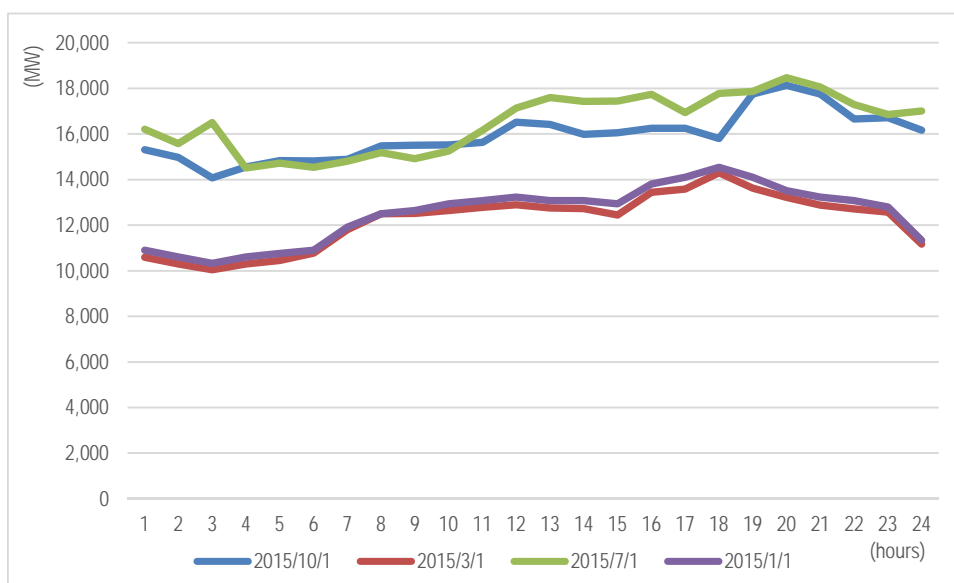


Figure 2.3-1 Daily Load Curves (Source: MOE)

The daily load curves show that there are two daily peaks: one in the early afternoon and the other in nighttime. The difference between night and day loads is not as large as expected for hot-climate countries where night peak is about 60-70% of day peak. It is considered that the non-residential load, especially the industrial load, is contributing to the high demand at night.

The load factor of January and February (winter and spring) was about 0.89 and that of July and October (summer and autumn) was about 0.86. These values mean that there are no significant demand changes throughout a day.

(2) Required Peak Demand

Table 2.3-1 shows the monthly average load required for each governorate in Iraq in 2015.

Table 2.3-1 Average Load Records in 2015 (source: MOE)

Governorates	Jan (MW)	Feb (MW)	Mar (MW)	Apr (MW)	May (MW)	Jun (MW)	Jul (MW)	Aug (MW)	Sep (MW)	Oct (MW)	Nov (MW)	Dec (MW)
Baghdad	3,671.8	3,508.9	2,904.6	2,655.3	3,414.5	3,826.7	4,118.7	4,055.5	3,837.1	3,410.7	2,720.8	3,337.8
Ninewa	1,352.4	1,270.9	1,049.0	964.9	1,240.2	1,578.4	1,710.2	1,719.5	1,621.4	1,393.3	1,155.9	1,766.0
Kirkuk	692.2	628.0	577.6	514.3	598.7	664.6	718.9	722.7	681.4	585.3	598.4	842.8
Salahaddin	614.1	577.1	476.3	440.1	620.1	760.8	824.3	828.8	781.5	671.6	540.9	877.0
Anbar	725.8	682.0	563.1	502.1	618.3	789.2	855.1	859.7	810.7	696.6	554.7	877.5
Diyala	519.9	489.2	410.1	402.2	542.5	607.7	658.4	662.0	624.2	536.4	443.0	588.9
Babel	594.3	557.8	466.3	467.7	605.5	631.4	684.2	691.9	652.3	557.9	470.2	593.2
Karbala	472.5	433.9	366.4	383.8	505.6	520.5	552.9	570.5	537.4	453.5	405.2	564.6
Najaf	539.1	506.3	419.9	402.2	511.3	536.7	581.5	586.6	555.3	475.8	396.4	570.8
Al-Qadesiyah	405.0	379.4	315.8	314.6	389.7	388.0	419.2	422.5	397.9	341.9	282.4	364.5
Wasit	467.4	425.6	348.7	332.0	446.9	536.7	580.1	606.6	546.7	446.9	368.3	487.5
Al-Muthanna	321.0	301.7	250.2	276.6	340.5	327.0	353.9	359.6	339.4	288.7	229.7	266.2
Dhi Qar	563.1	526.0	433.0	451.3	668.3	805.0	872.2	877.8	828.7	713.5	564.4	572.4
Maysan	412.3	386.1	320.6	318.0	442.6	500.4	537.5	547.6	528.4	437.3	340.7	388.2
Al-Basrah	1,280.4	1,184.1	982.7	1,065.3	1,822.9	2,202.0	2,384.2	2,460.1	2,295.3	1,906.8	1,470.9	1,293.0
Aux + Loss*	1,325.8	1,253.1	987.8	706.8	895.1	1,115.1	1,250.7	1,223.3	1,176.2	1,016.6	754.1	1,010.3
Total	13,957.0	13,110.1	10,872.3	10,197.2	13,662.6	15,790.3	17,102.1	17,194.9	16,213.9	13,932.8	11,295.8	14,400.5

note\*) "Aux." means auxiliary demand for station use (6.5%) and "Losses" means transmission line loss (3.5%).

The average load (MW) in the above table was calculated from the required monthly energy (MWh) divided by 24 hours and numbers of days in a month.

To grasp the actual peak loads for each governorate, the Study Team calculated peak demand based on the data shown in Table 2.3-1 with seasonal load factors. The calculated results are shown in Table 2.3-2. Since the data used for the calculation was the required amount of energy per month, the Study Team considered that these peak demands are different from the actual supplied power because it is calculated from the required amount.

The maximum total peak demand required in August was 19,946 MW in 2015. The largest demand was Baghdad, which accounted for 24% of the total peak demand. Next was Basra, which accounted for 14%. Ninewa accounted for 10%. Hence, total peak demand of Baghdad, Basra, and Ninewa accounted for about 50% of the total demand in Iraq.

Table 2.3-2 Calculated Peak Demand in 2015

Governorates	Jan (MW)	Feb (MW)	Mar (MW)	Apr (MW)	May (MW)	Jun (MW)	Jul (MW)	Aug (MW)	Sep (MW)	Oct (MW)	Nov (MW)	Dec (MW)
Baghdad	4,112	3,930	3,253	3,080	3,961	4,439	4,778	4,704	4,451	3,956	3,156	3,738
Ninewa	1,515	1,423	1,175	1,119	1,439	1,831	1,984	1,995	1,881	1,616	1,341	1,978
Kirkuk	775	703	647	597	695	771	834	838	790	679	694	944
Salahaddin	688	646	533	511	719	883	956	961	907	779	627	982
Anbar	813	764	631	582	717	915	992	997	940	808	643	983
Diyala	582	548	459	467	629	705	764	768	724	622	514	660
Babylon	666	625	522	543	702	732	794	803	757	647	545	664
Karbala	529	486	410	445	587	604	641	662	623	526	470	632
Najaf	604	567	470	467	593	623	675	680	644	552	460	639
Qadisiyah	454	425	354	365	452	450	486	490	462	397	328	408
Wasit	523	477	391	385	518	623	673	704	634	518	427	546
Muthanna	359	338	280	321	395	379	410	417	394	335	266	298
DhiQar	631	589	485	524	775	934	1,012	1,018	961	828	655	641
Maysan	462	432	359	369	513	580	623	635	613	507	395	435
Basra	1,434	1,326	1,101	1,236	2,115	2,554	2,766	2,854	2,663	2,212	1,706	1,448
Aux.+ Loss	1,485	1,403	1,106	820	1,038	1,293	1,451	1,419	1,364	1,179	875	1,132
Total	15,632	14,683	12,177	11,829	15,849	18,317	19,838	19,946	18,808	16,162	13,103	16,129

(Source: Prepared by the Study Team based on the MOE data)

As shown in the above table, peak loads are recorded in summer, July and August, because of the demand for air-conditioning facilities in the hottest season in Iraq, and bottom loads are recorded in March and April, in calm climate season.

According to the MOE's Annual Report 2014, electric power plants of MOE were able to meet only 38% of the actual electricity demand. Although some independent power producer (IPP) plants and power import from neighboring countries, Iran and Turkey tried to fill the gap; however, scheduled load shedding for the whole country was unavoidable.

### (3) Power Supply in Iraq

Recorded power supply hour rates of each governorate in 2015 are shown in Figure 2.3-2. The figure shows that power outage happened frequently in whole Iraq. In particular, the northern area such as Ninewa, Salah Al-Din, and Anbar has lowered power supply hour rates during summer. The reason for this seems to be derived from deterioration of generating equipment or the war.

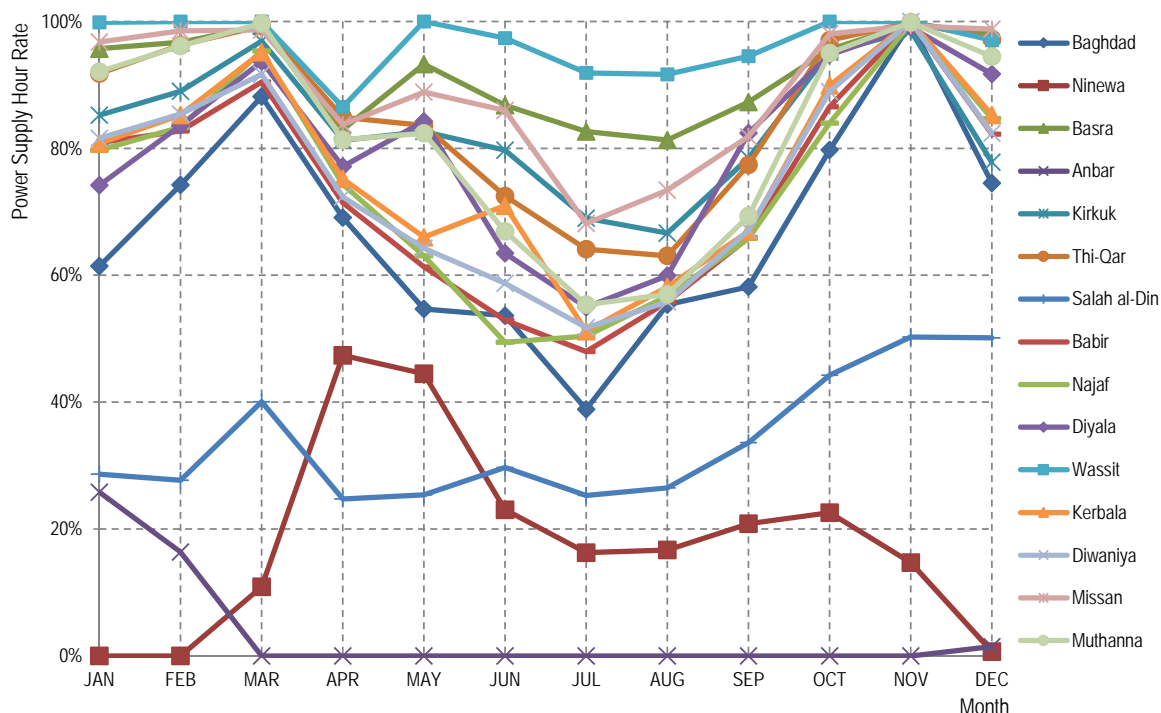


Figure 2.3-2 Record of Power Supply Hour Rates in 2015 (Source: MOE)

Tables 2.3-3 and 2.3-4 shows the required energy and supplied energy of each governorate in 2015, respectively.

Table 2.3-3 Required Energy of Each Governorate in 2015

[Unit: GWh]

Governorate	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average
Baghdad	2,732	2,358	2,161	1,912	2,540	2,755	3,064	3,017	2,763	2,538	1,959	2,483	30,282	2,524
Ninewa	1,006	854	780	695	923	1,136	1,272	1,279	1,167	1,037	832	1,314	12,296	1,025
Kirkuk	515	422	430	370	445	479	535	538	491	435	431	627	5,718	476
Salahaddin	457	388	354	317	461	548	613	617	563	500	389	652	5,859	488
Anbar	540	458	419	362	460	568	636	640	584	518	399	653	6,237	520
Diyala	387	329	305	290	404	438	490	493	449	399	319	438	4,739	395
Babylon	442	375	347	337	451	455	509	515	470	415	339	441	5,094	425
Karbala	352	292	273	276	376	375	411	424	387	337	292	420	4,215	351
Najaf	401	340	312	290	380	386	433	436	400	354	285	425	4,443	370
Qadisiyah	301	255	235	226	290	279	312	314	286	254	203	271	3,229	269
Wasit	348	286	259	239	333	386	432	451	394	332	265	363	4,088	341
Muthanna	239	203	186	199	253	235	263	268	244	215	165	198	2,669	222
Dhi Qar	419	353	322	325	497	580	649	653	597	531	406	426	5,758	480
Maysan	307	259	239	229	329	360	400	407	380	325	245	289	3,770	314
Basra	953	796	731	767	1,356	1,585	1,774	1,830	1,653	1,419	1,059	962	14,885	1,240
Aux + Loss	986	842	735	509	666	803	931	910	847	756	543	752	9,280	773
<b>Total</b>	<b>10,384</b>	<b>8,810</b>	<b>8,089</b>	<b>7,342</b>	<b>10,165</b>	<b>11,369</b>	<b>12,724</b>	<b>12,793</b>	<b>11,674</b>	<b>10,366</b>	<b>8,133</b>	<b>10,714</b>	<b>122,563</b>	<b>10,214</b>

(Source: MOE)

Table 2.3-4 Supplied Energy of Each Governorate in 2015

[Unit: GWh]

Governorate	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Average
Baghdad	1,811	1,564	1,572	1,438	1,868	2,040	1,964	2,327	2,130	1,875	1,685	2,090	22,365	1,864
Ninewa	0	0	97	356	330	175	193	214	201	147	57	41	1,811	151
Kirkuk	492	408	427	336	377	412	430	445	406	352	424	519	5,029	419
Salahaddin	164	129	141	129	147	176	182	224	204	184	192	260	2,130	178
Anbar	52	17	6	7	9	9	10	9	10	11	10	27	176	15
Diyala	324	286	273	247	315	288	278	321	335	299	280	373	3,619	302
Babylon	328	275	280	255	317	330	359	431	400	335	295	376	3,981	332
Karbala	320	260	247	225	307	334	352	397	362	307	272	368	3,750	312
Najaf	294	239	228	213	297	283	325	378	345	306	242	328	3,478	290
Qadisiyah	224	181	176	168	202	233	239	254	228	213	160	213	2,491	208
Wasit	329	263	233	223	324	378	422	450	386	297	222	341	3,867	322
Muthanna	163	124	113	117	196	197	209	239	226	193	121	177	2,076	173
Dhi Qar	370	292	261	278	444	483	511	556	531	461	270	403	4,859	405
Maysan	242	189	171	186	300	345	364	389	370	282	174	266	3,278	273
Basra	854	611	594	748	1,331	1,561	1,686	1,799	1,618	1,205	626	927	13,558	1,130
Aux + Loss	472	384	353	343	446	538	529	564	529	429	323	496	5,405	450
<b>Total</b>	<b>6,439</b>	<b>5,220</b>	<b>5,171</b>	<b>5,268</b>	<b>7,208</b>	<b>7,780</b>	<b>8,054</b>	<b>9,000</b>	<b>8,280</b>	<b>6,897</b>	<b>5,353</b>	<b>7,203</b>	<b>81,873</b>	<b>6,823</b>

(Source: MOE)

Power supply rates calculated from the required energy (Table 2.3-3), supplied energy (Table 2.3-4), and power supply hour rates (Figure 2.3-2) of each governorate in 2015 are shown in Figure 2.3-3.

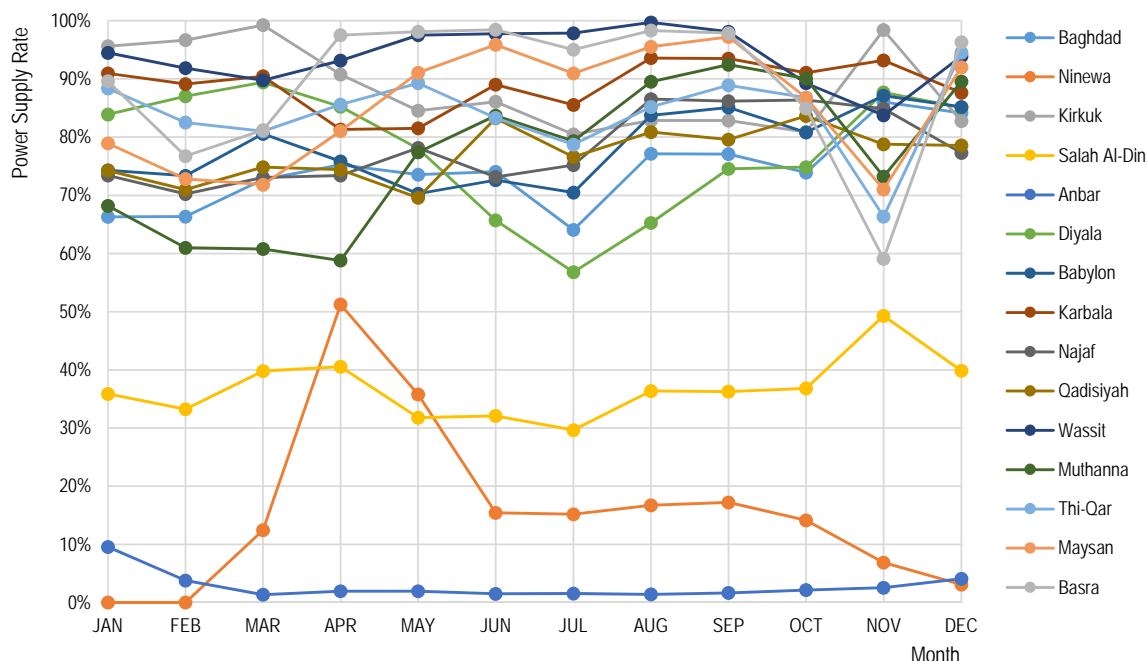


Figure 2.3-3 Power Supply Rates in 2015 (Source: MOE)

As shown in Figure 2.3-3, the power supply rates in the governorates in the northern area were less than 50%, and it is found that overall power supply situation in Iraq was insufficient.

### 2.3.2 Electric Power Generation

Total installed capacity of MOE's electric power generating plants as of April 2016 was 22,667 MW of which, steam thermal plants: 3,305 MW, gas thermal plants: 15,000 MW, diesel plants: 1,864 MW, and hydropower plants: 1,864 MW as shown in Table 2.3-5.

Table 2.3-5 Existing Power Plants in April 2016 (Source: MOE)

Power Plant Types		No. of Plants	Installed Capacity (MW)	Participation (%)
Thermal Power Plants	Steam Turbine	8	3,305	14.6%
	Gas Turbine	36	15,000	66.2%
	Diesel	20	2,498	11.0%
Hydro Power Plants		8	1,864	8.2%
Total		72	22,667	100.0%

As shown in the above table, about 92% of the total generating facilities of MOE are of thermal power. The total firm capacity is about 40% (about 9,100 MW) in accordance with the MOE.

Since the Study Team has not received the detailed data of the existing power plants shown in Table 2.3-5, the following description on the existing power plants is based on the MOE Annual Report 2014, which is the latest detailed data available. Table 2.3-6 summarizes the situations of the existing electric power generating plants in Iraq as of 2014.

Table 2.3-6 Existing Generating Plants in 2014 (Source: MOE Annual Report 2014)

Power Plants	No. of Plants	No. of Units	Total Installed Capacity (MW)	No. of Operating Units	Total Capacity of Operating Units (MW)	Firm Capacity (MW)	Energy Production (GWh/year)	Participation in Energy (%)
Steam stations	8	31	6,750	29	6,475	2,379	20,838.5	34.3%
Gas stations	27	163	11,288	154	10,067	4,229	30,049.5	49.4%
Portable stations	6	22	308	0	0	0	0.0	0.0%
Diesel stations	8	95	2,011	85	1,870	756	6,623.2	10.9%
Hydropower stations	11	29	1,864	27	1,862	335	2,930.8	4.8%
Sub-total (stations)	60	340	22,221	295	20,274	7,699	60,442.0	99.5%
Supporting diesels	-	212	290	100	75	0	0.0	0.0%
Diesels of Ministry of Oil	-	-	-	-	-	37	326.0	0.5%
Sub-total (diesels units)	-	212	290	100	75	37	326.0	0.5%
Total system	60	552	22,511	395	20,349	7,736	60,768	100.0%

Note\*: Supporting diesels: diesel generators for emergency use installed in power plants and/or substations

As shown in Table 2.3-6, the main power plants of MOE are categorized as i) Steam thermal ii) Gas thermal, iii) Portable, iv) Diesel, and v) Hydropower. Small-scale supporting generators and diesel generators owned by the Ministry of Oil are also listed. More than 95% of the total energy production were from thermal power plants.

Although the total installed power generation capacity of MOE in 2014 amounted to 22,511 MW, the firm capacity was 7,736 MW (34.4%) because of broken and deteriorated facilities. Tables 2.3-7 – 2.3-10 show the details of each type of power plant in 2014.

Table 2.3-7 Existing Steam Power Plants (Source: MOE Annual Report 2014)

Governorates	Plant Name	Unit No. X Capacity (MW)	No. of Operating Units	Installed Capacity of Operating Units (MW)	Energy Production (GWh/year)
Baghdad	South Baghdad	4 X 55	3	165	479.6
	Al-Doura	4 X 160	4	640	2,364.4
Al-Hilla	Al-Musayyib	4 X 300	4	1,200	3,170.8
Salahaddin	Baiji	6 X 220	5	1,100	808.6
Al-Basrah	Al-Najbiyah	2 X 100	2	200	931.6
	Al-Hartha	2 X 220	2	400	1,903.8
Dhi Qar	Al-Nasiriyah	4 X 210	4	840	3,000.0
Al-Kut	Wasit	1 X 610 + 4 X 330	5	1,930	8,179.7
Total of Steam Plants		6,750	29	6,475	20,838.5

Table 2.3-8 Existing Gas Power Plants (Source: MOE Annual Report 2014)

Governorates	Plant Name	Unit No. X Capacity (MW)	No. of Operating Units	Installed Capacity of Operating Units (MW)	Energy Production (GWh/year)
Baghdad	South Baghdad 1	2X 123	2	246	1,137.6
	South Baghdad 2	16 X 25	16	400	685.8
	Al-Rasheed	2 X 47	2	94	401.7
	Al-Doura	4 X 37.5	4	150	644.3
	Al-Taji	4 X 20	4	80	313.4
		3 X 25	3	75	
	Taji Gadidah	4 X 40	4	160	477.1
	Al-Quds	10 X 123	10	1230	6,201.1
	Al-Quds	4 X 43	4	172	
Al-Sadr	2 X 160	2	320	1,661.8	
Babel	Al-Hilla	7X20	7	120	471.8
	Al-Hilla	1 X 25			
	Al-Hilla Gadidah	2 X 123	2	246	1,259.3
	Al-Musayyib	9X50	9	450	778.3
	Al-Kherat	10 X 123	10	1230	5,376.3
Karbala	Karbala	2X 123	2	246	1,258.0
Al-Najaf	Najaf 1	3X 63	2	126	1,076.5
	Najaf 1	1X 55	1	55	
	Najaf Gadidah	2X 123	2	246	
	Alhaidariya	1X 160	1	160	
Salahaddin	Baiji	4X 159	4	636	1,025.6
	Dibiss	3X 37.5	3	112.5	565.3
	Mullah Abdullah Old	12X 120	11	220	1,068.6
	Mullah Abdullah New	6X 37	6	222	646.6
		1X 65	1	65	
1X 260		1	260		
Ninewa	Al-Mosul	12X 20	12	240	494.0
		2X 26.8	2	53.6	
	Ninewa Steam	6X 123	5	615	
	Al-Khala	4X 47	2	94	
Al-Amara	Bizirkan	1X 43	1	43	217.1
	Bizirkan 2	2X 60	2	120	4.7
	Al-Shuaiba	2X 20	2	40	28.1
Al-basrah	Khor Al-Zubair	4X 63	4	252	2,379.1
		2X 123	2	246	
	Al-Batro	4X 20	4	80	67.1
	Rumaila	5X 292	2	584	3,544.0
Dhi Qar	Al-Nasiriyah	1 X 43	1	43	213.8
AL-Muthanna	Al-Samawa	1 X 43	1	43	47.3
Total of Gas Plants		11,288	154	10,067	37,049.5



Table 2.3-9 Existing Diesel Power Plants (Source: MOE Annual Report 2014)

Governorates	Plant Name	Unit No. X Capacity (MW)	No. of Operating Units	Installed Capacity of Operating Units (MW)	Energy Production (GWh/year)
Baghdad	Al-Shshahid Sbaa	5X 11.8	1	12	83.4
	Al-Hurria	16 X25	8	62	272.5
Al-Samawa	Al-Samawa	4 X15	0	0	0.0
Salahaddin	Samarra	17 X20	18	306	592.2
Other provinces	Hyundai*	12 X30	12	360	270.2
Al-Anbar	Makhlis Kafi	10 X33	10	230	57.4
Maysan	North Amara	8 X25	8	200	1,027.9
AL-Diwaniya (Qadisiyah)	East Diwaniya	8 X25	8	200	1,293.1
AL-Diwaniya (Qadisiyah)	North Diwaniya	8 X25	8	200	1,195.0
Karbala	East Karbala	12 X25	12	300	1,831.3
Total of Diesel Plants		2,011	85	1,870	6,623.2
Others	Supporting diesels	290	100	75	0.0
	Diesels of oil	-	-	-	326.0
	Total Diesels	2,223	85	1,870	6,949.1

Note\*: Hyundai diesels are group of stations distributed in nine sites.

Table 2.3-10 Existing Hydro Power Plants (Source: MOE Annual Report 2014)

Governorates	Plant Name	Unit No. X Capacity (MW)	No. of Operating Units	Installed Capacity of Operating Units (MW)	Energy Production (GWh/year)
Salahaddin	Samarra	3 X 28	3	84	283.6
Diyala	Hamrin	2 X 25	2	50	115.5
Al-Anbar	Haditha	6 X 110	6	660	1,433.9
Karbala	Al-hindia	4 X 3.75	4	15	38.3
AL-Najaf	Al-Kufa	4 X 1.25	2	3	3.4
Ninewa	Main Mosul Dam	4 X 187.5	4	750	895.4
	Organizational Mosul Dam	4 X 15	4	60	125.5
	Pumped Storage	2 X 120	2	240	35.2
Total of Hydropower Plants		1,864	27	1,862	2,930.8

To make up for the electric power shortage, MOE imports electric power from neighboring countries such as Turkey and Iran, IPP power plants, and Kurdistan network as shown in Table 2.3-11.

Table 2.3-11 Electric Power Imports (Source: MOE Annual Report 2014)

Import Lines / Stations	Voltage	Imported Energy (MWh)	Imported Average Power* (MW)
Turkish line (Sloppy - Zakho)	132	0	0.0
Iranian line (Khanagiq - Serpil Zahab)	132	1,068,372	122.0
Iranian line (Khor Al-Zubair - Khorramshahr)	400	2,399,368	273.9
Iranian line (Diyala - Mirsad)	400	1,874,139	213.9
Iranian line (Amara - Krkhah)	400	1,586,471	181.1
Qaaem - Qeem	400	0	0.0
Tel Abu Zahir - Soideh	132	0	0.0
Al-Barijat	132	1,928,467	220.1
Hartha Investment (IPP)	132	892,102	101.8
Al-Shuaiba	132	284,658	32.5
Khor Malah	400	23,469	2.7
Import to Kirkuk	132	1,856,507	211.9
Import to Ninewa	132	336,998	38.5
Total		12,250,551	1,398.5

Note\*: Imported Average Power (MW) is calculated from Imported Energy (MWh) divided by 356 days and 24 hours.

The energy production situation in Iraq in 2014 is shown in Figure 2.3-4.

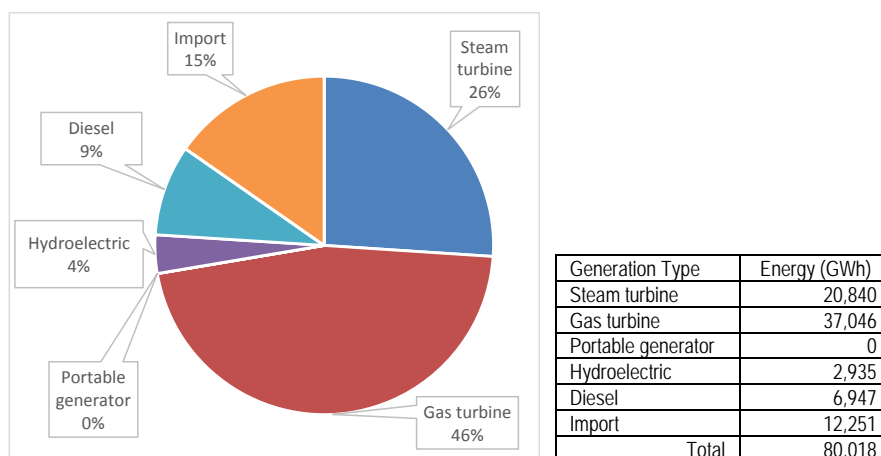


Figure 2.3-4 Energy Production in 2014 (Source: MOE Annual Report 2014)

The produced energy in 2014 was 80,018 GWh in total and higher energy production rates were gas turbine generation (46%) and steam turbine generation (26%).

Fifteen percent of energy was imported from neighboring countries and IPP plants to the MOE network. Figure 2.3-5 shows the breakdown of the imported energy in 2014. About 56% of the import energy (6,928 GWh) in 2014 was dependent on Iran.

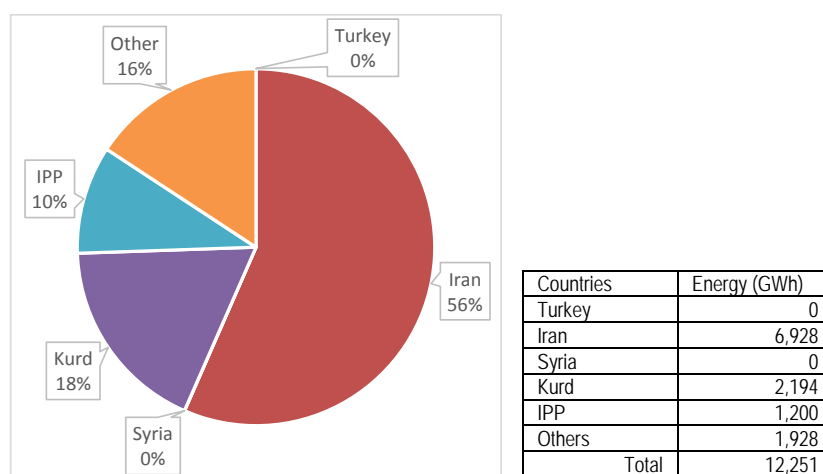


Figure 2.3-5 Imported Energy in 2014 (Source: MOE Annual Report 2014)

### 2.3.3 High Voltage Transmission Lines

Main transmission system voltages in Iraq are 400 kV and 132 kV of which, total transmission line length is 5,262 km and 13,223 km, respectively as of April 2016. Transmission losses was approximately 3.5% in accordance with the MOE, and this is comparable to the neighboring countries.

Figures 2.3-6 and 2.3-7 show the location of the existing 400 kV transmission lines and the existing 400 kV and 132 kV network diagram, respectively.

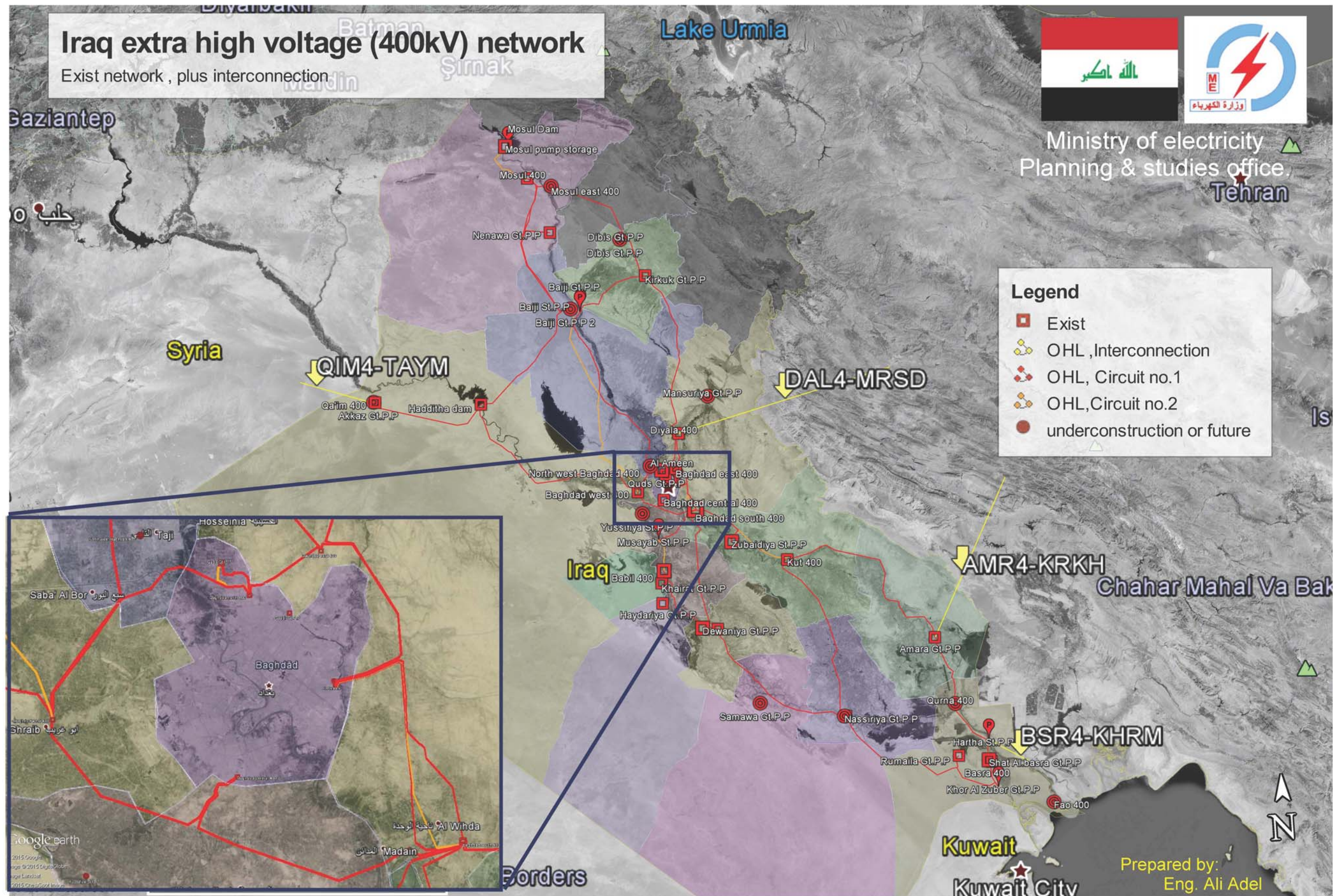


Figure 2.3-6 Location of the Existing 400 kV Transmission Lines (Source: MOE)

# IRAQ Extra High & High voltage Electrical Network

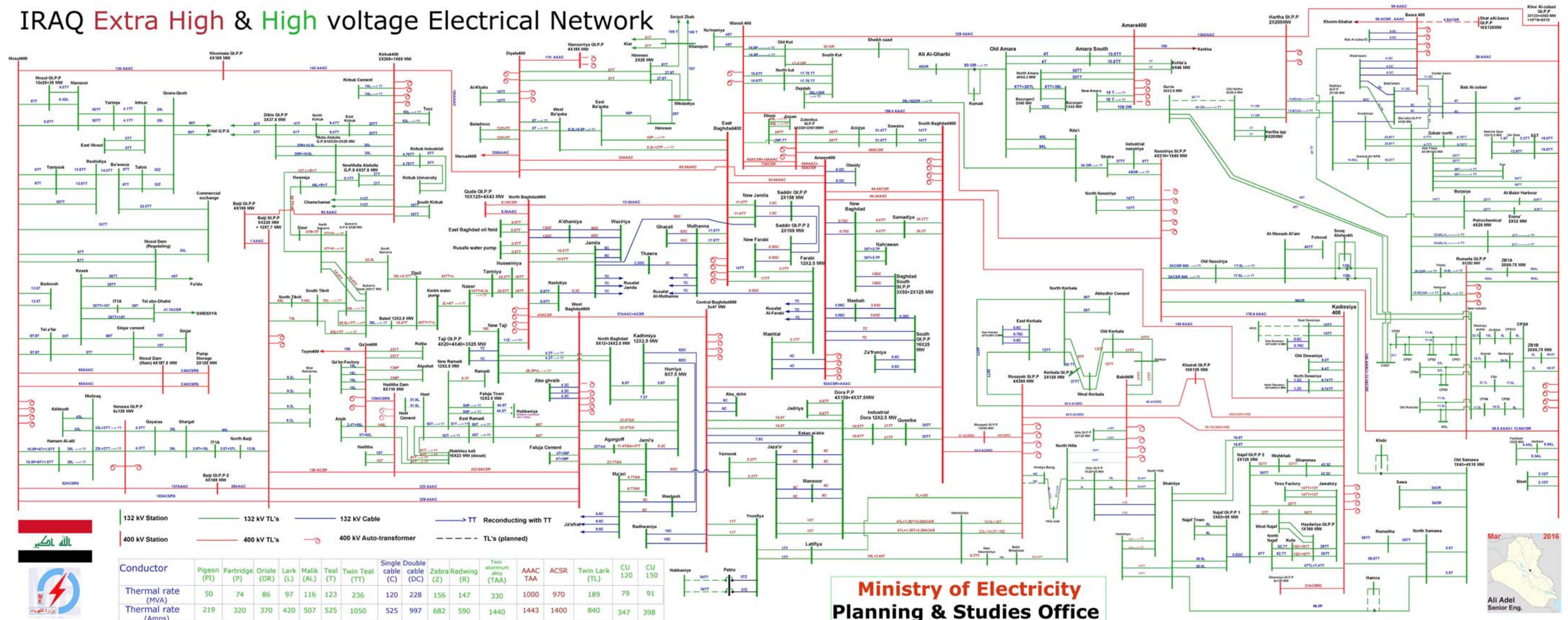


Figure 2.3-7 Existing 400 kV and 132 kV Network Diagram (Source: MOE)

### 2.3.4 High Voltage Substations

Table 2.3-12 shows the list of the existing 400 kV substations in Iraq as of 2015. There are 36 stations with 93 units of 250 MVA auto-transformers, 23,250 MVA capacity in total.

Table 2.3-12 Existing 400 kV Substations

Governorates	ID	Substation Name	No. of Auto-TR	Capacity (MVA)
Al-Anbar	1	Haditha Dam	2	500
	2	Qaim 400	2	500
Babil	3	Mussiab Gas	0	0
	4	Babil 400	4	1,000
	5	Mussiab Thermal	4	1,000
Baghdad	6	Quds gas	0	0
	7	Al-Sader Gas	2	500
	8	AL-Rasheed 400	4	1,000
	9	Baghdad East 400	4	1,000
	10	Baghdad North 400	4	1,000
	11	Baghdad South 400	4	1,000
	12	Baghdad West 400	4	1,000
	13	Ameen 400	4	1,000
Basra	14	Shatt Al_Basra Gas	0	0
	15	Najeebiya Gas	2	500
	16	Hartha Thermal	2	500
	17	Rumaila Gas	3	750
	18	Basra 400	4	1,000
	19	Khor Al-Zubair Gas	4	1,000
Diyala	20	Al-Mansooriya Gas	2	500
	21	Diyala 400	4	1,000
Kerbala	22	Al-kheirat Gas	2	500
Kirkuk	23	Kirkuk 400	4	1,000
Meisan	24	Amara 400	4	1,000
Nainawa	25	Mosul Dam	0	0
	26	Pump Storage	0	0
	27	Nainawa Gas	2	500
	28	Mosul 400	4	1,000
Najaf	29	Al-Hydaria Gas	4	1,000
Qadissiya	30	Al-Dewaniya Gas	0	0
	31	Qadissiya 400	4	1,000
Salah Al-Deen	32	Bajji Gas1	0	0
	33	Bajji Thermal	2	500
Thee-Qaar	34	Nassiriya Thermal	4	1,000
Wasit	35	Al-Zubaidiya Thermal	2	500
	36	Wassit 400	2	500
TOTAL			93	23,250

(Source: MOE)

The long list of existing 132 kV substations in Iraq as of 2015 is shown in Attachment 2-1, which is attached to the end of this chapter. Table 2.3-13 summarizes the existing 132 kV substations. There are 234 stations with 593 units of several capacities of transformers, 34,509.4 MVA capacity in total.

Table 2.3-13 Summary of Existing 132 kV Substations

Governorates	No. of Stations	No. of TR	TR Capacity (MVA)
Al-Anbar	16	36	1,976.4
Babil	9	28	1,523.0
Baghdad	62	146	9,255.0
Basra	44	112	5,507.0
Diyala	8	21	1,143.0
Kerbala	6	17	1,049.0
Kirkuk	11	30	1,812.0
Meisan	8	18	1,058.0
Nainawa	26	69	4,065.0
Najaf	7	21	1,314.0
Qadissiya	5	13	819.0
Salah Al-Deen	10	23	1,373.0
Thee-Qaar	8	22	1,386.0
Wasit	10	27	1,612.0
Al-Muthanna	4	10	617.0
<b>TOTAL</b>	<b>234</b>	<b>593</b>	<b>34,509.4</b>

(Source: MOE)

### 2.3.5 Distribution Network

Table 2.3-14 summarizes the operating 33 kV and 11 kV transformer stations for electricity distribution in each governorate, as of 2014.

