RAJASTHAN RAJYA VIDYUT PRASARAN NIGAM LTD.

STATE LOAD DESPATCH CENTRE

LOAD DESPATCH & SYSTEM OPERATION MANUAL

CONTENTS

ANNEXURES

Chapter-1

Overview

1.1 Introduction

1.1.1 Rajasthan State Power System is the part of Northern Regional Grid which operates in synchronous with Eastern, Western & Northern Eastern Grid. Northern Regional Grid System consists of power systems of constituent States of Haryana, Punjab, Rajasthan, Uttar Pradesh, Uttrakhand, Himachal-Pradesh, Delhi, Jammu and Kashmir and Union Territory of Chandigarh. It includes Inter-State Generating Stations of National Thermal Power Corporation (NTPC), National Hydel Power Corporation (NHPC), Nuclear Power Corporation (NPC), Partnership projects, IPP's, other generating companies, Inter-State Transmission System of Power Grid Corporation of India Limited (PGCIL) and transmission system of BBMB.

1.1.2 Rajasthan State Power System consists of generating stations of Rajasthan Rajya Vidyut Utapdan Nigam Limited (RVUN), Captive Power Stations, IPPs, other generating companies, partnership projects, ISGS located within state, distribution network of three Discoms namely Jaipur Vidyut Vitaran Nigam Ltd. (JVVN), Ajmer Vidyut Vitaran Nigam Ltd. (AVVN) and Jodhpur Vidyut Vitaran Nigam Ltd. (JdVVN).

1.1.3 The highlights of Rajasthan Power System and load despatch facility at State Load Despatch Centre (SLDC) have been described at Chapter 2.

1.2 Northern Regional Grid System

The role of various agencies operating in the Northern Regional Grid and their organisational linkages with RVPN and the SLDC as per Electricity Act 2003 is briefly described below :-

1.2.1 Northern Regional Load Despatch Centre (NRLDC)

(i)NRLDC is the apex body engaged in the activities of integrated operation of power system of the Northern Region. NRLDC is under PGCIL which is designated as a Central Transmission Utility (CTU).

(ii) The Regional Load Despatch Centre shall comply with such principles, guidelines and methodologies in respect of wheeling and optimum scheduling and despatch of electricity as the Central Commisson may specifiy in the Grid Code.

(iii) The Regional Load Despatch Centre shall -

a) be responsible for optimum scheduling and despatch of electiricty within the region, in accordance with the contracts entered into with the licensees or the generating companies operating in the region;
b) monitor grid operations;
c) keep accounts of quantity of electricity transmitted through the regional grid;
d) exercise supervision and control over the inter-state transmission system; and
e) be responsible for carrying out real time operations for grid control and despatch of electricity within the region through secure and economic operation of the regional grid in accordance with the Grid Standards and the Grid Code.

1.2.2 Regional Load Despatch Centre may levy and collect such fee and charges from the generating companies or licensees engaged in inter-state transmission of electricity as may be specified by the Central Commission.

1.3 State Load Despatch Centre (SLDC) :

1.3.1 The State Load Despatch Centre is the apex body to ensure integrated operation of the power system a State as per section 32 of EA 2003 .

1.3.2 The State Load Despatch Centre shall -

a) be responsible for optimum scheduling and despatch of electricity within State, in accordance with the contracts entered into with the licensees or the generating companies operating in the State;
b) monitor grid operations;
c) keep accounts of quantity of electricity transmitted through the state ;
d) exercise supervision and control over the intra-state transmission system; and
e) be responsible for carrying out real time operations for grid control and despatch of electricity within the State through secure and economic operations of the state grid in accordance with the Grid Standards and the Grid Code (s).

1.3.3 The State Load Despatch Centre may levy and collect such fee and charges from the Generating companies or licensees engaged in intra-state transmission of electricity as may be specified by the State Commission.

1.4 Indian Electricity Grid Code (IEGC)

1.4.1 The Indian Electricity Grid Code (IEGC) lays down the rules, guidelines and standards to be followed by the various agencies that connect with and/or utilise the ISTS. IEGC provide a common basis to plan, develop, maintain and operate the power system in the most efficient, reliable and economic manner, while facilitating healthy competition in the generation and supply of electricity in the Country.

1.4.2 Salient Provisions of IEGC

(i) Under section 1.3 (1) of IEGC, RVPN/SLDC & other utilities connected with interstate transmission system (ISTS), are to abide by the various provisions as defined in IEGC so far as they apply to RVPN/SLDC.

(ii) Except where specific provisions made in IEGC, the operation of SLDC shall be governed by Rajasthan Electricity Grid Code and Load Despatch & System Operation Manual.

(iii) As a constituent of the Northern Region the Connection Conditions specified in Chapter-4 of IEGC applies to RVPN.

(iv) All generating units, which are synchronized with the grid, irrespective of their ownership, type and size, shall have their governors in normal operation at all times. If any generating unit of over fifty (50) MW size is required to be operated without its governor in normal operation, the NRLDC shall be immediately advised about the reason and duration of such operation. All governors shall have a droop of between 3% and 6%. The exemption from free governor mode operation in respect of any generating stations shall be sought from CERC under clause 1.6 of IEGC. Such petitions for exemption shall be preceded by study preferably by CEA.

(v) Under Clause 5.1 (e) of IEGC, Control Rooms of NRLDC, all SLDC, power plants, substation of 132 KV & above and any other control centres of regional constituents shall be manned round the clock by qualified and adequately trained personnel.

(vi) Following chapters of IEGC set out the demarcation of responsibilities between NRLDC & SLDC and role of SLDC:

Chapter 4 - Connection conditions
Chapter 5 - Operating code for regional grid
Chapter 6 - Scheduling & despatch code

1.5 Rajasthan Electricity Grid Code (REGC)

RVPN being a Transmission and Bulk Supply Licensee and notified, as State Transmission Utility (STU) by the Government of Rajasthan is required to ensure that a Grid Code is in-force in the State Transmission System at all times. The Grid Code is a legally enforceable interface document agreed upon and to be complied with by all the SGSs, IPPs, CPPs, trading licensees and Discoms (including their HV/EHV consumers directly connected to STS) interconnected to State Transmission System. The Grid Code has been designed to operate and maintain an efficient and coordinated State Transmission System and allow RVPN to comply with its obligations in relation to the inter-state transmission of power and to operate the system in integration with the Northern Grid as per the provisions of Indian Electricity Grid Code issued by Central Electricity Regulatory Commission. The Grid Code specifies the standards, which the SGSs, IPPs, CPPs, trading licensees, RVPN and Discoms using State Transmission System must comply with. It lays down what is technically optimal with respect to operation and defines standards and common terms to reduce misunderstanding and avoid discrimination.

1.6 Load Despatch & System Operation Manual (LD & SOM)

1.6.1 This Load Despatch and System Operation Manual has been prepared in compliance to directions contained at clause No.2.1.1 of REGC issued by RERC vide its notification dated 24.5.2008 to ensure that SLDC manages the Rajasthan Power System effectively and efficiently in conformity with IEGC and Rajasthan Electricity Grid Code. The Load Despatch and System Operation Manual is legally enforceable and binding document to be complied with by all Users, STU and the SLDC. This Manual will provide guidelines and instructions to SLDC personnel and other officials engaged in operation in their day-to-day working. The Load Despatch and System Operation Manual defines responsibilities of SLDC personnel in operating matters and in interface with external agencies, viz. NRLDC, SGSs, IPPs, CPPs, RVPN, Trading licensees and Distribution Companies.

1.6.2 The role of SLDC with reference to RVPN and users (viz. Discoms, RVUN, other licensee or generators within the state but excluding ISGS) is analogous to that of NRLDC and other constituents of the Northern grid. This Manual brings out salient features of existing facility, principles governing the operation of integrated power system in accordance with IEGC, REGC and the operating procedures issued by NRLDC. The Load Despatch and System Operation Manual is a document requiring frequent changes based on augmentation of facility, amendment to IEGC and REGC, mutual agreements between utilities, Regulatory Commission's directives etc.