Table 2.3-14 Operating 33 kV and 11 kV Transformer Stations

Region	Governorates	No. of 33 kV and 11 kV TR Stations	TR Capacity (MVA)
Baghdad	Al-Rusafa (Baghdad)	60	3,136.5
	Al-Karkh (Baghdad)	83	4,023.0
	Al-Sader (Baghdad)	34	1,795.0
Subtotal		177	8,954.5
Northern	Ninewa	81	2,730.0
	Kirkuk	30	1,105.0
	Salahaddin	53	1,529.0
Subtotal		164	5,364.0
Middle Euphrates	Babel	30	1,339.0
	Karbala	21	1,076.0
	Najaf	28	1,278.0
	Al Qadesiyah	31	1,226.0
Subtotal		110	4,919.0
Middle	Anbar	42	1,292.0
	Diyala	33	872.0
	Wasit	26	946.0
Subtotal		101	3,110.0
Southern	Al-Basrah	77	3,904.0
	Dhi Qar	44	1,760.0
	Maysan	25	1,131.0
	Al-Muthanna	19	644.0
Subtotal		165	7,439.0
Total		717	29,786.5

(Source: MOE Annual Report 2014)

As shown in Table 2.3-14, Baghdad governorate is divided into three management area of MOE, and total capacity of distribution transformers in Baghdad (8,954.5 MVA) accounted for about 30% of the total capacity of entire Iraq.

Table 2.3-15 summarizes the operating 33 kV and 11 kV distribution lines and low-voltage (LV) distribution transformers in each governorate as of 2014.

Table 2.3-15 Operating 33 kV and 11 kV Distribution Lines and LV Transformers

Directorates	Governorates	33 kV Lines				11 kV Lines				33-11/0.4 kV Transformers	
		Aerial		Cables		Aerial		Cables		No.	Capacity (MVA)
		No.	Length (km)	No.	Length (km)	No.	Length (km)	No.	Length (km)		
Baghdad	Al-Rusafa (BGD)	14	115.0	105	343.0	354	1,165.0	282	905.0	6,233	2,718.0
	Al-Karkh (BGD)	33	232.0	116	414.0	636	4,260.0	245	715.0	13,996	4,842.0
	Al-Sadr (BGD)	5	27.0	61	216.0	120	675.0	331	969.0	6,872	1,955.0
Sub-total		52	374.0	282	973.0	1,110	6,100.0	858	2,589.0	27,101	9,515.0
Northern	Ninewa	71	1,476.0	78	336.0	680	8,161.0	107	1,426.0	12,722	4,050.0
	Kirkuk	31	741.0	21	85.0	249	5,379.0	6	137.0	8,319	2,097.0
	Salahaddin	62	1,097.0	27	103.0	359	5,754.0	35	142.0	10,392	2,673.0
Sub-total		164	3,314.0	126	524.0	1,288	19,294.0	148	1,705.0	31,433	8,820.0
Middle Euphrates	Babel	23	344.0	26	220.0	239	3,594.0	23	84.0	7,452	2,475.0
	Karbala	10	146.0	33	189.0	190	1,378.0	25	254.0	4,476	1,635.0
	Najaf	29	220.9	34	110.0	212	1,637.5	27	269.6	5,380	1,947.0
	Al-Qadesiyah	26	425.0	20	106.0	199	2,709.0	23	67.0	5,223	1,932.0
Sub-total		88	1,135.9	113	625.0	840	9,318.5	98	674.6	22,531	7,989.0
Middle	Anbar	46	749.0	12	67.0	283	4,298.6	20	14.8	7,383	2,036.0
	Diyala	26	485.0	12	39.7	235	3,989.0	7	17.0	5,386	1,563.0
	Wasit	40	676.0	10	37.7	240	3,061.0	6	24.0	5,400	1,710.0
Sub-total		112	1,910.0	34	146.4	758	11,349.0	33	55.8	18,169	5,309.0
Southern	Al-Basrah	84	718.0	104	446.0	779	3,779.0	372	661.0	11,930	4,231.0
	Dhi Qar	40	596.0	8	47.0	318	3,374.0	8	126.0	6,764	2,208.0
	Maysan	30	432.0	17	107.0	220	3,521.0	40	360.0	6,417	2,037.0
	Al-Muthanna	11	191.0	14	45.0	129	4,551.0	42	253.0	3,488	1,249.0
Sub-total		165	1,937.0	143	645.0	1,446	15,225.0	462	1,400.0	28,599	9,725.0
Total		581	8,670.9	698	2,913.4	5,442	61,286.5	1,599	6,426.4	127,833	41,906.0

(Source: MOE Annual Report 2014)

Total route length of the 33 kV and 11 kV overhead distribution lines as of 2014 was 69,957.4 km, and total route length of cable (underground) distribution line was 9,339.8 km. In other words, overhead lines are the main distribution lines in Iraq, and underground lines are mainly applied in urban areas such as Baghdad, Ninewa, and Al-Basra.

## 2.4 Development Plans

The MOE prepared a five-year National Network Development Master Plan 2013-2017, which is the latest development plan at present. According to the MOE staff, the next five-year plan is under progress and will be published in 2017.

In this clause, MOE’s development plans are to be described based on the data on the master plan 2013-2017 and a part of the updated data.

### 2.4.1 Demand Forecast

#### (1) Peak Demand Forecast in Iraq

Electric power demand forecast is essential for preparing national power system development plan. Power demand forecast in Iraq prepared by MOE is shown in Figure 2.4-1. The figure shows that the peak power demand in 2015 was forecasted at 20,993 MW and peak power demand is expected to increase at 54,094 MW in 2030, which is more than double that of 2015. For this reason, there will be a need for the development of the same size of power plants and power facilities.

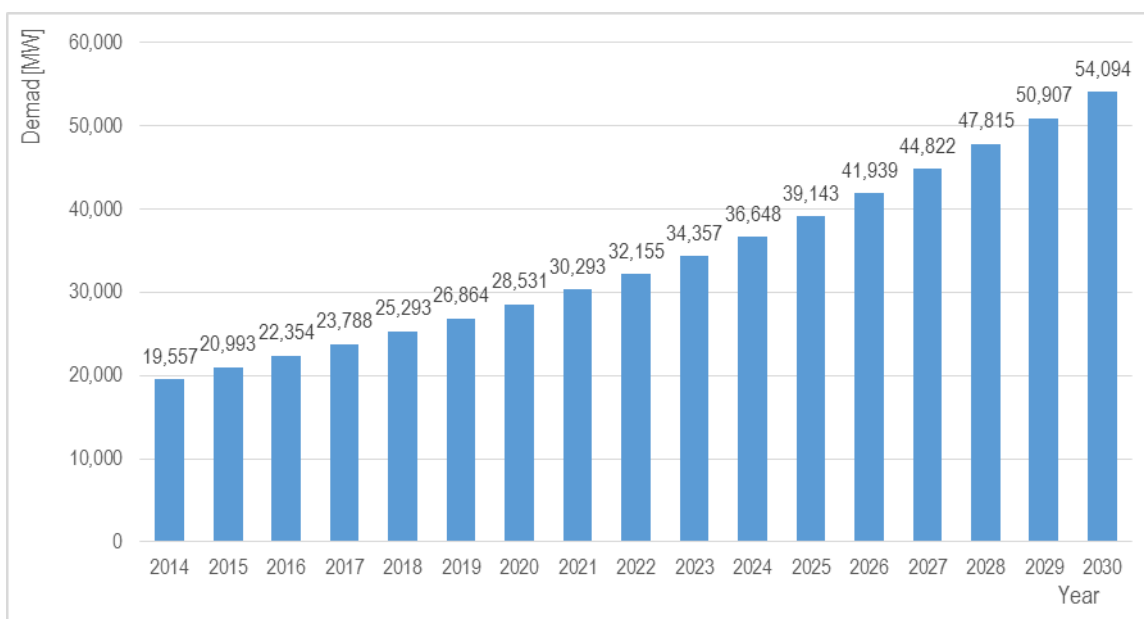


Figure 2.4-1 Demand Forecast 2015 – 2030 (Source: MOE)

#### (2) Peak Demand Forecast by Governorates

Table 2.4-1 shows the peak demand forecast by governorates in 2015 and 2030. The average growth rate of peak demand in the whole country is 6.51% per year. The highest growth rates among the governorates than the average growth rate are Thi-Qar (7.03% per year) and Kirkuk (6.91% per year).



Table 2.4-1 Peak Demand Forecast by Governorates

Governorates	2015	Contribution	2030	Contribution	Growth Rate
Ninawa	2,172 MW	10.3%	5,662 MW	10.5%	6.60%
Kirkuk	766 MW	3.6%	2,087 MW	3.9%	6.91%
Diyala	584 MW	2.8%	1,574 MW	2.9%	6.83%
Al-Anbar	1,431 MW	6.8%	2,742 MW	5.1%	4.43%
Baghdad	6,520 MW	31.1%	17,292 MW	32.0%	6.72%
Babil	1,103 MW	5.3%	2,632 MW	4.9%	5.97%
Kerbala	776 MW	3.7%	1,873 MW	3.5%	6.05%
Wasit	675 MW	3.2%	1,575 MW	2.9%	5.81%
Salah Al-Deen	935 MW	4.5%	2,513 MW	4.6%	6.81%
Al-Najaf	865 MW	4.1%	2,316 MW	4.3%	6.79%
Al-Qadisiya	753 MW	3.6%	1,974 MW	3.6%	6.64%
Al-Muthanna	508 MW	2.4%	1,260 MW	2.3%	6.24%
Thi-Qar	958 MW	4.6%	2,653 MW	4.9%	7.03%
Missan	672 MW	3.2%	1,802 MW	3.3%	6.80%
Basra	2,275 MW	10.8%	6,139 MW	11.3%	6.84%
Total	20,993 MW	100.0%	54,094 MW	100.0%	6.51%

(Source: MOE)

The higher peak demands by governorates in 2015 are Baghdad: 6,520 MW (31.1%), Basra: 2,275 MW (10.8%), and Ninawa: 2,172 MW (10.3%). The same situation is also expected in 2030.

#### 2.4.2 Planned Power System Network in 2020

The 400 kV network plays the role of the bulk power transmission system among areas and the 132 kV network plays the role of the local supply.

Figure 2.4-2 shows the planned 400 kV bulk power network as of 2020. The 400 kV transmission lines are particularly enhanced in the north-south direction. Mosul, Baghdad, and Basra cities are located on this transmission line.

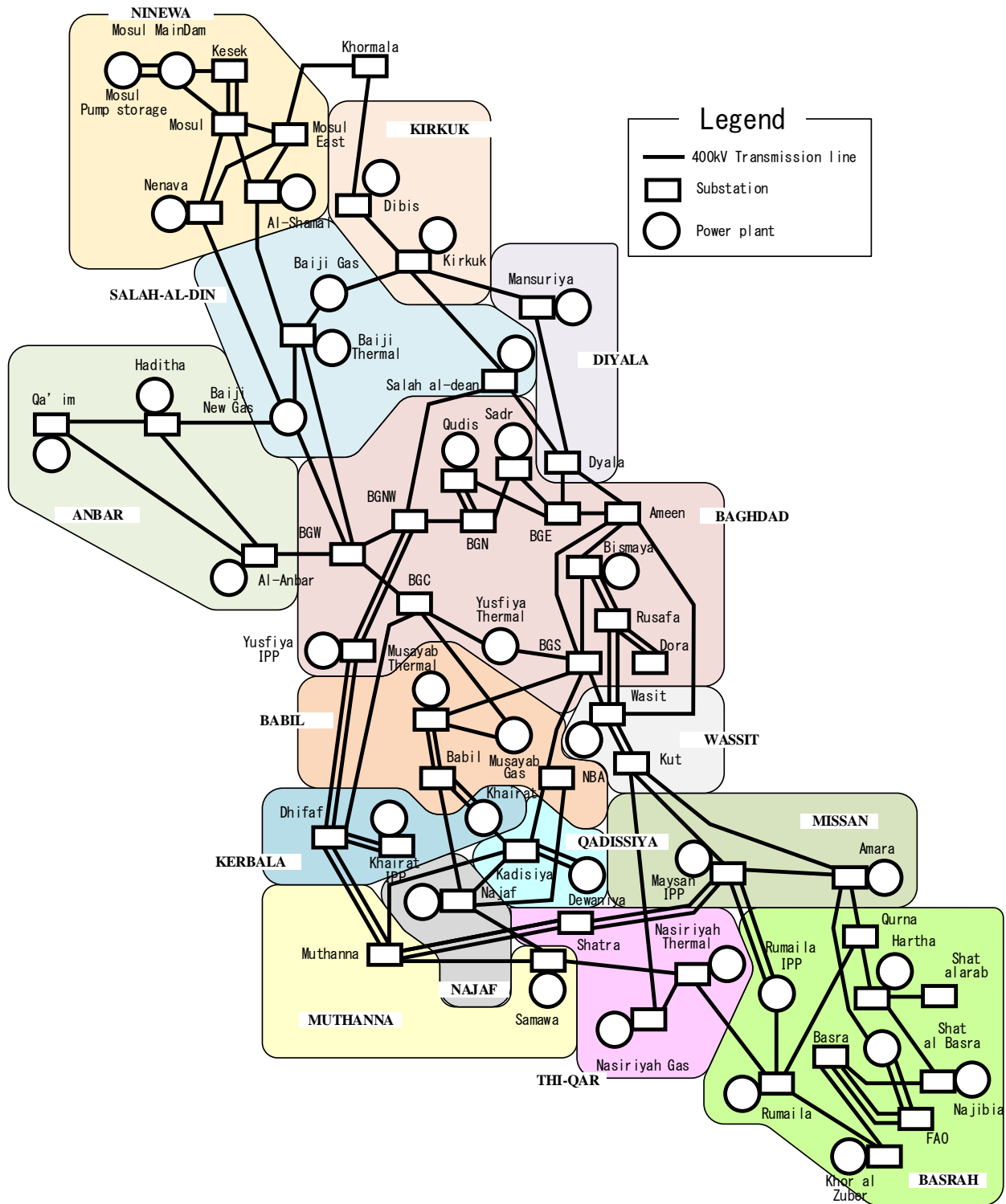


Figure 2.4-2 Planned 400 kV Network in 2020 (Source: MOE)

### 2.4.3 Power Plants Development Plan

Table 2.4-2 shows the power plants development plan from 2016 to 2024 provided by the MOE.

Table 2.4-2 Power Plants Development Plan

Type	No	Project Names	Capacity (MW)	2016	2017	2018	2019	2020	2021	2022	2023	2024	Note
Stalled Projects	1	Cruth gas project (125×2)	250		250								Underway, according to the security situation in the region, during 2016
	2	Mansriyah gas project (182×4)	728		364	364							
	3	Syrup carbonates project (169×2)	338		169	169							
	4	Syrup carbonates project (169×2) PM	338				320						
	5	Peggy gas 2nd project (169×4)	1,014		450	450							
New Proposed Projects	6	Samawa diesel project (125×4)+250	750		250	250	250						Required installation and operation simple cycle equipment available. In addition, combined cycle currently under the performing arts by qualified companies.
	7	Nasiriyah diesel project (125×4)+250	750		250	250	250						It is required to solve the problem legally and BGR Indian company. Then see the project for the installation and operation of equipment session statistics and add a combined cycle.
	8	The balance of the diesel (125×4)+250	750		250	250	250						It has an assignment to a company that has captain ships.
Combined Cycle Projects	9	Shatt al Basra, 625 + Rumaila gas 730 + architecture gas 250	1,605			667	938						It has the assignment of the Shatt al Basra and Rumaila to Carr Company.
	10	Creek + Najaf + Jerusalem + Hilla gas + Sinjar gas 1,2	954			954							
	11	Karbala, 125 + Al Haidariya gas 250 + 625 + Diwaniya, 250 + South BGD gas 125	1375			375	625	375					Under the provision of technical presentations by companies qualified for the allocation of the benefits of combined cycle gas.
	12	Kirkuk 278 + Mansuriyah 364	642				278	364					
	13	Pinned 169 + crutch 125 + Kiarh 375 + Baiji 2nd gas 507	1,176			125	1051						
IPP Investment	14	Basmajh investment project (Phase 1)	1,500	250	750	500							
	15	Basmajh investment project (Phase 2)	1,500			1000	500						
	16	Rumaila investment project (Phase 1)	1,500				1000	500					
	17	Rumaila investment project (Phase 2)	1,500					1,000		500			
Ongoing Projects	18	Anbar diesel project (1,642 MW)	1,642			289	578	289	486				
	19	Yusuifiya steam (210×2)	420				210	210					
	20	North steam (350×4)	1,400						350	350	700		
	21	North Baghdad steam to replace (160×3)	480				320	160					
	22	Baiji steam to replace (200×6)	1,200						600	600			
	23	Khairat steam (300×4)	1,200						300	600	300		Exploiting refinery in Karbala product.
	24	Expansion for Yusuifiya steam (350×4)	1,400						350	350	700		Companies under answer technical queries (three companies).
	25	Architecture steam (350×2)	700							300	300		
	26	Nasiriyah steam (300×2)	600							300	300		
	27	Expansion for Masayab steam (330×3)	600					300	300				
	28	Diwaniya steam (Shinafiya) (330×3)	990						330	330	330		
	29	Expansion for Haditha steam (610×2)	1,220								610	610	
	30	Anbar steam (350×4)	1,400						700	700			
	31	Salahuddin steam (630×2)	1,260		630	630							
	32	Expand Rasheed gas (125×2)	250				250						
33	Al Haidariya grant simple-cycle project (160×2), Add combined cycle	320							160	160			
Total			31,182	250	3,363	6,273	6,820	3,198	3,416	4,030	3,240	610	

(Source: MOE) Note: This table is in tentative translation.

Total installed capacity of the planned additional generating plants up to 2020 is approximately 19,400 MW as shown in Table 2.4-2, and the total firm capacity as of 2015 is about 9,100 MW as described in Subclause 2.3.2. Thus, total generating capacity expected in 2020 in Iraq is to be about 28,500 MW. It will almost be able to cover the forecast demand in 2020, which is about 28,531 MW as shown in Figure 2.4-1, however, there is no surplus margin, and if some development plans are to be delayed or some generating plants in maintenance, power shortage might happen.

Especially, it is reported that projects from No. 1 to No. 5 in Table 2.4-2 are stalled because of security situations in the region where project sites are located.

#### 2.4.4 Planned Transmission Lines

##### (1) 400 kV Transmission Lines

The MOE prepared 400 kV transmission lines development plans to cover the forecast demand in 2020 as shown in Table 2.4-3.

Table 2.4-3 Planned 400 kV Transmission Lines to Cover the 2020 Demand

No.	Sections	cct	Progress (%)	Length (km)	Note
<b>2013 Plan</b>					
1	NAJIBIYAH-Gas- HARTHA	1	2	6.5	cut off and insertion of aerial lines
2	NAJIBIYAH Gas- BASRAH400	1	2	6.5	cut off and insertion of aerial lines
3	BAIJI Gas 2-HADETHA	1	57	10	convert
4	BAIJI Gas 2- WEST BAGHDAD	1	56	10	convert
5	AL-QUDS-EAST BAGHDAD	1	38.38	18.5	
6	YUSUFIYA THRMAL-SOUTH BAGHDAD	1	87.28	43.3	
7	MOSUL-JAZRA	1	85	100	TURKEY
<b>2014 Plan</b>					
1	AL-MANSOURIYAH-KIRKUK	1	85	50	
2	AL-QURNA-HARTHA	1	64.17	3	cut off and insertion of aerial lines
3	AL-QURNA-AMARA	1	64.17	3	cut off and insertion of aerial lines
4	EAST MOSUL-NINEWA Gas	1	-	55	
5	EAST MOSUL-MOSUL400	1	80	6	cut off and insertion of aerial lines
6	EAST MOSUL-KHORMATA	1	80	6	cut off and insertion of aerial lines
7	DIWANIYAH Gas-QADDISSIYA 2	1	90.8	22.5	
<b>2015 Plan</b>					
1	EAST RUSAFA 400-GENERATOR BASMAYAH 1+2	2	-	40	quad cables
2	EAST RUSAFA-WASIT THERMAL 1+2	2	-	110	
3	SADR Gas-NORTH BAGHDAD	1	-	10	cut off and insertion of aerial lines
4	SADR Gas-EAST BAGHDAD	1	-	10	cut off and insertion of aerial lines
5	SAMAWA Gas-QADDISSIYAH	1	-	20	cut off and insertion of aerial lines
6	SAMAWA Gas-NASIRIYAH THERMAL	1	-	20	cut off and insertion of aerial lines
7	DIBIS -KIRKUK	1	78		cut off and insertion of aerial lines
8	DIBIS-KHORMATA	1	78		cut off and insertion of aerial lines
9	HAIIRIYAH-BABYLON 400	1	5	14	cut off and insertion of aerial lines
10	HAIIRIYAH-QADDISSIYA 400	1	5	14	cut off and insertion of aerial lines
11	AL-QURNA-RUMILAH Gas 1	1	-	60	
12	SHATT ALBASRAH -HARTHA	1	71	6.62	cut off and insertion of aerial lines
13	SHATT ALBASRAH -KHUR	1	71	6.62	cut off and insertion of aerial lines
14	AMARA-KUT2	1	-	220	
15	BASMAYAH - SOUTH BAGHDAD	1	-	3	
16	BASMAYAH - ALAMEEN	1	-	3	

2016 Plan					
1	NORTHWEST BAGHDAD-WEST BAGHDAD	1	-	20	cut off and insertion of aerial lines
2	NORTHWEST BAGHDAD-NORTH BAGHDAD	1	-	20	cut off and insertion of aerial lines
3	FAW-SHATT ALBASRAH Gas	1	-	110	
4	FAW-ALBASRAH400 Gas	1	-	120	
5	SALAHADDIN-KIRKUK	1	-	15	cut off and insertion of aerial lines
6	SALAHADDIN-DIYALA	1	-	15	cut off and insertion of aerial lines
7	SAMAWA Gas -HAIDRIYAH	1	-	220	
8	ANBAR Gas -ALQAEM	1	-	220	
9	ANBAR Gas -WEST BAGHDAD	1	-	25	cut off and insertion of aerial lines
10	ANBAR Gas -HADETHA	1	-	25	
11	YUSUFIYA 400 -NORTH BAGHDAD 1+2	2	-	60	quad cables
12	NASIRIYAH Gas - NASIRIYAH THERMAL	1	-	-	cut off and insertion of aerial lines
13	NASIRIYAH Gas -KUT	1	-	-	
14	SHATT ALBASRAH -AMARA 400	1	-	185	
15	INVESTMENT RUMAILA-RUMAILA Gas 1	1	-	10	
16	YUSUFIYA THERMAL -ALRASHEED	1	-	-	
2017 Plan					
1	NORTHWEST BAGHDAD-SALAHADDIN	1	-	-	
2	MAYSAN400-INVESTEMENT MAYSAN 1+2 Investor Responsibility	2	-	30	quad cables
3	ALSHATRA400-MAYSAN 1+2	2	-	140	quad cables
4	ALSHATRA400-MUTHANA 1+2	2	-	120	quad cables
5	ALSHATRA400-NASIRIYAH THERMAL	1	-	-	cut off and insertion of aerial lines
6	ALSHATRA400-KUT400	1	-	-	cut off and insertion of aerial lines
7	MAYSAN 400-AMARA 400	1	-	30	cut off and insertion of aerial lines
8	MAYSAN 400-KUT 400	1	-	30	cut off and insertion of aerial lines
9	MUTHANA 400-SAMAWA Gas	1	-	30	cut off and insertion of aerial lines
10	MUTHANA 400-QADDISSIYA 400	1	-	-	
11	SHATT ALARAB-KHRAM SHAHR	1	-	-	cut off and insertion of aerial lines
12	SHATT ALARAB-HARTHA 400	1	-	-	cut off and insertion of aerial lines
13	MAYSAN 400-INVESTEMENT RUMAILAH 1+2	2	-	160	quad cables
14	DHFAF KARBALA-ALRASHEED	1	-	160	
15	NORTH THERMAL-MOSUL 400	1	-	10	cut off and insertion of aerial lines
16	NORTH THERMAL-BAJI	1	-	10	
17	NORTH THERMAL-EAST MOSUL	1	-	55	
18	ALKHAIRAT THERMAL-DHAFAT KARBALA(1+2)	2	-	-	
19	KASAK-MOSUL DAM	1	-	-	
20	KASAK-MOSUL 400	1	-	-	
21	SHATT ALBASRAH G-BASRAH 400/2	1	-	-	
2018 Plan					
1		-	-	-	
2019 Plan					
1	DOURA 400-EAST RUSAFI 1+2	2	-	-	
2	BABYLON 400 NEW-SOUTH BAGHDAD	1	-	-	cut off and insertion of aerial lines
3	BABYLON 400 NEW-QADDISSIYA 400	1	-	-	cut off and insertion of aerial lines
4	BABYLON 400 NEW-DIWANIYA Gas	1	-	-	

(Source: MOE)

The following are additional details regarding Table 2.4-3:

- 1) The above table was updated on February 24, 2016.
- 2) Line length, which are not registered in the table due to incomplete technical surveys from the concerned directorates.
- 3) The completion percentages in the table were registered according to the Power Transmission Projects Report on January 31, 2016.

As shown in Table 2.4-3, 11 projects among 30 projects planned from 2013-2015 have not yet started.

(2) 132 kV Transmission Lines

The MOE also prepared 132 kV transmission lines development plans to cover the forecast demand in 2020 including 239 projects as shown in Attachment 2-2. Around 181 projects were planned to be completed from 2013 to 2015, but only 36 projects had started construction, especially, no projects stated planned for 2015 completion.

#### **2.4.5 Planned Substations**

(1) Planned 400 kV Substations

Table 2.4-4 shows the planned construction and/or augmentation of the 400 kV substations including the transformer addition to cover the forecast demand in 2020. During 2013–2019, 25,750 MVA transformer capacities with new substations and/or additional auto-transformers are planned to be added to the national network.

The following are additional details regarding this table:

- 1) This table was updated on March 23, 2016.
- 2) Completion percentage was registered according to the follow up reports on June 30, 2015 by the Power Transmission Projects Directorate.
- 3) No 400 kV substation is planned for construction in 2018.
- 4) In addition to the listed substations in Table 2.4-4, according to the MOE, Al-Mansouriya Gas Station in Diayla, Al-Haidariyah Gas Station in Najaf, and AL-Najibiyah Gas Station in Basra have already been completed.
- 5) The standard specifications of the main transformers are 400/132 kV and 250 MVA auto-transformer. Each substation has four units of transformers as standard, except some substations located at the end of the network.
- 6) Dora, Bismaya, and Dhifaf substations are planned to be installed with a larger capacity of 500 MVA transformer. These areas are expected to have higher power demand in the future.

Table 2.4-4 Planned 400 kV Substations to Cover the 2020 Demand (Source: MOE)

NO	Governorate	2013			2014			2015			2016			2017			2019			Total (MVA)
		Name	Capacity (MVA)	Progress (%)	Name	Capacity (MVA)	Progress (%)	Name	Capacity (MVA)	Progress (%)	Name	Capacity (MVA)	Progress (%)	Name	Capacity (MVA)	Progress (%)	Name	Capacity (MVA)	Progress (%)	
1	NAINAWA	East Mosul	1,000	88.9									AL-Kazak	1,000	0				2,500	
													Thermal North	500	0					
2	BAGHDAD							East Al-Rusafa	1,000	54	Generating Yus	0	0				Al-Doura 400, WB/German/JICA2/JICA3	2,000	7,750	
								West Baghdad, add AutoTR	250	48.5	Yusufiya IPP (Investor Responsibility)	1,000	0							
								Al-Quds, add 2 TRs	500	69	Northwest Baghdad	1,000	0							
											Basmaya IPP	2,000	0							
3	THI QAR							Nasiriyah Thermal,	250	0	Nasiriyah Gas	500	2	Al-Shatra /JBIC	1,000	0			1,750	
4	MAYSAN												Maysan /JBIC	1,000	0				1,000	
5	SALAHDINE										Salahdine Thermal, German/JICA	750	0						750	
6	BABYLON																Babylon 400 New, German/European/post paid/Swedish	1,000	1,000	
7	AL MUTHANA							Al-Samawha Gas	750	0				Al Muthana, JBIC	1,000	0			1,750	
8	BASRA				Al-Qurna	1,000	91	AL-Najbiyah Gas		done	Al-Faw	1,000	34	Shatt Al-arab, GE/JBIC	1,000	0	Shatt Al-Arab Gas, add 2	500	3,500	
9	KARBALA												Dheaf Karbala, German/	2,000	0			2,000		
10	WASIT										Wasit 400, expand 3rd TR	250		Wasit 400, expand 4th TR	250	0	Wasit Thermal (Al-Zubaidiah),	500	1,000	
11	DIAYLA				Al-Mansouriyah Gas		done												0	
12	KIRKUK							AL-Dibis 400, add 2 TRs,	500	0									500	
13	NAJAF				Al-Haidariyah Gas		done												0	
14	ANBAR				Okaz Al-Qaem	500	93.99				Al-Anbar Gas	1,000	Work Stop						1,500	
15	QADESIYA										Qadesiya 400, expand 5th TR	250					Diwaniyah Gas, add 2 TRs, GE	500	750	
Total			1,000			1,500			3,250			7,750			7,750			4,500	25,750	

(2) Planned 132 kV Substations

Table 2.4-5 shows the planned 132 kV substations up to 2019 in order to cover the 2020 demand. In the table, there are 153 planned substations with 31,141 MVA transformer capacities that are under construction or required to complete during 2013-2019.

The percentage of completion in the table was registered according to reports of projects follow up (Power Transmission Projects) on May 31, 2015.

In addition to the listed substations in Table 2.4-5, according to the MOE, the following substations had already been commissioned:

- North Al-Zubair Substation on April 1, 2015
- Kirkuk University Substation on April 1, 2015
- Al-Meshkhab Substation on October 10, 2015
- Souq Al-Shiyookh Substation on October 15, 2015
- Kumait Substation on October 15, 2015
- North Basra Substation on January 18, 2016
- Ali Al-Gharbi Substation on January 28, 2016



Table 2.4-5 Planned 132 kV Substations to Cover the 2020 Demand

Governorates	2013			2014			2015			2016			2017			2018			2019			Total (MVA)		
	Name	Cap.	%	Name	Cap.	%	Name	Cap.	%	Name	Cap.	%	Name	Cap.	%	Name	Cap.	%	Name	Cap.	%			
Nainawa	Al-Noor	189	0	South Mosul	189	0	Al-Maamon	189	0	Al-Farouk	189	0												
	Tal Awainat	189	50				Al-Namrood	189	0	Shalalat	189	0												
	Sinjar	189	60				Talafar 2	189	0	Al-Qaiyara 2	150	0												
	Bartala	189	0				Nahlat	189	0	Al-Baaj	100	0												
	West Mosul	189	32.45				South Yarmaja	189	0	Sharqat 2	189	0												
							Al-Resala	189	0															
						Arbajja	189	0																
	Sub-total	945			189			1,323			817			0			0					0	3,274	
Baghdad				Al-Shaab	189	53.9	Al-Sabiyat	189	52	Al-Tareq	270	0	Boob Al-Sham	270	0									
				Al-Shoula	189	54	Al-Turalh	189	0	Abu Ghareeb	189	0												
				Al-Sadir	189	0	Al-Tujaar	270	0	Al-Amary	270	0												
				Al-Zawraa	189	8	Al-Sahafiyen	270	0	Al-Karada	270	0												
				Basmayah 2	540	0	Al-Adala	270	0	Al-Baladiat	270	0												
				Al-Ghazali	270	0	Al-Aamel	189	0	Gesaiba	189	0												
				Baghdad	270	0	Alboaltha	189	0															
				Khan Bani	189	0	Al-Kayara	270	0															
				Al-Tajiyat	189	0	Salman Pak	270	0															
				Al-Adhamiya	189	81.5	Basmayah 1	540	0															
				Al-Yarmook	189	0	Al-Rabea	189	0															
				Zayona	189	0																		
				Al-Mahmodia	189	0																		
				Al-Latifiya	189	0																		
			Kadimiya	270	0																			
			Al-Rusafa	189	45																			
	Sub-total	0			3,618			2,835			1,458			270			0					0	8,181	
Thi Qar				Al-Eskan Al-	189	0	East Al-	189	0	Al-Zaqora	189	0	Al-Jebaiysh	126	0									
				Al-Refaey	189	0	Arido	270	0	Al-Bathaea	189	0												
				Al-Shatra	189	55																		
	Sub-total	0			567			459			378			126			0					0	1,530	
Maysan	Al-Maymona	189	99	East Amarah	189	55	Al-Betaira	189	0	Al-Kahlaa	189	0												
	West Amarah	189	0				Kalaat Salih	189	0															
	Sub-total	378						378			189			0			0					0	1,134	
Salahdine				Al-Hewaitsh	189	0	Balad 2	189	0				South Baiji	189	0									
				South Samara	189	0	Wadi Sheshen	189	0	Al-Malwiya	270	0												
	Sub-total	0			378			378			270			189			0					0	1,215	
Babylon				Jurf Al-Sakhar	189	0	Al-Hashmiya	189	0	Al-Kifal	189	0	Al-Musaiyab	189	0									
				West Al-Hilla	189	42	Mahaweel	270	0															
				Al-Shomali	189	40	Abi Garaq	189	0															
	Sub-total	0			567			648			189			189			0					0	1,593	
Al-Mulhana				Rumaita	189	0				Al-Soyer	189	55		Al-Salman	126									
				Al-Khedir	189	72																		
				Al-Samawa	189	55																		
	Sub-total	0			567			0			189			0			126					0	882	
Basra	Basrah Center 2	189	50	Al-Medaina	270	0	Industrial Institute	189	0	Al-Imam Al-Sadiq	189	0	Turkish Hospital	189	0	Al-Sarajy	189	0	Shatt Al-Arab	270	0			
	Airport	189	0	Al-Dair	189	0	Basrah Water	126	0				N-Um Qasir	270	0					Sport city	270	0		
	Central Al-	189	13.5				Al-Oebla	270	0				Al-Ghadeer	189	0					Al-Qurra	189	0		
	Al-Fayhaa	270	0				North Al-	189	0				Al-Merbad	189	0									
	Sub-total	837			459			774			189			837								729	4,014	
Karbala	Al-Ibrahimiya	189	55	New Karbala	189	52	New North	270	0	New South	270	0	Najaf Road	189	0	Al-Hosainiya	189	0						
							Al-Sawada	189	0															
	Sub-total	189			189			270			459			189								0	1,485	
Wasit				North Al-Sewaira	189	0	North West Al-Kut	189	0	Mafraq Al-Zubaidiya	189	0	Center Al-Kut	189	0	Al-Hakeem	189	0						
				Al-Hay	189	0																		
	Sub-total	0			378			189			189			189								0	1,134	
Diala	South Baquba	189	89.9	North Baquba	189	0	North East	189	0															
				Jalawlaa	189	0																		
	Sub-total	189			378			189			0			0			0					0	756	
Kirkuk	North Kirkuk	189	0				Banja Ali	189	0	New Al-Debis	189	0												
							Al-Zaab	189	0															
	West Kirkuk	189	88				Tooz 2	189	0															
	Sub-total	378			0			667			189			0			0					0	1,234	
Najaf				Al-Nidaa	189	42.5	Al-Najaf Sea	270	0	Al-Manathira	189	0	Al-Mathana	189	0	Al-Iarat	189	0						
				Al-Abasiya	189	0	Al-Ataba Al-Alawiya	189	0															
	Sub-total	0			378			459			189			189								0	1,404	
Anabar				West Al-	189	62/0	Al-Baghdadi	189	0	Al-Saqlawiya	189	0	S-Khaldiya	189	0	N-Ramadi	189	0						
				Al-Qaem	189	0	West Al-Qaem	189	0															
				South Falluja	189	0	West Al-	189	0															
				South Ramadi	189	0	Sement 1	100	0															
	Sub-total	0			756			767			189			189								0	2,090	
Qadesiya				West	189	0	New Shamiya	270	0															
				South Diwaniya	189	0																		
				Al-Hamza	189	69																		
				Al-Salahiya	189	0																		
			Alak	189	69																			
	Sub-total	0			945			270			0			0			0					0	1,215	
	Total (MVA)	2,916			9,558			9,606			4,894			2,367			1,071					729	31,141	

(Source: MOE)

## 2.5 Cooperation from Other Donners

In this section, the Study Team describes aid trends by international donor agencies in recent years for the electricity sector in Iraq excluding the Kurdish Region. All the contents described in this section are summarized information on the website of each donor agency.

### (1) World Bank Group

The main assistance projects undertaken / underway by the World Bank Group on the electricity sector in Iraq in the past ten years are as follows:

#### 1) Emergency Electricity Reconstruction Project (March 2007 – June 2015)

The objectives of this project were to: (i) alleviate the current power supply shortfall by restoring the generation capacity of the Hartha Power Station Units 2 and 3 to 400 MW (200 MW × 2 units), and (ii) lay the groundwork for improved power system planning and fuel supply by providing the tools and other support necessary to enhance in-house capability to prepare, implement, and operate current and future projects.

The project had the following two main components:

#### i) Rehabilitation of Hartha Power Station (USD 144 million at appraisal including contingencies; USD 183.02 million actual)

This component included the rehabilitation of units 2 and 3 of the Hartha Power Station, engineering services, support in bid evaluation, supply of equipment and installation services, construction supervision, partial implementation of environmental mitigation measures, and support to the Project Management Team (PMT) as well as to the MOE up to the end of the defects liability period.

#### ii) Support Services (USD 6 million at appraisal; USD 4.6 million actual)

This component intended to provide the PMT and MOE with support services for the preparation and supervision of the rehabilitation contract and other capacity-building activities, including: preparation of least-cost reconstruction and expansion plans, feasibility studies, advisory services for future projects, office equipment, independent audits, and regional and overseas training in such areas as operations, maintenance, environmental quality, financial management, and project management.

However, despite the rehabilitation work for about eight years including the interruption period, the project components i) mentioned above, due to contractual problems with contractors and project fund shortage, about 76% at the time of equipment delivery and 30% installation work were carried out. It was terminated in June 2015 and the renovation work is incomplete.

- 2) Integrated National Energy Strategy Technical Assistance Project (October 2010 – June 2013)

The objective of this project was to improve the ability of the government to develop an energy strategy that was designed to increase the contribution of the sector to sustainable development. The final project cost was about USD 8.5 million, but the allocation by sector was 60% for the oil and gas sector, 30% for the electricity sector, and 10% for the other energy sectors.

The project had the following two main components:

- i) Development of an Integrated National Energy Strategy (USD 4.5 million at appraisal; USD 7.9 million actual): Provision of technical assistance for the development of an integrated national energy strategy for Iraq's oil, gas, and power sectors.
- ii) Project Management (USD 1.75 million at appraisal; USD 0.6 million actual): Supporting the PMT in project management, monitoring, and evaluation through provision of training, consultant services, including project audit and financing of operating costs.

- 3) Emergency Operation for Development Project (July 2015 – June 2020 (planned))

The objective of this project is to support the Republic of Iraq in the reconstruction of damaged infrastructure attacked by ISIL and the restoration of public services delivery in targeted municipal areas including Tikrit, Dour, Al Daloeya and Al-Alam in Salah Al-Din Province; and Jalula, As-Sadiya and Al-Azeem in Diyala Province.

The project consists of six components, with a total project cost of USD 350 million, each allocated budget is as follows:

- i) Restoring Electricity Infrastructure and Connectivity (USD 75 million)
- ii) Restoring Municipal Waste, Water, and Sanitation Services (USD 60 million)
- iii) Restoring Transport Infrastructure and Developing a Housing Reconstruction Subsidy Scheme (USD 140 million)
- iv) Restoring Health Services (USD 42 million)
- v) Technical Assistance (USD 25 million)
- vi) Project Management, Sensitization, and Monitoring and Evaluation (USD 8 million)

Among the above, Component 1, of which the MOE is the executing agency, includes restoration of the electricity transmission and distribution network and procurement of equipment and materials to restore the power supply reliability of the target cities. As of January 2017, the procurement procedures of equipment and materials are underway in the following subprojects:

- a) Procurement of 33 kV mobile substations and LV pole-mounted switchgear

in Salah Al-Din (ICB)

- Lot 1: 5 units of 33/11kV, 31.5 MVA mobile substations
- Lot 2: 980 units of LV pole-mounted switchgear

b) Procurement of conductors and cables in Salah Al-Din and Diyala (ICB)

- Lot 1: Conductors in Salah Al-Din and Diyala
- Lot 2: LV cables in Salah Al-Din and Diyala
- Lot 3: Twisted cables in Diyala

c) Procurement of materials for 132 kV substation rehabilitation in Salah Al-Din and Diyala (ICB)

d) Procurement of 132/400 kV transmission line materials in Salah Al-Din and Diyala (ICB)

- Lot 1: Transmission Towers
- Lot 2: Insulators
- Lot 3: Conductors and accessories

e) Procurement of distribution transformers in Salah Al-Din and Diyala (ICB)

- Salah Al-Din: 400 kVA 390 units
- Diyala: 250 kVA 60 units, 400 kVA 95 units, 630 kVA 22 units

f) Procurement of 132 kV mobile substations and spare parts in Salah Al-Din and Diyala (ICB)

- Salah Al-Din: 132/33 31.5 MVA MS 3 units and 132/11 25 MVA MS one unit
- Diyala: 132/33 31.5 MVA MS 3 units

g) Procurement of 132 kV main transformers and accessories in Salah Al-Din and Diyala (ICB)

- Salah Al-Din: 132/33/11 kV 63 MVA main transformers three units
- Diyala: 132/33/11 kV 63 MVA main transformer one unit

(2) United Nations Development Programme (UNDP)

The UNDP currently contributes USD 215,200 through the Global Environment Facility (GEF) fund and supports the following projects:

1) Catalyzing the Use of Solar Photovoltaic Energy (October 2014 – October 2018)

The purpose of this project is to suppress the use of power generation facilities in Iraq, especially private diesel generators with poor efficiency, which depends heavily on fossil fuels by introducing small and large-scale solar photovoltaic generation facilities, and the following effects are expected:

- i) Reduce dependence on fossil fuel;

- ii) Result in direct GHG reductions of approximately 741,622 tones CO<sub>2</sub>; and
- iii) Provide reliable power to the Iraqi people to support development and a better standard of living.

Specifically, the project aims to achieve the following:

- Installation of 5 MW of distributed rooftop PV in the Bytti development in Najaf;
- Installation of 16 utility-scale solar PV plants;
- Establishment of government policies, regulations, and financial incentives to promote investment in solar energy;
- Completion of technical and regulatory standards needed for the connection of private power generators to the grid;
- Development of a solar resource map for Iraq;
- Development of a feed-in tariff, packaged as a NAMA;
- Development of human capacity in government, the private sector, and academia to support a solar energy market in Iraq.

The MOE plans to develop 16 on- and off-grid solar power plants distributed throughout Iraq, with a total capacity of 36.5 MW. Five of these plants are planned to be hybrid solar-wind plants. The provisional selection has established the following 14 sites:

- Al-Waleed (3.5 MW PV, hybrid)
- Treibeel (3.5 MW PV, hybrid)
- Al Nukheib (5 MW PV)
- Al-Salman (6 MW PV, hybrid)
- Al Ruffia (1 MW PV)
- Al Khairy (2 MW PV)
- Al Khuasa (1 MW PV)
- Al Dawaia (1 MW PV)
- Shbaka (2 MW PV)
- Al-Sheeb (3 MW PV)
- Bazirgan (1 MW PV)
- Shalamcha (3 MW PV)
- Rahmania (3 MW PV, hybrid)
- Iskandarona (1.5 MW PV, hybrid)

Two sites are still to be nominated. The MOE has asked the Ministry of Science and Technology (MOST) to study three sites, i.e., Al-Waleed, Treibeel, and Shalamcha, with additional three sites to be selected for study in the near future.

(3) KfW Development Bank (KfW)

According to the press release from KfW dated on 13 February 2017, KfW and the

---

Government of Iraq signed a framework agreement for an untied financial credit EUR 500 million in total emphasizing on restoring the foundations for basic public services in order to enable internally displaced persons to return to areas liberated from ISIL.

The funds will be used for maintaining public infrastructure, particularly in regions that could be liberated from ISIL. The measures being supported will include supplying basic services such as water, sanitation, and electricity, as well as transport infrastructure.

(4) Korea International Cooperation Agency (KOICA)

In recent years, KOICA is undertaking the following support for the electric power sector in Iraq:

1) Project for the Energy Efficiency Improvement in Electric Distribution and Pilot AMR / Billing System in Iraq (May 2013 – December 2016 (planned))

The objectives of the project are:

- i) Formulation of energy efficiency improvement strategy;
- ii) Implementation of pilot project for automatic meter reading (AMR) and electricity tariff collection system; and
- iii) Capacity building for MOE staff.

The project cost is USD 4.3 million in total.

The project is scheduled to be completed in December 2016, but according to KOICA's website, as of February 2017, the completion flag has not been set yet.

**ATTACHMENT 2-1**

**EXISTING 132 KV SUBSTATIONS**

# 132 kV Substations Power Transformers Report

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
<b>Wasit</b>																	
	Diboony	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Swaira	0	2	0	1	0	0	0	0	0	0	0	0	0	0	176	Exist
	Sheikh Saad	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Kut North	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Kut South	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Dejaila	0	0	0	0	0	0	0	0	2	0	0	0	0	0	50	Exist
	Azeeziya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Jessan New	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Numaniya	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Kut Old	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
<b>Thee-Qaa</b>																	
	Shatra	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist



Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Refai	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Nassiriya North	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Al-Fuhood	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Nassiriya Industrial(nev	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Masab Al-Aam	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Nassiriya Old	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Soog Al-Shiukh	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
<b>Salah Al-</b>																	
	Al-Dour	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Al-Dijail	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Sammara Diesle 132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Exist
	Sammara South	0	0	0	0	0	0	0	2	0	0	0	0	0	0	50	Exist
	Sammara Nouth	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Tikrit Nouth	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Sammara Hydro 132	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Balad	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Tikrit south	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Tikrit East	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
<b>Qadissiya</b>																	
	Gammas	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Shamiya	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Deewaniya	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Deewaniya East	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Deewaniya North	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
<b>Najaf</b>																	
	Najaf North	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Najaf Old	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Mishkhab	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Kufa	0	0	3	0	0	0	0	0	0	0	0	0	0	0	180	Exist
	Najaf West	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Najaf Gas	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Jawahery	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
<b>Nainawa</b>																	
	'armook (mosul north)	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Gayara	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Yaremja	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Mosul East 132	0	1	0	2	0	0	0	0	0	0	0	0	0	0	163	Exist
	Comercial Exchange	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Mosul Gas 132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Exist
	Mansoor (new mosul)	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	sul Regulation Dam 1:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Exist
	Qaraqush	0	0	0	3	0	0	0	0	0	0	0	0	0	0	150	Exist
	Al-Intisar	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	hammam Al-Aleel New	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Baiji Refinery	0	1	0	3	0	0	0	0	0	0	0	0	0	0	213	Exist

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Tel Abu Dahir	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Sinjar Cement	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Telafer	0	1	0	2	0	0	0	0	0	0	0	0	0	0	163	Exist
	Al-Mishrag	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Tahreer	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	IT2A	0	0	0	0	0	0	0	0	2	0	0	0	0	0	50	Exist
	Addaya	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Al-Rasheediya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Badoosh	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Baawiza	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Kesek 132	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Baiji North	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-shergat	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	IT1A	0	0	0	0	0	0	0	0	2	0	0	0	0	0	50	Exist

## Meisan

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Kumait	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Amara South	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Bezergan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Exist
	Amara Old	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Ali Gharbi1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	50	Exist
	ali algarbi2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Amara New	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Amara North	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
<b>Kirkuk</b>																	
	Kirkuk Cement	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Kirkuk South	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Kirkuk Old(teppa)	0	2	0	1	0	0	0	0	0	0	0	0	0	0	176	Exist
	Kirkuk Industrial	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Kirkuk East	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Tozz	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Kirkuk University	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Haweeja	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Dibis 132	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Mulla Abdullah New	0	0	0	2	0	0	0	0	0	0	0	0	0	0	100	Exist
	Mulla Abdullah Old	0	0	0	3	0	0	0	0	0	0	0	0	0	0	150	Exist
<b>Kerbala</b>																	
	Kerbala West	0	0	3	0	0	0	0	0	0	0	0	0	0	0	180	Exist
	Kerbala Old(south)	0	2	0	1	0	0	0	0	0	0	0	0	0	0	176	Exist
	Kerbala East	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Kerbala North	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Ukhaider	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Al-Hindia	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
<b>Diyala</b>																	
	Himreen Hydro	0	0	0	0	0	0	0	0	2	0	0	0	0	0	50	Exist
	Baladrooz	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Al-kHalis	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Baquba East	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Baquba West(old)	0	2	0	1	0	0	0	0	0	0	0	0	0	0	176	Exist
	Al-Meqdadia New	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Himreen 132	0	0	0	0	0	0	0	0	1	0	0	0	1	0	35	Exist
	Khanaqeen	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist

## Basra

	CPS8	0	0	0	0	0	0	0	0	2	0	0	0	0	0	50	Exist
	ZBIA	0	0	0	0	0	2	0	0	0	0	0	0	0	0	68	Exist
	Basra East	0	4	0	0	0	0	0	0	0	0	0	0	0	0	252	Exist
	Fao 132	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Garma	0	0	0	0	0	0	0	2	0	0	0	0	0	0	63	Exist
	Um Qaser New	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Qurna Old	0	2	0	0	0	0	0	0	1	0	0	0	0	0	151	Exist
	Qurna New	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Basra Centre	0	4	0	0	0	0	0	0	0	0	0	0	0	0	252	Exist
	Petro	0	2	0	1	0	0	0	0	0	0	0	0	0	0	176	Exist
	NGL	0	0	0	3	0	0	0	0	0	0	0	0	0	0	150	Exist
	Al-Meenaa	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Um Qaser Old	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Toba	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	CPS9	0	0	0	0	0	0	0	2	0	0	0	0	0	0	63	Exist
	Najeebiya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	CPS7	0	0	0	0	0	0	0	0	2	0	0	0	0	0	50	Exist
	CPS6	0	0	0	0	0	0	0	2	0	0	0	0	0	0	63	Exist
	CPS5	0	0	0	0	0	0	0	2	0	0	0	0	0	0	63	Exist
	CPS4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	63	Exist
	CPS3	0	0	0	0	0	0	0	2	0	0	0	0	0	2	73	Exist
	CPS2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	80	Exist
	CPS10	0	0	0	0	0	0	0	0	2	0	0	0	0	0	50	Exist



Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	CPS1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	63	Exist
	Basra north	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Akadeemiya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Basra West	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Abo floos	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Bab-Al-Zubair 2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Shammiya Petroleum	0	0	0	0	0	0	2	0	0	0	0	0	0	0	64	Exist
	ZB1B	0	0	0	0	0	2	0	0	0	0	0	0	0	0	68	Exist
	ibair Petroleum(brjssiy	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Rumaila 132	0	0	0	0	0	0	0	0	2	0	0	0	0	0	50	Exist
	Al-Asmeda	0	0	0	0	2	0	0	0	0	0	0	0	0	0	80	Exist
	Al-Baker	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Al-Zubair North	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Shuaiba	0	1	0	0	0	0	0	0	2	0	0	0	0	0	113	Exist
	Southern Petolium	0	0	0	0	0	0	2	0	0	0	0	0	0	0	64	Exist

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Hartha Old	0	2	0	1	0	0	0	0	0	0	0	0	0	0	176	Exist
	Hammar	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	SST	0	0	0	3	0	0	0	0	0	0	0	0	0	0	150	Exist
	Bab Al-Zubair	0	4	0	0	0	0	0	0	0	0	0	0	0	0	252	Exist
	Al-Rumaila Old 132	0	0	0	0	0	0	0	0	2	0	0	0	0	0	50	Exist
	Al-Gurienat	0	0	0	0	0	0	2	0	0	0	0	0	0	0	64	Exist

## Baghdad

	Baghdad North 132	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Huriya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Baghdad New	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Baghdad Oil Field	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Al-Jameaa	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Wazeeriya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Husainiya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Masbah	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Baghdad South Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Exist
	Baghdad South Thermo	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Radwaniya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Jazaer	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Ubaidy	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Abu-Ghraib	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Rusafa 9	1	0	0	0	0	0	0	0	0	0	0	0	0	0	90	Exist
	Rusafa Water	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Rusafa1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	90	Exist
	Rusafa2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	90	Exist
	Rusafa 3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	90	Exist
	Rusafa 8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	90	Exist
	Rusafa 7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	90	Exist
	Rusafat 4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	90	Exist
	Rusafat 5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	90	Exist

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Rusafat 6	1	0	0	0	0	0	0	0	0	0	0	0	0	0	90	Exist
	Juaifer 1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	90	Exist
	Samadiya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Nehrawan	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Abu-Dsheer	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Taji Gas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Exist
	Taji New	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Tarimiya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Thawra	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Washash	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Yarmook	0	0	0	3	0	0	0	0	0	0	0	0	0	0	150	Exist
	Yousufiya 132	0	2	0	1	0	0	0	0	0	0	0	0	0	0	176	Exist
	Zafaraniya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	خارجة petro	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Exist
	Sader Gas 132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Exist

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Juaifer 2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	90	Exist
	Dora Thermal	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Eskan Al-Kher	0	2	0	1	0	0	0	0	0	0	0	0	0	0	176	Exist
	Farabi New	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Farabi Old	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	AL-Ghazali	0	0	0	3	0	0	0	0	0	0	0	0	0	0	150	Exist
	Qusaiba	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Aadamiya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	iraqi industrial خارجة	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Exist
	Jaderiya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Jameela New	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Agarguf	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Jameela Old	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Rashdiya	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Juaifer 3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	90	Exist

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Kadhimiya	0	0	0	3	0	0	0	0	0	0	0	0	0	0	150	Exist
	Karkh Water	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Latifiya	0	0	0	0	0	0	0	0	2	0	0	1	0	0	65	Exist
	Maari	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Mansoor	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Meshtel	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Muthana	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Naser	0	4	0	0	0	0	0	0	0	0	0	0	0	0	252	Exist
	Dora Industrial	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
<b>Babil</b>																	
	Al-Hashimiya	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Hilla Old Gas (Hilla)	0	1	0	1	0	0	0	0	0	0	0	0	0	0	113	Exist
	Askandariya New	0	4	0	0	0	0	0	0	0	0	0	0	0	0	252	Exist
	Hilla East	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Hilla South	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	Babil Poroadcast	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Hilla North	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Askandariya Old	0	0	0	0	0	0	0	0	6	0	0	0	0	0	150	Exist
	Al-Sadda	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
<b>Al-Mutha</b>																	
	Rumaitha	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Samawa North	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Samawa Old	0	2	0	1	0	0	0	0	0	0	0	0	0	0	176	Exist
	Sawa	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
<b>Al-Anbar</b>																	
	Falloja Cement	0	1	0	1	0	0	0	0	0	0	0	0	0	0	113	Exist
	Akashat Old	0	0	0	0	0	0	0	0	0	2	0	0	0	0	37,4	Exist
	Mukhlis Kafi Deasle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Exist
	Haditha Ruseia	0	0	0	0	0	0	0	0	0	0	2	0	0	0	32	Exist
	Akashat New	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist

Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
	heet Cement (Kubaisa)	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Haditha New	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Al-Qaim Factory(qaim)	0	1	3	0	0	0	0	0	0	0	0	0	0	0	243	Exist
	Falloja	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Habaniya	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Ana	0	2	0	0	0	0	0	0	0	0	0	0	0	0	126	Exist
	Al-Rutba	0	0	0	1	0	0	0	0	0	0	0	1	0	0	65	Exist
	Al-Ramadi New	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Ramadi East	0	3	0	0	0	0	0	0	0	0	0	0	0	0	189	Exist
	Al-Ramadi (old)	0	2	0	1	0	0	0	0	0	0	0	0	0	0	176	Exist
	Heet	0	1	0	1	0	0	0	0	0	0	0	0	0	0	113	Exist



Location	Plant_Name	90 MVA	63 MVA	60 MVA	50 MVA	40 MVA	34 MVA	32 MVA	31,5 MVA	25 MVA	18,7 MVA	16 MVA	15 MVA	10 MVA	5 MVA	Transformers Capacity (MVA)	Status
----------	------------	--------	--------	--------	--------	--------	--------	--------	----------	--------	----------	--------	--------	--------	-------	-----------------------------	--------

Sum of Transformers

12	457	9	44	4	4	6	14	34	2	2	2	1	2
----	-----	---	----	---	---	---	----	----	---	---	---	---	---

Sum of Transformers Capacity(MVA)

1080	28791	540	2200	160	136	192	441	850	37,4	32	30	10	10
------	-------	-----	------	-----	-----	-----	-----	-----	------	----	----	----	----

Sum of Substations

234

Grand Capacity of Total Transformers(MVA)

34509,4

Total Transformers

593

## **ATTACHMENT 2-2**

**PLANNED 132 KV TRANSMISSION LINES TO COVER THE 2020 LOADS**

**Attachment 2-2 Planned 132 kV Transmission Lines to cover the 2020 Loads**

No.	Sections	cct	Progress (%)	Length (km)	note
<b>2013 Plan</b>					
1	Khairat W.-Hindiya (1+2)	2	-	37	Aerial Line + Cable
2	Maymouna-Amarah 400 (1+2)	2	4	40	
3	West Amarah-Amarah 300 (1+2)	2	-	25	
4	Musayeb Th.-Iskandariyah S. (1+2)	2	96	30	
5	North Beiji-Beiji Thermal	1	69	12	
6	Ibrahimiya-Khairat W. (1+2)	2	-	30	
7	North Kirkuk S.-Kirkuk 400 (1+2)	2	-	-	cut off and insertion of aerial lines
8	North Kirkuk Th.-Chimchymal (1+2)	2	-	-	cut off and insertion of aerial lines
9	North Kirkuk S.-Dibis W. (1+2)	2	-	-	
10	West Kirkuk-Dibis W. (1+2)	2	36	-	
11	West Kirkuk-North Kirkuk (Tabba) (1+2)	2	36	20	cut off and insertion of aerial lines
12	North Zubair-Basra 400 (1+2)	2	-	6	
13	Qurna 400-Qurna Old (1+2)	2	-	1	
14	Qurna 400-Amarah New (1+2)	2	-	-	
15	Qurna 400-Qurna Old (temp.)	1	-	-	It will be diverted to Amarah New after rehab.
16	South Baqubah-Diyala 400 (1+2)	2	40	20	
17	Tell Awaynat-Tell Abu Dahir (1+2)	2	54	1.5	
18	Tell Awaynat-Kisik 132 (1+2)	2	54	1.5	
19	Tell Awaynat-ITA2 (1+2)	2	54	1.5	
20	Bartalla-East Mosul (1+2)	2	-	-	
21	Sinjar-Sinjar Cement (1+2)	2	10	0.2	
22	West Mosul-Tabadul Tijari (1+2)	2	-	2	cut off and insertion of aerial lines
23	West Mosul-Mosul 400 (1+2)	2	-	2	cut off and insertion of aerial lines
24	Mansuriya-Miqdadiya	1	16	-	
25	Mansuriya-Himreen Dam (Diyala)	1	-	-	
26	Fayhaa-Najibiyah W. (1+2)	2	-	-	
27	Fayhaa-Hartha	1	-	25	
28	East Tikrit-North Samarra	1	70	65	
29	South Ramadi-Ramadi New (1+2)	2	66	8	
30	Mulla Abdullah-Hawija	1	4	39	
31	Tabadul Tijari-Rasheediya	1	43	7	
32	Tabadul Tijari-Mosul Dam	1	4	40	
33	Kirkuk University-Mulla Abdullah Old	1	38	20	cut off and insertion of aerial lines
34	Kirkuk University-Kirkuk 400	1	38	10	cut off and insertion of aerial lines
35	Fuhood-General Downstream (River)	1 (2)	-	-	only requires stringing the 2nd cct
36	Kisik-Talafar Old	1	-	-	
37	Kiski 400-Shamal Town	1	-	-	
38	Mansuriya W.-Khanakeen	1	-	70	
39	Rumaila Central-Rumaila W.	1	-	-	
40	Qurna 400-Qurna Old	1	-	1	Temporary cut off and insertion of aerial lines
41	Qurna 400-Amarah New	1	-	-	Temporary cut off and insertion of aerial lines
42	West Najaf-Najaf Cement	1	-	-	
<b>2014 Plan</b>					
1	Shoala - north west of Baghdad(1,2)	2	-	-	Aerial Line + Cable
2	Shoala - west of Baghdad(1,2)	2	-	-	cut off and insertion of aerial lines
3	Shoala - Hurriya(1,2)	2	-	-	cut off and insertion of aerial lines
4	Khan Bani Saad - Sadir 132 (1,2)	2	-	-	
5	Tajiyat - North west of Baghdad (1,2)	2	-	-	Aerial Line + Cable
6	Al-Mahmudiya - old Yousifiya (1,2)	2	-	20	Temporarily cut off
7	Al-Latifiya -- Al-Mahmudiya (1,2)	2	-	25	Temporarily cut off
8	Kadimiya - North west of Baghdad (1,2)	2	-	15	Aerial Line + Cable
9	Al-Eskan Al-Sinaay - North of Al-Nasiriya (1,2)	2	-	15	cut off and insertion of aerial lines
10	Al-Eskan Al-Sinaay - Nasiriya (H) (1,2)	2	-	15	cut off and insertion of aerial lines
11	New Al-Rifaay - AlShatra 400 (1,2)	2	-	-	
12	New AlShatra - Shatra 400 (1,2)	2	-	-	
13	New AlShatra - Nasiriya industrial	1	-	1	Modification of old line
14	Souq Al-Shiyookh - AlMasab AlAam (1,2)	2	21	20	cut off and insertion of aerial lines
15	Souq Al-Shiyookh - New Al-Rumaila (1,2)	2	21	20	cut off and insertion of aerial lines
16	East of Al-Amarah- Amarah 400 (1,2)	2	-	-	
17	Al-Hewaish - Samara Dieselat (temporary)	1	-	-	Temporary line
18	Al-Hewaish - Samara Hydro (temporary)	1	-	-	Temporary line
19	Al-Hewaish - south of Tikrit (temporary)	1	-	-	Temporary line
20	Bazrqan West - Amarah 400	1	-	80	

**Attachment 2-2 Planned 132 kV Transmission Lines to cover the 2020 Loads**

No.	Sections	cct	Progress (%)	Length (km)	note
21	Rumaila West - cps(1,2,3,4,5,6,7)	7	62	33	
22	Rumaila West - Krainat Shamiya	1	61	11.5	cut off and insertion of aerial lines
23	North of Al-Sewaira - Wasit thermal (1,2)	2	-	25	
24	Sheikh Saad - Wasit	1	-	45	
25	Ali AlGharbi 2 - Old Amarah	1	-	-	
26	Ali AlGharbi 2 - North of Kut	1	-	-	Rehabilitation
27	Akadimiya - Garma (for Governorate)	1	-	-	
28	Samawa West - Samawa North	1	-	20	
29	North of Baquba - Diyala 400(1,2)	2	-	-	Expanding
30	Jurf AlSakhar - AIMusaib 400 (1,2)	2	-	16	cut off and insertion of aerial lines
31	Jurf AlSakhar - North of Karbala	1	-	16	cut off and insertion of aerial lines
32	Jurf AlSakhar - East of Karbala (1,2)	2	-	-	
33	West of Hilla - Babil 400(1,2)	2	-	10	cut off and insertion of aerial lines
34	West of Hilla - South of Hilla	1	-	10	cut off and insertion of aerial lines
35	AlShomali - AlShamiya (1,2)	2	-	-	cut off and insertion of aerial lines
36	AlShomali - Hashimiya(1,2)	2	-	-	cut off and insertion of aerial lines
37	New AlRumaiha - West Samawa (1,2)	2	-	45	
38	AlKhedir - West Samawa (1,2)	2	-	20	
39	New Samawa - West Samawa (1,2)	2	-	15	
40	AlMedaina - Qurna 400 (1,2)	2	-	15	
41	AlMedaina - CBS3 (1,2)	2	-	-	
42	AlDair - Qurna 400 (1,2)	2	-	10	
43	New Karbala - Khairat West (1,2)	2	28	34	
44	Al-Hay - Dujaila 1	1	-	20	cut off and insertion of aerial lines
45	Al-Hay - Refai 1	1	-	20	cut off and insertion of aerial lines
46	Al-Hay - Wasit 400 (1,2)	2	-	40	
47	Haidariya west - West Najaf	1	72	45	
48	East Hilla - Babil 400	1	43	24	
49	AlQaem - Qaem 400 (1,2)	2	4	21.6	cut off and insertion of aerial lines
50	AlQaem - Fosfaat (1,2)	2	4	21.6	cut off and insertion of aerial lines
51	Jalawlaa - Khanaqeen (1,2)	2	-	-	cut off and insertion of aerial lines
52	Jalawlaa - Klaar (1,2)	2	-	-	cut off and insertion of aerial lines
53	AlNidaa - AlJawahery (1,2)	2	-	4	cut off and insertion of aerial lines
54	AlNidaa - AlEtarat (1,2)	2	-	4	cut off and insertion of aerial lines
55	AlAbasiya - Haidariya West (1,2)	2	-	40	
56	AlMeshkhab - Najaf west(1,2)	2	72	16	cut off and insertion of aerial lines
57	AlMeshkhab - Gamas (1,2)	2	72	16	cut off and insertion of aerial lines
58	West of AlDiwaniya - Qadesiya 400 (1,2)	2	-	-	cut off and insertion of aerial lines
59	West of AlDiwaniya - North of AlDiwaniya (1,2)	2	-	-	
60	South of AlDiwaniya - Qadesiya 400 (1,2)	2	-	-	
61	AlHamza - Qadesiya 400 (1,2)	2	-	-	cut off and insertion of aerial lines
62	AlHamza - existed Rumaiha (1,2)	2	-	20	cut off and insertion of aerial lines
63	AlHamza - Qadesiya 400 (1,2) temporarily cut off	2	-	-	cut off and insertion of aerial lines
64	AlHamza - North of Samawa (1,2) temporarily cut	2	-	20	cut off and insertion of aerial lines
65	AlSalahiya - Qadesiya 400 (1,2)	2	-	20	
66	Afak - East of AlDiwaniya (1,2)	2	-	20	
67	West of AlRamadi - Anbar (H) (1,2)	2	-	-	
68	South of Falluja - Falluja (1,2)	2	27	5.5	cut off and insertion of aerial lines
69	South of Falluja - Habaniya (1,2)	2	27	5.5	cut off and insertion of aerial lines
70	South of AlRamadi - Falluja (1,2)	2	-	-	cut off and insertion of aerial lines
71	South of AlRamadi - Ramadi (1,2)	2	-	-	cut off and insertion of aerial lines
72	South of AlRamadi - North of Falluja	1	-	50	
73	West of AlRamadi - Anbar west	1	-	-	
74	East Mosul 400 - Qaraqosh	1	4	14	cut off and insertion of aerial lines
75	East Mosul 400 - Entisar	1	4	14	cut off and insertion of aerial lines
76	East Mosul 400 - Tahreer	1	60	12	
77	Rumaila west - Rumaila old	1	60	11	
78	Samawa West - Samawa old	1	-	15	
79	South Mosul - West Mosul	1	-	-	cut off and insertion of aerial lines
80	South Mosul - new Mosul	1	-	-	cut off and insertion of aerial lines
81	Shomali - Hashimiya	1	-	-	cut off and insertion of aerial lines
82	Shomali - Shamiya	1	-	-	cut off and insertion of aerial lines
83	South of Diwaniya - Qadesiya	1	-	-	
84	North Basra - Hartha (1,2)	2	100	2	Completed, cut off and insertion of aerial lines

**Attachment 2-2 Planned 132 kV Transmission Lines to cover the 2020 Loads**

No.	Sections	cct	Progress (%)	Length (km)	note
85	North Basra - Najbiya (1,2)	2	-	-	cut off and insertion of aerial lines
<b>2015 Plan</b>					
1	AlSabiya - North west Baghdad (1,2,3,4)	4	-	20	Aerial Line + Cable
2	Salman Pak - East Rusafa (1,2)	2	-	35	
3	East Nasiriya - AlNasiriya Gas	1	-	-	
4	Aredo - AlNasiriya Gas	1	-	-	
5	AlBetaira - Maysan 400 (1,2)	2	-	-	
6	Kalaat Salih - Amarah 400 (1,2)	2	-	-	
7	Balad 2 - Salahdine 400 (1,2)	2	-	-	
8	AlAtaba AlAlawiya - AlHaidariya (1,2)	2	-	-	
9	North West of Kut - Wasit 400 (1,2)	2	-	-	
10	AlNajaf Sea - AlAtaba AlAlawiya (1,2)	2	-	-	
11	North east Baquba - Diyala 400 (1,2)	2	-	-	
12	Banjat Ali - Kirkuk 400 (1,2)	2	-	-	
13	Zab - Haweeja (1,2)	2	-	-	
14	Big Basra Water - North Basra (1,2)	2	-	-	
15	Daqq - Kirkuk Cement Factory (1,2)	2	-	-	
16	North AlQurna - Qurna 400 (1,2)	2	-	-	
17	AlNamrood - East Mosul 400 (1,2)	2	-	-	
18	South Yarmjah - East Mosul 400 (1,2)	2	-	10	
19	AlAnbar West - Ramadi South	1	-	60	
20	Basmaiya 1 South of Baghdad 400 ( Hanwa Co.)	1	-	12	
21	Basmaiya Generation - Basmaiya 1	1	-	3	
22	Basmaiya Generation - Basmaiya 2	1	-	13	
23	West AlAnbar - East Ramadi	1	-	25	cut off and insertion of aerial lines
24	West AlAnbar - Heet	1	-	25	cut off and insertion of aerial lines
25	Talafar 2 - Kisk 400 (1,2)	2	-	-	
26	new North Karbala - East Karbala	1	-	-	Aerial Line + Cable
27	AlResala - East Mosul (1,2)	2	-	-	
28	AlMamon - Mosul (1,2)	2	-	-	
29	Wadi Sheshen - Salahdine 400 (1,2)	2	-	-	
30	Salahdine 400 - Dieslat Samara	1	-	-	
31	Salahdine 400 - Hydroelectric	1	-	-	
32	Salahdine 400 - South Tikrit	1	-	-	
33	Salahdine 400 - Haweesh	1	-	-	
34	AlHashimiya Road - South of Hilla	1	-	-	cut off and insertion of aerial lines
35	AlHashimiya Road - Hashimiya	1	-	-	cut off and insertion of aerial lines
36	AlMahaweel - Babil 400 (1,2)	2	-	-	cut off and insertion of aerial lines
37	AlMahaweel - East Hilla (1,2)	2	-	-	cut off and insertion of aerial lines
38	Abu Gharag - Babil 400 (1,2)	2	-	-	cut off and insertion of aerial lines
39	Abu Gharag - West Hilla old (1,2)	2	-	-	cut off and insertion of aerial lines
40	AlBaghdadi - AlAnbar West (1,2)	2	-	-	
41	West AlQaem - AlQaem Secondary (1,2)	2	-	-	
42	West AlGarma - West Baghdad 400 (1,2)	2	-	-	cut off and insertion of aerial lines
43	West AlGarma - Falluja Cement (1,2)	2	-	-	cut off and insertion of aerial lines
44	Cement 1 - old Ramadi (1,2)	2	-	-	
45	Cement 1 - Cement 2 (1,2)	2	-	-	
46	Cement 2- Nikhaib (1,2)	2	-	-	
47	Industrial Institute - Bab AlZubair (cut off)	1	-	-	
48	Industrial Institute - Khor AlZubair (cut off)	1	-	-	
49	Industrial Institute (cut off Abu Floos-Bab AlZubair)	1	-	-	Temporary until Faw station is completed
50	AlBetaira - Maysan 400	1	-	-	
51	AlNajaf sea - West AlNajaf (1,2)	2	-	-	
52	AlNajaf sea - AlJawahery (1,2)	2	-	-	cut off and insertion of aerial lines
53	Salahdine 400 - Balad 2	2	-	-	cut off and insertion of aerial lines
54	AlAnbar Gas - East Rusafa 400	1	-	-	
<b>2016 Plan</b>					
1	AlFarouk station lines	1	-	-	
2	AlShalalat station lines	1	-	-	
3	AlGaiara station lines	1	-	-	
4	Tariq - East Baghdad (1,2)	2	-	-	
5	AlAmari - East Rusafa (1,2)	2	-	12	Aerial Line + Cable
6	AlZaqora - AlNasiriya west (1,2)	2	-	-	
7	AlBathaa - AlNasiriya west (1,2)	2	-	-	

**Attachment 2-2 Planned 132 kV Transmission Lines to cover the 2020 Loads**

No.	Sections	cct	Progress (%)	Length (km)	note
8	AlKahlaa - Amarah 400 (1,2)	2	-	-	
9	AlSherqat - Nainawa Gas	1	-	-	
10	West AlMalwiya lines	1	-	-	
11	AlKefel - West Hilla (1,2)	2	-	-	cut off and insertion of aerial lines
12	AlKefel - South Hilla (1,2)	2	-	-	cut off and insertion of aerial lines
13	AlSoyer - Samawa West (1,2)	2	-	-	
14	AlEmam Al Sadiq - Qurna 400 (1,2)	2	-	-	2nd connection after Al Qurna expansion
15	AlSawada - Musab (h) (1,2)	2	-	-	
16	Mafraq AlZubaidiya - Wasit 400 (1,2)	2	-	10	
17	South Dibis - West Dibis (1,2)	2	-	-	
18	AlManathera - Haidariya (1,2)	2	-	-	
19	AlSaqlawiya connection lines	1	-	-	
20	Qurna 400 - Majnon field	1	-	-	
21	AlFaw 400 - Abu Floos	1	-	70	
22	AlFaw 400 - AlFaw secondary	1	-	5	
23	Yousefiya - Habaniya/ Regional Development	1	-	-	
24	Habaniya - East Ramadi	1	-	-	
25	Qadesiya - existed Rumaitha	1	-	-	
26	Old south Karbala - AlEbrahimiya	1	-	-	
27	Thermal AlYousifiya - Mahmodiya/ permanent	1	-	-	
28	Dibis 132 - West Dibis (1,2)	2	-	-	
29	AlHewaish - Salahdine 400 (1,2)	2	-	-	
30	Tariq - East Baquba	1	-	-	cut off and insertion of aerial lines
31	Tariq - West Baquba	1	-	-	cut off and insertion of aerial lines
32	West Hilla - Babil	1	-	-	cut off and insertion of aerial lines
33	West Hilla - South Hilla	1	-	-	cut off and insertion of aerial lines
<b>2017 Plan</b>					
1	AlJebayesh - AlMedaina (1,2)	2	-	-	
2	AlMusaib - Theraml AlMusaib (1,2)	2	-	-	
3	Turkish hospital - Basra 400 (1,2)	2	-	-	
4	AlDora - East Rusafa	1	-	-	
5	Um Qasir north - Faw 400 (1,2)	2	-	-	
6	AlGhadeer - AlShaiba (1,2)	2	-	-	
7	AlMerbad - AlShaiba (1,2)	2	-	-	
8	AlMerbad - Turkish hospital (1,2)	2	-	-	
9	Najaf Road - AlKhairat Gas (1,2)	2	-	-	
10	AlKut center - Wasit 400	1	-	-	
11	AlMathana - AlHaidariya (1,2)	2	-	-	
12	Deboni - Jasan (1,2)	2	-	-	
13	Deboni - Zubaidiya (1,2)	2	-	-	
<b>2018 Plan</b>					
1	AlSaraji - Basra 400 (1,2)	2	-	-	
2	AlHosainiya - AlMusaib thermal (1,2)	2	-	-	
3	AlHakeem - Shaikh Saad	1	-	-	cut off and insertion of aerial lines
4	AlHakeem - AlKut 400	1	-	-	cut off and insertion of aerial lines
5	AlEtarat - AlHaidariya (1,2)	2	-	-	
6	North AlRamadi - Anbar (h) (1,2)	2	-	-	
7	Yarmok - Jazaer	1	-	-	
8	Sawa - AlSalman District	1	-	90	
9	Samawa Gas - Samawa	1	-	-	
<b>2019 Plan</b>					
1	Sport city connection lines	1	-	-	
2	AlQurra - Industrial Institute (1,2)	2	-	-	
3	AlQurra - Abu Floos (1,2)	2	-	-	

note:

- 1) The above table was updated on 24/2/2016
- 2) Lines lengths which were not registered in the table due to uncomplete technical surveys from the concerned directorates.
- 3) The completion percentages were registered according to Power Transmission Projects Report on 31/1/2016.

**CHAPTER 3**  
***POWER SYSTEM ANALYSIS***

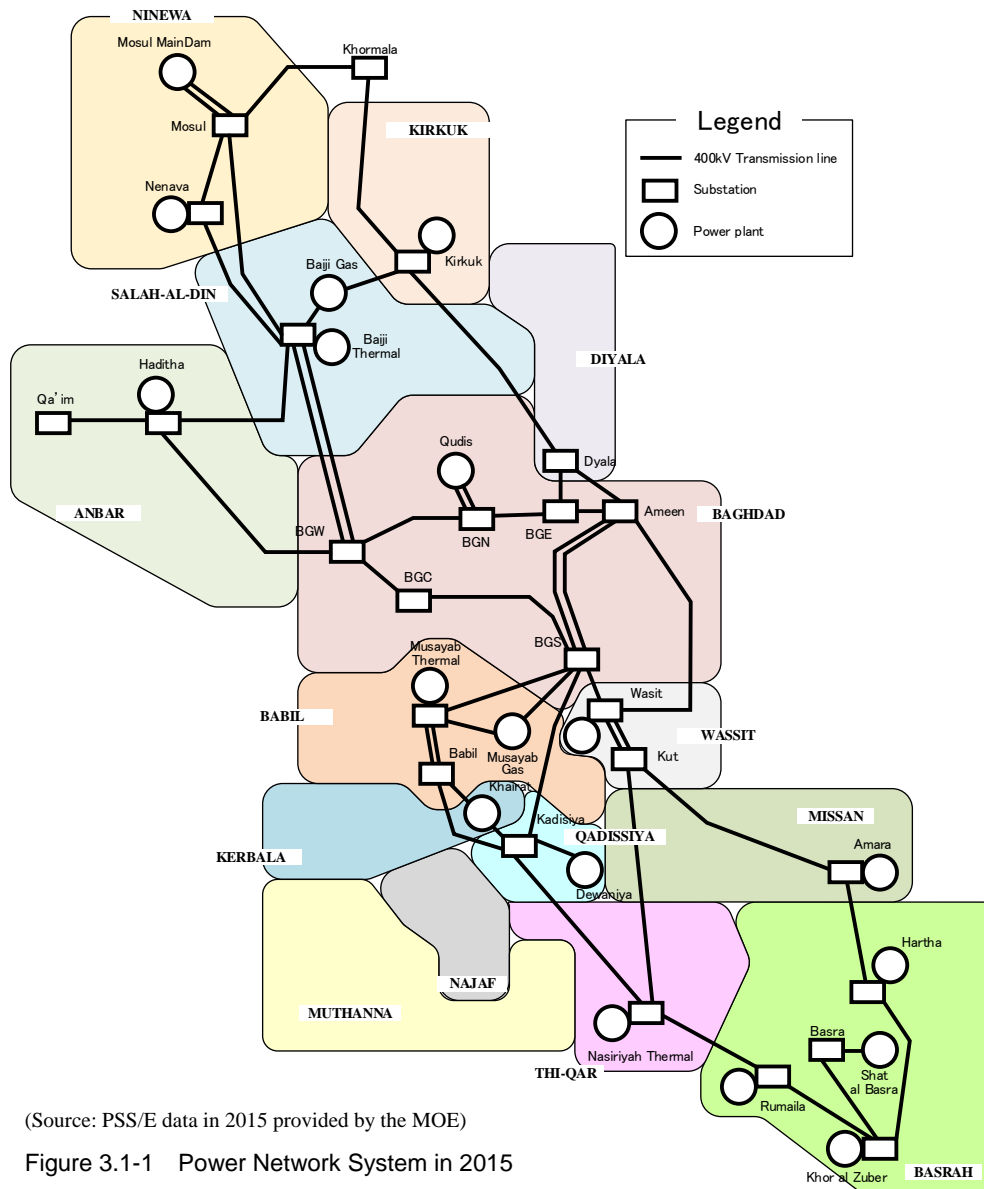
## CHAPTER 3 POWER SYSTEM ANALYSIS

To grasp the current situations of the existing and future electric power network in Iraq, the Study Team conducted power flow calculations using PSS/E data provided by the MOE including the calculation cases in 2015, existing network, and the planned network in 2020. In this chapter, the results of the power flow calculations for 2015 and 2020 cases are to be described.

### 3.1 Power System Analysis for 2015

#### 3.1.1 Power Network System in 2015

Figure 3.1-1 shows the existing power network system in 2015 based on the PSS/E data.





The PSS/E data in 2015 contains 32 numbers of 400 kV substations and about 4,500 km in total length of 400 kV transmission lines. Those 400 kV substations and transmission lines are mentioned in Chapter 2.

### 3.1.2 Allowable Variations

According to the “Iraq Grid Code”, the allowable frequency variation, voltage variation, and fault current of power system are shown in Tables 3.1-1 to 3.1-3.

Table 3.1-1 Allowable Frequency Variation

Situation	Frequency
Normal Operation	49.95 Hz to 51.25 Hz
System Stress	48.75 Hz to 51.25 Hz

(Source: Iraq Grid Code)

Table 3.1-2 Allowable Voltage Variation

Busbar Standard Voltage	Normal Operation Condition
400 kV	±5% (380 kV – 420 kV)
132 kV	±10% (118.8 kV – 145.2 kV)

(Source: Iraq Grid Code)

Table 3.1-3 Allowable Fault Current

Busbar Standard Voltage	Permissible Fault Current
400 kV	50 kA
132 kV	40 kA

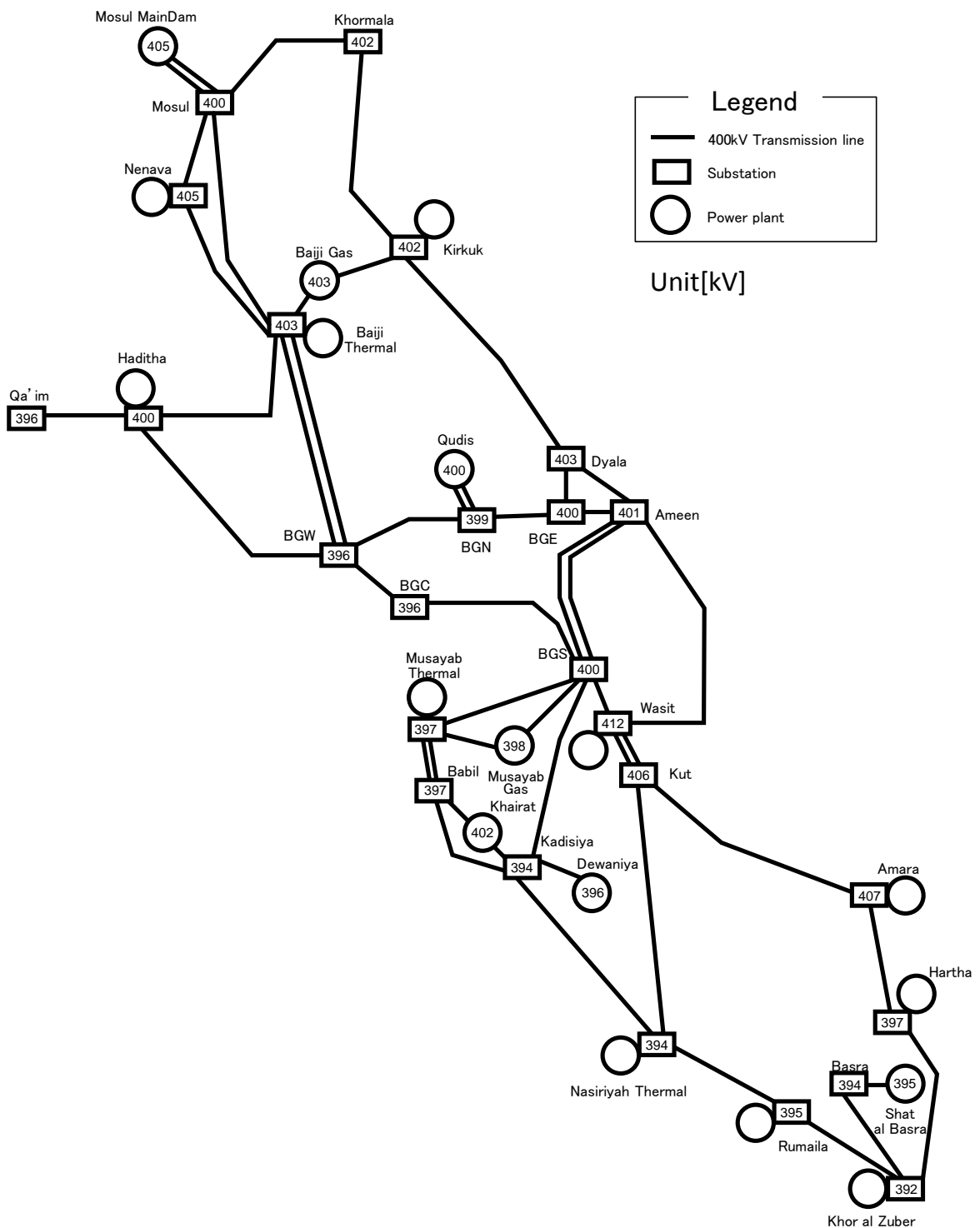
(Source: Iraq Grid Code)

### 3.1.3 Power Flow Analysis

The PSS/E data provided by the MOE contains the 400 kV and 132 kV power system in 2015. The Study Team corrected some parts of the data which apparently contained incorrect data regarding the 132 kV network. Some transformer tap values in the same substation were also modified to its proper range.