1.7 Definition & interpretation

1.7.1 The terms used in the Load Despatch and System Operation Manual shall have the meaning as defined in the REGC. The terms, which are used in this LD&SO Manual and not defined in the Rajasthan Electricity Grid Code, will have the same meaning as defined in IEGC.

1.7.2 The Load Despatch and System Operation Manual is prepared such that it is consistent/ compatible with REGC and IEGC. If any provisions of the Load Despatch and System Operation Manual are inconsistent with the provisions of the REGC, then the provisions of REGC shall prevail in case of intra-state transmission network. However, in the matters relating to interstate transmission network, if any provisions of LD & SOM is inconsistent with the provisions of IEGC, then the provisions of IEGC shall prevail.

Chapter-2

Existing Power System and Load Despatch Facility

2.1 Generation Capacity within State:

2.1.1 Major generating Stations operating in the State are mentioned below :-

S.No.	Name of Generating Station	Unit Ratings & Nos	Total capacity MW
(A) RVUN			
1	Kota Super Thermal Power Station (KSTPS)	2 X 110 MW 3 X 210 MW 1 X195 MW	1045 MW
2	Suratgarh Super Thermal Power Station (SSTPS)	5 X 250 MW	1250 MW
3	Ramgarh Gas Thermal Power Station (RGTPS)	1 X 3.0 MW 1 X 35.5 MW 1 X 37.5 MW 1 X 37.5 MW	113.5 MW
4	Giral LTPS	1 X 125 MW	125 MW
5	Dholpur CCPP	3 X 110 MW	330 MW
6	Mahi Hydel Power Station-I (Mahi-PH-I)	2 X 25 MW	50 MW
7	Mahi Hydel Power Station-II (Mahi-PH-II)	2 X 45 MW	90 MW
(B) RVPN -Partnership Projects in State			
1	Ranapratap Sagar Hydel Power Station (RPS)	4 X 43 MW	172 MW
2	Jawahar Sagar Hydel Power Station (JS)	3 X 33 MW	99 MW
(C) NTPC Projects in State			
1	Anta Gas Power Station (Anta GPS)	3 X 88.71 MW 1 X 153.2 MW	419.3 MW
(D) NPC Projects in State			
1	Rajasthan Atomic Power Station-A (RAPS-A)	1 X 100 MW 1 X 200 MW	300 MW
2	Rajasthan Atomic Power Station-B (RAPS-B)	2 X 220 MW	440 MW

Note :- 1. RPS and JS power stations are part of Chambal-Satpura Project in partnership between Rajasthan & M.P. Rajasthan's share is 50% in hydel projects and 40% in Satpura TPS-stage-I. RPS and JS power stations are owned by RVPN but operated and maintained by RVUN and two other

power stations of partnership projects viz. Gandhisagar Hydel power station (5x23 MW) and Satpura TPS -stage-I (5x62.5 MW) are owned, operated and maintained by MP.

2. RAPP Unit 1 (100 MW) and RGTPS (3 MW) are presently not in operation.

3. Sr. No. (C) and (D) above are Central Sector Generating Stations located in the State. RAPS- A is operated and maintained by NPC in which Rajasthan has 100% allocation.

2.1.2 Rajasthan have partnership in Bhakra & Beas Projects also and gets its partnership share of 15.22% in Bhakra, Gangwal and Kotla Hydel Power Stations (Capacity 1480.30 MW), 20% in Dehar Hydel Power Station (Capacity 990 MW) and 58.5% in Pong Hydel Power Station (Capacity 396 MW) through common transmission system of Bhakra and Beas Projects. These Power Stations and transmission system are operated and maintained by Bhakra & Beas Management Board (BBMB).

2.1.3 Rajasthan have firm allocations in various central sector power stations. Besides this, temporary allocations from unallocated capacity are also made from time to time by Government of India/CEA. The list of ISGS generating stations in which Rajasthan has shares/allocations is given at ANNEXURE-2.1

2.1.4 The RVPN's EHV transmission system as on 31st March 2008 consists of 4 Nos. 400 KV Sub-stations, 57 Nos. 220 kV Sub-stations and 267 nos. 132 KV GSS's.