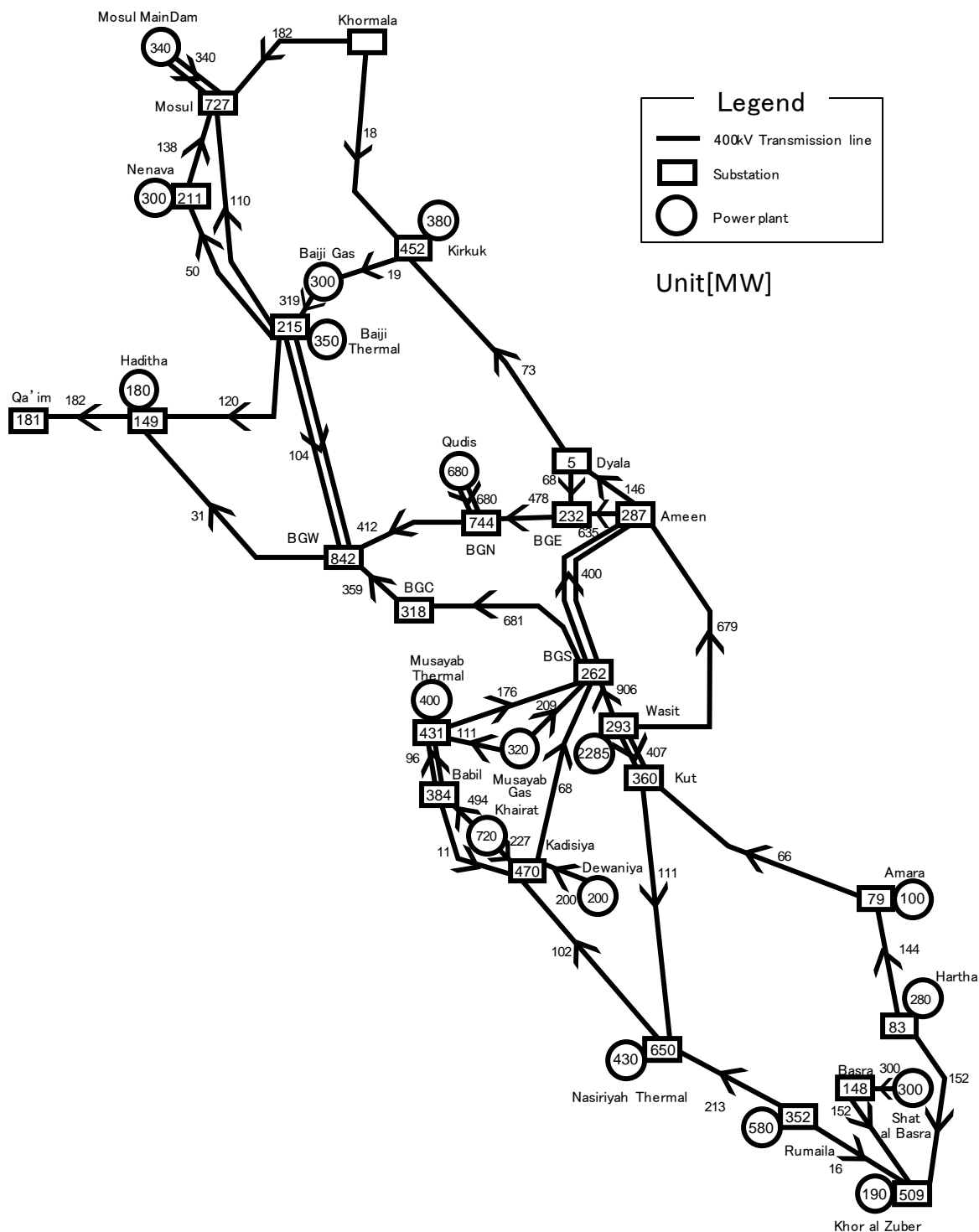
Figures 3.1-2 and 3.1-3 show the results of the power flow analysis for 2015. Figure 3.1-2 shows the substation busbar voltage profile in the 400 kV network system in 2015 during the

peak demand. Figure 3.1-3 shows the power flow of the 400 kV network system in 2015 during the peak demand.



(Source: Prepared by the Study Team)

Figure 3.1-2 Substation Busbar Voltage Profile in 400 kV Network in 2015



(Source: Prepared by the Study Team)

Figure 3.1-3 Power Flow on 400 kV Network in 2015

As shown in Figure 3.1-2, voltage profile of the 400 kV network, substation busbar voltages of the 400 kV and the 132 kV system were prescribed value by adjusting the generator terminal voltage, transformer tap value and amount of the static condensers.

As shown in Figure 3.1-3, no overload is observed on all the 400 kV substations and transmission lines.

### 3.1.4 Fault Current Analysis

Figure 3.1-4 shows the result of the fault current analysis which assumed all generator operators are connected to the grid. The fault currents on the 400 kV and 132 kV systems up to the fifth level are shown in Tables 3.1-4 and 3.1-5, respectively.

Table 3.1-4 Result of Fault Current Analysis for 400 kV System

No.	Station Name	Fault Current [kA]
1	Bagdad South	34
2	Musayab Thermal	31
3	Ameen	29
4	Musayab Gas	28
5	Baghdad East	26

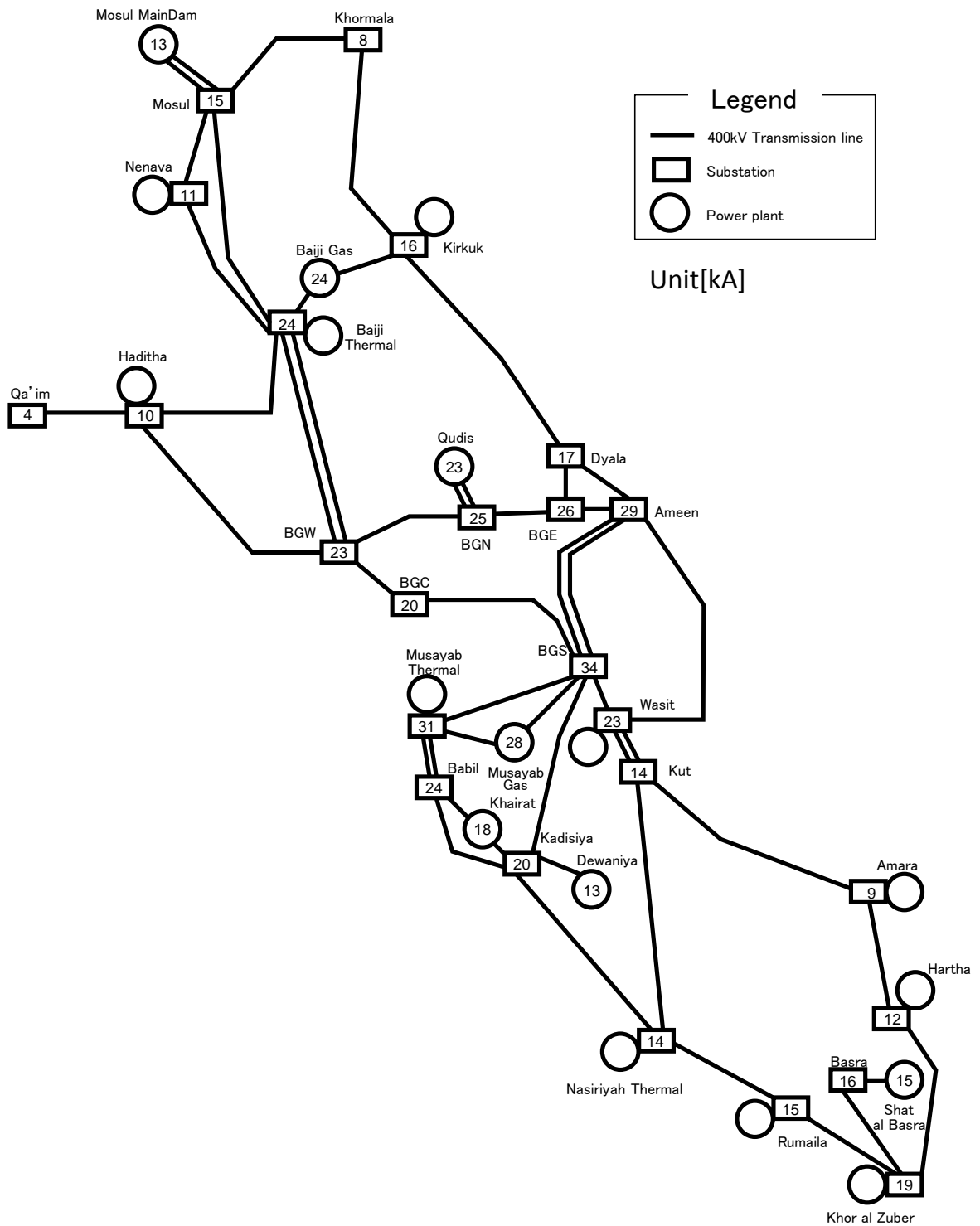
(Source: Prepared by the Study Team)

Table 3.1-5 Result of Fault Current Analysis for 132 kV System

No.	Station Name	Fault Current [kA]
1	Khor al Zuber	39.8
2	Baghdad Center	35.9
3	BGCR	35.7
4	Eskan al-khir	34.7
5	Abu_dchir	34.4

(Source: Prepared by the Study Team)

The fault currents shown in the tables are within the allowable range. But several substations of the 132 kV system have fault current closer to 40 kA. The fault current may exceed 40 kA, if power plants or transmission lines are constructed near these substations.



(Source: Prepared by the Study Team)

Figure 3.1-4 Maximum Fault Currents on 400 kV Network in 2015

### 3.1.5 N-1 Analysis

To check the reliability level of the power network system, the Study Team carried out an N-1 analysis for the 400 kV and 132 kV network in 2015. Those results are shown in;

Table 3.1-6: Overloaded 400 kV Transformers under the N-1 Condition in 2015

Table 3.1-7: Overloaded 400 kV Transmission Lines under the N-1 Condition in 2015

Table 3.1-8: Overloaded 132 kV Transmission Lines under the N-1 Condition in 2015

Table 3.1-6 Overloaded 400 kV Transformers under N-1 Condition in 2015

Substation Name	Voltage	Capacity	Overload Level
Kut	400/132/33 kV	250 MVA/Unit	143.9%
Basra	400/132/33 kV	250 MVA/Unit	123.0%
Baghdad West	400/132/33 kV	250 MVA/Unit	121.7%
Mosul	400/132/33 kV	250 MVA/Unit	115.0%
Baghdad North	400/132/33 kV	250 MVA/Unit	104.2%
Nassiriya Thermal	400/132/33 kV	250 MVA/Unit	101.9%
Wasit	400/132/33 kV	250 MVA/Unit	100.1%

(Source: Prepared by the Study Team)

Table 3.1-7 Overloaded 400 kV Transmission Lines under N-1 Condition in 2015

From	To	Capacity	Overload Level
Baghdad South	Wasit Thermal	1,000 MVA	147.9%
Ameen	Wasit Thermal	1,000 MVA	137.7%
Baghdad East	Ameen	1,000 MVA	103.1%
Baghdad South	Wasit Thermal	1,000 MVA	101.9%
Baghdad South	Baghdad Center	1,000 MVA	100.9%
Baghdad South	Wasit Thermal	1,000 MVA	100.6%

(Source: Prepared by the Study Team)

Table 3.1-8 Overloaded 132 kV Transmission Lines under N-1 Condition in 2015

From	To	Capacity	Overload Level
Kerkh water pumo	Nassr	97 MVA	274.0%
Tarmiya	Baghdad North	97 MVA	269.0%
Latifiya	Musayab	97 MVA	229.6%
Musayab	North Kerbala	236 MVA	217.8%
Heet	Mukhliss kafi	123 MVA	210.2%
North Tikrit	Bajji Thermal	97 MVA	202.0%
Djeil	Tarmiya	97 MVA	196.1%
Kadisiya	Rumaita	236 MVA	194.6%
Kadisiya	North Samawa	236 MVA	192.2%
Jaza'ir	Dora P.P.	123 MVA	188.0%

Djeil	Tarmiya	97 MVA	187.3%
Kerkh water pumo	Nassr	97 MVA	185.3%
Tarmiya	Baghdad North	97 MVA	181.8%
North Kerbala	East Kerbala	236 MVA	166.2%
Latifiya	Iskandariya	97 MVA	165.8%
Kut	Old Kut	74 MVA	162.4%
Najaf Gt.P.P	Najaf Town	97 MVA	161.1%
Djeil	Kerkh water pumo	97 MVA	159.3%
Kirkuk	Mulla Adbulla	97 MVA	154.0%
South Kut	Dejelah	86 MVA	153.6%
Rumaiatha	North Samawa	236 MVA	151.3%
NJBP	Acadmiya	156 MVA	147.2%
Nasiriya thermal	Old Nassiriya	185 MVA	147.0%
Kadisiya	North Samawa	236 MVA	144.6%
South Tikrit	Baiji Thermal	97 MVA	143.0%
North Tikrit	Baiji Thermal	97 MVA	141.7%
New rumaila	CPS3	97 MVA	140.3%
Tarmiya	Nassr	189 MVA	138.5%
NJBP	Acadmiya	156 MVA	132.1%
North Baghdad	New Taji	123 MVA	128.1%
Bagdad West	Jami'a	180 MVA	125.0%
NJBP	Acadmiya	156 MVA	124.8%
Baghdad North	Husseiniya	236 MVA	121.9%
Mosul	Mosul Gt.P.P	236 MVA	121.8%
Mosul	Mansoor	236 MVA	121.5%
Fao	Abo Floos	123 MVA	120.0%
Khor al Zuber	BAZR-1	123 MVA	119.5%
Baghdad North	Husseiniya	236 MVA	118.4%
Baghdad North	Husseiniya	236 MVA	118.1%
North Hilla	Hilla east	97 MVA	118.0%
Mosul	Yarmook	236 MVA	117.9%
Shu'alba GT.P.P.	Petrochemical	97 MVA	117.7%
Farabi	Bagdad East	236 MVA	115.6%
New rumaila	Rumaila	236 MVA	115.3%
Farabi	New Farabi	236 MVA	115.0%
Musayab	East Kerbala	236 MVA	112.4%
North Kerbala	East Kerbala	236 MVA	111.9%
Kerkh water pumo	Nassr	97 MVA	111.7%
Djeil	Kerkh water pumo	97 MVA	110.6%
Hurriya	Jami'a	228 MVA	110.5%
Old Hartha	Hartha	91 MVA	110.4%
South Tikrit	Baiji Thermal	97 MVA	110.0%
Tarmiya	Baghdad North	97 MVA	109.4%
North Tikrit	Baiji Thermal	97 MVA	107.9%

Jami'a	Ma'ari	180 MVA	107.5%
CPS3	Qurna	123 MVA	106.9%
Saddir Gt.P.P.	New Jamila	228 MVA	106.2%
NJBP	Acadmiya	156 MVA	104.9%
Djeil	Kerkh water pumo	97 MVA	104.5%
Musayab	Iskandariya	97 MVA	104.3%
Djeil	Kerkh water pumo	97 MVA	103.9%
Khor al Zuber	BAZR-1	123 MVA	103.3%
Khor al Zuber	BAZR-1	123 MVA	103.3%
Eskan al-khir	Dora P.P.	120 MVA	103.1%
Musayab	Iskandariya	97 MVA	103.0%
Kirkuk	Mulla Adbulla	97 MVA	102.3%
Yarimja	Mansoor	236 MVA	102.1%
North Tikrit	South Tikrit	97 MVA	101.9%
South Tikrit	Baiji Thermal	97 MVA	101.8%
NJBP	Acadmiya	156 MVA	101.3%
NJBP	Acadmiya	156 MVA	101.3%
NJBP	Acadmiya	156 MVA	101.1%
Haditha	Mukhliss kafi	123 MVA	100.6%
Tarmiya	Husseiniya	236 MVA	100.4%
Mishraq	Nenava	97 MVA	100.3%
Old Amara	Amara South	123 MVA	100.3%
North Tikrit	Baiji Thermal	97 MVA	100.3%

(Source: Prepared by the Study Team)

The analysis results show;

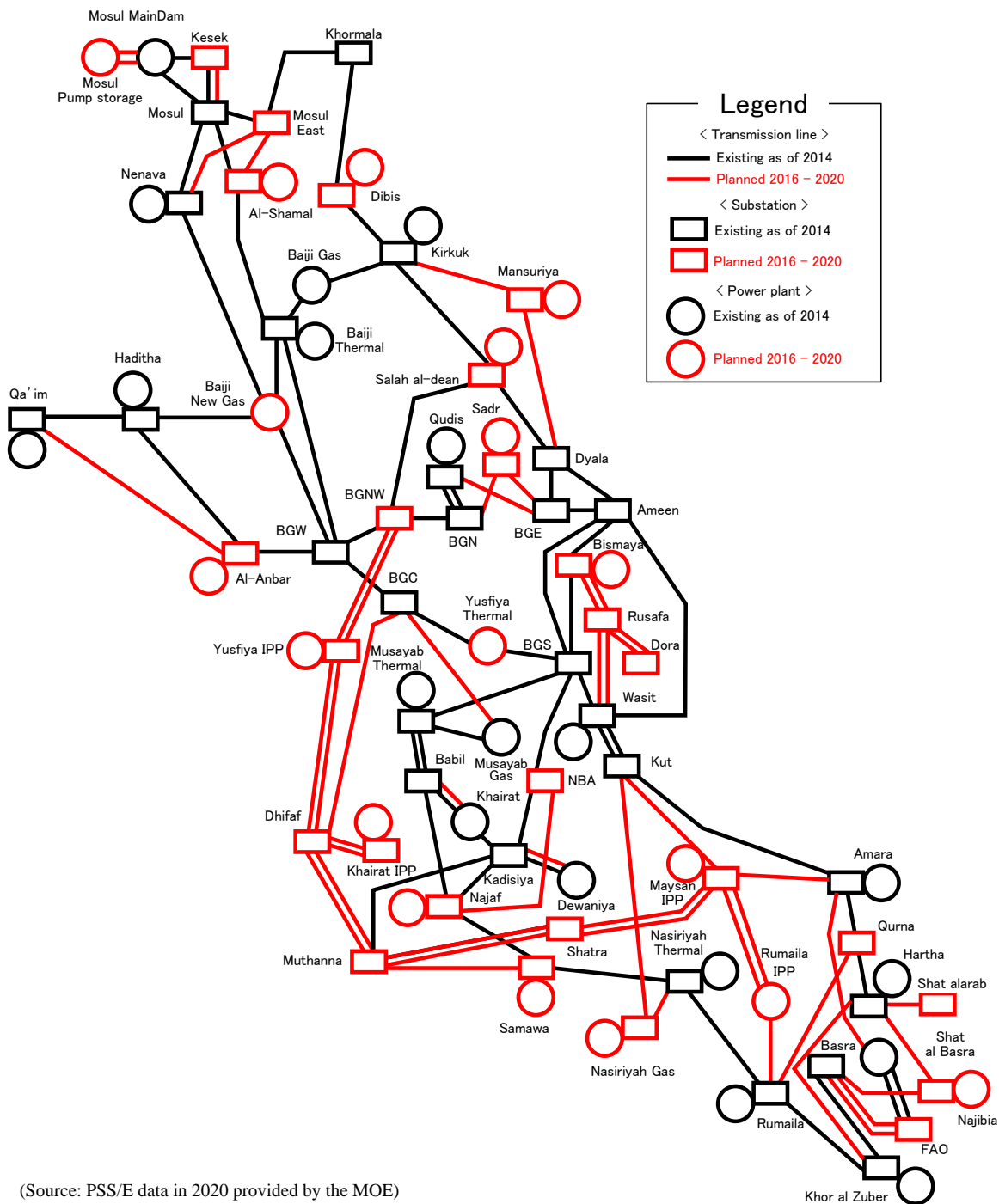
- 1) On the normal condition as described above there was no overload in the substations and transmission lines. However, overload of the same substations and transmission lines occurred under the N-1 condition.
- 2) Particularly, 132 kV transmission lines often do not meet the N-1 criterion.
- 3) Maximum overload of the 400 kV transformer and transmission lines was approximately 150%.
- 4) Maximum overload of the 132 kV transmission line was about 270%.
- 5) There is a need for expansion of the transformers and transmission lines to meet the N-1 criterion.



### 3.2 Power System Analysis for 2020

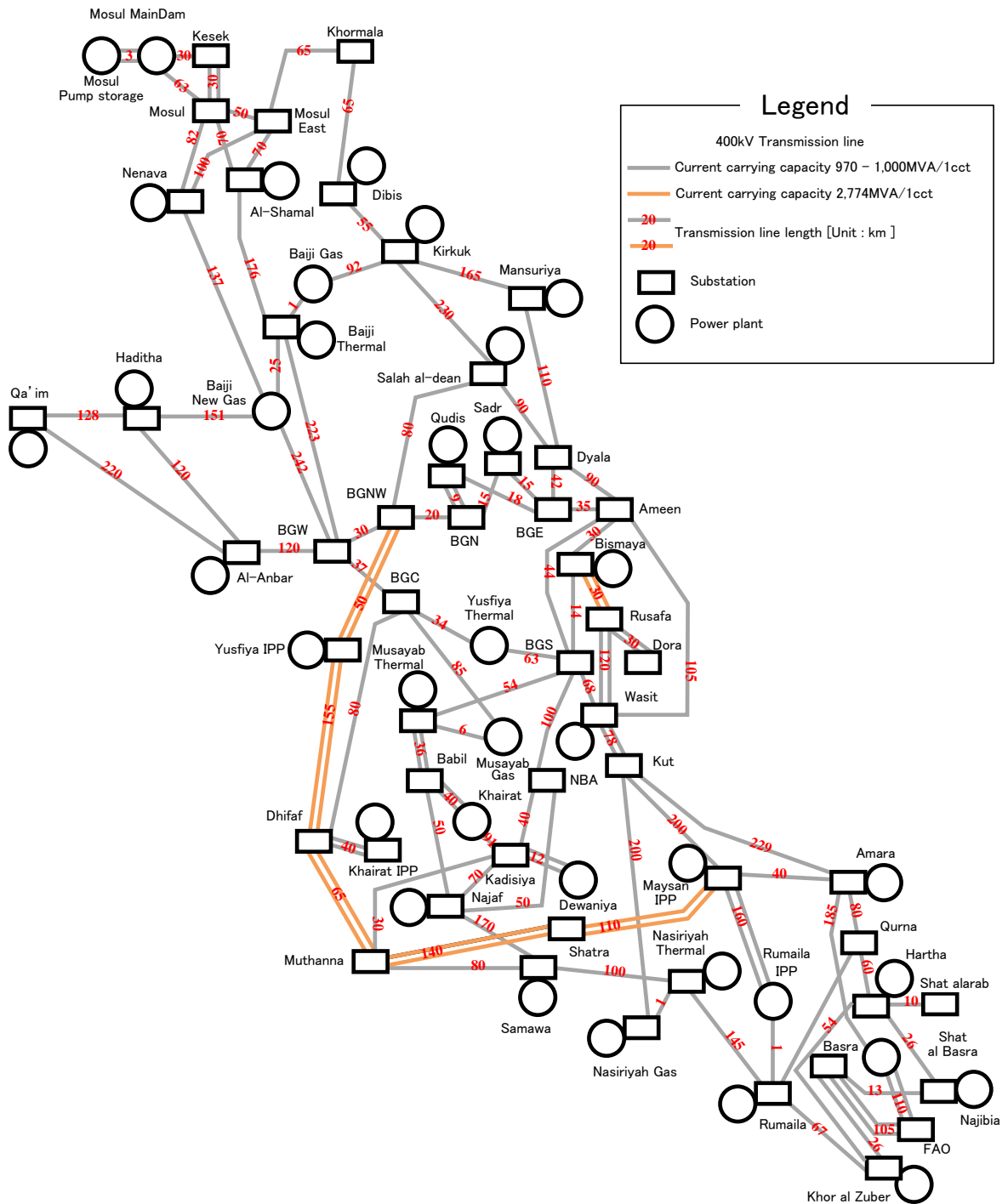
#### 3.2.1 Power Network System in 2020

Figures 3.2-1 and 3.2-2 show the planned 400 kV transmission line network in 2020 based on the PSS/E data provided by the MOE. The total length of the 400 kV transmission line is approximately 9,100 km, which is about two times that of in 2015.



(Source: PSS/E data in 2020 provided by the MOE)

Figure 3.2-1 Planned Power Network System in 2020



(Source: PSS/E data in 2020 provided by the MOE)

Figure 3.2-2 Planned 400 kV Transmission Line Length and Capacity in 2020

Two types of current carrying capacities are applied for the 400 kV transmission lines (i.e. 970-1,000 MVA and 2,774 MVA per one circuit). The later transmission lines are constructed from Maysan IPP Power Station to Baghdad North West Substation to transport generated power by the power plants in the southern area to central Baghdad area.

### 3.2.2 Power System Analysis

PSS/E data provided by the MOE contains the planned 400 kV and 132 kV power system in 2020. The Study Team corrected some parts of the data which apparently contained incorrect data regarding the 132 kV network. Some transformer tap values in the same substation were also modified in its proper range. Figures 3.2-3 and 3.2-4 show the results of the power flow analysis for the 2020 network, and the busbar voltage profile and power flow on the 400 kV network during the peak demand, respectively.

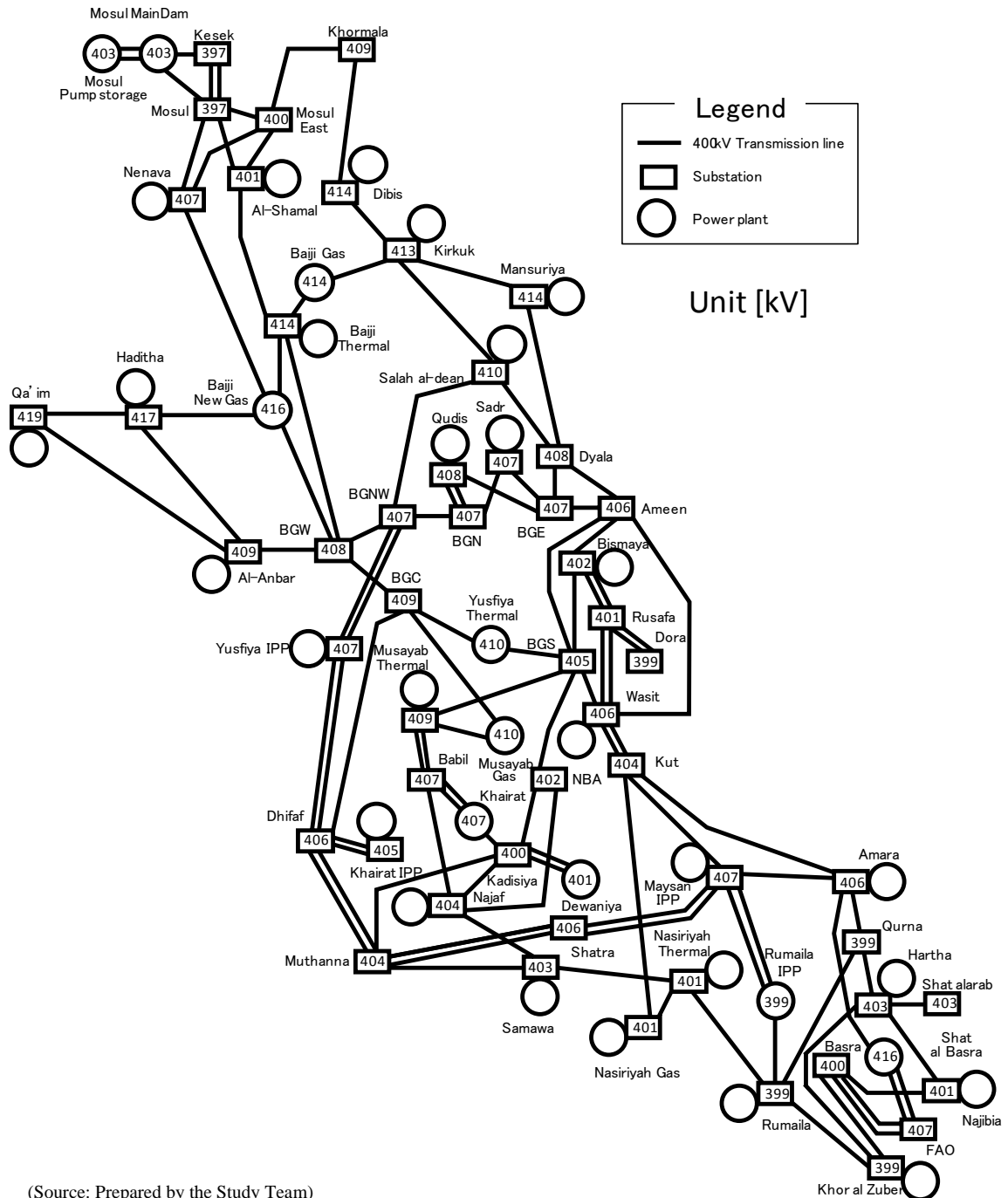


Figure 3.2-3 Substation Busbar Voltage Profile in 400 kV Network in 2020

As shown in Figure 3.2-3, the busbar voltage profile of the 400 kV and 132 kV systems were prescribed value by adjusting the generator terminal voltages, transformer tap values, and the amount of the static capacitors.

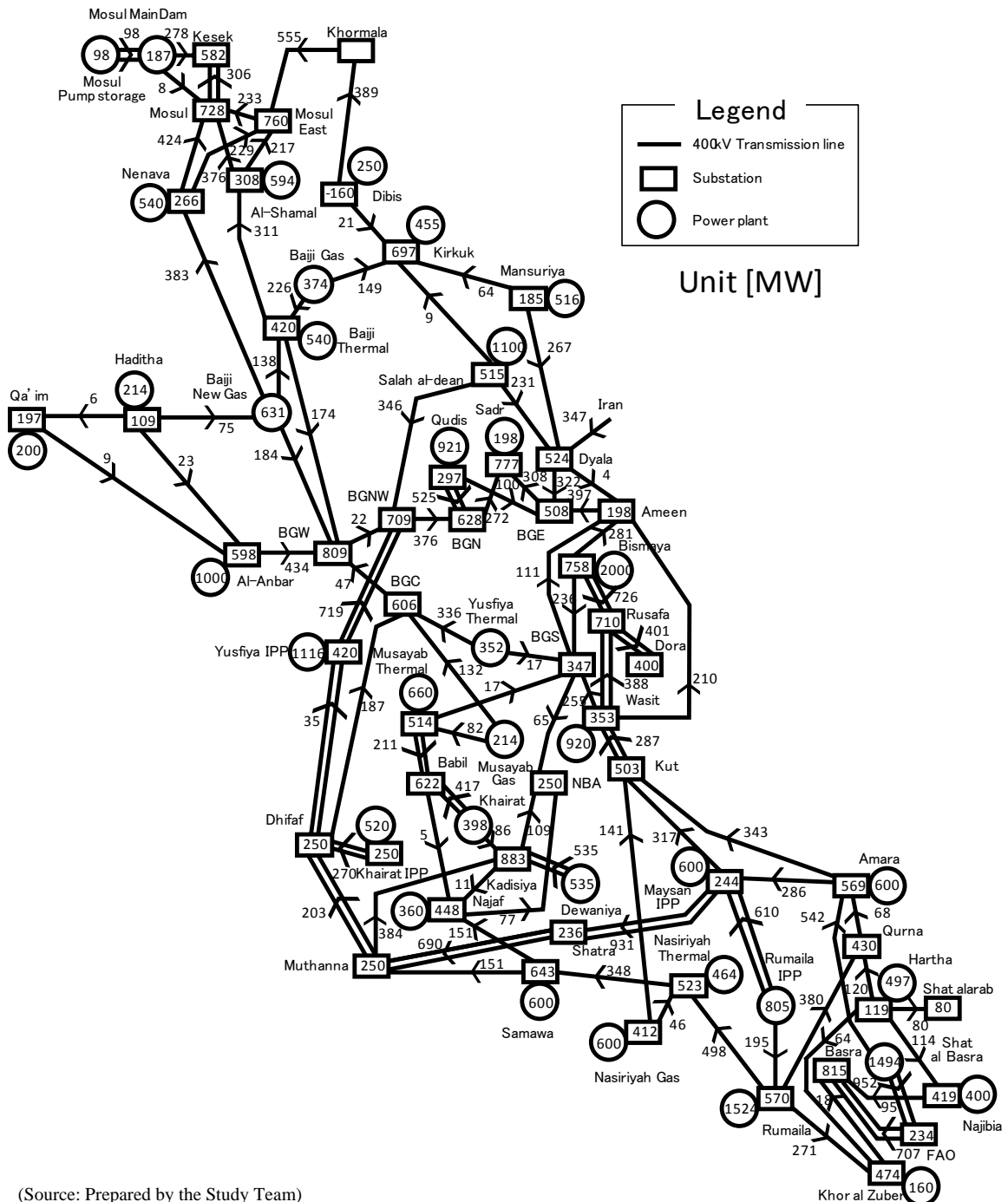


Figure 3.2-4 Power Flow on 400 kV Network in 2020

As shown in Figure 3.2-4, no overload is observed on all the 400 kV substations and transmission lines. On the 132 kV network, however, some overloaded lines and transformers are observed as shown in Tables 3.2-1 and 3.2-2.

Table 3.2-1 Overloaded 132 kV Transmission Lines

From	To	Capacity	Overload Level
Jamilah	New Jamilah	228 MVA	231.6%
New Jamilah	Sadr city	120 MVA	197.4%
Muthanna	Thawra	120 MVA	149.1%
Jamilah	Thawra	228 MVA	136.5%
Bagdad West	Jami'a	330 MVA	114.0%

(Source: Prepared by the Study Team)

Table 3.2-2 Overloaded 132 kV Transformers

Station Name	Capacity (132/33 kV)	Overload Level
East Dewaniya	63 MVA	110.3%
Himrin Hydra H.P.S	63 MVA	108.7%
North Najaf	63 MVA	100.7%

(Source: Prepared by the Study Team)

As shown in Table 3.2-1, five sections of the 132 kV transmission lines were overloaded. These transmission lines connect the 400 kV Baghdad East and Baghdad North substations. It seems that the planning of the 132 kV network expansion does not keep up with the rapid demand growth. As shown in Table 3.2-2, three 132 kV transformers were overloaded. To solve the situation;

- 1) Additional one or more transformers are to be installed at the overloaded substation.
- 2) A new substation is to be constructed near the overloaded substation.

### 3.2.3 Fault Current Analysis

Figure 3.2-5 shows the result of the fault current analysis, which assumed all generators connected to the grid are operating. The fault currents on the 400 kV and 132 kV systems up to the fifth level are shown in Tables 3.2-3 and 3.2-4, respectively.

Table 3.2-3 Result of Fault Current Analysis for 400 kV System

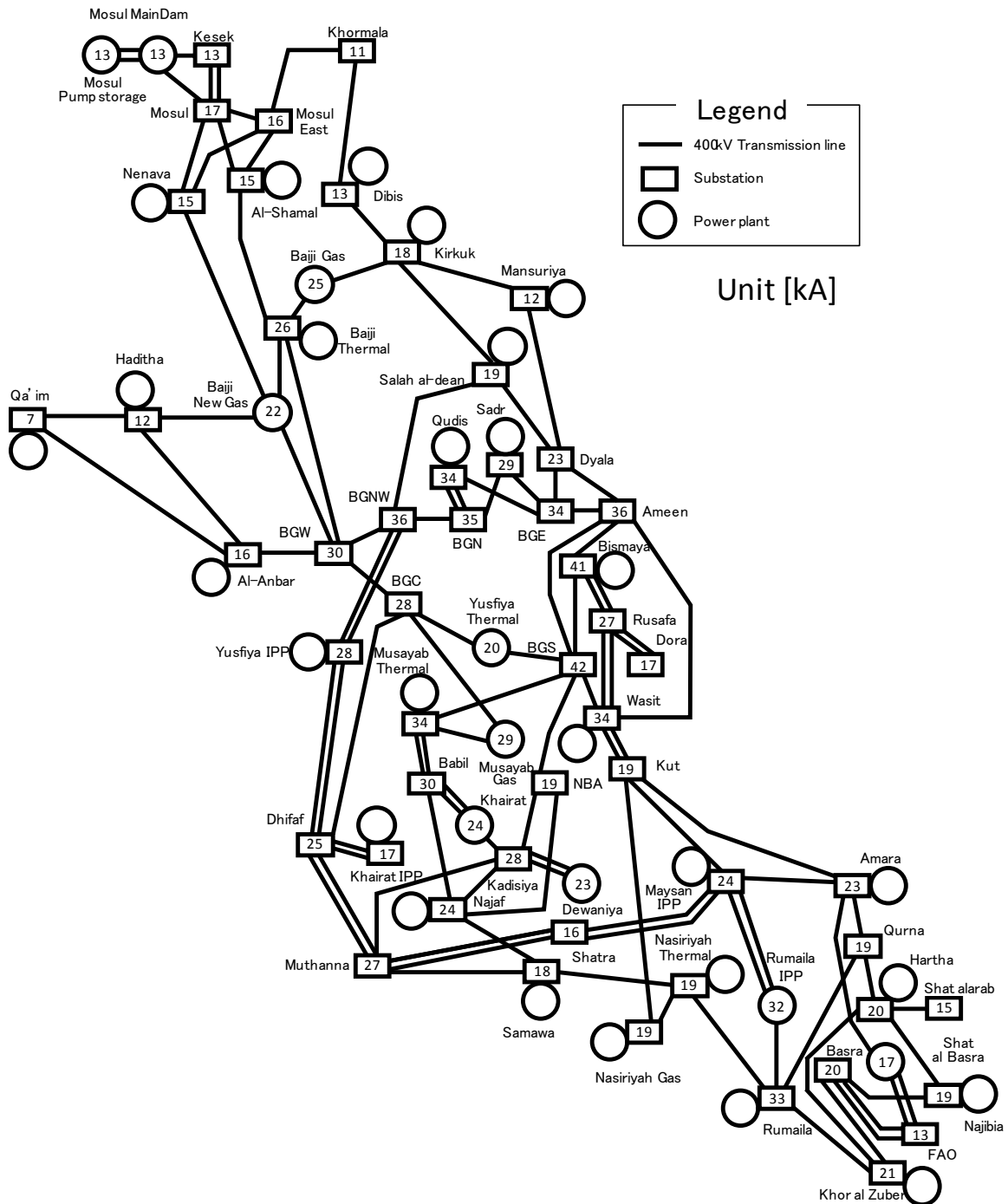
No.	Station Name	Fault Current [kA]
1	Bagdad South	42
2	Bismaya	41
3	Ameen	36
4	Baghdad North West	36
5	Baghdad North	35

(Source: Prepared by the Study Team)

Table 3.2-4 Result of Fault Current Analysis for 132 kV System

No.	Station Name	Fault Current [kA]
1	Jamilah	52
2	New Jamilah	52
3	Sadr city	51
4	Baghdad North	50
5	Thawra	50

(Source: Prepared by the Study Team)



(Source: Prepared by the Study Team)

Figure 3.2-5 Maximum Fault Currents on 400 kV Network in 2020

As shown in the tables, although all fault currents in the 400 kV substation are within the allowable range, in some of the 132 kV substations, they exceeded 40 kA. It is considered that the reason for the increment of fault currents in the 132 kV substations are as follows;

- 1) Development of many 400 kV transmission lines, substations, and power plants, and
- 2) Complex 132 kV loop network system.

To reduce the fault currents without cost, the following methods can be considered;

- 1) To change the loop network system to radial one, and
- 2) To change the substation double busbar system operation to split one.

However, these methods are not the best way because the system reliability might be reduced. The other way to reduce the fault current while keeping the system reliability is to change the rating of the 132 kV circuit breakers from 40 kA to 50 kA or 63 kA. However, since this may require changing the circuit breaker's rated voltage to the upper class, it is more realistic to reduce the fault currents by optimal network operation.

### 3.2.4 N-1 Analysis

To check the reliability level of the power network system, the Study Team carried out an N-1 analysis for the 400 kV and 132 kV network in 2020. The results of the analysis are shown in Table 3.2-5. In this table, overloaded transmission lines under the normal operation condition are excluded.

Table 3.2-5 Overloaded 132 kV Transmission Lines under N-1 Condition in 2020

From	To	Capacity	Overload Level
Mulla Adbulla	HWYJ	97 MVA	245.1%
Farabi	New Farabi	236 MVA	203.7%
Sadr city	Sadr city	120 MVA	189.2%
Najaf Gt.P.P	Najaf Town	97 MVA	171.8%
Farabi	Muthanna	228 MVA	167.4%
Shamiya	Kadisiya	123 MVA	159.1%
Kesil	KSK	236 MVA	153.4%
Bagdad East	BQBE	74 MVA	143.3%
Sinijar Cement	Talaafar	123 MVA	138.6%
Bismaya	Bismaya	330 MVA	136.1%
Kadisiya	North Dewaniya	123 MVA	135.5%
North Samarra	Daur	147 MVA	134.1%
Hurriya	Jami'a	120 MVA	131.6%
Basrah East	BSRW	120 MVA	131.1%
Baghdad South St.P.P.	Masbah	120 MVA	125.9%
Nasiriya thermal	Old Nassiriya	330 MVA	122.8%
Eskan al-khir	Baghdad Center	120 MVA	121.5%
Kesil	IT2A	123 MVA	120.9%
RMDN	RMDS	74 MVA	120.1%
Sadr city	New Farabi	228 MVA	120.0%
Kesil	Tel ado-Dhair	123 MVA	118.4%
Balad	Samarra Diesel	97 MVA	117.6%
Babil Broadcast	HILN	97 MVA	116.7%

South Samarra	Djeil	97 MVA	115.4%
New Rumaila	CPS3	97 MVA	115.3%
Jawahiry	HYD3	236 MVA	114.6%
Daur	HWYJ	147 MVA	114.5%
Nasiriya thermal	Insustrial Nassiriya	236 MVA	113.8%
Anah	Qa'im 400	97 MVA	111.9%
New Rumaila	Hmmar	97 MVA	111.8%
Shatra	Nasiriya thermal	236 MVA	110.7%
Babil Broadcast	New Iskandariya	97 MVA	109.5%
Kufa	HYD3	156 MVA	107.7%
Mosul	Badoosh	123 MVA	107.0%
New Baghdad	Nahrawan	74 MVA	106.7%
Kut 400( Wasit)	ZBP3	74 MVA	106.6%
Masbah	Alameen	120 MVA	105.7%
East Mosul	INSR	236 MVA	104.8%
IT2A	TWNT	123 MVA	104.8%
MSE3	INSR	236 MVA	104.3%
Baiji Thermal	North Baiji	97 MVA	103.7%
Old Nassiriya	Al-Massab Al'am	236 MVA	103.4%
Kadisiya	East Dewaniya	236 MVA	102.6%
Najibya P.S	AKDM	120 MVA	102.4%
Baghdad North	Adamyah	228 MVA	101.7%
Mshraq	NYN3	97 MVA	101.5%
Basrah Center	BSR3	228 MVA	101.4%
Yousfiya	Baghdad Center	123 MVA	100.5%

(Source: Prepared by the Study Team)

The analysis results shows;

- 1) The 400 kV transmission lines and the 400 kV substations satisfy the N-1 criterion.
- 2) The expansion plan of the 400 kV transmission lines and substations is not considered a problem.
- 3) The 132 kV transmission lines often do not meet the N-1 criterion.
- 4) Maximum overload on the 132 kV transmission line is about 245%.
- 5) The expansion plan of the 132 kV network needs further study.



**CHAPTER 4**  
***ELECTRICITY SECTOR RECONSTRUCTION PROJECT***  
***(IQ-P8)***

## CHAPTER 4 ELECTRICITY SECTOR RECONSTRUCTION PROJECT (IQ-P8)

### 4.1 General

Even though the power sector in Iraq is the foundation of all economic and social activities, because of the shortage of new investment and maintenance over the years, in power generation, transmission and substation and distribution to all areas, the function has drastically decreased, and the recovery is one of the most important issues in the country's reconstruction. Power generation capacity, which was over 9,000 MW in the 1990s slump to less than 4,000 MW at the moment, and nationwide and permanent long period of time of planed outages have been forced. Therefore, in addition to consumer supply, the power supply to the basic infrastructures including water supply and hospitals has also been suspended. It has been a major obstacle to social stability recovery and economic recovery. Therefore, the recovery of not only power generation facilities but also transmission and substation and distribution facility with low functionality have been crucial problems to be solved.

The main objective of the Electricity Sector Reconstruction Project (IQ-P8, hereinafter referred to as "the Project") is to stabilize the power supply over the country by means of construction and maintenance of substations and distribution facilities.

The fund provided by the Japanese ODA loan has been used for the supply of substation and distribution facilities and consulting services for the Project.

Executing agency of the Project is the Ministry of Electricity (MOE) in Iraq.

### 4.2 Scope of the Project

The Project consists of the following lots (subprojects);

**Lot 1:** Rehabilitation for the Existing 132 kV Mobile SS and Supply of New 132 kV Mobile SS  
(Subproject 1 and Subproject 2)

**Lot 2:** Supply of Transformer and Switchgear (Subproject 3 and Subproject 4)

**Lot 3:** Construction of New 132 kV SS (Subproject 5)

**Lot 4:** Construction of 33/11 kV Substations (Subproject 6 and Subproject 7)

**Lot 5:** Supply of 33/11 kV Mobile SS (Sub-project 8)

**Lot 6:** Construction of 400 kV GIS Substation

The scope of each lot (sub-project) is described below.

Lot 1: Rehabilitation for the Existing 132 kV Mobile SS and Supply of New 132 kV Mobile SS

Original contract rehabilitation for the existing 132 kV mobile substations and procurement for the new 132 kV mobile substation;

- 132/33 kV, 15 MVA Power Transformers (3 units)
- 132/11.5 kV, 10 MVA Power Transformers (3 units)
- 145 kV Vacuum Circuit Breakers (5 sets)
- 36 kV Vacuum Circuit Breakers (8 pcs)
- Earthing/Auxiliary Transformers 33/0.4 kV (4 units)
- Earthing/Auxiliary Transformers 11/0.4 kV (4 units)
- New Mobile SS 132/33 kV, 25 MVA (14 units)
- New Mobile SS 132/11.5 kV, 25 MVA (14 units)

Amendment of the Contract:

- 132/11.5 kV, 10 MVA Power Transformers (2 units)
- 36 kV Vacuum Circuit Breakers (2 pcs)
- 12 kV Vacuum Circuit Breakers (10 pcs)
- Earthing/Auxiliary Transformers 33/0.4 kV (4 units)
- Earthing/Auxiliary Transformers 11/0.4 kV (4 units)

Lot 2: Supply of Transformer and Switchgear

The scope of work includes but not limited to, design, manufacturing, and supply/delivery of transformers and switchgears to designated MOE warehouse that includes the following;

A) For Procurement of Transformers

- Auto Transformer 400/132/11 kV, 250/250/75 MVA
- Power Transformer 132/33/11 kV, 63/50/25 MVA, YDY
- Power Transformer 132/33/11 kV, 63/50/25 MVA, YYD
- Power Transformer 132/11 kV, 32 MVA
- Power Transformer 132/33 kV, 63 MVA

B) For Switchgears:

- 33 kV Metal-clad Switchgears (Complete substation set)
- 11 kV Metal-clad Switchgears (Complete substation set)

Lot 3: Construction of New 132 kV Substations

The scope of work includes but not limited to, design, manufacturing, supply/delivery, civil works, erection/installation, training and testing and commissioning for two 132 kV Air

Insulated Substations that includes the following:

A) For Basrah North Substation

- Ten - 132 kV AIS CB bays with steel structures, conductors and fitting, double busbar system;
- Three - three phase 63 MVA, 132/33 kV transformers;
- 23 - 33 kV metal-clad switchgear (GIS) bays, single busbar system; and
- Substation Control System (SCS), control/protection and communication system.

B) For Ali Gherby Substation

- Nine - 132 kV AIS CB bays with steel structures, conductors and fitting, double busbar system;
- Two - three phase 63 MVA, 132/33/11 kV transformers;
- 13 - 33 kV metal-clad switchgear (GIS) bays, single busbar system;
- 13 - 11 kV metal-clad switchgear bays, single busbar system; and
- SCS, control/protection and communication system.

Lot 4: Construction of 33/11 kV Substations

The scope of work includes but not limited to, design, manufacturing, supply/delivery, demolition, civil works, erection/installation, training and testing and commissioning for the following:

Original scope

A) Rehabilitation of the following 16 existing 33/11 kV substations (Subproject No.6)

- Al-Riyath (2x31.5 MVA)
- Thawra-B (2x31.5 MVA)
- Al-Sinaa (2x31.5 MVA)
- Al-Battaween (2x31.5 MVA)
- Al-Mekaneek (2x31.5 MVA)
- Al-Mutanabi (2x31.5 MVA)
- Al-Salam (2x31.5 MVA)
- Al-Jumhure (2x31.5 MVA)
- Al-Uruba (2x31.5 MVA)
- Al-Karama (2x31.5 MVA)
- Aluminum Sections (2x31.5 MVA)
- Al-Mirded (2x31.5 MVA)
- Al-Tomoor (2x31.5 MVA)
- Al-Mulawatha Al-Aysar (2x31.5 MVA)
- Dawasa (2x31.5 MVA)
- Shafaa (2x31.5 MVA)

- B) Extension of the following eight 33/11 kV substations (Subproject No.7)
- Abu Jasra (2x31.5 MVA)
  - Al Yabanya (2x31.5 MVA)
  - Kilo 29 (2x31.5 MVA)
  - Al Amir (2x31.5 MVA)
  - Al Garraf (2x31.5 MVA)
  - Hammam Al-Alil (2x31.5 MVA)
  - Al-Naseej (2x31.5 MVA)
  - Al-Darragy (2x31.5 MVA)

Modified scope

The following 24 numbers of 33/11 kV substations are covered by the Project:

- A) North Region: A total of five substations
- N1: Al-Mulawatha (2x31.5 MVA)
  - N2: Al-Dawasa (2x31.5 MVA)
  - N3: Al-Shifa (2x31.5 MVA)
  - N4: Hammam Al-Alil (2x31.5 MVA)
  - N5: Abu Jasra (2x31.5 MVA)

However, the scopes of the above substations have finally eliminated.

- B) Baghdad Region: A total of six substations
- B1: Al Riyath (2x31.5 MVA)
  - B2: Thawra-B (2x31.5 MVA)
  - B3: 14th of July (2x31.5 MVA)
  - B4: Abbakhana (2x31.5 MVA)
  - B5: Al-Sabiaat (2x31.5 MVA)
  - B6: Al-Mutanabi (2x31.5 MVA)

The following scopes of the substations were added instead of the above N1 to N5 substations:

- B7: Al Dora (2x31.5 MVA)
  - B8: Al Jawadeen (2x31.5 MVA)
  - B9: Cotton Industries (2x31.5 MVA)
  - B10: Affaq (2x31.5 MVA)
  - B11: Al Furat (2x31.5 MVA)
- C) Middle Region: A total of seven substations
- M1: Al-Salam (2x31.5 MVA)
  - M2: New Al-Jumhure (2x31.5 MVA)
  - M3: Al-Uruba (2x31.5 MVA)

- M4: Al-Amir (2x31.5 MVA)
- M5: Al-Naseej (2x31.5 MVA)
- M6: Al-Shuhada (2x31.5 MVA)
- M7: Kilo 29 (2x31.5 MVA)

D) South Region: A total of six substations

- S1: New Al-Karama (2x31.5 MVA)
- S2: Aluminum Sections (2x31.5 MVA)
- S3: New Al-Mirbed (2x31.5 MVA)
- S4: Al-Tomoor (2x31.5 MVA)
- S5: New Al-Fathliaa (2x31.5 MVA)
- S6: Al-Darragy (2x31.5 MVA)

Lot 5: Supply of 33/11 kV Mobile SS

The scope of work is not limited to, design, manufacturing, and supply of mobile substation but includes the following:

- Mobile substations for 33/11 kV, 16 MVA, eight units

Lot 6: Construction of 400 kV GIS Substation

The scope of work is not limited to, design, manufacturing, supply/delivery, civil works, erection/installation, training and testing and for 400 kV GIS substation but includes the following:

1) Indoor type 400 kV GIS-50 kA (1-1/2 CB system)	12 CB
2) Indoor type 132 kV GIS-40 kA (double busbar)	24 CB
3) 400/132/11 kV 250/3 MVA Auto transformers (3x1P)	4 units
4) 400 kV 50 MVA shunt reactors	4 units
5) 11 kV metal-clad switchgear for auxiliary circuits	1 Lot
6) 400 kV outdoor equipment	4 ccts
7) 132 kV outdoor equipment	16 ccts
8) SCS (Substation Control System)	1 Lot
9) Protection system and other associated systems	1 Lot

Figure 4.2-1 shows the location of the project sites.

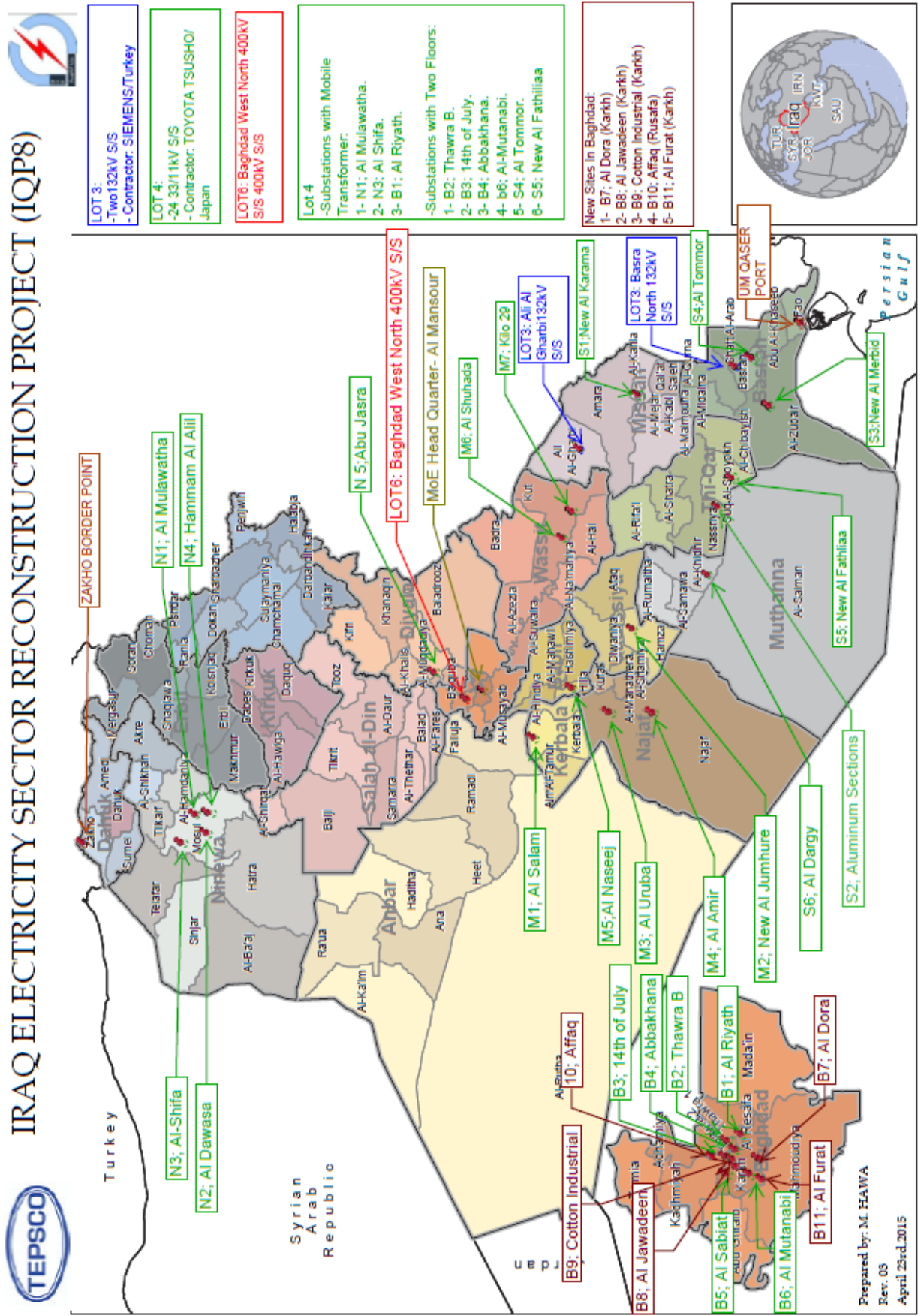


Figure 4.2-1 Location of the Project Sites (Source: MOE)

### **4.3 Progress of the Project**

The progress of the Project in each milestone is described below.

1) PQ Announcement

PQ announcement, which was done through a newspaper advertisement, was made through three newspapers in Iraq and two newspapers in Jordan. In order to secure fairness in the tenderers, all the advertisements were made in the same lot and on the same day. Also, the MOE immediately reported JICA a copy of the advertisement.

2) PQ Submission

Tenderers were requested to submit its PQ application to the Office of the Consultants in Amman, Jordan with the presence of MOE delegates. No late submission was accepted in accordance with the instruction of PQ. All the pages of the submitted PQ application have been duly stamped in order to identify the original copy and the MOE delegates took copies for further evaluation.

3) Tender Document Distribution

The MOE submitted the PQ evaluation report to JICA with support from the consultants for concurrence. Upon the issuance of the no objection letter from JICA, the MOE informed those who passed the PQ process to pick up their tender documents from the Office of the Consultants. The consultants reported to the MOE the distribution of the tender documents.

4) Tender Document Submission and Opening

Tenderers who passed the PQ process were requested to submit the tender documents (two-envelope system) to the Office of the Consultants by the designated time and date in the tender documents. The consultants performed the tender openings with the presence of the MOE delegates and representatives from the different tenderers. Some of the tenderers have been disqualified because of their failure to comply with the tender documents at the opening. The MOE strictly followed the guidelines of JICA.

No late submission was accepted in accordance with the instruction. All the pages of the submitted tender have been duly stamped in order to identify the original copy and the MOE delegates took copies for further evaluation.

5) Contract Negotiation

Upon concurrence from JICA, the MOE invited the first ranked tenderer for the contract negotiation. All the negotiations have been performed at the Office of the Consultants with the support from the consultants. As soon as the contracts were initialed, the MOE submitted them to JICA for their initial review.



6) Contract Signing

Upon the completion of the review of JICA, the MOE and the contractor signed the contract.

The MOE sent the signed contract to JICA for concurrence.

7) Construction Commencement

The commencement of the contract has been set as the issuing date of the L/Com for all the contracts under the IQP8.

8) Taking Over Acceptance Certificate (TOAC)

When the MOE and the contractor have confirmed a snag list, the contractor is then entitled to submit a request for TOAC.

9) Final Acceptance Certificate (FAC)

As soon as the warranty period of two years is completed, the contractor is entitled to submit a request for FAC.

Table 4.3-1 shows the milestones of each of the lot of the Project.

Table 4.3-1 Milestones of the Project (Source: MOE)

Activity	Lot 1		Lot 2	Lot 3	Lot 4		Lot 5	Lot 6
	Contract	Amendment Contract			Contract	Amendment Contract		
PQ Announcement Date	-		Nov 09, 2009	Dec 15, 2009	Jan 12, 2010		Dec 07, 2009	Dec 14, 2011
PQ Submission Date	-		Jan 10, 2010 (16 applicants)	Mar 10, 2010 (10 applicants)	Apr 11, 2010 (5 applicants)		Feb 1, 2010 (13 applicants)	Jan 16, 2012 (7 applicants)
Distribution Date of Tender Documents	Nov1, 2009 -Toyota Tsusho		August 1-2, 2010 -Toyota Tsusho -Sumitomo -Hyosuug	Feb 28-Mar 1, 2011 -Toyota Tsusho -ABB -Areva -Siemens	April 27-28, 2011 -Toyota Tsusho -Saudi Cable		August 23-24, 2010 -Toyota Tsusho -Sumitomo -Nissin -Hyuudai	May 29-30, 2012 -JVC of Siemens AG & Siemens AS -JVC of Toshiba &STX -Alstom Grid SAS
Submission Date of Tender	Nov 23, 2009		Oct 03, 2010	Jun 15, 2011	Aug 15, 2011		Oct 20, 2010	Sep 24, 2012
Signing Date of Contract	March 1, 2010	Aug 15, 2011	Mar 10, 2010	Apr 04, 2012	Jul 02, 2012	Nov 05, 2015	Mar 11, 2011	May 24, 2015
Commencement Date	Jun 30, 2010	Sep 22, 2011	May 12,2011	Nov 01, 2013	Dec 27, 2012	Jan28,2016	May 27, 2011	Nov27,2015
Date of TOAC	- SP01:Dec 29, 2010 - SP02:Aug 28, 2011	-Amendment of Contract: July 18, 2012	-TOAC 11kV HHI SWGR: June 26, 2014. -TOAC33kV Siemens SWGR: November 30, 2014. -TOAC Meidensha: June 29, 2013. -TOAC 400kV HHI Auto Transformer: November 18, 2013	Ali Gharbi: March 13, 2016. Basrah North: March 13, 2016.	-B1: Feb 14, 2016 -B2: July 2, 2015. -B3: July 12, 2015. -B4: July 2, 2015. -B5: Oct 8, 2015 -B6: July 2, 2015. -M1: July 5, 2015. -M2: July 7, 2015. -M3: July 27, 2015. -M4: Aug 2, 2015. -M5: July 5, 2015. -M6: Aug 27, 2015. -S1: Sep 2, 2015. -S2: July 27, 2015. -S3: Aug 9, 2015. -S4: July 2, 2015. -S5: Sep 7, 2015 -S6: July 15, 2015.		Jul 23, 2012	
Date of FAC	-SP01:July13, 2012	-	-FAC_Meidensha: January 5, 2015	-	-		-	-

**CHAPTER 5**  
***LESSONS LEARNED FROM IQ-P8***

## **CHAPTER 5 LESSONS LEARNED FROM IQ-P8**

The Study Team received the replies from the MOE Distribution Office and comments from the consultant of the project implementation concerning “Lessons Learned from the IQ-P8 Project”. Those lessons learned are described hereunder.

### **5.1 Lessons Learned from IQ-P8 Lot-4 and Lot-5**

The Distribution Office of MOE was in charge of Lot-4: Construction of 33/11 kV Substations, and Lot-5: Supply of 33/11 kV Mobile Substations of IQ-P8.

According to the Distribution Office of MOE, lessons learned from Lot-4 and Lot-5 of IQ-P8 are as follows:

- 1) Working with a reputable consultant (TEPSCO) was a very good opportunity to develop the human resources abilities. Moreover, full confidence about the importance of the consultant’s role in the projects was reached.
- 2) These projects gave them a chance to learn more on the pre-qualification stage (which are not usually used at MOE). The Distribution Office learned how to manage this stage and the preparation of documents.
- 3) Working with JICA made the Distribution Office understand a lot about the Fédération Internationale des Ingénieurs-Conseil (FIDIC) rules, which is internationally recognized.
- 4) The Distribution Office experienced on how to prepare contract documents, and build a strong contract.
- 5) Preparing the technical specifications for the tender document made the Distribution Office review (with the help of the consultants) all already used specifications, thus, the office was able to improve and develop it according to the latest international standards.
- 6) During the design stage, many meetings were held with the contractor, the Distribution Office had an opportunity to improve their human resources capabilities in the discussion, designing, and decision-making. Moreover, the office learned that the longer the time spent to finalize the designs, the less unforeseen problems are faced at the implementing stage.
- 7) The Distribution Office’s site staff also had experienced and learned from all the site activities during the project implementation stage, high performance implementation, and how to speed up work, solve conflicts, and prioritize safety.

- 8) As Lot-4 project suffered from serious implementation delay, the Distribution Office also learned much about evaluating the real reasons of delay and countermeasures.

## 5.2 Lessons Learned from IQ-P8 Lot-1 to Lot-6

According to the consultant of the project implementation of IQ-P8, the following comments are lessons learned from Lot-1 to Lot-6 of IQ-P8 as follows:

- (1) Lot-1: Rehabilitation of Existing 132 kV Mobile SS and Supply of New 132 kV Mobile SS

### Defects and accidents after competition

- 1) Failure on 33 kV vacuum circuit breakers during the warranty period  
Internal short circuit on phase R caused heavy damage on the 33 kV vacuum circuit breakers; the winding and insulation material were damaged.
- 2) 132/11.5 kV 25 MVA transformer during the warranty period  
Lightning surge caused severe damage on phase A, resulting to failure of the winding and breakdown on the insulation material.

The countermeasures to the abovementioned will be;

A highly and comprehensive periodical check and maintenance should be carried out on the equipment, to assure the health conditions of the equipment, also following the manuals' procedures in the general maintenance of the equipment will prevent any problems to arise.

The Study Team's comment:

Initial troubles sometimes occur after the completion and commissioning of general projects, however, periodical check and maintenance will help find out the troubles in the earlier stage.

- (2) Lot-2: Supply of Transformers and Switchgear

### Design period (Design conditions)

The following terms will contribute to the efficient procedure of this stage:

- 1) Defining in advance exactly where the supplied equipment will be installed.
- 2) Deciding if there will be interconnection between the existing equipment and the new supplied equipment.
- 3) Highlight any special requirements or critical things in the existing sites.
- 4) Reviewing the design with the authorized staff of the existing sites, and recording exactly their approval or comments, if any.

The Study Team's comment:

Those terms seem to be what the project implementation team of MOE and the consultant

has carried out and recommended to follow in the future projects.

Construction period (Manufacturing stage)

- 1) According to the contract conditions, the owner (the MOE) has the right to visit the manufacturing factory during the manufacturing process; this will eliminate any possible mistakes at the latter stage as what happened with the 33 kV switchgear from Hyundai Heavy Industries.
- 2) From the experience in Lot-2, it was found that the third party inspector (IRI: International Reputable Inspector) employed by the contractor was not useful and the appointed IRI was blacklisted from the owner. In case the owner prefers to use a third party inspector, they should be hired directly by the owner and not through the contractor.

The Study Team's comment:

As for the factory visit: Although the owner has the right to visit the manufacturing factory during the manufacturing process, it may be difficult and not practical to visit all the manufacturing processes.

As for the third party: The lesson learned could be a good reference and helpful to the future project.

Construction period (Transportation stage)

Tax exemption arrangement should be completed as early as possible for smooth execution of the project. The owner should assist the contractor more in coordination with related governmental officials to facilitate importing and releasing of equipment from the customs.

The Study Team's comment:

This kind of problem occurs in projects in other countries as well. The contractor should make the arrangement as early as possible, and the owner's assistance is also important.

Accidents and defects after competition;

- 1) Damage on oil pipe for 132/11 kV 25 MVA transformer in handling work of cargo at Umm Qasr Port  
Damaged transformer was shipped back to the manufacturer's factory in Japan on December 20, 2012 and the repaired one was shipped back to Khor Al-Zuber warehouse on June 30, 2013, where the total delay period was 322 days.
- 2) Defect on on-load tap changer for 132/33/11.5 kV 63 MVA transformer for Old Jameela Substation during the warranty period (Date of fault: July 27, 2014).  
New main tank for the transformer including on-load tap changer was supplied

(restoration work was duly completed on February 15, 2017), where the total non-availability period of the transformer was about 30 months.

3) Busbar segregation of 33 kV switchgear (HHI)

It was found that during the factory test of the HHI that the 33 kV switchgear failed to fulfill the technical specifications of the contract. The new manufacturer (Siemens) of the 33 kV switchgear was proposed by the contractor and it was supplied on November 30, 2014 with a delay of about 27 months from the original completion date.

4) Bushing connections for the 400 kV auto-transformer

Bushing connections for the 400 kV auto-transformer did not match the existing 400 kV GIS during the installation at site within the warranty period. Modified bushing connections were supplied by the contractor on November 18, 2013 with a delay of about 15 months from the original completion date.

5) Defects on the 11 kV protection relays

The contractor replaced all the defected equipment for the 11 kV protection relays during the warranty period and also after the warranty period.

The countermeasures to the abovementioned will be;

- Handling work of cargo at Umm Qasr Port should be carried out with more care and by experienced staff.
- Contract documents should include specific requirements in case of shipping back the equipment to the manufacturer's factory.
- Issuing re-export permission should have a simpler and faster process.

The Study Team's comment:

Although it may be difficult even for the contractor to control the handling work at the port, the contractor should request/instruct the handler to be more careful and use experienced staff.

(3) Lot-3: Construction of New 132 kV Substations

Tender procedure (Tender evaluation, etc.)

The tender documents were issued to the four prequalified applicants, and three tenderers submitted their tender offers, which comprised

- Envelope A; Letter of technical proposal and tender security
- Envelope B; Letter of financial offer and price schedule

One of the three tenderers submitted a copy of the tender security documents instead of the original document, and the evaluation committee considered this tenderer to be disqualified,

so this is one of the lessons to be learned.

The Study Team's comment:

The lesson is applicable to the tenderers, which is clearly requested in the tender documents.

Construction period (Contractual matters)

Delay for Letter of Credit (L/C) opening: after fully signing the contract on April 4, 2012

- The Bank of Tokyo Mitsubishi requested to change the beneficiary bank country of origin to be the same as the contractor's country of origin.
- The Ministry of Planning instructed that the project should be exempted from tax.
- Contract was amended on March 25, 2013, according to the tax exemption.
- L/C was issued on July 1, 2013.
- L/C was amended on October 31, 2013, to change the latest shipping date and expiry date.
- Total period of delay was 12 months.

The Study Team's comment:

L/C opening process should be proceeded as early as possible. This kind of delay in L/C opening is sometimes found in other projects. It is important that all the concerned parties should fully understand in advance the procedure for a smooth process in the opening of the L/C.

Construction period (Transportation stage)

The materials' shipments were delayed due to force majeure (ISIL attack) that occurred in the northern part of Iraq, which caused the main road from the north of Iraq through Mosul to Baghdad to be closed, accordingly, the contractor claimed for time and monetary compensation.

In regard to this situation, the owner might/could have advised the contractor to choose an alternate route to safely deliver the materials' shipments.

The Study Team's comment:

This is a typical incident of force majeure, which would not occur in normal projects. The owner might give some advice/information in selection of alternate routes, but the selection of the route is the contractor's responsibility and at his discretion.

Construction period (Site management structure)

The contractor should assign an efficient site manager with a good team of engineers,



technicians and workers to have the work done smoothly and of quality.

The Study Team's comment:

The abovementioned statement is correct, however, considering the country's security situation, it might have been difficult.

Construction period (Safety measures)

- 1) One of the most important points on project implementation is to secure the safety of workers, where the contractor should assign a well-trained safety engineer to monitor the site work, and should consider the safety requirements to keep it safely executed, preventing all kinds of harmful accidents.
- 2) Due to tribe conflicts near the Basrah North Substation which are using different kinds of weapons, one bushing of 132 kV circuit breaker was damaged and the contractor replaced it with a new one. Although one cooling radiator of the main power transformer was shot by a bullet, fortunately, no oil leakage happened.

The owner and the consultant noticed that the contractor should take the maximum safety measures to protect the life of their staff. One of the most important safety measures was to give priority to complete the boundary wall around the project site and install it in the main entrance gate. More security information could have been shared among all relevant parties.

The Study Team's comment:

The tribal conflicts are not normal circumstances for project implementation. In such situation, frequent communication among the project relevant parties seems to be important.

- (4) Lot-4: Construction of 33/11 kV Substations

Design Period

- 1) Delay due to the contractor's design works  
The contractor started the design work after the successful contract meeting since the design work took a long time during the contract period. However, they held a design submission until the final approval of the contract. In addition, the contractor did not start their work with "Conditionally Approved" drawings and the contractor waited until the full approval of the complete set of drawings.

The delay could be avoided if the contractor was able to start the mobilization as soon as the "Conditionally Approved" drawings were issued.

The Study Team's comment:

The contractor could have avoided the delay if they had started their work upon the receipt of

the “Conditionally Approved”, however, to be contractual, it is the contractor’s discretion to proceed or wait.

#### Tender procedure (Preparation of Tender Documents)

At the stage of preparing the tender documents, there was a change in the project scope as follows:

At the beginning; Construction on new location: 16 sites, Rehabilitation of existing substation: 8 sites.

At final; Construction on new location: 21 sites, Rehabilitation of existing substation: three sites.

The total period of delay for the abovementioned was 12 months.

Preparation and changing of tender documents should be started in the very early stage of the project as it consumes time for long discussions and clarification between the owner and the Consultant, as follows:

- Selection of locations
- Site investigation for conditions inside and outside (adjacent obstacles on boundary line) according to changing of sites/locations
- Changing of civil design on specified sites/locations
- Discussion for selecting reusable equipment (switchgear, others) on the rehabilitation of existing substation
- Individual layout design is required due to limited and different dimensions of land location

To minimize the tender documents’ preparation period, it is recommended that the standardized substation layout may be applied to all substation sites as much as the owner can require an adequate land for the standardized layout.

The Study Team’s comment:

In case that there are changes in the site location, design condition and scope, then more time is required in the preparation of design, based on which tender documents are prepared. Therefore, it is important to firm up the fundamental conditions of the project beforehand.

#### Contract procedure (Contract negotiation)

Piling issue: refer to Construction period – “Issues during construction”.

Construction period (Transportation stage)

Due to the ISIL invasion, the northern border was closed after June 2014, resulting in a failure or delay in the equipment and materials transportation. Although this was an unpredictable situation, the owner might be able to better support the contractor in cooperation with the concerned government officials.

The Study Team's comment:

In this emergency situation, the owner might be able to share security information among the government organizations and support the contractor. However, this type of case is an unpredictable abnormal situation, which is a case not applicable to ordinary projects.

Construction period (Safety measures)

The contractor should have nominated and arranged safety officers at the sites to keep safety conditions as per the contract, however, they have not been arranged at some sites.

The Study Team's comment:

As per the contract, it is recommended to arrange safety officers at the sites by the contractor. This lesson learned could be a reference and could be helpful for future projects.

Construction period (Issues during construction)

1) Price of Piling Works:

The issue started once the contractor confirmed the technical needs for piling works at the two substations (M1; Al Salam and S4; Al Tomoor), the project suffered a lot of delay due to the consequence of unconfirmed unit price for piling works in the contract documents.

The unit price for piling works in the contract was deleted in the contract negotiation stage and agreed to be discussed in due time, if needed. However, once the technical needs for piling confirmed the point of disagreement on the cost of pile affected the progress, it will keep a major outstanding pending issue delaying the time of the project.

2) Land Ownership:

The issue of land ownership started at B1; Al Riyath Substation after the contractor completed the demolition of the existing substation equipment and started the works in the raft foundation for MV switchgear and auxiliary building. An unknown person claimed the property of the land, where the substation will be built (replacing the old one) and as a result, all site works were stopped for seven months due to the assaults on the people working at the site.

The issue caused delay in the completion of site works as the contractor was prevented

from entering the site and continuing the works until the owner reached an agreement with the party claiming the land.

The Study Team's comment:

Piling Work: The unit price of the piling work should have remained in the contract documents.

Land Ownership: The land ownership of the project site should be confirmed and/or acquired as necessary at the early stage of the project implementation. This case would be a lesson for future projects in general.

After completion (Defect, etc.)

Some shock log data during the transformer transportation could not be extracted from some of the shock recorders installed on the transformers at the site. And the solution to this matter was to conduct necessary tests in accordance with the IEC to prove the healthiness of the transformers.

The Study Team's comment:

This incident sometimes occurs during the heavy equipment transportation of substation projects. One of the alternative countermeasures is that the shock log meter should be locked and sealed so that the data would not disappear. This lesson learned could be a reference and could be helpful to the future projects.

(5) Lot-5: Supply of new 33/11 kV Mobile Substations

After completion (Defect, etc.)

- 1) In Final Receiving Inspection;
  - Broken oil pipe for one spare transformer
  - Oil leakage for all auxiliary transformers
  - Shock log data could not be exacted from all shock recorders

The contractor repaired and replaced all the defects of the equipment.

- 2) The 11 kV current transformer was damaged during the warranty period, and the contractor provided replacement.
- 3) The auxiliary transformer with a defect that was found during the warranty period, the contractor provided replacement (but is not yet complete).

The Study Team's comment:

Initial troubles sometimes occur after completion and commissioning in general projects, however, periodical check and maintenance helps to find out the troubles in the earlier stage.

A highly and comprehensive periodical check and maintenance should be carried out on the equipment, to assure the health conditions of the equipment, also following the manuals' procedures in the general maintenance of the equipment will prevent any arising problems.

(6) Lot-6: Construction of the 400 kV Baghdad West North Substation

Design period (Design conditions)

- 1) Site situation in addition to checking the nearby places is important; the site coordinates were located accurately before the tender stage to avoid any problems. However, six months after signing the contract, it was informed that the near land was a military land and there will be restrictions for the overhead lines and towers to pass through the military land. Finally, after many discussions and meetings, the layout of the substation was completely changed, and the arrangements of the building were modified to match the new restrictions.
- 2) Soil report, which was a part of the tender documents, should have been requested to the owner at the earlier stages of the project, since the soil report was delivered to the consultant after around six months.

The Study Team's comments:

Restrictions for the overhead lines and towers: The restrictions for the overhead lines and towers to pass through the military land should have been identified during the planning stage of the substation. This lesson learned could be a reference and could be helpful to the future projects.

Soil reports: This lesson learned could be a reference and could be helpful to the future projects.

Tender procedure (Preparation of Tender Documents)

To reduce the needed time and effort; it is recommended to send individually the technical specification by each subject and discuss it with the interested department or engineers of the owner. Sending the whole tender documents to the owner can cause a lot of delay and may not be reviewed by the interested department, which will generate future technical comments that are not in line with the contract specifications after the contract signing.

The Study Team's comment:

This procedure seems to be what the consultant and the owner conducted during the preparation of the tender documents. This practice that was carried out could be a reference and could be helpful to the future projects.

Tender procedure (Qualification)

It was not sufficient for the validity of tender security to be 30 days after the validity of the proposed tender documents as correspondences among the owner, tenderers and the consultant need more time than expected.

The Study Team's comment:

Around 30 days is the standard period of tender security after the validity of the tender proposal. This case may be an exceptional case because the owner, the consultant and the tenderers could not conduct a face-to-face communication due to the country's security. This should be taken into account in the same stage of the future projects.

Construction period (Contractual matters)

- 1) The owner's site teams were trained before the commencement date by the Consultant to be familiar with the Documentation Manual, Site Management Manual and different site situation with the contractual action to deal with.
- 2) It was noted that the contractor has some time or a gap between the approved design and the installation plan, considering that many equipment drawings were issued by the factories and the installation was a scope of another teams of the contractor or the subcontractor. Therefore, especially for the benefit of the civil work team, it is important to confirm for the installation plan, layout and information for each equipment to reflect necessary details to the civil/installation drawings.

The Study Team's comments:

Training for site team: This case is categorized as a preferable example of training of the site staff before the contractor's commencement by the consultant. This lesson learned could be a reference and could be helpful to the future projects.

Contractor's gap in design: For the installation and civil design work, the installation plan, layout and information for each equipment should have been prepared so that electrical and civil work could be coordinated with each other within the contractor's scope. This lesson learned could be a reference and could be helpful to the future project.

Construction period (Transportation stage)

Letters for tax exemption must be requested well enough in advance by the contractor through the owner before the shipment (i.e., recommended to be done as early as possible even before the commencement date).

The Study Team's comment:

The tax exemption process is generally preceded by the contractor, a tax authority

sometimes including the borrower with assistance from the executing agency, and longer time tends to be taken. This lesson learned could be a reference and could be helpful to the future project.

Construction period (Safety measures)

- 1) As feedback from previous projects, it was difficult to make the laborers from the contractor or subcontractors to follow the safety regulations at the site. However, for this project, all the laborers were wearing safety equipment and following the safety regulations most of the time. This could be ensured by the continuous concern from the subcontractor and a follow up from the contractor, from time to time.
- 2) For the security of the site; the owner, contractor and the consultant should consider the possibility to call out the police force from the owner to secure the site for 24 hours for seven days, depending on the security condition.

The Study Team's comments:

Safety regulation: This case seems to be what the contractor's project implementation team has already carried out. Therefore, it is recommended to follow this practice in the future projects as well.

Site security: This case seems to be a special case where security is not good. Therefore, this case may not be a reference for future ordinary projects.

(7) Common Issues

Tax Exemption before ISIL invasion (in June 2014) in the northern part of Iraq

Normal procedure;

- The contractor requests the owner to issue the tax exemption letter with shipping document in Arabic.
- The owner will convey the contractor's request to the Ministry of Planning (MOP).
- MOP will issue a reply letter to the owner's request, if the contractor's request is eligible, with a copy to the Ministry of Finance (MOF).
- MOF will issue the letter to the points of entry (Zakho border point and Umm Qasr Port) to facilitate importing material as per shipping document with a copy to the owner for information.
- The owner will officially inform the contractor about the MOF's letter to the entry point.

Total period of issuance of tax exemption letter was not more than four weeks.

#### Tax Exemption after ISIL invasion

Same procedure as before, however;

- MOF's letter to the entry point (Zakho border) was not effective. Kurdish authorities requested the contractor to pay the custom fees for importing materials, which is out of the contract conditions.
- Al Sufra Custom Point was newly established near Aludhims City, which adds more difficulties to the contractor in getting the exemption letter (additional letter: the mission facilitation letter) from the owner.
- Recently, the owner dispatches the representative to Al Sufra Custom Point to facilitate material passing this point. However, it is not clear if MOF's letter to the entry points (Zakho Border and Al Sufra Custom point) is effective or not up to now.

Transportations for each lot after the ISIL invaded the northern part of Iraq were affected and delayed the transportations. The abovementioned problem is, however, beyond the owner's control as it came up from the state of affairs between Iraqi Central Government and Kurdish Regional Government.

The Study Team's comment:

This case is beyond the owner's control since this problem derived from Iraqi Central Government and Kurdish Regional Government as mentioned above. Therefore, this is an exceptional case and should not to be used as a reference and helpful lesson for the future projects in general.

Letter for tax exemption must be requested by the contractor through the owner in advance before the shipment (i.e., recommended to be done as early as possible even before the commencement date).