2.2 Inter-State Transmission System

Rajasthan Power System is inter-connected with Inter-State Transmission System through following tie lines/ICT's:-

i) 400 KV Bassi- Heerapura- I & II

ii) 220 KV Badarpur- Alwar

iii) 220 KV Agra -Bharatpur

iv) 220 KV Dadri- Khetri- I & II

v) 220 KV Hissar- Khetri

vi) ICTs At 400 KV GSS Bassi

vii) ICTs At 400 KV GSS Bhiwadi

2.3 Load Despatch Facility

2.3.1 The State Load Despatch Centre (SLDC) of Rajasthan is functioning at Heerapura (Jaipur). The SLDC has communication links with NRLDC, all major generating stations and important sub-stations for system operation and load despatch function. Basic data necessary for System Operation is available in the LD Control Room, through the existing ULDC system. PLCC is main communication channel between Sub LDC and RTU stations. Microwave has been used as data communication link between Sub-LDCs and SLDC at Heerapura. At few locations, OFC links have also been provided for data transfer. The communication link between SLDC and NRLDC is through optical fibre cable. The on-line flow of MW, MVAR of the inter-state tie lines, generating stations, 220 KV/132 kV Grid Sub-stations etc. is being monitored at the SLDC, Heerapura round the clock. On-line data is displayed on screen of

operator consoles in the LD Control Room. ULDC has facility for displaying the MW, MVAR flows on single-line diagram of respective stations along with digital status of breakers and isolators etc. These online screens displaying data and single line diagrams can be modified/ reprogrammed if required.

2.3.2 In the present set-up, line flows on various important transmission lines with the Northern Grid, generation data from major power stations as well as mimic diagrams of 400 kV and several 220 kV Sub-Stations are available on the monitors which also display the scheduled drawl from NR Grid vis-a-vis actual load flows on 400/220 kV lines. This enables monitoring of over drawl/under drawl of energy from the grid, which is essential to enable the SLDC to regulate the generation of various SGS or load of Discoms.

2.3.3 In addition to this, important on-line data of Central sector generating stations & BBMB stations, relevant to RVPN, are being received from NRLDC. The ULDC Scheme has provision of remote control operation of circuit breakers etc. from SLDC/NRLDC Control Room but the operation thereof has not been activated. Additionally, EMS function, Contingency Analysis, Scheduling and weather based load forecasting are available under ULDC Scheme which are also yet to be activated.

Chapter-3

Current Black Start and System Restoration Procedures

3.1 Overview

A 'Grid Disturbance' denotes the situation under which a set of generating units/transmission elements trip in an abrupt and unplanned manner affecting the power supply in a large area and/or causing the system parameters to deviate from the normal values in a wide range. In the event of a grid disturbance, utmost priority is to be accorded to early restoration/revival of the system. It is possible that during such a situation the system may have to be operated with reduced security standards and suspension of all commercial incentives/penalties.

This chapter is based on System Restoration Procedures for Northern Regional Grid brought out by NRLDC. The classification of grid disturbance is given at chapter-9. This chapter describes the existing system restoration procedure for Rajasthan system and general guidelines and precautions for system revival.

3.2 Northern Regional Grid –System Restoration Procedure Overview

The Rajasthan Power System is the part of Northern Regional Grid and therefore Northern Regional Grid restoration procedure applies for Rajasthan System as well.

The Northern region consists of a large network. In the event of a total blackout, extending start-up power from one end of the region to the other end is rather impractical. The restoration of the system back to normal has to be achieved in a sectionalized manner. Accordingly the Northern Region has been divided into 4 sub-systems for system restoration process so that in the event of total grid failure, initially each subsystem is to be restored independently and once the subsystems separately built-up, these can be synchronised in stages to integrate into a complete system.

1. Restoration of Eastern UP Sub-system
2. Restoration of North Central Sub-system
3. Restoration of Rajasthan Sub-system
4. Restoration of Western UP Uttrakhand Sub-system

The restoration process for each sub-system can be divided into following steps:

1. Sub-system Overview
2. Sub-system restoration procedure
3. Sub-system Synchronization
4. Start-up stages and sequence in a sub-system

The boundaries of sub-system have been defined on the criteria of most likely possibility. However during actual operations there can be variation in these sub-systems and or sequencing depending upon the real time situations. The system

restoration procedure is required to be carried out in close co-ordination with NRLDC.

3.3 Restoration of Rajasthan Subsystem

3.3.1. Subsystem Overview:

1. Important Connecting Links with North-Central (NC) subsystem

a) 400 kV Ballabgarh - Bhiwadi
b) 400 kV Hissar - Bhiwadi
c) 400 kV Agra – Bassi
d) 220 kV BTPS-Alwar
e) 220 kV Agra- Bharatpur
f) 220 kV Hissar-Khetri
g) 220 kV Dadri – Khetri I & II

2. Major Generating Stations:

a) Thermal: Suratgarh STPS, Kota STPS, Giral LTPS
b) Hydel: Rana Pratap Sagar (RPS) PS, Jawahar Sagar (JS) PS, Mahi PH I & II
c) Gas: Anta, Ramgarh GTPP, Dholpur (CCPP)
d) Nuclear: RAPS (A), RAPS (B)

3. Sources of Start-up power

a) RPS HEP-Self start:	172 MW
b) JS HEP- Self start:	99 MW
c) Anta (Gas):	80 MW
Total:	351MW

4. Requirement of Start-up power:

a) Start-up at Kota STPS:	60 MW
b. RAPS (A) & RAPS (B):	50 MW
c. Railway Traction:	70 MW
d. Other Essential Loads:	171 MW
Total:	351 MW

5. System Synchronization:

After build-up of the Rajasthan Sub-system, it can be synchronized with the combined North-Central (NC) and Eastern U.P Subsystems or only with North-Central Subsystem as per situation at the following possible connections.

i) 400 kV Hissar-Bhiwadi at Hissar/Bhiwadi
ii) 400 kV Agra-Bassi at Agra/Bassi
iii) 400 kV Ballabgarh-Bhiwadi at Ballabgarh/Bhiwadi

3.3.2. Sequence for restoration of Rajasthan Sub-System

At the time of subsystem build up, the action to be taken at the major generating stations/ grid substations is as given below:

1. R.P.Sagar HEP

i) R.P.Sagar HEP shall self-start the units and synchronize with WR supply on 132 kV R.P.Sagar-Gandhi Sagar line for stabilization.

ii) In case of any problem in self-starting of units at R.P. Sagar, avail start-up power from Gandhi Sagar (WR) and start the units at R.P.Sagar.

iii) Extend start-up power or receive power from Jawahar Sagar as the case may be.

iv) Extend supply to Kota (S)

2. Jawahar Sagar HEP

Jawahar Sagar HEP shall self start the units and extend power to R.P.Sagar. In case of problem in self-starting the units, avail start-up Power from R.P.Sagar and start-up its units.

3. Kota (Sakatpura) 220 kV Grid Sub-Station

i) Avail power from Ujjain (WR) on 220 kV Ujjain-Kota circuit and start-up power shall be extended to Kota STPS, RAPS (A) and RAPS (B). Simultaneously synchronization with the supply from R.P. Sagar shall also be carried out.

ii) In case start-up power from Ujjain is not available, Kota (S) shall avail the power from RP Sagar and extend it to Kota (STPS), RAPS (A) and RAPS (B).

iii) Extend power supply for Railway Traction.

iv) Synchronize with supply extended from survived RAPS (A) /RAPS (B) islands.

v) Synchronize with supply extended from Anta or, in case request received from Anta, start-up power / reference shall be extended from Kota (S) to Anta, in consultation with SLDC Heerapura.

vi) Extend supply to Jaipur for other essential load.

4. Kota (STPS)

i) Kota STPS to avail start-up power from Modak or from Kota (S).

ii) Extend supply to Jaipur, in case of supply could not be extended to Jaipur through Kota (S).