**CHAPTER 6**  
***RECONSTRUCTION NEEDS FOR POWER SECTOR***

## CHAPTER 6 RECONSTRUCTION NEEDS FOR POWER SECTOR

This chapter describes the reconstruction needs of the Iraqi power sector. First, based on the collected data and information from MOE, Clause 6.1 describes the substation projects under construction as the current situation of the power sector in Iraq. Next, Clause 6.2 introduces MOE's reconstruction needs. And, Clause 6.3 describes MOE's urgent reconstruction needs especially in/around Baghdad and procurement of substation facilities for Anbar Governorate where power supply facilities were destroyed by ISIL.

### 6.1 Substation Projects under Construction

Table 6.1-1 shows the substation projects under construction provided by MOE. Comments of MOE on the projects are shown in the notes and additional notes in the table. Although 35 projects are listed in Table 6.1-1, most of the projects are delayed. For some projects, the reasons for the delay are mentioned in the table such as financial problems in seven projects, inability of contractors in eight projects, and security problems in twelve projects.

Regarding financial problems, due to insufficient funds of the governorates, the works are delayed. For example, Project No. 1 in the table has a reason that "The company of industrial design and construction did not start working on the project due to financial difficulties in our directorate". This sample project is located in Baghdad and financial problems occurred in five out of seven projects in Baghdad.

Eight projects are delayed because of the contractor's inability. For example, Project No. 2 has the reason that "A warning letter was sent to the company due to delay", and Project No. 26 has the reason that "Work was stopped due to security threat and inability of staff".

Twelve projects are delayed because of safety problems; and such problems occurred in Basra for one project, in Ninawa for five projects, in Kirukuk for one project, in Diyala for one project, in Al-Anbar for two projects, and in Karbala for two projects. For example, Project No. 24 in Ninawa has the reason that "Work was stopped due to continuous security threat and we got information about damages of all equipment that arrived at the site (damage and theft) which represent 60% from all equipment due to military actions". Thus, safety problems are happening most frequently as twelve projects are affected.

Table 6.1-2 also shows the substation projects under construction provided by MOE. Although this table contains the column of planned project starting year as "year of plan", this table does not contain the actual project starting year like Table 6.1-1. However, Table 6.1-2

contains the latest information on the current status of the projects. This table lists 89 projects; and 42 out of 89 projects seem to have several problems. Five projects have financial problems, fifteen projects have security problems, and 28 projects have land problems. Some projects mentioned multiple problems such as security and land problems.

Regarding financial problems, for example, Project Nos. 72, 80, 83, and 86 are commented as “The invitation No. 128/nt/2015 was stopped due to insufficient funds according to the decision of Council of Ministers No. 347.” in Table 6.1-2. The financial problems occurred in Basra, Babil, Karbara, and Al-Najaf.

Fifteen projects have safety problems. For example, Project No. 69 in Al-Anbar was commented that “Work was stopped in 31/12/2014 because of military actions, we got information about complete destruction of the station”. Five projects with safety problems are located in Baghdad, seven projects are in Al-Anbar, and one project each in Ninawa, Diyala, and Babil, respectively.

Land problems happened in 28 projects and prevailed in all governorates. For example, Project No. 63 was commented that “It will be executed by defer payment after solving its land possession issue” and “The work was not started because of security issue. There is difficulty in commencing the work because of security issues”. In the case of this project, it is assumed that the land problem is related to security issues. On the other hand, some projects are only commented land issues without security problems such as “Work was not started because its land was replaced”. However, even in this case, it is undeniable that possible root of all land problems is safety.

Considering the current situation of power sector from Tables 6.1-1 and 6.1-2, security condition heavily affects the implementation of the projects. Therefore, in order to execute the projects smoothly, it must be required to survey the security condition of the project sites before identifying the projects.

Table 6.1-1 Substation Projects under Construction (1) (Source: MOE)

No.	Governorate	Project Name, Capacity, and Execution Company Name	Contract Amount, Signing Date, and Contract Execution Duration	Upper: Starting Date Middle: Completion Date Lower: Accumulated Financial Percentage (%)		Notes	Additional Notes
				Planned	Actual		
1	Baghdad	AL-Shaab Station 33/132 kV company L.S Industrial for equipment supply + Industrial Design and Construction Company to execute the civil works	USD 39,407,472 + IQD 39,517,932,000 (for 9 132 kV stations + 400 kV station)	12/2012 8/2015 100	12/2012 ----- 55	Percentage of deviation is 45%. Supply of equipment of the two stations according to the Import Contract 16/nt/2012 with the Korean company LS. It includes supply and design only. Note that the weight of civil and electrical works represents 50% and the equipment represents 50%. The company of Industrial Design and Construction did not start working on the project due to financial difficulties in our directorate. A letter was sent to the company of Industrial Design and Construction, No. 5096 on 2/3/2016 about confirmation of contract ending.	The deviation percentage is related to the start of civil works of Tender 124/nt/2014. Working on ending of Contract 124/nt/2014 according to the decision of Council of Ministers 347 in 2015 and our directorate Letter No. 2090 on 27/1/2016. Invitations were sent to the three companies of the Ministry of Housing and Construction to apply for civil works. Currently, there are negotiations with two companies, Al Mansor and Al Faw Engineering, by defer payment (First priority).
2	Baghdad	AL-Shuala Station 132 kV company L.S Industrial for equipment supply + Industrial Design and Construction Company to execute the civil works	USD 39,407,472 + IQD 39,517,932,000 (for 9 132 kV stations + 400 kV station)	1/2013 10/2016 88	1/2013 ----- 56	Percentage of deviation is 32%. Sets of equipment of the station were supplied according to the Import Contract 16/nt/2012 with the Korean company LS. It includes supply and designs only. Note that the weight of civil and electrical works represents 50% and the weight of equipment represents 50%. The work in the station stopped due to financial difficulties in 2015/2016 and inability of the company of Industrial Design and Construction to fulfill its contractual obligation. Currently, working on ending the contract of the Invitation 124/nt/2014 according to the Decision of Council of Ministers 347 in 2015. Our directorate is trying to find alternatives to complete the project by defer payment.	The deviation percentage is related to the start of civil works of Tender 124/nt/2014 Working on ending of Contract 124/nt/2014 according to the Decision of Council of Ministers 347 in 2015 and our Directorate Letter No. 2090 on 27/1/2016. Invitations were sent to the three companies of Ministry of Housing and Construction to apply for civil works. Currently, there are negotiations with two companies, Al Mansor and Al Faw Engineering, by defer payment. A letter was sent to the company of Industrial Design and Construction No. 5096 on 2/3/2016 about confirmation of contract ending.
3	Baghdad	East AlRusafa Station, 400 kV Husnick, a Korean company for equipment supply + Industrial Design and Construction Company to execute the civil works	USD 56,213,781 + IQD 39,517,932,000 (for 9 132 kV stations + 400 kV station)	9/2013 6/2016 92	9/2013 ----- 55	Percentage of deviation is 37% Soil works, fence, guards building, and items supplying at 100%. The equipment was supplied by the Korean company, Husnick according to the Contract 39/nt/2012. Working on variation order to expand the 400 kV network by adding one (bundle) to receive the lines of Basmayah City. Note that the weight of civil and electrical works represents 50% and the weight of equipment represents 50%. A letter was sent to the company of Industrial Design and Construction No. 5096 on 2/3/2016 about confirmation of contract ending.	The company started working and completed the excavation works for (buildings 400, 132, 11, and the transformers), and the burying by subbase under the facilities above with lean concrete for the Building 400. The company stopped working due to insufficient funds from 1/8/2015. Working on ending of Contract 124/nt/2014 according to the Decision of Council of Ministers 347 in 2015 and our Directorate Letter No. 2090 in 27/1/2016. Invitations were sent to three companies of Ministry of Housing and Construction to apply for civil works Currently, there are negotiations with two companies, Al Mansor and AlFaw Engineering, by defer payment.

Chapter 6 Reconstruction Needs for Power Sector

No.	Governorate	Project Name, Capacity, and Execution Company Name	Contract Amount, Signing Date, and Contract Execution Duration	Upper: Starting Date Middle: Completion Date Lower: Accumulated Financial Percentage (%)		Notes	Additional Notes
				Planned	Actual		
4	Baghdad	Expanding of Al Qudus Station 400 kV, Variation order for the Turkish Siemens Company for equipment supply + Industrial Design and Construction Company to execute the civil works	IQD 2,487,275,000	1/2015 5/2015 100	----- ----- 89	Percentage of deviation is 11%. The annex of the Contract 6/nt/2012 was signed for the company Siemens on 26/4/2015 and the annex of the contract (117/nt) on 29/4/2015 for supplying the equipment of 132 and 400 kV GIS. The Invitation 152/nt/2015 was assigned to the company of Industrial Design and Construction according to the Assignment Letter 9253 on 8/3/2015 for the civil works with an execution duration of 120 days, and this requires funds (350) million dinar to fulfill the required obligation. The funds were paid to the company in (1,607,732,000) dinar which represent 65% of the contract amount.	Currently, the work is ongoing, and increasing the labor and staff to reach advanced stages of the control building. The required amount to complete the projects before summer 2016 is (650) million dinar which include (several works, checking, and operation). It is expected to be operated on 1/6/2016.
5	Baghdad	Expanding of West Baghdad Station 400 kV Equipment supply by the directorates of the ministry + Al Faw Engineering Company to execute civil works	IQD 573,525,000	1/2015 6/2015 100	1/2015 ----- 97,5	Percentage of deviation is 2.5%. Civil works are completed. Preliminary acceptance letter was issued for the Invitation 151/nt/2015.  The required amount to complete the projects before summer 2016 is (650) million dinar which include (several works, checking, and operation).	Currently, the work is ongoing and the electrical works reached advanced stages. The percentage of cable (d100) works is 90%, its length (350 m). Currently, the work stopped due to insufficient funds.  The funds were paid to the company in (348,965,000) dinar which represent 61% of the contract amount. Note that cables works, the electrical works and mechanical works need to provide funds (250) in million dinar.
6	Baghdad	Al Sabiyat Station 132 kV Variation order for the Turkish Siemens Company for equipment supply + Industrial Design and Construction Company to execute the civil works	IQD 39,517,932,000 (for 9 132 kV stations + 400 kV station)	10/2014 6/2016 92	10/2014 ----- 55.5	Percentage of deviation is 36.5% Fence works and soil embankment are completed. Supply of the equipment within the Import Tender 51/nt/2013. The equipment will be shipped soon. The contract is supply only. Installation, checking, and operation works will be started by the staff of ETP. The work at the station stopped due to insufficient funds in 2015/2016 and the inability of the Industrial Design and Construction Company to fulfill its contractual obligation. Currently, working on ending the contract of the Invitation 124/nt/2014 according to the decision of Council of Ministers 347 in 2015. Our directorate is trying to find alternatives to complete the project by defer payment.	Currently, working on ending the contract of the Invitation 124/nt/2014 according to the decision of Council of Ministers 347 in 2015 and according to the Letter 2090 of our directorate on 27/1/2016. Invitations were sent to three companies of the Ministry of Housing and construction to apply for civil works.  Currently, there are negotiations with two companies, Al Mansor and Al Faw Engineering, by defer payment. A letter was sent to the company of Industrial Design and Construction No. 5096 on 2/3/2016 about confirmation of contract ending.
7	Baghdad	Al-Zawraa Station 132 kV CG, a Belgian company to supply the equipment and execute civil works		8/2013 7/2015 100	8/2013 ----- 39	Percentage of deviation is 61% Civil works started within the Import Contract 17/nt CG. Equipment supply and civil works. A warning letter was sent to the company due to delay. The letter of Notary's Office in Karadah 30458 on 24/9/2014, the work completion percentage is still low. The installation, checking, and operation works will be started by our staff after the completion of civil works by the company.	Currently, the work is ongoing. Power transformers are supplied. The sub-contractor started the execution of civil works.

No.	Governorate	Project Name, Capacity, and Execution Company Name	Contract Amount, Signing Date, and Contract Execution Duration	Upper: Starting Date Middle: Completion Date Lower: Accumulated Financial Percentage (%)		Notes	Additional Notes
				Planned	Actual		
						Note that the weight of civil works represents 40%, electrical 10%, and equipment is 50%.	
8	Baghdad	Al Rusafa Central Station 132 kV	USD 39,407,472	12/2012 7/2016 88	12/2012 ----- 49	Percentage of deviation is 39%. The equipment of Al Rusafa Central Station was transferred to Al Basra Central Station/2. Working on issuing a variation order to transfer the equipment of Al Hashimiya Station within the Contract 38/nt/2012. The contract is supply only. The acceptance was granted according to the decision of the central delegation for review and approval of the assignment, Session No. 49 on 21/12/2014. Note that the weight of civil and electrical works represents 50%, and equipment is 50%. The station was fenced with concrete blocks. About 95% of equipment was supplied within variation order, which is expected to be signed for Contract 38/nt/2012.	The deviation percentage is related to the starting date of civil works execution. The company LS started to submit the civil designs after signing the contract annex.  Civil works within the Tender 183/nt/2015, currently, it is under study and analysis. (First priority).
9	Baghdad	Al Adhamyia Substation/2 132 kV	USD 45,800,347 2013/3/28	12/2012 7/2016 90	12/2012 ----- 52.5	Percentage of deviation is 37.5%. The station was fenced with concrete blocks. The equipment was supplied within the Contract 38/nt/2012 by the Korean company (LS). Note that the weight of civil and electrical works represents 50%, and equipment is 50%. The completion percentage represents equipment supply with percentage of 100%.	Civil works within the Tender 183/nt/2015, currently, it is under study and analysis.
10	Baghdad	Northwest Baghdad Station 400 kV (Japanese Loan)	EUR 43,325,185 USD 35,985,599	11/2015 11/2017 -----	11/2015 ----- 5.2	-----	The site was handed over and work started, the contract was reactivated on 27/11/2015. Soil investigations and topographic survey were completed. Currently, the resident engineer office is under preparation as well as the structural materials to execute and install the concrete mixer. A meeting was held with the company between 26-28/11/2016 in Istanbul, and it was agreed that the company will apply work program with a deadline on 10/2/2016. A letter was sent to the Deputy Minister of Distribution Affairs No. 5178 on 2/3/2016 about the importance of providing armed security by the police for the site. A letter was sent to the police by our Directorate No. 5941 on 13/3/2016 about the police who did not take any action of providing armed security until now although the preparations of security accessories and the administrative requirements for the wanted force.
11	Baghdad	Al Yarmook 132 kV	EUR 45,758,227 USD 21,723,813	11/2015 3/2017	11/2015	-----	Execution of site preparations works and the fence by direct execution. The contract was signed on 23/7/2015 with a duration of 16 months. Al Yarmook and Al Ghazaly stations were handed over to Siemens

Chapter 6 Reconstruction Needs for Power Sector

No.	Governorate	Project Name, Capacity, and Execution Company Name	Contract Amount, Signing Date, and Contract Execution Duration	Upper: Starting Date Middle: Completion Date Lower: Accumulated Financial Percentage (%)		Notes	Additional Notes
				Planned	Actual		
				-----	0,5		company. Installation, checking, and operation works will be executed by our staff after the end of civil works within the invitation mentioned above.
12	Baghdad	Baghdad Al Jadida Station 132 kV	EUR 45,758,227 USD 21,723,813	----- ----- -----	The station was not handed over to the Turkish Siemens Company until now    ----- 0,5	-----	Execution of site preparations works and the fence by direct execution. The contract was signed on 23/7/2015 with a duration of 16 months. Al Yarkmook and Al Ghazaly stations were handed over to Siemens company. Installation, checking, and operation works will be executed by our staff after the end of civil works within the invitation mentioned above.
13	Baghdad	Al Ghazaly Station 132 kV	EUR 45,758,227 USD 21,723,813	11/2015 3/2015 -----	11/2015 ----- 0,5	-----	Execution of site preparations works and the fence by direct execution. The contract was signed on 23/7/2015 with a duration of 16 months. Al Yarkmook and Al Ghazaly stations were handed over to Siemens company. Installation, checking, and operation works will be executed by our staff after the end of civil works within the invitation mentioned above.
14	Baghdad	Al Kadhimiya Station 132 kV	EUR 45,758,227 USD 21,723,813	2/2016 6/2017 -----	2/2016 ----- 0,5	-----	Execution of site preparations works and the fence by direct execution. The contract was signed in 23/7/2015 with duration of 16 months. Al Yarkmook and Al Ghazaly stations were handed over to Siemens company. Installation, checking, and operation works will be executed by our staff after the end of civil works within the invitation mentioned above.
15	Basra	Al Qurna Station 400 kV Turkish Siemens Company Equipment supply Execution of civil, electrical, and mechanical works.	EUR 76,457,573,98  Execution of civil, electrical, and mechanical works.	2/2012 2/2014  100	2/2012 -----  98.5	Deviation percentage is 1.5%. Work was stopped due to tribal conflict on 1/7/2014 which caused to the withdrawal of the executing company (Siemens) and requested the ending of contract due to repeated threats through the Council of Governorate intervention. Equipment was supplied according to the Import Contract 49/nt/2008/Siemens. Civil, installation, checking, and operation works are completed according to the Contract 64/n/2011 of Siemens Company.	Current status: the station is ready for operation and waiting to connect 400 kV line to the station. Required amount to complete the projects before 2016 is (50) million dinar. Work will continue after the stoppage because of the people of the region. Siemens Company is currently checking the required tests on the station in order to start operation.
16	Basra	Al Basrah Central-2 Substation	USD 39,407,472	12/2012 7/2016	12/2012 -----	Deviation percentage is 38%. Work start was delayed due to refusal of Iraqi Ports General Company on the suggested site, and the issue was solved after the intervention of	Completion percentage represents materials supply with 100%. Civil works within the Tender 178/nt/2015. Currently, it is under study and analysis and waiting for approval.

No.	Governorate	Project Name, Capacity, and Execution Company Name	Contract Amount, Signing Date, and Contract Execution Duration	Upper: Starting Date Middle: Completion Date Lower: Accumulated Financial Percentage (%)		Notes	Additional Notes
				Planned	Actual		
		132 kV		88	50	Ministers of Electricity and Transport. Equipment was supplied according to the Import Contract 16/nt/2012 LS company according to variation order. The contract is supply only. Note that the weight of civil and electrical works represents 50% and equipment is 50%.	
17	Basra	Al Rumail Central Station 132 kV Turkish Siemens Company Equipment supply		8/2013 3/2015 100	8/2013 ----- 54	Deviation percentage is 46%. Equipment supplies according to the Contract 51/nt/2012/siemens/. The contract is supply only. Installation, checking, and operation works will be started by our staff after the completion of civil works.	Some of its equipment will be borrowed in Al Qudus Station. Civil works are in the Tender 178/nt/2015. Currently, it is under study and analysis and waiting for approval.
18	Basra	Al Faw Station 400 kV Alstom Company (turnkey)		12/2013 12/2015 100	12/2013 ----- 68	Deviation percentage is 32%. Work was stopped due to strategic oil pipe works in the site of the station for (110) days.	Current status: the work is ongoing at the site.
19	Basra	North Al Basra Substation (Japanese Loan)		----- 5/2015 100	5/2014 ----- 99	Deviation percentage is 1%. Equipment supplies according to the contract between the Ministry of Electricity and Turkish Siemens Company/ Responsible party/ Power Transmission Directorate.	The station is completed and operated.
20	Ninawa	West Mosul Station 132 kV Turkish Siemens Company Equipment supply Execution of civil works.	EUR 67,467,691.97	4/2012 9/2013 100	4/2012 ----- 32.45	Deviation percentage is 67,55% Work was stopped on 14/1/2013 due to unknown threat, and the issue was solved with the company according to the contract terms and instructions of governmental contracts for the item of civil works execution within the signed contract with the company.	Work was stopped due to continuous security threat, and the completion percentage was decreased because of information we got on the damages occurred in the station due to military actions.
21	Ninawa	Sinjar Substation 132 kV Turkish Siemens Company (turnkey)	EUR 77,272,779.84	4/2012 8/2013 100	4/2012 ----- 60	Deviation percentage is 40%. Equipment was transferred to execute Al Akademiya Station in Basra Governorate as a variation order of the contract. Work was stopped due to security threat and inability of staff to work. The completion percentage was decreased because of information we got about damages occurred in the station due to military actions.	Work was stopped due to continuous security threat, and the company requested to end the work at the site and a financial settlement after calculating the compensations. Currently, there is a negotiation with the company to end the work according to the decision of Central Contracts Delegation Session 46 on 30/11/2014. Negotiation and financial settlement were done with the company during the meeting in Baghdad between 7-9/1/2015. A delegation was made and sent to the site to inspect and evaluate the damages, the delegation could not reach the site due to security issue.
22	Ninawa	Tal Awainat Substation 132 kV Turkish Siemens Company	EUR 77,272,779.84	4/2012 8/2013	4/2012 -----	Deviation percentage is 50%. Procedures of land possession and handover of the site caused delay in the commencement of works execution. Work was stopped due to security threat and inability of work staff.	Work was stopped due to continuous security threat, the company requested to end the work of this site and a financial settlement after calculating the compensations. Currently, there is a negotiation with the company to end the work according to the decision of Central



Chapter 6 Reconstruction Needs for Power Sector

No.	Governorate	Project Name, Capacity, and Execution Company Name	Contract Amount, Signing Date, and Contract Execution Duration	Upper: Starting Date Middle: Completion Date Lower: Accumulated Financial Percentage (%)		Notes	Additional Notes
				Planned	Actual		
		(turnkey)		100	50	Negotiation and financial settlement were done with the company during the meeting in Baghdad between 7-9/1/2015.	Contracts Delegation Session 46 on 30/11/2014. The completion percentage was decreased because of information and photos we got on the damages occurred in the station due to military actions. A delegation was made and sent to the site to inspect and evaluate the damages.
23	Ninawa	East Mosul Station 400 kV Alstom Company (turnkey)	EUR 66,033,535	5/2012 5/2014 100	5/2012 ----- 88.9	Deviation percentage is 11.1%. Work is completely stopped due to security threat. It was expected to run the station last June.	Work was stopped due to security threat, the company requested to end the contract and a request was applied to the minister and he ordered to put it on hold.
24	Ninawa	Expanding the Mosul Dam Station 400 kV Turkish Siemens Company (turnkey)		1/2013 5/2014 100	1/2013 ----- 0	Work was stopped due to continuous security threat and we got information on the damages of all the equipment arrived to the site (damage and theft) which represent 60% from all equipment due to military actions. The completion percentage was decreased because of the information we got about damages occurred in the station due to military actions.	Work was stopped in the site, and the company is supplying continuously the equipment to our directorate stores in the secured regions. The transformers will be used in the project of expanding Al Qudus Thermal Station within the projects of network jams solution, summer 2015 and canceling the civil and electrical works and replace them with electrical equipment.
25	Kirkuk	West Kirkuk Station 132 kV Turkish Siemens Company Equipment supply Execution of civil works.	EUR 67,467,691.9	4/2012 9/2013 100	4/2012 ----- 94	Deviation percentage is 6%.	Current status: Delay in work completion due to security issues and insufficient funds. Expected date of operation of the station is 1/4/2016. Required amount to complete the projects before summer 2016 is (150) million dinar.
26	Diyala	Baquba South Station 132 kV Turkish Siemens Company (turnkey)	EUR 77,272,779.84	4/2012 8/2013 100	4/2012 ----- 93	Deviation percentage is 7%. Work was stopped due to security threat and inability of staff to work.	We made a work team to prepare the site for the completion of checking and operation works. Final checking works will continue with the completion of connection lines when the funding is available. Required amount to complete the projects before summer 2016 is (350) million dinar which include several works, checking, and operation.
27	Al-Anbar	Al Qaem Station 132 kV Siemens Company Equipment supply Execution of civil works.	EUR 67,467,691.91	4/2012 9/2013 100	4/2012 ----- 0	Deviation percentage is 100%. Work was stopped on 2/1/2014 due to security threat and inability of staff to work. The completion percentage was decreased because of the information we got about damages occurred in the station due to military actions.	Work stopped due to security issue, and a request was sent to the minister to end the works, and we are waiting for the decision. Negotiation with the company and financial settlement are done until the date of its withdrawal from the site, we do not have now any information about the site. The completion percentage was decreased because the information we got on the station was damaged due to military actions.
28	Al-Anbar	Al Falluja South Station 132 kV	EUR	4/2012 8/2013	4/2012 -----	Deviation percentage is 100%. Work was stopped in the station due to security threat and inability of staff to work.	Work stopped due to security issue, information about the station was completely damaged due to military actions, we are working on variation order which includes canceling the remaining works and

No.	Governorate	Project Name, Capacity, and Execution Company Name	Contract Amount, Signing Date, and Contract Execution Duration	Upper: Starting Date Middle: Completion Date Lower: Accumulated Financial Percentage (%)		Notes	Additional Notes
				Planned	Actual		
		Siemens Company (turnkey)	77,272,779.84	100	0	The completion percentage was decreased because of the information we got about complete damage of the station due to terrorist actions.	waiting for the ministry decision. Negotiation with the company and financial settlement are done until the date of its withdrawal from the site, we do not have now any information about the site.
29	Babil	Al Shomali Station 132 kV Company ISLS for equipment supply + Industrial Design and Construction Company to execute the civil works	IQD 39,517,932,000 (for 9 132 kV stations + 400 kV station)	9/2013 9/2015 100	9/2013 ----- 40	Deviation percentage is 60%. The installation, checking, and operation works will be started by our staff after the completion of civil works within the Invitation 124/nt/2012. A letter was sent to the company of Industrial Design and Construction No. 5096 on 2/3/2016 about confirmation of contract ending.	Current status: Note: supplying its equipment is our directorate priority. Working on ending of Contract 124/nt/2014 according to the decision of Council of Ministers 347 in 2015 and our Directorate Letter No. 2090 in 27/1/2016. Invitations were sent to the three companies of Ministry of Housing and Construction to apply for civil works. Currently, there are negotiations with two companies, Al Mansor and Al Faw Engineering, by defer payment.
30	Babil	Al Hilla West Station CG, a Belgian company to supply the equipment and execute civil works		9/2013 ----- 100	9/2013 ----- 33	Deviation percentage is 67%. Civil works started within the Import Contract 17/nt CG/; the contract is equipment supply and executing civil works.  Note that the weight of civil works represents 40%, electrical 10%, and equipment is 50%.	Current status: A warning letter was sent to the company due to delay. The letter of Notary's office in Karadah 30458 on 24/9/2014, and civil works completion percentage is still low. Installation, checking and operation works will be started by our staff after the completion of civil works by company. A minutes of meeting was signed on 26/4/2015 at the Office of the Deputy Minister of Distribution Affairs after the meeting of the company representatives with the Minister, which include presenting the duration tables of execution no later than 3/5/2015 as a last chance for the company. All civil drawings were approved and delivered to work team, the company started the execution of civil works but it is not at the required level, a last warning letter will be sent to the company. The completion percentage is increased because of percentage increase of the equipment arrival to the site.
31	Karbala	Al-Ibrahimia Station 132 KV LSIS Company Equipment supply + Industrial design and construction company for the execution of civil works	IQD 39,517,932,000 (for 9 132 kV stations + 400 kV station)	7/2013 7/2015 100	7/2013 ----- 55	Percentage of deviation is 45%. The equipment was supplied according to the Import Contract 38 / NT / 2012 / signed with the Korean company, LS and it is assigned. Deviation percentage is beyond the control of our directorate. Note that the civil and electrical works weight accounted for 50% and equipment 50%.	Note: The actual completion percentage includes supplying the equipment and site preparation works. Working on terminating the Contract 124 / NT / 2014 according to the Council of Ministers Resolution 347 of 2015, and our Directorate Letter Number 2090 on 27/01/2016. Invitations were sent to the three companies of Ministry of Housing and Construction to apply for civil works. Currently, there are negotiations with two companies, Al Mansor and Al Faw Engineering, by defer payment. A letter was directed to the Industrial Design and Construction Company No. 5096 on 2/3/2016 regarding the confirmation on the termination of the contract.

Chapter 6 Reconstruction Needs for Power Sector

No.	Governorate	Project Name, Capacity, and Execution Company Name	Contract Amount, Signing Date, and Contract Execution Duration	Upper: Starting Date Middle: Completion Date Lower: Accumulated Financial Percentage (%)		Notes	Additional Notes
				Planned	Actual		
32	Karbala	Karbala New Station 132 KV LSIS Company Equipment supply + Industrial design and construction company for the execution of civil works	IQD 39,517,932,000 (for 9 132 kV stations + 400 kV station)	12/2013  12/2015  100	12/2013  -----  52	Percentage of deviation is 48% The site is relatively unsafe because it is within a desert area adjacent to the borders of Al-Anbar governorate. Note: The actual completion percentage include equipment supply and site preparation works. Note that the civil and electrical works weight accounted for 50% and equipment 50%.	Current status: Approval of the minister on transferring station equipment to Al Ataba Al Alawiya Al Muqadasa Station. Working on terminating the Contract 124 / NT / 2014 according to the Council of Ministers resolution 347 of 2015, and our Directorate Letter Number 2090 on 27/01/2016. Invitations were sent to three companies of Ministry of Housing and Construction to apply for civil works. Currently, there are negotiations with two companies, Al Mansor and Al Faw Engineering, by defer payment. A letter was directed to Industrial Design and Construction Company No. 5096 on 2/3/2016 regarding the confirmation on the termination of the contract. It was listed within the suggestions of GE Loan.
33	Al-Najaf	Al Meshkhab Station 132 KV Anana Company Equipment supply + Direct execution of civil works	EUR 434,387,545.12	9/2008  7/2010  100	9/2008  -----  97.5	Percentage of deviation is 2.5%.	Current status: The station started operation on 10/10/2015. Currently, the execution of cables works of external lines 33 kV with the financial support from Al Ataba Al Alawiya. The remaining works will be completed in case of availability of funds (about 500 million dinar).
34	Al-Najaf	Al Nidaa Station 132 KV CG Company Equipment supply and execution of civil works		8/2013  7/2015  100	8/2013  -----  44	Percentage of deviation is 56% Civil works are started with the Import Contract 17 / Nt CG / contract is supplying equipment and execution of civil works. A warning letter was sent to the company due to delay. The letter of Notary's office in Karadah 30458 on 24/9/2014, the work completion percentage is still low. The installation, checking, and operation works will be started by our staff after the completion of civil works by the company. Note that the weight of civil works represents 40%, electrical 10%, and equipment is 50%.	Current status: Works are ongoing slowly and they are under pursuance The completion percentage is increased because of percentage increase of the equipment arrival at the site.
35	Al-Najaf	Al Ataba Al Alawiya Station 132 KV	USD 39,174,864 2013/10/22 12 months only supply	1/2016  5/2017  57	1/2016  -----  51	Percentage of deviation is 6%. The Invitation No. 128/nt/2015 (execution of external fence and embankment works) was stopped due to insufficient funds according to the decision of Council of Ministers No. 347. It was listed within the Invitation 18/2015. It is listed within the Transferable Letter of Credit. Also, the approval of the minister is granted to transfer the equipment of Karbala New Station to Al Ataba Al Alawiya Station, and its equipment will be compensated throughout the several invitations mentioned above, Diwan Al Waqef Al Sheiey is ready to support us in the execution of the station. It requires an amount of (750) million dinar for the electrical works.	Al Ataba Al Alawiya Al Muqadasa is executing the civil works according to the drawings and design submitted by the Korean LS Company. Civil and mechanical works are within the responsibility of our directorate and the civil works are started. Approval of the minister of transferring the equipment of Karbala New Station to Al Ataba Al Alawiya Secondary Station according to the letter of Ministry of Electricity/Planning and Study Directorate No. 8181 on 9/2/2016, a delegation was made to issue a variation order to cancel the station from the Invitation 128/nt/2014 regarding the fence and embankment works.

Table 6.1-2 Substation Projects under Construction (2) (Source: MOE)

No.	Governorates	Project Name	Year of Plan	Current Status
1	Baghdad	Zayona Substation 132 kV	2008	It was suggested to execute it according to variation order for the Contract 65/nt/2012 with Alstom Company instead a station in unsecured region/turnkey. The site is fenced with concrete blocks, a meeting was held with the company on 7/3/2016 at the ministry to find a solution for it.
2	Baghdad	Al Turath Electricity Substation 132 kV	2013	Fence and embankment works were executed by Al Nahrawan General Company. It was suggested to execute it according to variation order for the Contract 65/nt/2012 with Alstom Company instead a station in unsecured region/turnkey. The site is fenced with concrete blocks, a meeting was held with the company on 7/3/2016 at the ministry to find a solution for it. It was listed within the suggestion of the Japanese Loan Stage/3 according to the Letter of Power Transmission Directorate No. 3831 on 24/11/2015.
3	Baghdad	Al Rabea Substation 132 kV	2013	It was suggested to execute it according to variation order for the Contract 65/nt/2012 with Alstom Company instead a station in unsecured region/turnkey. It was listed within the suggestion of the Japanese Loan stage/3 according to the Letter of Power Transmission Directorate No. 3831 on 24/11/2015.
4	Baghdad	Gesaiba Station 132 kV	2014	It was suggested to execute it according to variation order for the Contract 43/nt/2012 with the Korean company (LS), and the contract is supply only, transferring equipment of Al Latifiya Station due to deterioration of the security situation. The Invitation 146/nt/2015 will be assigned to the Industrial Design and Construction to execute the civil works.
5	Baghdad	Al Amel Station 132 kV	2014	Approval of the minister was granted to our Letter No. 35552 on 26/11/2014 of transferring the equipment of Al Hewaish according to the Variation Order 17/nt/2012 to the site with the CG company, The contract is supplying the equipment and executing the civil works within the variation order. It was listed within the suggestion of the dependence on fast installed stations according to the Letter of Electrical Power Transmission Directorate No. 63053 on 22/9/2015. It was listed within the suggestion of the Japanese Loan Stage/3 according to the Letter of Power Transmission Directorate No. 3831 on 24/11/2015.
6	Baghdad	Al Sadir Substation 132 kV	2009	Currently, the procedures of signing the Contract 66/nt/2012 are ongoing with the French company, Alstom to execute the station (turnkey), a meeting was held with the company on 7/3/2016 at the ministry to find a solution for it. Site inspection is done in Al Sadir Gaseous Station to identify the specified land for Al Sadir Secondary Station 132 kV.
7	Baghdad	Al Latifiya Substation 132 kV	2012	Rehabilitation of the station site was started and stopped due to security issues. Supplying station equipment within the import Contract 43/nt/2012 - the Korean company (LS). A variation order will be issued to use the equipment for the execution of Gesaiba Station 132 kV in Baghdad governorate. It was listed within the suggestion of the dependence on fast installed stations according to the Letter of Electrical Power Transmission Directorate No. 63053 on 22/9/2015.
8	Baghdad	Al Buaiha 2 Substations 132 kV	2013	It was listed within the Invitation 18/2015
9	Baghdad	Al Tajjat Station 132 kV	2013	The execution of the fence and embankment works were assigned to Al Nahrawan General Company and work has started. It was listed within the Invitation 22/2015
10	Baghdad	Al Adala Station 132 kV	2013	Working on finding a new site. It will be executed by defer payment by the Directorate of Investments and Contracts.
11	Baghdad	Al Tujaar Substation 132 kV	2013	A new site was selected and approvals were granted by the Directorates of Technical Services. It will be executed by defer payment by the Directorate of Investments and Contracts. It was listed within the suggestion of the Japanese Loan Stage/3 according to the Letter of Power Transmission Directorate No. 3831 on 24/11/2015.
12	Baghdad	Al Sahafiyen Substation 132 kV	2013	The site land was possessed, the station will be fenced by concrete block precast (t-wall). It will be executed by defer payment according to the suggestion of Directorate of Investments and Contracts. It was listed within the Invitation 18/2015
13	Baghdad	Al Gayara Substation 132 kV	2013	Schematic approval was granted for station site in order to replace it with a neighboring site. It was listed within the Invitation 22/2015
14	Baghdad	Salman Pak Substation 132 kV	2013	The execution of the fence and embankment works and guard rooms are completed within the Tender 46/nt/2013. Currently, it is in the preliminary handover. It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts. It was listed within the Invitation 22/2015
15	Baghdad	Al Farahidy (Abu Ghraib) Substation	2014	It will be executed by defer payment according to the suggestion of Directorate of Investments and Contracts.(suggestion/1) It was listed within the suggestion of the dependence on fast installed stations according to the Letter of Electrical Power Transmission Directorate No. 63053 on 22/9/2015.

Chapter 6 Reconstruction Needs for Power Sector

No.	Governorates	Project Name	Year of Plan	Current Status
		132 kV		(suggestion/2) and also within the suggestions of GE loan
16	Baghdad	Al Karada Al Sahrqiya Substation 132 kV / ABC Radial	2014	Working on finding three new sites to replace the current possessed site because it is not suitable for the requirements of Distribution Directorates. It was suggested to issue a variation order for our contracts with LS company in order to buy equipment and supply the remaining within the next contracts.
17	Baghdad	Al Baladiyat Substation 132 kV	2014	The site land was possessed, the station will be fenced by concrete block precast (t-wall). It will be executed by defer payment.
18	Baghdad	Al Amaary Substation 132 kV	2014	The land was allotted. It will be executed by defer payment. It was listed within the Invitation 22/2015
19	Baghdad	Bob Al Sham 2 Substations 132 kV	2014	The land is possessed. It was listed within the suggestion of the Japanese Loan JICA/2 (suggestion/1). It was listed within the suggestion of the dependence on fast installed stations according to the Letter of Electrical Power Transmission Directorate No. 63053 on 22/9/2015. (suggestion/2) and also within the suggestions of GE loan.
20	Baghdad	Al Tareq Substation 132 kV	2015	Currently, procedures of lands allotment. It will be executed by defer payment.
21	Baghdad	Al Mahmodiya Electricity Substation 132 kV	2012	There is a suggestion to execute it instead of Khan Bani Saad Station according to Variation Order 66/nt/2012. Fencing of the station is started and a meeting was held with the company on 7/3/2016 at the ministry to find a solution for it. It will be executed by defer payment by the Directorate of Investments and Contracts. It was listed within the Invitation 18/2015
22	Basra	Airport Substation 132 kV	2011	The execution of the fence and embankment works and guard buildings were completed. Work is stopped because of nonpayment of the Contractor's Advance 153/nt/2015, the contract (153/nt) was stopped according to the Decision 347. It was listed within the Invitation 18/2015 (3X63) by the Directorate of Investments and Contracts and it is currently under study and analysis.
23	Basra	Al Dair Substation 132 kV	2011	It will be executed by defer payment by the Directorate of Investments and Contracts. It was listed within the Invitation 18/2015.
24	Basra	Industrial Institute 132 kV	2013	It will be executed by defer payment by the Directorate of Investments and Contracts after solving the issue on land possession. It was listed within the Invitation 22/2015 (3X63), it is currently under study and analysis.
25	Basra	Al Shafy 132 kV	2014	It will be executed by defer payment by the Directorate of Investments and Contracts after solving the issue on land possession. It was listed within the Invitation 18/2015 (3X63), it is currently under study and analysis.
26	Basra	Al Fayhaa Station 132 kV	2013	The execution was assigned to our directorate since the visit of the Minister to Basra Governorate in February/2015 instead of Basra Council of Governorate. The land will be possessed through the coordination with the Distribution and Transmission directorates/ South. It was listed within the suggestion of the German Loan according to the Letter of Power Transmission Directorate No. 76263 on 24/11/2015 (3X90).
27	Basra	Al Medaina Station 132 kV	2013	The execution was assigned to our directorate since the visit of the Minister to Basra Governorate in February/2015 instead of Basra Council of Governorate. The land will be possessed through the coordination with the Distribution and Transmission directorates/ South. It was listed within the suggestion of the German Loan according to the Letter of Power Transmission Directorate No. 76263 on 24/11/2015 (3X90).
28	Basra	Al Sarajy Station 132 kV	2013	The execution was assigned to our directorate since the visit of the Minister to Basra Governorate in February/2015 instead of Basra Council of Governorate. The land will be possessed through the coordination with the Distribution and Transmission directorates/ South. It will be executed within the suggestion of the Japanese Loan JICA/2 (3X90).
29	Basra	Al Oebla Station 132 kV	2013	The execution was assigned to our directorate since the visit of the Minister to Basra governorate in February/2015 instead of Basra Council of Governorate. It was listed within the Invitation 18/2015.
30	Basra	Shatt Al Arab 132 kV	2013	The execution was assigned to our directorate since the visit of the Minister to Basra Governorate in February/2015 instead of Basra Council of Governorate. The land will be possessed through the coordination with the Distribution and Transmission directorates/ South. It will be executed within the suggestion of the Japanese Loan JICA/2.
31	Basra	Shatt Al Arab 400 kV		It will be executed with the suggestion of the Japanese Loan JBIC and also within the suggestions of GE Loan. It is listed within the Japanese Loan (3X90).