5. RAPS (A) & RAPS (B)

i) In case of survival of either of RAPS islands, extend supply to Kota (S) and synchronise with Kota (S) once the supply around Kota (S) has been stabilized.

ii) In case of tripping of RAPS (A), avail start-up power from Kota (S). In case of non-availability of power from Kota (S) / RP Sagar, RAPP(A) shall initiate action to draw power from Western Grid by charging 132/220 kV, 50 MVA transformer at RAPP(A) through 132 kV Gandhi Sagar-RP Sagar line.

iii) In case of tripping of RAPS (B). avail start-up power from Kota. (S). In case of any problem in RAPS (B)-Kota (S) ckt, the start-up power can be availed through Anta/ RAPS(A)

iv) In case RAPS (B) survives, then, in consultation with SLDC control Room, it shall extend power to Anta for starting of GTs /synchronization.

6. Anta (Gas)

i) In case, Anta has survived on house load, extend supply to Kota (S) for synchronization/build-up of system. Alternatively receive the supply from Kota (S) / RAPS (B), if 220 kV Kota (S) / RAPS (B) buses are in charged condition. The two supplies also to be synchronized at the earliest opportunity.

ii) In case of tripping of units at Anta, self start GT's at Anta and extend supply to Kota(S).

iii) In case of any problem in self starting of units at Anta or extending supply to Kota (S) request Kota (S) to extend supply and start GT's /synchronise.

iv) Extend supply from Anta to Sawai-Madhopur, Dausa, Bharatpur and Hindaun for Railway Traction load.

7. Jaipur 220 kV Grid Sub-Station

i) Avail power supply from Kota (S)/Kota STPS.

ii) Extend power to Dausa and Bharatpur for Railway Traction and other emergency loads.

iii) Extend power to Khetri for further extension to Suratgarh STPS as startup power, in case there is delay in getting BBMB supply at Khetri.

iv) Extend power to 400 kV Heerapura / Bassi substation for synchronization of Rajasthan Subsystem with North-Central (NC) Subsystem.

8. Khetri 220 kV Grid Sub-Station

i) Khetri shall get BBMB supply from Hissar and start up power shall be extended to Suratgarh STPS.

ii) In case there is delay in getting BBMB supply, then Khetri shall avail power through Jaipur from Rajasthan Subsystem and extend it to Suratgarh STPS.

9. Restoration of Suratgarh STPS

Suratgarh Super Thermal Power Station (SSTPS) shall avail start-up power in the following descending order of priority:

Priority-1: From BBMB System through Bhakra (R)- Jamalpur- Sangrur- Hissar- Khetri- Ratangarh- Suratgarh STPS.

Priority-2: From Rajasthan Subsystem through Kota (S)-Jaipur- Khetri- Ratangarh- Suratgarh.

10. Dholpur CCPP

(i) In case Dholpur CCPP has survived, extend supply to Bharatpur/Hindaun for railway traction load.

(ii) In case of tripping of Dholpur CCPP, request Bharatpur to avail power from Agra and extend to Dholpur and start/synchronise GT.

(iii) Extend supply to Hindaun, Dausa & Jaipur.

11. **Giral LTPS**

Giral LTPS shall avail start- up power in the following descending order of priority:

Priority 1 : From 220 KV GSS Amarsagar

Priority 2 : From 220 KV GSS Barmer

12 Ramgarh GTPP

Self start the units at Ramgarh and extend start up power to Giral LTPS through Amarsagar.

3.4 Caution while Restoration of Rajasthan Sub-System

I. While restoring the Subsystem, the load generation balance is to be maintained.

II. In case of survival of RAPS (A)/RAPS (B) islands, these must be synchronized with the supply of R.P Sagar / Kota (S) at the earliest opportunity.

III. The power supply to Railway Traction and RAPS (A) / RAPS (B) is to be extended on top priority.

IV. In case, Kota (S) has availed start-up power from Ujjain and RP Sagar has been started up separately, then the two supplies are to be synchronized at Kota (S) / R.P. Sagar for stability and then the supply be extended further to other stations.

3.5. Synchronization of Rajasthan Sub-System

Rajasthan Sub System is to be synchronized with rest of the NR grid at the following possible connections as indicated at 3.3 (5).

3.6. Start-Up Stages And Sequence

a. For different Restoration Stages in Rajasthan Subsystem, refer ANNEXURE 3.1

b. For detailed Start-up Sequence in Rajasthan Subsystem refer ANNEXURE -3.2

3.7 General guidelines & precautions in system restoration

The general guidelines and precautions to be followed during system revival are mentioned below:

a. SLDC shall at all time have the latest amended copy of this document available in the Control Room.

b. The Shift Incharge, SLDC shall inform the Head of SLDC about the situation and request assistance in the restoration process.

c. During total grid collapse/ failure of supply at the GSS, the In-charge of the shift will inform about grid failure to the XEN/ AEN In-charge of the GSS and also to SLDC control room and wait for the instructions from SLDC control room. The shift In-charge will get all the incoming (if no power is available) & outgoing feeders including circuit breakers controlling main power transformers opened immediately. On load tap changers (OLTCs) of the transformers would be brought down to normal tap position by local manual control. **This should be completed within 10 minutes of the grid failure by each Shift duty In charge. The In-charge of the GSS shall reach the Control room as soon as the information regarding disturbance is conveyed to him.**

d. During revival of the system, In-charge of sub stations, power stations and SLDC would remain present in control rooms of substations so as to expedite restoration of the system.

e. In order to maintain a balance between load - generation at the time of grid contingency the list of generating stations with black start facility, inter-state/inter-regional ties, synchronizing points and essential loads to be restored on priority, should be prepared and updated regularly and must be available at all times in SLDC.

f. While building up the system, it would be ensured that the voltage at the charging end remains within limits. Before switching next section, essential load of substation shall be connected to enable charging of battery, shunt reactor shall be connected and a small load may be switched on at each sub station to ensure charging end voltage. However, the ultimate objective, viz. building up of the network should not be lost sight of, while connecting the loads and large loads shall not be switched on. If charging end voltage dips at any substation, non-essential load or shunt reactor at intermediate stations may be switched off.

g. Security of the network being built up would be strengthened at the earliest by closing the parallel lines available in the restoration path.

h. Priority would be accorded for extending supplies to railway traction and installations where safety is of paramount importance such as nuclear power stations. The list of Priority Load is given at Annexure 3.3

i. All switching instructions for a particular system have to emanate from SLDC, Heerapura. For synchronization of two systems, NRLDC would be the co-ordinating agency.

j. In line with Clause 5.8(e) of IEGC, during system revival all communication channels required for restoration process shall be used for operational communication only, till grid normalcy is restored.

k. Synchronizing facility should be available at following grid substations so as to have maximum flexibility in choosing the point of synchronization.

i. 400 kV Heerapura GSS
ii. 400 kV Ratangarh GSS
iii. 400 KV Jodhpur GSS
iv. 400 KV Merta GSS
v. 220 kV Heerapura GSS
vi. 220 kV Kota (Sakatpura) GSS
vii. 220 kV Khetri GSS
viii. 220 kV Alwar GSS
ix. 220 kV Bharatpur GSS
x. 220 kV Modak GSS

l. Synchronizing facility, available at the switchyard of generating station can also be used as the point of synchronization

m. Despite the urgency of the situation, careful and complete logging of all messages and all operations is essential to facilitate subsequent investigation into the incident and the efficiency of the restoration process.

3.8 Inter-regional support

In case of disturbance or any other contingency in the northern region or any other neighbouring region, NRLDC shall permit exchange of such power with the neighbouring region needed to meet the essential load, start-up-power, railway traction and other such emergent requirements for the duration of such contingencies.

3.9 System Security Aspects

While restoring the system, load generation balance is to be maintained in each subsystem and all efforts to be carried out by all the users to maintain the parameters within the subsystem near nominal values for security of operation of the restored subsystem as well for ease of synchronisation.

3.10 Power Supply to Railway Traction Substations from Rajasthan Subsystem

Details of the existing Railway Traction Connections falling under Rajasthan subsystem are as under:

i) Railway West – Central.
ii) Section : Mathura-Kota-Mumbai
iii) Railway traction substation: Bharatpur, Bayana, Hindaun City, Gangapur city, Sawai Madhopur, Lakehri, Gurla & Ramganj Mandi.
iv) Max. Rly traction load : (60 MVA)
v) Feeding grid sub-stations: 220KV GSS Kota (S), Hindaun Bharatpur Sawai Madhopur, Modak.