No.	Governorates	Project Name	Year of Plan	Current Status
32	Basra	Turkish Hospital Station 132 kV	2013	The execution was assigned to our directorate since the visit of the Minister to Basra Governorate in February/2015 instead of Basra Council of Governorate. The land will be possessed through the coordination with the Distribution and Transmission directorates/ South. It will be executed within the suggestion of the Japanese Loan JICA/2 (3X90).
33	Basra	Sport City Station 132 kV	2013	The execution was assigned to our directorate since the visit of the Minister to Basra Governorate in February/2015 instead of Basra Council of Governorate. The land will be possessed through the coordination with the Distribution and Transmission directorates/ South. It will be executed within the suggestion of the Japanese Loan JICA/2 (3X90).
34	Basra	Al Qurna North Substation 132 kV	2013	The execution was assigned to our directorate since the visit of the Minister to Basra Governorate in February/2015 instead of Basra Council of Governorate. The land will be possessed through the coordination with the Distribution and Transmission directorates/ South. It is listed within the defer payment.
35	Basra	Al Merbad Substation 132 kV	2013	The execution was assigned to our directorate since the visit of the Minister to Basra Governorate in February/2015 instead of Basra Council of Governorate. The land will be possessed through the coordination with the Distribution and Transmission directorates/ South.
36	Basra	Al Ghadeer Substation 132 kV	2013	The execution was assigned to our directorate since the visit of the Minister to Basra Governorate in February/2015 instead of Basra Council of Governorate. The land will be possessed through the coordination with the Distribution and Transmission directorates/ South.
37	Basra	Um Al Qurra Substation 132 kV		The execution was assigned to our directorate since the visit of the Minister to Basra Governorate in February/2015 instead of Basra Council of Governorate. The land will be possessed through the coordination with the Distribution and Transmission directorates/ South. It will be executed within the suggestion of the Japanese Loan JICA/2 (3X90).
38	Ninawa	Al Kesk Substation 400 kV	2015	Direct execution of the fence and embankment works and guards building (work is stopped, completion percentage of site preparation is 15%). The tender was canceled 79/nt/2014 according to the approval of the minister in our Letter No. 35690 on 26/11/2014.
39	Ninawa	Yarmja Substation 132 kV	2015	The execution of the fence and embankment works was started (work is now stopped, completion percentage of site preparation is 25%). It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts.
40	Ninawa	Al Shamal Region substation 132 kV	2015	It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts.
41	Ninawa	Talafar Second Substation 132 kV	2015	It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts.
42	Ninawa	Al Namrod Substation 132 kV	2015	Work has not started and waiting for the schematic approval. It will be executed by defer payment according to suggestion of the Directorate of Investments and Contracts after solving the land possession issue.
43	Ninawa	Al Arejiya Station 132 kV	2015	Work has not started and waiting for the required schematic approval. It will be executed by defer payment according to suggestion of the Directorate of Investments and Contracts.
44	Ninawa	Al Resala Substation 132 kV	2015	Work has not started, currently, working on getting the approvals for the land. It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts after solving the land possession issue.
45	Ninawa	Al Maamon Station 132 kV	2013	Its equipment will be supplied within Variation Order No. 3 of the Contract 38/nt/2012/ LS, a recommendation was sent to use its equipment for Al Diwaniya South Station due to security deterioration. It will be executed by defer payment according to suggestion of the Directorate of Investments and Contracts.
46	Ninawa	Al Hashimiya Station 132 kV in (Al Noor)		Its equipment were supplied within the Contract 38/nt/2012, a recommendation was sent to transfer its equipment to Al Rusafa Central Station. It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts. It is listed within the Invitation No.18/2015.
47	Ninawa	Al Farooq 132 kV	2014	It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts after solving the land possession issue.
48	Ninawa	Al Shalalat Station 132 kV	2014	It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts after solving the land possession issue.
49	Ninawa	Al Gaiyara Station(2) 132 kV	2014	It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts after solving the land possession issue.
50	Ninawa	Al Ba'aj Station 132 kV	2014	It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts after solving the land possession issue.

Chapter 6 Reconstruction Needs for Power Sector

No.	Governorates	Project Name	Year of Plan	Current Status
51	Ninawa	Bartala Station 132 kV	.	Procedures of issuing a variation order to transfer its equipment to Al Turath Station.
52	Ninawa	South Mosul Station 132 kV		Procedures of issuing a variation order to transfer its equipment to Zayona Station.
53	Kirukuk	North Kirkuk Substation 132 kV	2011	It was listed within the suggestion of the dependence on fast installed stations according to the Letter of Electrical Power Transmission Directorate No. 63053 on 22/9/2015. It was listed within the suggestion of the German Loan according to the Letter of Power Transmission Directorate No. 76263 on 24/11/2015 also within the suggestions of GE Loan.
54	Kirukuk	Al Zaab Substation 132 kV	2013	Direct execution of the fence and embankment works and guard buildings (work has now stopped, completion percentage is 31.5%). It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts after solving the land possession issue.
55	Kirukuk	Daqoq Substation 132 kV	2013	The site land is not possessed. It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts.
56	Kirukuk	Al Debis New Substation 400 kV	2014	It was listed within the suggestion of the German Loan according to the Letter of Power Transmission Directorate No. 76263 on 24/11/2015 also within the suggestions of GE Loan.
57	Kirukuk	Banjat Ali Station 132 kV	2013	It was listed within the suggestion of the dependence on fast installed stations according to the Letter of Electrical Power Transmission Directorate No. 63053 on 22/9/2015.
58	Diyala	Jalawla Substation 132 kV	2013	The execution of the fence and embankment works is started (work is now stopped, completion percentage is 31.5%). It was listed within the Invitation No. 22/2015. Under the Peshmerga Forces control.
59	Diyala	Baquba North Substation 132 kV	2013	Working on procedures of land sorting and evaluating the compensation. It will be executed by defer payment according to suggestion of the Directorate of Investments and Contracts. It was listed within the Invitation No. 22/2015.
60	Diyala	Baquba Northeast Substation 132 kV	2014	Working on procedures of land sorting and evaluating the compensation. It will be executed by defer payment. It was listed within the Invitation No. 22/2015.
61	Diyala	Khan Bani Saad Station	2009	Work has not started due to security issues. Equipment supply within the Import Contract 66/nt/2012, there is a suggestion to cancel it from the contract and transfer its equipment to Al Mahmodiya Station 132 kV because of security issue. A meeting was held with the company on 7/3/2016 at the ministry to solve the matter.
62	Al-Anbar	Al Baghdadi Substation 132 kV	2013	The compensation is paid and working on the land sorting and registration, direct execution of the fence and embankment works. It will be executed by defer payment. There is difficulty in starting the work because of security issues.
63	Al-Anbar	Al Garma West Substation 132 kV	2013	The execution of the civil works according to Invitation 46/nt/2014 by Al Faw General Company. The work was not started because of security issue. there is difficulty in starting the work because of security issues. It will be executed by defer payment after solving its land possession issue.
64	Al-Anbar	Al Qaem West Substation 132 kV	2013	The execution of the civil works according to Invitation 46/nt/2014 by Al Faw General Company. The work has stopped because of security issue. there is difficulty in starting the work because of security issues. It will be executed by defer payment after solving its land possession issue.
65	Al-Anbar	Al Saqlawiya Substation 132 kV	2014	The execution of the civil works according to Invitation 46/nt/2014 by Al Faw General Company. The work has not started because of security issue. There is difficulty in starting the work because of security issues. It will be executed by defer payment after solving its land possession issue.
66	Al-Anbar	Al Khalidiya South Substation 132 kV	2015	Working on procedures of its land possession. It will be executed by defer payment after solving its land possession issue.
67	Al-Anbar	Al Ramadi West Substation 132 kV	2011	Its equipment supply within the Contract 65/nt/2012 Alstom Company, a variation order will be issued to use the station equipment for another station. A meeting was held with the company on 7/3/2016 at the ministry to solve the issue. It will be executed by defer payment.
68	Al-Anbar	Al Ramadi North Station	2017	It will be executed within the World Bank Loan for year 2017. It will be executed by defer payment after solving its land possession issue.

No.	Governorates	Project Name	Year of Plan	Current Status
69	Al-Anbar	Al Ramadi South Station	2008	The station is completed, checked, and waiting for lines completion. Work has stopped on 31/12/2014 because of military actions, we got information about complete destruction of the station.
70	Al-Anbar	Cement 1 Factory	2013	A letter was sent to Al-Anbar Governorate No. 29671 on 5/9/2013 about its land possession and no action is taken due to security issue.
71	Al-Anbar	Cement 2 Factory	2013	A letter was sent to Al-Anbar Governorate No. 29671 on 5/9/2013 about its land possession and no action is taken due to security issue.
72	Babil	Al Hashimiya Road Substation 132 kV	2013	The Invitation No. 128/nt/2015 is stopped due to insufficient funds according to the decision of Council of Ministers No. 347. It will be executed by defer payment within the announced invitation (18/2015) by the Directorate of Investments and Contracts.
73	Babil	Abi Gharaq Substation 132 kV	2013	Work has not started. Working on getting approvals of concerned directorates. It is listed within the Invitation 18/2015.
75	Babil	Al Mahaweel Substation 132 kV	2013	The execution of fence and embankment works was done by Al Nahrawan General Company according to the Invitation 45/nt/2013. It will be executed by defer payment according to suggestion of the Directorate of Investments and Contracts. It is listed within the Invitation 22/2015.
76	Babil	Jurf Al Sakhar Substation 132 kV	2012	Work has not started due to security issues and currently working on getting approval for compensation evaluation. It will be replaced according to the variation order of the Contract 66/nt/2012 which expected to be signed with Alstom Company according to the approval of the minister on 3/12/2014 for the letter of the Office of Deputy Minister of Projects Affairs No. 1413 on 2/12/2014 and to use its equipment in Al Rumaitha New Station. A meeting was held with the company on 7/3/2016 at the ministry to solve the issue. It will be executed by defer payment.
77	Babil	Expanding of Babil Station 400 kV	2014	The contract has ended according to the decision of the central delegation for review and approval of the assignment, Session No. 6 on 28/2/2016.
78	Babil	Al Kifil Substation 132 kV	2014	It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts after solving its land possession issue.
79	Babil	Al Musaiyab Substation 132 kV	2015	Site land is not possessed. It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts after solving its land possession issue.
80	Karbara	Karbala North New Substation 132 kV	2015	The Invitation No. 128/nt/2015 is stopped due to insufficient funds according to the decision of Council of Ministers No. 347. It is listed within the Invitation 18/2015.
81	Karbara	Al Najaf Road Substation 132 kV	2015	It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts after solving its land possession issue.
82	Karbara	Al Sawada Substation 132 kV	2014	It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts after solving its land possession issue.
83	Karbara	Karbala South New Substation	2014	The Invitation No. 128/nt/2015 is stopped due to insufficient funds according to the decision of Council of Ministers No. 347. It is listed within the Invitation 22/2015.
84	Karbara	Al Husainiya Station	2017	It was listed within the suggestion of the Japanese Loan JICA/2 according to suggestion of the Directorate of Investments and Contracts.
85	Al-Najaf	Al-Najaf Sea Substation 132 kV	2013	Work was not started because its land was replaced. It will be executed by defer payment.
86	Al-Najaf	Al Manathera Substation 132 kV	2014	The Invitation No. 128/nt/2015 is stopped due to insufficient funds according to the decision of Council of Ministers No. 347. It was listed within the suggestion of the dependence on fast installed stations according to the Letter of Electrical Power Transmission Directorate No. 63053 on 22/9/2015 also with the suggestions of GE Loan.
87	Al-Najaf	Al Mat'hana Substation 132 kV	2015	It will be executed by defer payment according to the suggestion of the Directorate of Investments and Contracts.
88	Al-Najaf	Al Abasiya 132 kV Substation	2010	The Tender Contract 78/nt/2014 was signed recently with Siemens Company according to Assignment Letter No. 35745 on 18/10/2015 and waiting for LC opening.
89	Al-Najaf	Al-Etarat Substation 132 kV		The land is not possessed. It was listed within the suggestion of the Japanese Loan JICA/2.



## 6.2 Reconstruction Needs

Before considering candidate projects for the Electricity Sector Reconstruction Project (Phase 3), current reconstruction needs in Iraq are to be confirmed in this clause.

### (1) Reconstruction Needs for Liberated Area and Conflict Affected Area

Tables 6.2-1 and 6.2-2 show reconstruction needs of distribution substations in the Liberated Area and Conflict Affected Area provided by the Distribution Office of MOE. Reconstruction needs in Al-Anbar, Upper Euphrates, and Diyala are shown in Table 6.2-1 and needs in Ninawa and Salah El-Din are shown in Table 6.2-2.

Al-Anbar Governorate has most reconstruction needs, 26 distribution substations. The second largest needs are in Salah El-Din governorate, 15 distribution substations. As shown in Table 6.2-1, most urgent needs are mobile substations, and as for the further needs, construction of distribution substations is required. Although there are no explanations about specific needs in Table 6.2-2 like Table 6.2-1, Table 6.2-2 shows the degree of damage percentage in distribution substation. Seven out of 20 distribution substations are 100% damaged; and 16 out of 20 distribution substations are more than 50% damaged.

Table 6.2-1 Reconstruction Needs for Liberated Area and Conflict Affected Area (1)

No.	Governorates	Substation Name	Installed Capacity	Urgent Needs	Further Needs
1	Al-Anbar	Al-Hadra Station	2 x 31.5 MVA	One mobile (16 MVA)	Construction of 2 x 31.5 MVA
2	Al-Anbar	Al-Nasir Station	2 x 31.5 MVA	One mobile (10 MVA)	Construction of 2 x 31.5 MVA
3	Al-Anbar	AL-Garma 1 Station	2 x 10 MVA	One mobile (10 MVA)	Two Transformers (10 MVA)
4	Al-Anbar	AL-Garma 2 Station	2 x 10 fixed and Mobile 16 MVA	One mobile (10 MVA) and One mobile (16 MVA)	Construction of 2 x 31.5 MVA
5	Al-Anbar	Al Nasaf Station	Mobile 16 MVA	One mobile (16 MVA)	-----
6	Al-Anbar	Al Taawon Station	Mobile 16 MVA	One mobile (16 MVA)	-----
7	Al-Anbar	Al Amiriya 1 Station	2 x 10 MVA	-----	-----
8	Al-Anbar	Al Amiriya 2 Station	2 x 5 MVA	-----	-----
9	Al-Anbar	Al Saqlawiya Station	2 x 10 MVA fixed and Mobile 16 MVA	One mobile (16 MVA)	Construction of 2 x 31.5 MVA
10	Al-Anbar	Al Siyahiya Station	1 x 10 MVA + 1x 5 MVA	-----	-----
11	Al-Anbar	Al Tharthar Station (22 km)	fixed 1 x 5 MVA and mobile 16 MVA	One Transformer (16 MVA)	-----
12	Al-Anbar	Al Shuhadaa Station	2 x 31.5 MVA	Two Transformers (31.5 MVA)	-----
13	Al-Anbar	Al Sharqiya Station	2 x 31.5 MVA	One mobile (10 MVA)	Construction of 2 x 31.5 MVA
14	Al-Anbar	Al Qadesiya/Ramadi	2 x 31.5 MVA	One mobile (10 MVA) and One mobile (16 MVA)	Construction of 2 x 31.5 MVA
15	Al-Anbar	Al Hussain/Ramadi	2 x 31.5 MVA	One mobile (16 MVA)	Construction of 2 x 31.5 MVA
16	Al-Anbar	Kubaisa	2 x 10 MVA	One Transformer (10 MVA)	
17	Al-Anbar	Al Mohamadi	2 x 10 MVA	One mobile (10 MVA)	Two Transformers (16 MVA)
18	Al-Anbar	Al Furat	2 x 16 MVA	One mobile (16 MVA)	Two Transformers (31.5 MVA)
19	Al-Anbar	Al Mashtal	2 x 31.5 MVA	One mobile (16 MVA)	Two Transformers (31.5 MVA)
20	Al-Anbar	7-kilo	2 x 10 MVA	One mobile (10 MVA)	Two Transformers (16 MVA)

No.	Governorates	Substation Name	Installed Capacity	Urgent Needs	Further Needs
21	Al-Anbar	Al Easkan/mobile	1 x 16 MVA	One mobile (16 MVA)	-----
22	Al-Anbar	South Ramadi	2 x 31.5 MVA	Two Transformers (31.5 MVA)	-----
23	Al-Anbar	Al Jaraishiy	2 x 31.5 MVA	Two Transformers (31.5 MVA)	-----
24	Al-Anbar	Al Khaldiya	2 x 10 MVA Fixed + 16 MVA mobile	One mobile (16 MVA)	Construction of 2 x 31.5 MVA
25	Al-Anbar	Al Malahama	2 x 10 MVA	One mobile (10 MVA)	One Transformer (10 MVA) + One Transformer (16 MVA)
26	Al-Anbar	Al Habaniya Tamoz Base	2 x 5 MVA	-----	-----
27	Upper Euphrates	Barawana Station	Mobile (16 MVA)	One Mobile (16 MVA)	Two Transformers (16 MVA)
28	Diyala	Al Odhaim Station	2 x 31.5 MVA	One mobile (16 MVA)	Construction of 2 x 31.5 MVA
29	Diyala	Nawfal Station	2 x 16 MVA	One Transformer (16 MVA)	-----
30	Diyala	Dalli Abbas Station	2 x 16 MVA	One mobile (16 MVA)	One Transformer (16 MVA)
31	Diyala	Jalawlaa Station	2 x 16 MVA	Two mobile (10 MVA)	Two Transformers (31.5 MVA)
32	Diyala		2 x 10 MVA	One mobile (10 MVA)	Two Transformers (10 MVA)
33	Diyala	Al Sedor Area Station	1 x 16 MVA	One mobile (16 MVA)	Construction of 2 x 31.5 MVA
34	Diyala	Qara Naba mobile Station	2 x 16 MVA + Two mobile 5 MVA	-----	Construction of 2 x 31.5 MVA

(Source: MOE Distribution Office)

Table 6.2-2 Reconstruction Needs for Liberated Area and Conflict Affected Area (2)

No.	Governorates	Substation Name	Installed Capacity	Damage Percentage
1	Ninawa	Rabiea	10 MVA + 16 MVA	50% + 50%
2	Ninawa	Domez Zamar	10 MVA	50%
3	Ninawa	Snoni (North)	10 MVA	50%
4	Ninawa	Wanah	10 MVA	50%
5	Ninawa	Eski Mosul	10 MVA	50%
6	Salah El-Din	Hetin Station/Tikrit District	2 x 31.5 MVA	100%
7	Salah El-Din	Al Qadesiya Station/Tikrit District	2 x 31.5 MVA	40%
8	Salah El-Din	Al Rayash Station/Tikrit District	2 x 16 MVA	100%
9	Salah El-Din	Al Adja Station/Tikrit District	2 x 31.5 MVA	100%
10	Salah El-Din	Al Shaheed Abdallah Station/Tikrit District	2 x 16 MVA	20%
11	Salah El-Din	Al Maghibdi Station/Tikrit District	2 x 16 MVA	20%
12	Salah El-Din	Albo-ajeel (mobile) Station/Tikrit District	1 x 16 MVA	100%
13	Salah El-Din	Yathrib Station/Balad	2 x 31.5 MVA	100%
14	Salah El-Din	Shatt AlArab Station/Balad	2 x 16 MVA	100%
15	Salah El-Din	Albo-nimir Station/Samara	2 x 16 MVA	50%
16	Salah El-Din	Yankja Station/Tooz District	2 x 16 MVA	50%
17	Salah El-Din	Salman Bek Station/Tooz District	2 x 16 MVA	50%
18	Salah El-Din	Al Dor New Station/Al Dor District	2 x 16 MVA	100%
19	Salah El-Din	Al Mutawakil Station/Al Dor District	2 x 16 MVA	50%
20	Salah El-Din	Jalam Al Dor (mobile) Station/Al Dor District	1 x 16 MVA	10%

(Source: MOE Distribution Office)

## (2) Construction Needs for All Areas

Tables 6.2-3 through 6.2-6 show planned 400 kV and 132 kV substations, 400 kV auto

transformers and 132 kV mobile substations for all areas in Iraq. These tables show high priority substations and transformers to be constructed and/or procured.

These tables show the target year of completion, which is assumed in the “National Development Plan 2013-2017”. However, because of the changing situation in Iraq, at this time, the degree of priority of projects is explained as “Urgent”, “High”, and “Middle” in descending order. Considering the priority in the tables, the priority is classified as follows:

- Urgent needs: Ninawa, Salah Ad-Den, and Al-Anbar governorates
- High needs: Kirkuk and Diyala governorates, and
- Middle needs: Other than those above.

Tables 6.2-3 and 6.2-4 show planned 400 kV substations and 132 kV substations, respectively. Comparing these tables, 132 kV substations seem to be more required than the 400 kV substations. It is understandable that the number of 400 kV substations needs is fewer than that of 132 kV substations needs. Against the 8,250 MVA of the total capacity for 400 kV substations needs, the total capacity of 132 kV substations needs is 21,943 MW. In other words, required capacity of 132 kV substations is more than 2.5 times of 400 kV substations. In addition, as shown in Tables 6.2-5 and 6.2-6, procurement of 400 kV auto-transformers and 132 kV mobile substation are planned.

Table 6.2-3 Planned 400 kV Substations

No.	Governorate	Substation Name	Priority	MVA	Type	Target Year of Completion	New/ Rehabilitation
1	Ninawa	Kesek	Urgent	1,000	GIS	2017	New
2	Baghdad	Yosofiyah	Middle	1,000	AIS	2016	New
3	Baghdad	Dora	Middle	2,000	GIS	2019	New
4	Salah Ad-Den	Salah Ad-Den	Urgent	750	AIS	2016	Upgrading
5	Kerbala	Dhefaf Kerbala	Middle	2,000	GIS	2017	New
6	Kirkuk	Debes	High	500	---	2015	Upgrading
7	Babil	New babil	Middle	1,000	GIS	2019	New

(source: MOE)

Table 6.2-4 Planned 132 kV Substations

No.	Governorates	Substation Names	Priority	MVA	Type	Target Year of Completion	New/ Rehabilitation
1	Ninawa	Alnoor	Urgent	189	GIS	2013	New
2	Ninawa	Bertella	Urgent	189	GIS	2013	New
3	Ninawa	Mosel South	Urgent	189	GIS	2014	New
4	Ninawa	Mamoon	Urgent	189	GIS	2015	New
5	Ninawa	Namroud	Urgent	189	GIS	2015	New
6	Ninawa	Tal-Afer 2	Urgent	189	GIS	2015	New
7	Ninawa	Shemal dist.	Urgent	189	GIS	2015	New
8	Ninawa	Yaremja South	Urgent	189	GIS	2015	New
9	Ninawa	Resala	Urgent	189	GIS	2015	New
10	Ninawa	Arbajyyah	Urgent	189	GIS	2015	New

*SAPI for Electricity Sector Reconstruction Project in Iraq*

No.	Governorates	Substation Names	Priority	MVA	Type	Target Year of Completion	New/ Rehabilitation
11	Ninawa	Farouq	Urgent	189	GIS	2016	New
12	Ninawa	Shallalat	Urgent	189	GIS	2016	New
13	Ninawa	Qayara 2	Urgent	150	GIS	2016	New
14	Ninawa	Baaj	Urgent	100	GIS	2016	New
15	Ninawa	Sherqat 2	Urgent	189	GIS	2016	New
16	Babil	Jorf Al Skher	Middle	189	GIS	2014	New
17	Babil	Hashimaha Way	Middle	189	GIS	2015	New
18	Babil	Mahaweel	Middle	270	GIS	2015	New
19	Babil	Abo Gharaq	Middle	189	GIS	2015	New
20	Babil	Keffel	Middle	189	GIS	2016	New
21	Babil	Mosayab	Middle	189	GIS	2017	New
22	Baghdad	Al Turath	Middle	189	GIS	2015	New
23	Baghdad	Al Rabeea	Middle	189	GIS	2015	New
24	Baghdad	Al-Amel	Middle	189	GIS	2015	New
25	Baghdad	Tojjar	Middle	270	GIS	2015	New
26	Baghdad	Sader	Middle	189	GIS	2014	New
27	Baghdad	Zayona	Middle	189	GIS	2014	New
28	Baghdad	Khan Bany Saad	Middle	189	GIS	2014	New
29	Baghdad	Tajeyat	Middle	189	GIS	2014	New
30	Baghdad	Mahmodeyah	Middle	189	GIS	2014	New
31	Baghdad	Latifeya new	Middle	189	AIS	2014	New
32	Baghdad	Sahafyeen	Middle	270	GIS	2015	New
33	Baghdad	Adala	Middle	270	GIS	2015	New
34	Baghdad	Alboatha	Middle	189	GIS	2015	New
35	Baghdad	Gayara	Middle	270	GIS	2015	New
36	Baghdad	Salman Bak	Middle	270	GIS	2015	New
37	Baghdad	Tariq	Middle	270	GIS	2016	New
38	Baghdad	Abo Ghreeb	Middle	189	GIS	2016	New
39	Baghdad	Emari	Middle	270	GIS	2016	New
40	Baghdad	Karada East	Middle	270	GIS	2016	New
41	Baghdad	Baladeyat	Middle	270	GIS	2016	New
42	Baghdad	Boob Alsham	Middle	270	GIS	2017	New
43	Dhi Qar	Refaee new	Middle	189	GIS	2014	New
44	Dhi Qar	Nasseryah East	Middle	189	GIS	2015	New
45	Dhi Qar	Aredoo	Middle	270	GIS	2015	New
46	Dhi Qar	Zaqoora	Middle	189	GIS	2016	New
47	Dhi Qar	Battha	Middle	189	GIS	2016	New
48	Dhi Qar	Chebeyeesh	Middle	126	GIS	2017	New
49	Meisan	Albetera	Middle	189	GIS	2015	New
50	Meisan	Salih Castle	Middle	189	GIS	2015	New
51	Meisan	Kahla	Middle	189	GIS	2016	New
52	Salah Ad-Den	Samara South	Urgent	189	GIS	2014	New
53	Salah Ad-Den	Balad 2	Urgent	189	GIS	2015	New
54	Salah Ad-Den	Shesheen Vally	Urgent	189	GIS	2015	New
55	Salah Ad-Den	Malweyah	Urgent	270	GIS	2016	New
56	Salah Ad-Den	Beiji South	Urgent	189	GIS	2017	New
57	Al-muthanna	Romaytha new	Middle	189	GIS	2014	New
58	Al-muthanna	Qadhaa Al Slman	Middle	126	GIS	2018	New

**Chapter 6 Reconstruction Needs for Power Sector**

No.	Governorates	Substation Names	Priority	MVA	Type	Target Year of Completion	New/ Rehabilitation
59	Najaf	Bahr-Al Najaf	Middle	270	GIS	2015	New
60	Najaf	Manathera	Middle	189	GIS	2016	New
61	Najaf	Matthana	Middle	189	GIS	2017	New
62	Najaf	Tire Factory	Middle	189	GIS	2018	New
63	Basra	Airport (Nkhaila)	Middle	189	GIS	2013	New
64	Basra	Fayhaa	Middle	270	GIS	2013	New
65	Basra	Almdayna	Middle	270	GIS	2014	New
66	Basra	Aldaer	Middle	189	GIS	2014	New
67	Basra	Industrial institute	Middle	189	GIS	2015	New
68	Basra	Qebla	Middle	270	GIS	2015	New
69	Basra	Qurna North	Middle	189	GIS	2015	New
70	Basra	Al Emam Al Sadek	Middle	189	GIS	2016	New
71	Basra	Turkish hospital	Middle	189	GIS	2017	New
72	Basra	Om-qaser North	Middle	270	GIS	2017	New
73	Basra	Ghadeer	Middle	189	GIS	2017	New
74	Basra	Marbid	Middle	189	GIS	2017	New
75	Basra	Saraji	Middle	189	GIS	2018	New
76	Basra	Shatt-Al Arab	Middle	270	GIS	2019	New
77	Basra	Sport City	Middle	270	GIS	2019	New
78	Basra	Qura	Middle	189	GIS	2019	New
79	Qadissiya	Dewanea West	Middle	189	GIS	2014	New
80	Qadissiya	Shameya new	Middle	270	GIS	2015	New
81	Diyala	Baquba North	High	189	GIS	2014	New
82	Diyala	Jalawla	High	189	GIS	2014	New
83	Diyala	Baquba North East	High	189	GIS	2015	New
84	Kerbala	Kerbala new	Middle	189	GIS	2014	New
85	Kerbala	Kerbala North new	Middle	270	GIS	2015	New
86	Kerbala	Kerbala South new	Middle	270	GIS	2016	New
87	Kerbala	Sawada	Middle	189	GIS	2016	New
88	Kerbala	Najaf Way	Middle	189	GIS	2017	New
89	Kerbala	Hussaineyah	Middle	189	GIS	2018	New
90	Wasit	Al-hay	Middle	189	GIS	2014	New
91	Wasit	Kout North West	Middle	189	GIS	2015	New
92	Wasit	Zubaidieah int. sec.	Middle	189	GIS	2016	New
93	Wasit	Kout Center	Middle	189	GIS	2017	New
94	Wasit	Hakeem	Middle	189	GIS	2018	New
95	Kirkuk	Kirkuk North	High	189	GIS	2013	New
96	Kirkuk	Banja Ali	High	189	GIS	2015	New
97	Kirkuk	Al-zab	High	189	GIS	2015	New
98	Kirkuk	Doz 2	High	189	GIS	2015	New
99	Kirkuk	Daqouq	High	100	GIS	2015	New
100	Kirkuk	Debes new	High	189	GIS	2016	New
101	Al-Anbar	Ramadi west	Urgent	189	GIS	2014	New
102	Al-Anbar	Baghdadi	Urgent	189	GIS	2015	New
103	Al-Anbar	Qaeem west	Urgent	189	GIS	2015	New
104	Al-Anbar	Garma west	Urgent	189	GIS	2015	New
105	Al-Anbar	Cement fact. 1	Urgent	100	GIS	2015	New
106	Al-Anbar	Cement fact. 2	Urgent	100	GIS	2015	New

No.	Governorates	Substation Names	Priority	MVA	Type	Target Year of Completion	New/ Rehabilitation
107	Al-Anbar	Saqlaweyah	Urgent	189	GIS	2016	New
108	Al-Anbar	Khalideyah south	Urgent	189	GIS	2017	New
109	Al-Anbar	Ramadi north	Urgent	189	GIS	2018	New

(Source: MOE)

Table 6.2-5 Planned Procurement of 400 kV Auto-Transformers

No.	Governorate	Substation Name	Priority	Target Year of Completion
1	AL-Kadisya	AL-Kadisya	Middle	2016
2	Wasit	Wasit	Middle	2016
3	Baghdad	Baghdad West	Middle	2016
4	Anbar	Al-Qaim	Urgent	2016

(Source: MOE)

Table 6.2-6 Planned Procurement of 132 kV Mobile Substations

No.	Governorate	Substation Name	Priority	Target Year of Completion
1	Mesan	Amara East	Middle	2016
2	Wasit	Numanya	Middle	2016
3	Baghdad	Al-Mansure	Middle	2016
4	Babylon	Jurf Al-Sakher	Middle	2016
5	Babylon	Hilla South	Middle	2016
6	Babylon	Latifia	Middle	2016
7	Anbar	Fallujah North	Urgent	2016
8	Anbar	Fallujah South	Urgent	2016
9	Anbar	Old Anbar	Urgent	2016
10	Anbar	South Anbar	Urgent	2016

(Source: MOE)

### 6.3 Urgent Reconstruction Needs

To stabilize and strengthen the electric power supply in Iraq, the MOE listed the following projects which require urgent implementation including construction of new 132 kV substations in/around Baghdad and procurement of substation facilities for Anbar Governorate where power supply facilities were destroyed by ISIL.

- 1) Construction of new 132 kV substations in/around Baghdad
  - Al Amel 132 kV SS (GIS)
  - Al Mahmodiya 132 kV SS (GIS)
  - Al Tajiyat 132 kV SS (GIS)
  - Abo Ghreeb 132 kV SS (GIS)
  - Al Boaita 132 kV SS (GIS)
  - Al Latifiya 132 kV SS (AIS)
- 2) Procurement of 132 kV mobile substations for Anbar
  - Falluja cement, 132/33 kV 45 MVA

- Old Ramaadi, 132/33 kV 31.5 MVA
  - Ruttba, 132/33 kV 31.5 MVA
  - Falluja, 132/33 kV 45 MVA
  - Kubaisah, 132/33 kV 31.5 MVA
  - New Ramadi, 132/33 kV 45 MVA
  - Old Ramaadi, 132/11 kV 25 MVA
  - Falluja cement, 132/11 kV, 25 MVA
  - Ruttba, 132/11 kV 25 MVA
  - New Ramadi, 132/11 kV 25 MVA
  - Falluja, 132/11 kV 25 MVA
- 3) Procurement of 33 kV mobile substations for Anbar
- AL Mashtal, 33/11 kV 31.5 MVA
  - AL Qadisiyah, 33/11 kV 31.5 MVA
  - AL Hussain, 33/11 kV 31.5 MVA
  - AL Khaldiyah, 33/11 kV 31.5 MVA
  - AL Rutba, 33/11 kV 31.5 MVA
  - Al karma (2), 33/11 kV 31.5 MVA
  - AL Nasr, 33/11 kV 31.5 MVA
  - AL Hathra, 33/11 kV 31.5 MVA
  - AL Karma (1), 33/11 kV 31.5 MVA
  - AL Sharqiyah, 33/11 kV 31.5 MVA
  - AL Janobiyah, 33/11 kV 31.5 MVA
  - AL Saqlawiyah, 33/11 kV 31.5 MVA
  - AL Nasaaf, 33/11 kV 31.5 MVA
  - AL Taawin, 33/11 kV 31.5 MVA
  - AL Therthar, 33/11 kV 31.5 MVA

Among the above subprojects, the Study Team conducted the survey for construction sites of new 132 kV substations in/around Baghdad. The results of the survey are to be described in Chapter 7.

**CHAPTER 7**  
**SITE SURVEY FOR**  
**URGENT RECONSTRUCTION PROJECTS**



## CHAPTER 7 SITE SURVEY FOR URGENT RECONSTRUCTION PROJECTS

### 7.1 General

Among the MOE's urgent needs projects which described in Clause 6.3, the Study Team conducted the survey for construction sites of new 132 kV substations in/around Baghdad. The following clauses show the results of the survey.

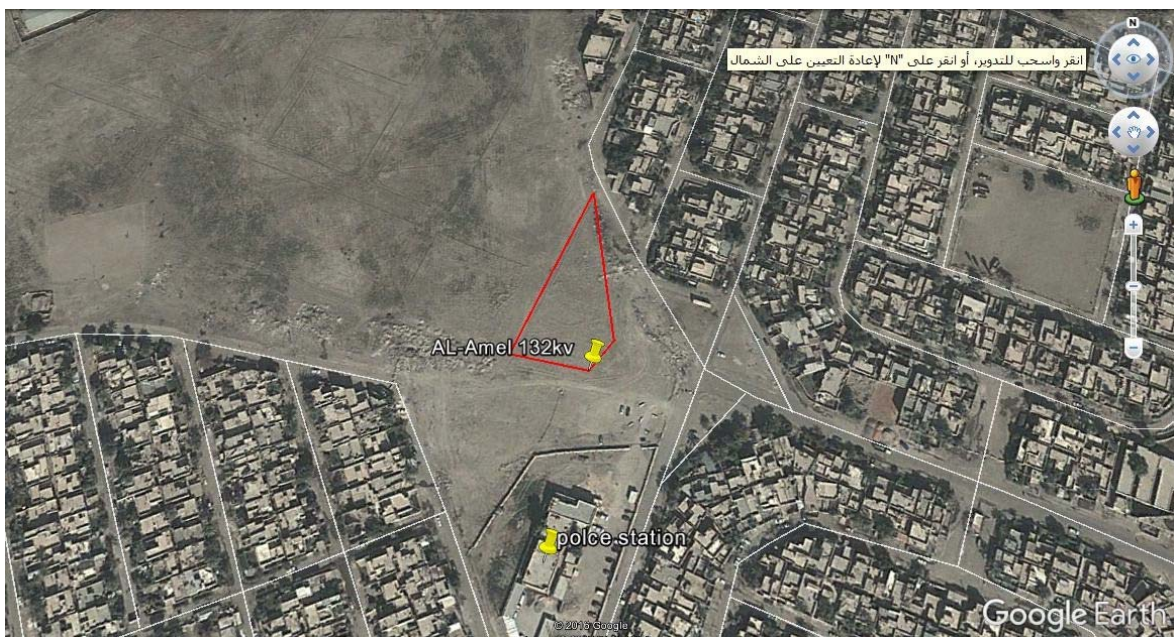
### 7.2 Candidate Projects

#### (1) 132 kV Al Amel Substation

##### 1) Objective

The MOE plans to construct a new substation to meet the electric power demand expected to increase the planned supply area within Al Amel Village. Although Dora Thermal, 132 kV Al Jazaer, and 132 kV Mansoor substations currently supply electric power to the area, it is difficult to supply the increased demand from these substations in the future.

As shown in Figure 7.2-1, the planned construction site is located in the residential area, a vacant land surrounded by the T-walls around the site, and is adjacent to the police station (refer to Attachment 7-1 to be attached at the end of this chapter).



(Source: Google Earth, Prepared by the Study Team)

Figure 7.2-1 132 kV Al Amel Substation Location

2) Substation Location

- Governorate: Baghdad
- District: Al Karkh
- Village: Al Amel
- Coordination: Lat. N 33° 16' 56.76" Lon. E 44° 20' 13.5"
- Total area: 3,277.5 m<sup>2</sup>
- Land owner: MOE

3) Weather Conditions

- Maximum temperature in summer: 55 °C
- Minimum temperature in winter: -2 °C
- Average maximum wind speed: 75 km/h (= 20 m/s)

4) Planned Supply Areas and Population

Planned supply areas with rough population are as follows:

- Bayyaa: 2,000
- Qasdeseyyah: 1,800
- Jaber Ibn Hayan: 2,000
- Medical Center: 2,200

5) Peak Demand Forecast

Peak demand forecast done by the MOE is as follows:

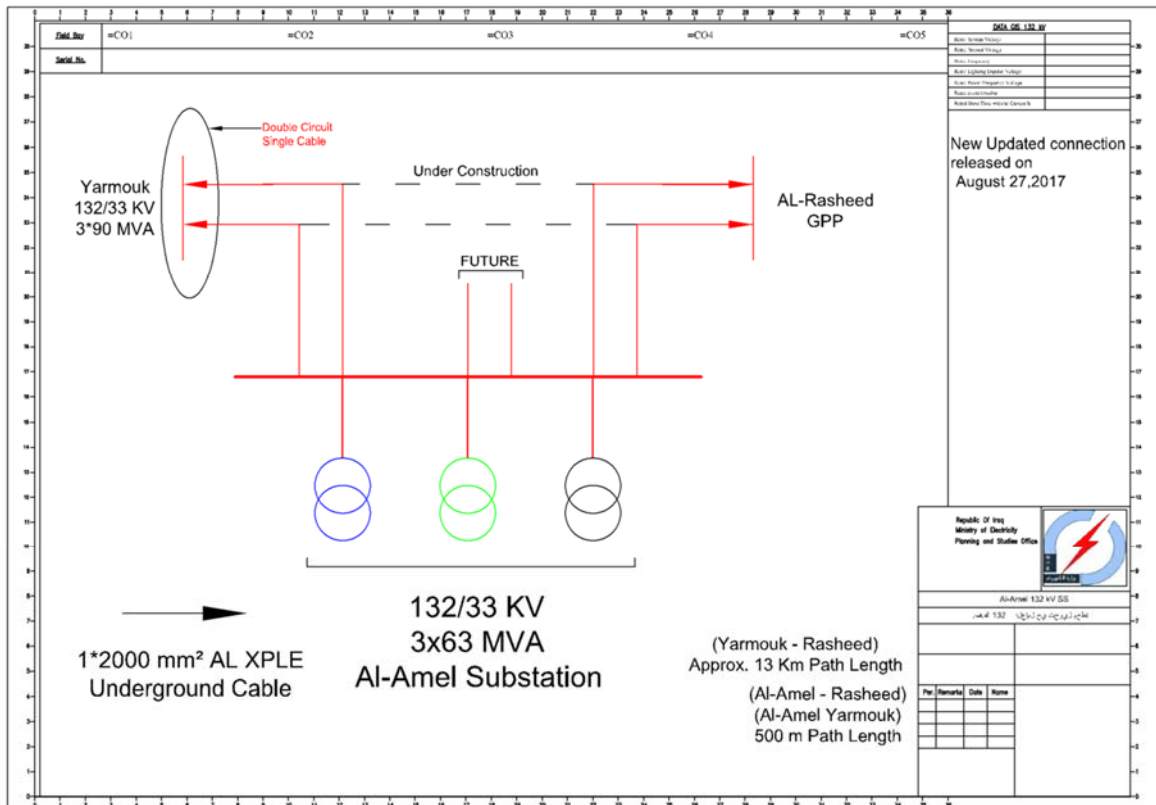
Year	2016	2021	2026	2031	2036
Demand	40 MW	70 MW	100 MW	120 MW	150 MW

6) Major Equipment (refer to Figure 7.2-2 Single Line Diagram)

- Switchgear: Gas Insulated Switchgear (GIS)
- Main Transformers: 63 MVA x 3 units
- 132 kV Feeders: 6 feeders
- 33 kV Feeders: 12 feeders
- 11 kV Feeders: N/A

7) Planned Operation and Maintenance Structure

- Operators: 9 people (3 people x 3 shifts)
- Security Guards: 12 people (4 people x 3 shifts)
- Maintenance Staff: 24 people (not full time, in-charge of General Directorate of Electrical Transmission / Middle Region of MOE)



(Source: MOE)

Figure 7.2-2 132 kV Al Amel Substation: Single Line Diagram

8) Substations to be Connected

132 kV Al Amel Substation will be connected to transmission line between Al Rasheen Gas Turbine Power Plant and 132 kV Al Yarmook Substation by T-branch connection. A part of this transmission line is under construction.

Substation 1

- Substation: Al Rasheed Gas Turbine Power Plant
- Generator Capacity: 47 MVA x 2 units
- Planned Transmission Line: XLPE 2000 mm<sup>2</sup>, 2 circuits

Substation 2

- Substation: 132 kV Al Yarmook Substation
- Generator Capacity: 90 MVA x 3 units
- Planned Transmission Line: XLPE 2000 mm<sup>2</sup>, 2 circuits

9) Others

- Security situation surrounding the site: According to the MOE, the planned site is very safe and under government control. No trouble encountered with neighbouring residents during the site survey.

10) Site Photographs (taken during the site survey)



T-walls surrounding the Site



Residents around the Site

(2) 132 kV Al Mahmodiya Substation

1) Objective

The MOE plans to construct this new substation to meet the electric power demand expected to increase the planned supply area within Al Mahmodiya area. Although 132 kV Yousufiya Substation currently supplies electric power to the area, 132 kV Al Mahmodiya Substation aims to reduce electricity loads of 132 kV Yousufiya Substation.

As shown in Figure 7.2-3, the planned construction site is located in the cultivated field and a vacant land is surrounded by the T-walls around the site (refer to Attachment 7-2 to be attached at the end of this chapter).

2) Substation Location

- Governorate: Baghdad
- District: Al Mahmodiya
- Village: Al Qaser Alawsaat / Hay Al Salam Village
- Coordination: Lat. N 33° 4' 9.44" Lon. E 44° 23' 39.6"
- Total area: 10,000 m<sup>2</sup>
- Land owner: MOE

3) Weather Conditions

- Maximum temperature in summer: 55 °C
- Minimum temperature in winter: -5 °C
- Average maximum wind speed: 80 km/h (= 22.2 m/s)



(Source: Google Earth, Prepared by the Study Team)

Figure 7.2-3 132 kV Al Mahmodiya Substation Location

#### 4) Planned Supply Areas and Population

Planned supply areas with rough population are as follows:

- Rasoul: 4,000
- Mahmoudiya: 2,000
- Al Rasheed: 2,300
- Iskan Al Mahmodiya: 2,300
- Al Latyfiyah: 2,000
- Agricultural project: 2,000

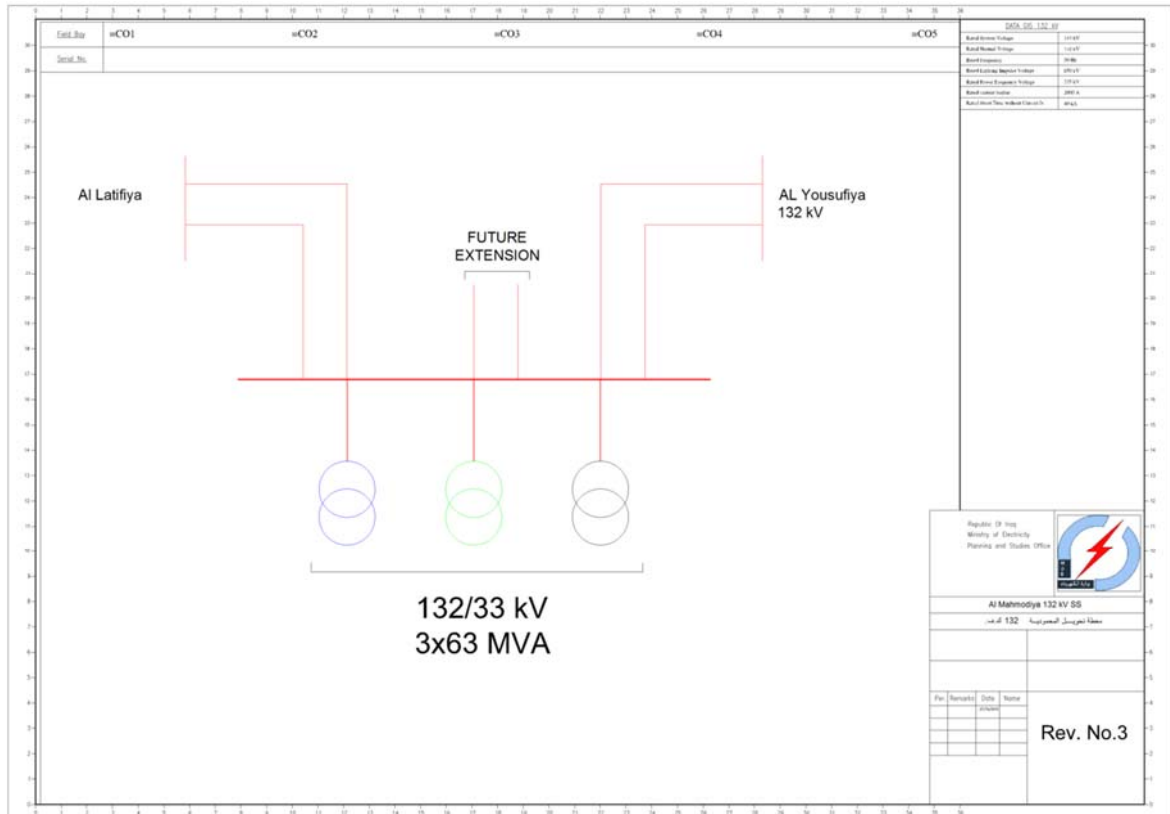
#### 5) Peak Demand Forecast

Peak demand forecast done by the MOE is as follows:

Year	2016	2021	2026	2031	2036
Demand	45 MW	70 MW	85 MW	100 MW	115 MW

#### 6) Major Equipment (refer to Figure 7.2-4 Single Line Diagram)

- Switchgear: Gas Insulated Switchgear (GIS)
- Main Transformers: 63 MVA x 3 units
- 132 kV Feeders: 6 feeders
- 33 kV Feeders: 12 feeders
- 11 kV Feeders: N/A



(Source: MOE)

Figure 7.2-4 132 kV Al Mahmodiya Substation: Single Line Diagram

7) Planned Operation and Maintenance Structure

- Operators: 9 people (3 people × 3 shifts)
- Security Guards: 12 people (4 people × 3 shifts)
- Maintenance Staff: 24 people (not full time, in-charge of General Directorate of Electrical Transmission / Middle Region of MOE)

8) Substations to be Connected

Substation 1

- Substation: 132 kV Al Yousufiya Substation
- Transformer Capacity: 63 MVA x 2 units and 50 MVA x 1 unit
- Planned Transmission Line: Overhead transmission line, 2 circuits

Substation 2

- Substation: 132 kV Al Latifiya Substation (Existing)
- Transformer Capacity: 25 MVA x 2 units and 15 MVA x 1 unit
- Planned Transmission Line: Overhead transmission line , 2 circuits

9) Others

- Security situation surrounding the site: According to the MOE, the planned site is very safe and under government control. No trouble with neighbouring residents during the site survey.

10) Site Photographs (taken during the site survey)



T-walls surrounding the Site



Cultivated Field around the Site

(3) 132 kV Al Tajiyat Substation

1) Objective

The MOE plans to construct this new substation to meet the electric power demand expected to increase the planned supply area within Al Tajiyat Village. Although 132 kV Al Taji Substation currently supplies the electric power to the area, 132 kV Al Tajiyat Substation aims to reduce electricity loads of Al Taji Substation.

As shown in Figure 7.2-5, the planned construction site is located in the cultivated field and a vacant land is surrounded by the walls with barbed wire around the site (refer to Attachment 7-3 to be attached at the end of this chapter).

2) Substation Location

- Governorate: Baghdad
- District: Taji
- Village: Tajiyat
- Coordination: Lat. N 33° 25' 23.76" Lon. E 44° 17' 15.93"
- Total area: 8,710.5 m<sup>2</sup>
- Land owner: MOE

3) Weather Conditions

- Maximum temperature in summer: 55 °C
- Minimum temperature in winter: -5 °C
- Average maximum wind speed: 90 km/h (= 25 m/s)

4) Planned Supply Areas and Population

Planned supply areas with rough population are as follows:

- Naser: 2,300
- Sabea Al Bour: 2,500
- Um Al Jadabel: 4,000



(Source: Google Earth, Prepared by the Study Team)

Figure 7.2-5 132 kV Al Tajiyyat Substation Location

5) Peak Demand Forecast

Peak demand forecast done by the MOE is as follows:

Year	2016	2021	2026	2031	2036
Demand	25 MW	50 MW	80 MW	100 MW	115 MW

6) Major Equipment (refer to Figure 7.2-6 Single Line Diagram)

- Switchgear: Gas Insulated Switchgear (GIS)
- Main Transformers: 63 MVA x 3 units
- 132 kV Feeders: 6 feeders
- 33 kV Feeders: 12 feeders
- 11 kV Feeders: N/A

7) Planned Operation and Maintenance Structure

- Operators: 9 people (3 people x 3 shifts)
- Security Guards: 12 people (4 people x 3 shifts)
- Maintenance Staff: 24 people (not full time, in-charge of General Directorate of Electrical Transmission / Middle Region of MOE)



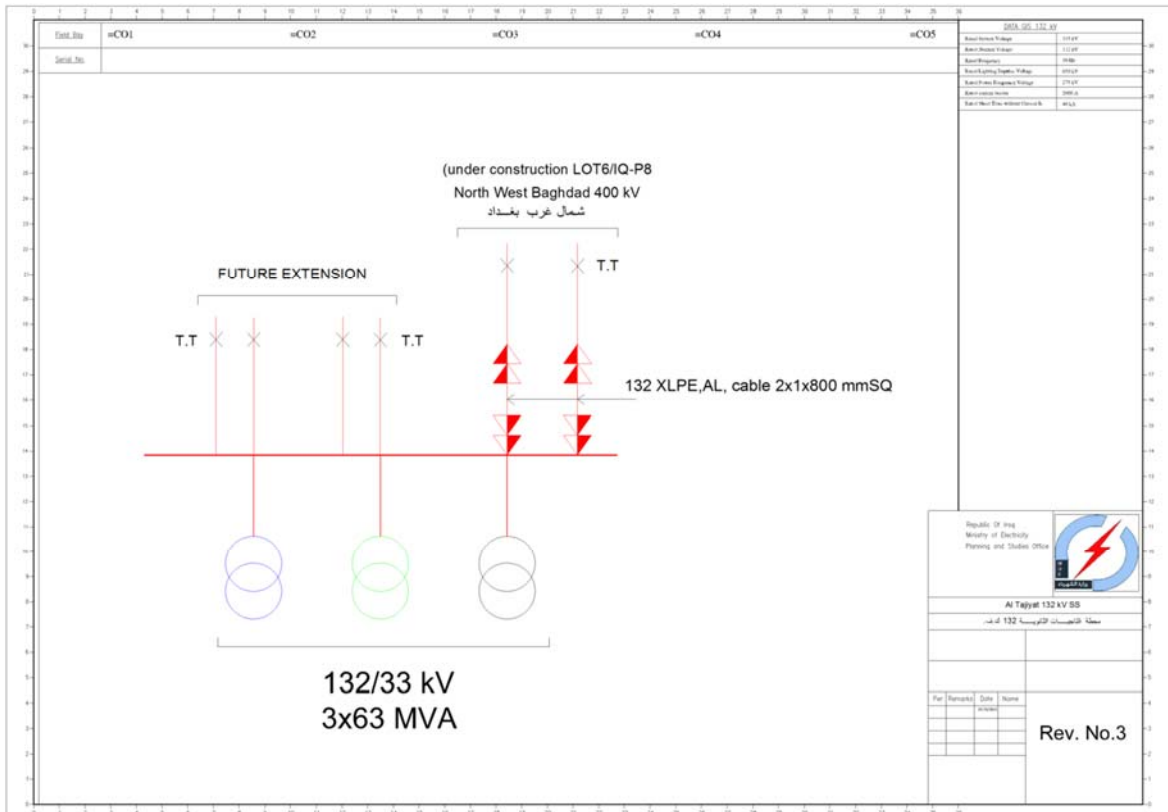


Figure 7.2-6 132 kV Al Tajiyat Substation: Single Line Diagram

8) Substations to be Connected

- Substation: 400 kV North West Baghdad Substation (Under construction)
- Transformer Capacity: 250 MVA x 4 units
- Planned Transmission Line: XLPE 800 mm<sup>2</sup>, 2 circuits

9) Others

- Security situation surrounding the site: According to the MOE, the planned site is very safe and under government control. No trouble with neighbouring residents during the site survey.

10) Site Photographs (taken during the site survey)



Walls surrounding the Site



Situation around the Site

(4) 132 kV Abo Ghreeb Substation

1) Objective

The MOE plans to construct this new substation to meet the electric power demand expected to increase the planned supply area within White Gold Village. Electric power demand has been increasing currently in the supply area.

As shown in Figure 7.2-7, the planned construction site is located in the residential area and a vacant land is surrounded by the T-walls around the site (refer to Attachment 7-4 to be attached at the end of this chapter).



(Source: Google Earth, Prepared by the Study Team)

Figure 7.2-7 132 kV Abo Ghreeb Substation Location

2) Substation Location

- Governorate: Baghdad
- District: Abo Ghreeb
- Village: White Gold Village
- Coordination: Lat. N 33° 18' 59.43" Lon. E 44° 10' 15.54"
- Total area: 2,386.5 m<sup>2</sup>
- Land owner: MOE

3) Weather Conditions

- Maximum temperature in summer: 55 °C

- Minimum temperature in winter: -5 °C
- Average maximum wind speed: 90 km/h (= 25 m/s)

4) Planned Supply Areas and Population

Planned supply areas with rough population are as follows:

- Abo Monayseer: 4,000
- Al Razi: 3,500

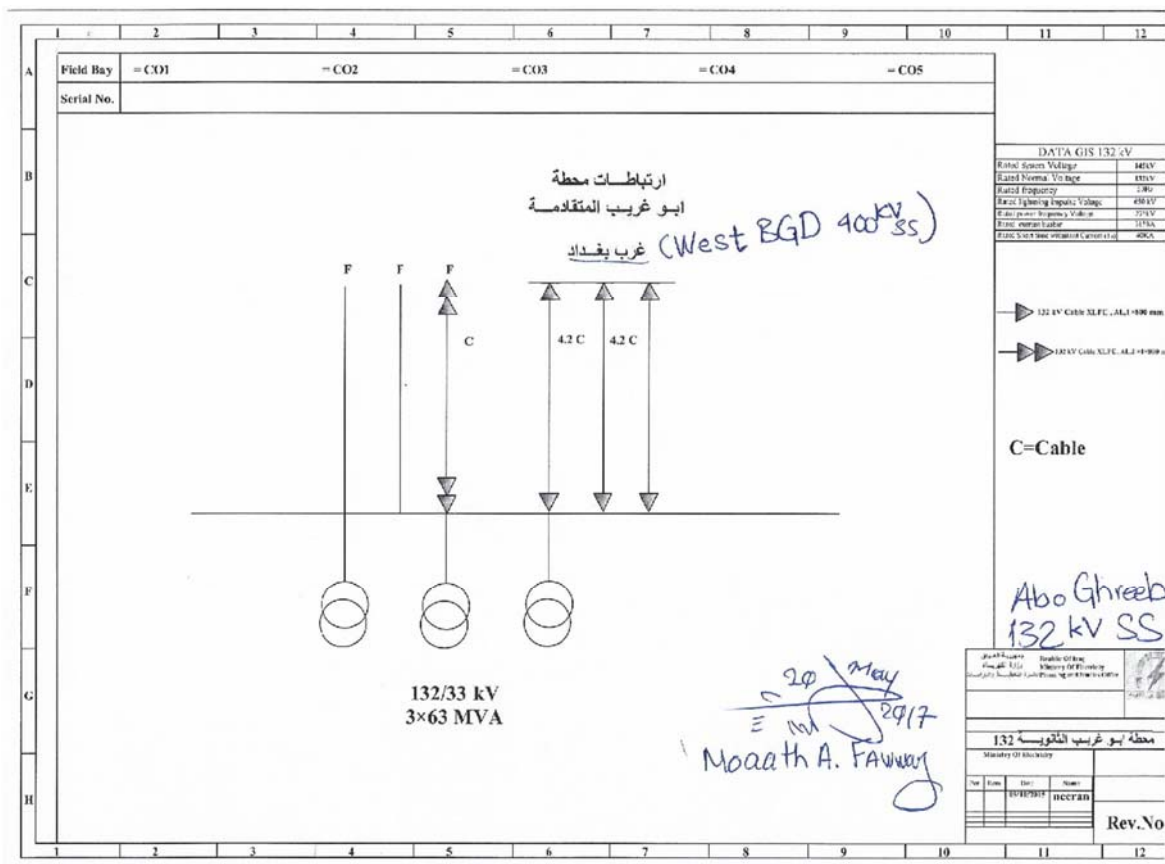
5) Peak Demand Forecast

Peak demand forecast done by the MOE is as follows:

Year	2016	2021	2026	2031	2036
Demand	30 MW	55 MW	75 MW	90 MW	110 MW

6) Major Equipment (refer to Figure 7.2-8 Single Line Diagram)

- Switchgear: Gas Insulated Switchgear (GIS)
- Main Transformers: 63 MVA x 3 units
- 132 kV Feeders: 6 feeders
- 33 kV Feeders: 12 feeders
- 11 kV Feeders: N/A



(Source: MOE)

Figure 7.2-8 132 kV Abo Ghreeb Substation: Single Line Diagram

- 7) Planned Operation and Maintenance Structure
  - Operators: 9 people (3 people × 3 shifts)
  - Security Guards: 12 people (4 people × 3 shifts)
  - Maintenance Staff: 24 people (not full time, in-charge of General Directorate of Electrical Transmission / Middle Region of MOE)
- 8) Substations to be Connected
  - Substation: 400 kV West Baghdad Substation
  - Transformer Capacity: 250 MVA x 4 units
  - Planned Transmission Line: XLPE 800 mm<sup>2</sup>, 3 circuits
- 9) Others
  - Security situation surrounding the site: According to the MOE, the planned site is very safe and under government control. No trouble with neighbouring residents during the site survey.
- 10) Site Photographs (taken during the site survey)



T-walls surrounding the Site



Residents around the Site

(5) 132 kV Al Boaita Substation

1) Objective

The MOE plans to construct this new substation to meet the electric power demand expected to increase in the planned supply area within Dora Village. Although Dora Thermal, 132 kV Abu Dsheer, 132 kV Ekan La Kher, and 132 kV Dora Industrial substations currently supply electric power to the area, Al Boaita substation aims to reduce electricity loads of each substation.

As shown in Figure 7.2-9, the planned construction site is located in the residential area and a vacant land is surrounded by walls with barbed wire around the site (refer to Attachment 7-5 to be attached at the end of this chapter).



(Source: Google Earth, Prepared by the Study Team)

Figure 7.2-9 132 kV Al Boaita Substation Location

2) Substation Location

- Governorate: Baghdad
- District: Al Karkh
- Village: Dora
- Coordination: Lat. N 33° 13' 38.76" Lon. E 44° 24' 35.77"
- Total area: 5,959 m<sup>2</sup>
- Land owner: MOE

3) Weather Conditions

- Maximum temperature in summer: 55 °C
- Minimum temperature in winter: -5 °C
- Average maximum wind speed: 8.64 km/h (= 2.4 m/s)

4) Planned Supply Areas and Population

Planned supply areas with rough population are as follows:

- Sayafeyajh: 4,000
- Al Jameyah: 3,500
- Ibn Al Betar: 4,000
- Iskan Al Dora: 2,000
- Al Jahedh: 2,300

- Al Sehha: 2,300
- Al Mekanek: 2,500

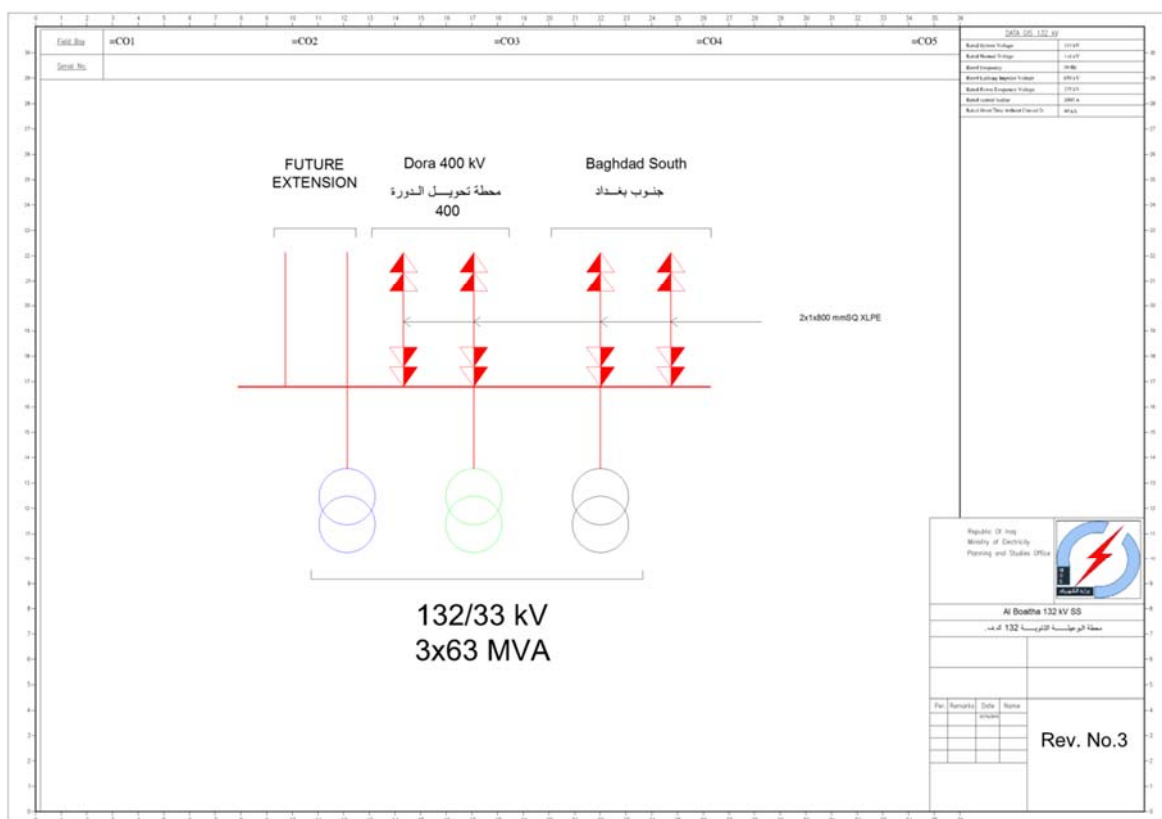
5) Peak Demand Forecast

Peak demand forecast done by the MOE is as follows:

Year	2016	2021	2026	2031	2036
Demand	40 MW	70 MW	85 MW	100 MW	120 MW

6) Major Equipment (refer to Figure 7.2-10 Single Line Diagram)

- Switchgear: Gas Insulated Switchgear (GIS)
- Main Transformers: 63 MVA x 3 units
- 132 kV Feeders: 6 feeders
- 33 kV Feeders: 12 feeders
- 11 kV Feeders: N/A



(Source: MOE)

Figure 7.2-10 132 kV Al Boaita Substation: Single Line Diagram

7) Planned Operation and Maintenance Structure

- Operators: 9 people (3 people x 3 shifts)
- Security Guards: 12 people (4 people x 3 shifts)
- Maintenance Staff: 24 people (not full time, in-charge of General Directorate of Electrical Transmission / Middle Region of MOE)

8) Substations to be Connected

Substation 1

- Substation: 400 kV Dora Substation
- Transformer Capacity: 250 MVA x 8 units
- Planned Transmission Line: XLPE 800 mm<sup>2</sup>, 2 circuits

Substation 2

- Substation: 400 kV Baghdad South Substation
- Transformer Capacity: 250 MVA x 4 units
- Planned Transmission Line: XLPE 800 mm<sup>2</sup>, 2 circuits

9) Others

- Security situation surrounding the site: According to the MOE, the planned site is very safe and under government control. No trouble with neighbouring residents during the site survey.

10) Site Photographs (taken during the site survey)



Walls surrounding the Site



Residents around the Site

(6) 132 kV Al Latifiya Substation

1) Objective

The MOE plans to construct this new substation to meet the electric power demand expected to increase the planned supply area within Al Latifiya Village. Although the existing 132 kV Al Latifiya and 132 kV Yousufiya substations currently supply electric power to the area, Al Latifiya Substation is aiming to reduce electricity loads of each substation.

This candidate substation, Al Latifiya, had been planned and implemented its construction work once. However, the construction work has been cancelled at the stage of civil work until now.

As shown in Figure 7.2-11, the planned construction site is adjacent to the existing Al 132 kV Latifiya Substation and a vacant land is surrounded by walls with barbed wire

around the site (refer to Attachment 7-6 to be attached at the end of this chapter).



(Source: Google Earth, Prepared by the Study Team)

Figure 7.2-11 132 kV Al Latifiya Substation Location

2) Substation Location

- Governorate: Baghdad
- District: Al Mahmodiya
- Village: Al Latifiya
- Coordination: Lat. N 33° 0' 24.81" Lon. E 44° 13' 31.59"
- Total area: 21,000 m<sup>2</sup>
- Land owner: MOE

3) Weather Conditions

- Maximum temperature in summer: 55 °C
- Minimum temperature in winter: -2 °C
- Average maximum wind speed: 90 km/h (= 25 m/s)

4) Planned Supply Areas and Population

Planned supply areas with rough population are as follows:

- Al Latifiya: 3,000
- Sadr Al Latifiya: 1,800
- Small Latifiya: 2,000
- Al Rasheed: 1,600



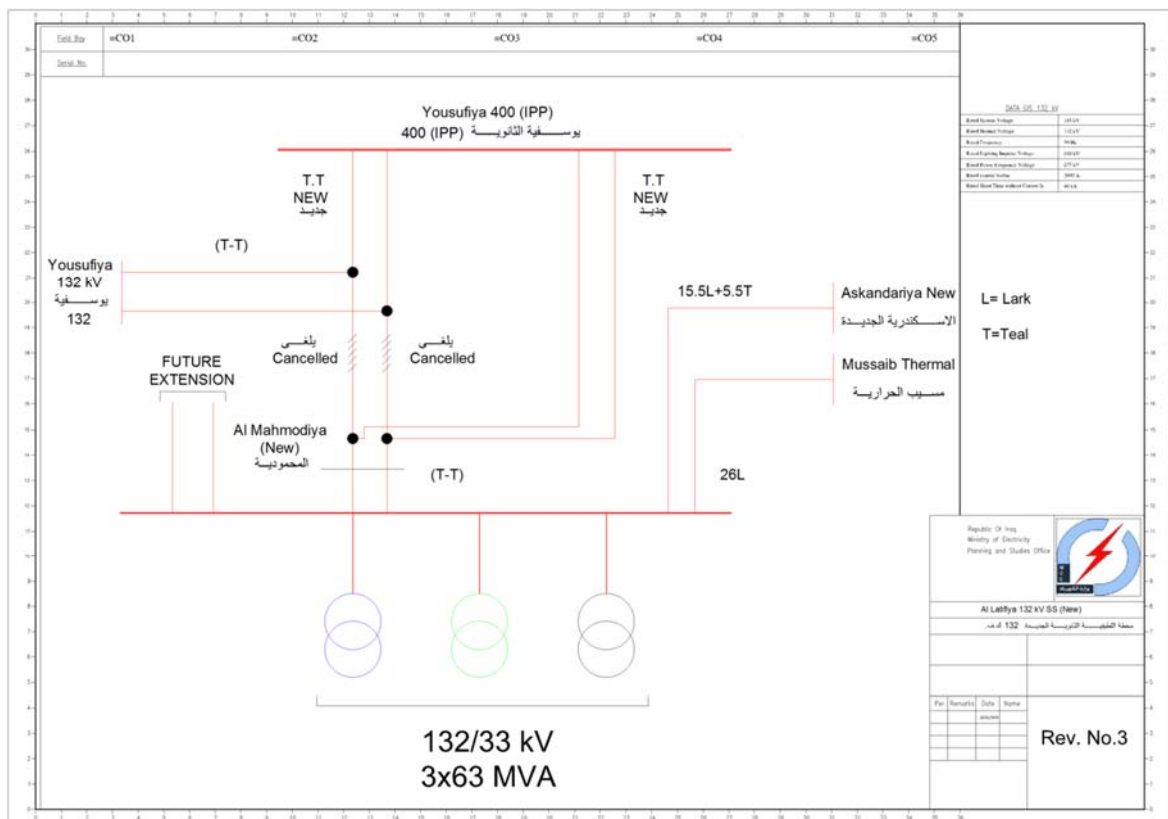
5) Peak Demand Forecast

Peak demand forecast done by the MOE is as follows:

Year	2016	2021	2026	2031	2036
Demand	45 MW	60 MW	85 MW	100 MW	120 MW

6) Major Equipment (refer to Figure 7.2-12 Single Line Diagram)

- Switchgear: Air Insulated Switchgear (AIS)
- Main transformers: 63 MVA x 3 units
- 132 kV Feeders: 6 feeders
- 33 kV Feeders: 12 feeders
- 11 kV Feeders: N/A



(Source: MOE)

Figure 7.2-12 132 kV Al Latifiya Substation: Single Line Diagram

7) Planned Operation and Maintenance Structure

- Operators: 9 people (3 people x 3 shifts)
- Security Guards: 12 people (4 people x 3 shifts)
- Maintenance Staff: 24 people (not full time, in-charge of General Directorate of Electrical Transmission / Middle Region of MOE)

8) Substations to be Connected

Substation 1

- Substation: 132 kV Al Mahmodiya Substation

- Transformer Capacity: 63 MVA x 3 units
- Planned Transmission Line: Overhead transmission line, 2 circuits

Substation 2

- Substation: 132 kV Askandariya New Substation
- Transformer Capacity: 63 MVA x 4 units
- Planned Transmission Line: Overhead transmission line, 1 circuit

Substation 3

- Substation: Mussaib Thermal Power Plant
- Transformer Capacity: 250 MVA x 4 units
- Planned Transmission Line: Overhead transmission line, 1 circuit

9) Others

- Security situation surrounding the site: According to the MOE, the planned site is very safe and under government control. No trouble with neighbouring residents during the site survey.

10) Site Photographs (taken during the site survey)



Walls surrounding the Site



Situation inside the Site

**ATTACHMENT 7-1**

**PLANNED CONSTRUCTION SITE  
132 KV AL AMEL SUBSTATION**



**ATTACHMENT 7-2**

**PLANNED CONSTRUCTION SITE  
132 KV AL MAHMODIYA SUBSTATION**



**ATTACHMENT 7-3**

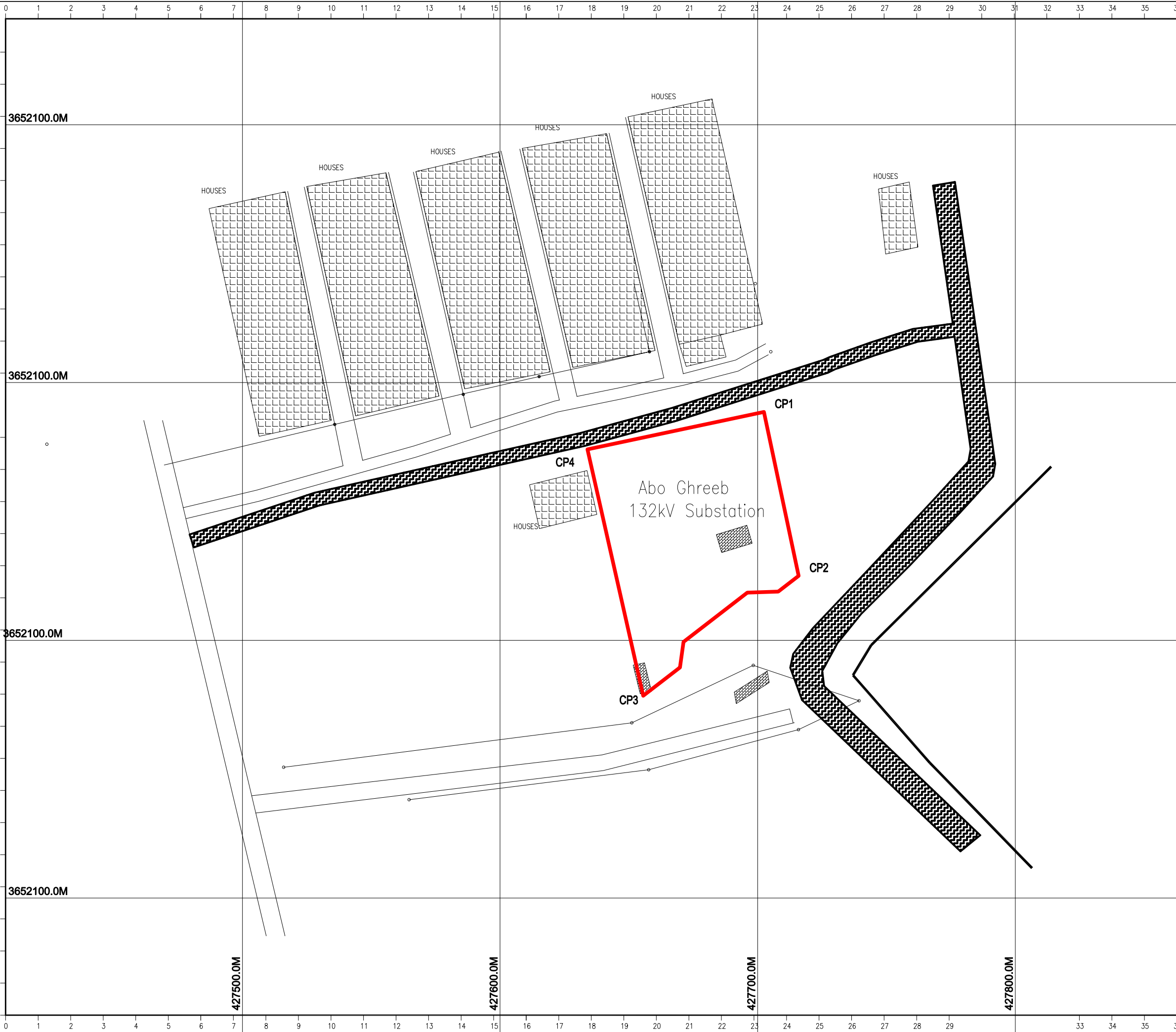
**PLANNED CONSTRUCTION SITE  
132 KV AL TAJIYAT SUBSTATION**





**ATTACHMENT 7-4**

**PLANNED CONSTRUCTION SITE  
132 KV ABO GHREEB SUBSTATION**



**NOTES**

**GEODETTIC PARAMETERS:**

Name : UTM Zone 38N  
 Datum : EGM 2008  
 Projection Type : WGS 1984  
 Units of Coordinates : Meters  
 Latitude of Origin : 00° 00' 00.000" N  
 Longitude of Origin : 045° 00' 00.000" N  
 False Easting at Origin : 500000m  
 False Northing at Origin : 0 m  
 Scale Factor at Origin : 0.99960

**CORNERS OF SITE**

Point	Northing	Easting
CP1	3686688.595	422802.408
CP2	3686625.010	422815.896
CP3	3686578.486	422755.563
CP4	3686674.069	422733.931

**LEGENDS/ABBREVIATION**

**LEGEND**

$\times_{0.712}$	SPOT LEVEL
	PAVED ROAD
	UNPAVED ROAD
	<b>BUILDING</b>
	MAJOR CONTOUR
	WC Septic tank
	11 kV overhead line
	Border
	Concrete T wall
	Water channel

PROJ NO:

WBS:

CONTRACT NO:

**REFERENCE DRAWINGS**

DRAWING NUMBER	DRAWING TITLE

ISSUE	DATE	BY	DESCRIPTION	CHK'D	APP'D

EPC CONTRACTOR

SUBCONTRACTOR

DRAWING TITLE:

**Abo Ghreeb 132 kV Substation  
 site plan**

DRAWN BY:	DATE: 16-5-17	SCALE: 1:1000	CHK'D:
DRAWING NUMBER:		SHEET: A2	APP'D:
			ISSUE: 01

427900.0M

CAD FILENAME:

**ATTACHMENT 7-5**

**PLANNED CONSTRUCTION SITE  
132 KV AL BOAITHA SUBSTATION**



**ATTACHMENT 7-6**

**PLANNED CONSTRUCTION SITE  
132 KV AL LATIFIYA SUBSTATION**



**CHAPTER 8**  
**CONCLUSIONS AND RECOMMENDATIONS**

## CHAPTER 8 CONCLUSIONS AND RECOMMENDATIONS

As for the conclusions and recommendations of this Study, the lessons learned from the Electric Power Sector Reconstruction Project Phase 1 (IQ-P8) and the possibility of Japan's support for the Iraq power sector are described in this chapter.

### 8.1 Lessons Learned from IQ-P8

Based on the lessons learned from IQ-P8 described in Chapter 5, lessons and recommendations for each project implementation stage are described in this clause in order to make it a reference for future project implementation in Iraq.

#### (1) Design Stage (Project scope, design conditions, etc.)

- 1) In case that there are changes in site location, design condition and scope, then more time is required in preparation of the design, based on which tender documents were prepared. Therefore, it is important to firm up fundamental conditions of the project beforehand.
- 2) It is recommended to comply with the following procedure when setting the design conditions.
  - i) Defining in advance exactly where the supplied equipment will be installed.
  - ii) Deciding if there will be interconnection between the existing equipment and the new supplied equipment.
  - iii) High light any special requirement or critical things in the existing sites.
  - iv) Reviewing the design with the authorized staff of the existing site, and recording exactly their approval or comments, if any.

Those terms seem to be what the project implementation team of MOE and the consultant has carried out and recommended to follow in the future projects.

- 3) It is important for the owner to confirm ownership of the land of the project site at an early stage and acquire it as necessary. It is also important to check not only the project site but also the presence or absence of regulation near the site.

#### (2) Tender Stage (Preparation of tender documents, evaluation, contract negotiation, etc.)

- 1) Preparation and changing of tender documents should be started in the very early stage of the project as it consumes time for long discussions and clarification between the owner and the Consultant, as follows:
  - Selection of locations



- Site investigation for conditions inside and outside (adjacent obstacles on boundary line) according to changing of sites/locations
- Changing of civil design on specified sites/locations
- Discussion for selecting reusable equipment (switchgear, others) on the rehabilitation of existing substation
- Individual layout design is required due to limited and different dimensions of land location

To minimize the tender documents' preparation period, it is recommended that the standardized substation layout may be applied to all substation sites as much as the owner can require an adequate land for the standardized layout.

- 2) To reduce the needed time and effort; it is recommended to send individually the technical specification by each subject and discuss it with the interested department or engineers of the owner.
  - 3) The contract documents should include specific requirements in case there is a need to ship back the equipment to the manufacturer's factory.
  - 4) Around 30 days are the standard period of tender security after the validity of the tender proposal. However, because of the country's security, the owner, the consultant and the tenderers could not conduct a face-to-face communication, and are in need of more time than what was expected.
  - 5) L/C opening process should be proceeded as early as possible. It is important that all the concerned parties should understand well in advance the procedure to smoothly open the L/C.
- (3) Construction Stage (Design and manufacturing, transportation, installation, etc.)
- 1) The owner's site teams were trained before the commencement date by the consultant to be familiar with the documentation manual, site management manual and different site situation with the contractual action to deal with. This good practical example should also be practiced in the future projects.
  - 2) The contractor should assign an efficient site manager with a good team of engineers, technicians and workers to have the work done smoothly and with quality. This should be clearly mentioned in the tender documents.
  - 3) One of the most important points on project implementation is to secure the safety, where the contractor should assign a well-trained safety engineer to monitor the site work, and should consider the safety requirements to keep it safely executed, preventing all kinds of harmful accidents. This should be clearly mentioned in the tender documents.

- 4) In order to smoothly carry out civil engineering works and equipment installation work, the contractor needs to share installation plans and layout information of each equipment for civil subcontractors and manufacturers, and to implement equipment manufacturing design and civil engineering design in cooperation with each other.
  - 5) With regard to tax exemption procedures, the owner ought to actively support the contractor in cooperation with related government authorities in order to promote the import and receive of the equipment from customs. The contractors are also encouraged to implement tax exemption applications for imported equipment and materials through the owner at the earliest possible time, even before shipment.
  - 6) In case the owner prefers to use a third party inspector for factory inspections and/or commissioning tests, they should be hired directly by the owner and not through the contractor.
  - 7) Handling work of cargo at Umm Qasr Port should be carried out with more care and by experienced staff. Although it may be difficult even for the contractor to control the handling work at the port, the contractor should request/instruct the handler to be more careful and use experienced staff.
  - 8) Contract documents should include specific requirements in case of shipping back the equipment to the manufacturer's factory. Issuing re-export permission should have a simpler and faster process.
- (4) After Completion (Troubles during warranty period, etc.)
- 1) Although initial troubles on electrical equipment sometimes occur after completion and commissioning in general projects, periodical check and maintenance helps to find out the troubles in early stages.
  - 2) A highly and comprehensive periodical check and maintenance should be carried out on the equipment, to assure the health conditions of the equipment, also following the manuals procedures in the general maintenance of the equipment will prevent any arising problems.
- (5) Others (Force majeure)
- In case a force majeure event occurs, the owner should make efforts to gather information and grasp the situation through government-related organizations, promptly share information with the contractors and the consultants, and discuss the countermeasures among the stakeholders.

## 8.2 Possibility of Japan's Support for Electricity Sector in Iraq

As discussed, the power supply facilities in Iraq are aging and being destroyed due to the three wars and the long-term economic sanctions after the 1980s, despite the MOE's efforts to restore its power facilities since the end of the war in 2003, Iraq has fallen into a chronic power supply shortage. Especially, in the summer when power supply/demand balance is very tight, planned blackouts are inevitable for a long time and have a great influence on people's lives and economic activities. Furthermore, in addition to the situation where restoration and maintenance of destroyed/aged transmission lines and substation equipment cannot be made in time, due to the impact of the ISIL invasion after 2014, the power equipment were seriously damaged and the normal power supply falls into more difficult situation.

Also, as of November 2017, although recapturing Mosul by Iraqi forces is reported, the electricity demand in Baghdad and its surrounding areas is increasing due to the population increase because of the influx of internally displaced persons. Furthermore, in Anbar in the west, the return of residents to the liberated areas recaptured from ISIL has started, but damage to power facilities is enormous and sufficient electric power supply has not been made so emergency restoration measures are required.

Under such circumstances, as described in Clause 2.6, each international donor such as the World Bank Group is implementing or expressing support for infrastructure reconstruction including the electric power facilities in the liberated areas recaptured from ISIL and support for returning internally displaced persons.

Japan has already been implementing the "Electricity Sector Reconstruction Project (E/N signed in April 2007)" and "Electricity Sector Reconstruction Project (Phase 2) (E/N signed in May 2015)", which are official development assistance (ODA) loan projects for reconstruction and improvement of substation facilities in Iraq.

In addition to these, in order to encourage the return of internally displaced persons to the liberated area as well as support for the improvement of electricity supply-demand balance and restoration of electric power facilities, implementation of Japan's emergency reconstruction assistance, "Electricity Sector Reconstruction Project (Phase 3)", has been covenanted between the Government of Japan and the Government of the Republic of Iraq (E/N signed in January 2017). The Phase 3 project has enormous significance in contributing not only to the regional stabilization but also to the cooperation with other donors. Therefore, early implementation of the Phase 3 Project, including the construction of six 132 kV substations that described the results of the site survey in Chapter 7, is expected.