Chapter- 4

Islanding Schemes

4.1 Overview

This is a system requirement under contingency conditions according to which the power network is splitted into healthy and self-sustaining zones so that cascade tripping of all generating stations in the entire region is avoided.

As per the philosophy being followed in Northern Region, an attempt to keep entire system integrated through adequate under frequency relays to shed load should be the first priority. Islanding schemes are the last resort and need to be confined to following two situations:

(i) Sensitive generating stations such as nuclear power stations
(ii) Sensitive/ strategic loads

All efforts to be carried out by all the users to maintain the system parameters near nominal values for security of operation of the restored subsystem as well for ease of synchronisation.

4.2 Islanding Schemes

4.2.1 In order to isolate and save healthy parts of the grid during any disturbance, under frequency islanding schemes have to be designed and developed based on system study and simulating the conditions requiring isolation of a generator from rest of the grid.

4.2.2 SLDC shall make the islanding schemes in consultations with NRPC and shall modify as per system requirement.

4.2.3 SLDC shall formulate one or more sets or subsets of islanding scheme(s) to prevent tripping of nuclear generating units operating within the state. Such schemes shall be formulated in consonance with the principles and guidelines decided by NRPC. NRLDC/SLDC shall effect changes to any such islanding scheme, as may be suggested by NRPC and NRLDC. These changes have to be informed to NRPC/NRLDC as and when implemented.

4.2.4 SLDC shall effect real time monitoring of difference between generation and load of the area covered by each islanded scheme in operation. In case of large deviation, SLDC shall effect appropriate changes in area covered by an islanding scheme by making operative or blocking the

tripping of lines through respective under frequency relays. These changes have to be informed to NRPC/NRLDC as and when implemented.

4.2.5 The incharge of Grid Substations where under frequency relays for islanding purposes are installed shall confirm to SLDC through a numbered message, the status of UF relays which are blocked / made operative as per latest system conditions / changing loads. No alterations in Under Frequency Relays (UFR) status/settings shall be made without specific approval through a coded message from SLDC. .At the time of change in system status necessitating blocking / operating of these relays, the shift engineer of LD centre shall convey the changed requirement to respective GSS and obtain confirmation that the relay status has been suitably changed. It has to be ensured that due permission is taken from NRLDC in respect of any such tripping of inter-state lines and inter-connection with ISTS.

4.2.6 SLDC shall also have backup system of tripping such lines using direct circuit breaker control from SLDC.

4.3 Existing Islanding Schemes

4.3.1 RAPP Islanding Scheme

Rajasthan have two nuclear stations RAPP 'A' and RAPP 'B' with following capacities:

	Unit No.	**MW**
RAPP-'A'	Unit-I	100 MW
	Unit-II	200 MW
	Total	300 MW
RAPP-'B'	Unit-III	220 MW
	Unit-VI	220 MW
	Total	440 MW

It is important that during any major Grid Disturbance in the Northern Region, the tripping of units of nuclear stations is prevented because of sensitive nature of such generating units. The islanding scheme for RAPP has been designed such that the generating units separate from the main Regional Grid and remain survived with islanded loads through intentional implementation of under frequency relays schemes. The frequency setting and time delay for Islanding and units coming to house loads are given in table below:

	RAPP- A		RAPP- B	
	Frequency Hz.	Time Delay Sec.	Frequency Hz.	Time Delay Sec.
Islanding	-	-	47.7	5 seconds
	47.5	Instantaneous	47.5	Instantaneous
House Loading	47.5	10 seconds	47.5	5 seconds
	47.1	Instantaneous	47.2	Instantaneous

4.3.2 RAPP 'A' Islanding

A Single line diagram of this islanding Scheme is placed at Annexure- 4.1

RAPP 'A' islands at 47.5 Hz instantaneous

The following conditions are envisaged:

1. When only one machine is generating at RAPP 'A', matching load will be provided by 220 KV GSS Debari alone. Under this condition, 220 kV RAPP 'A' – Kota-I & III lines shall trip at 47.5 Hz (with Kota-II already connected to RAPP 'B'). Thus Kota loads are automatically disconnected from RAPP 'A'.

2. When both the machines of RAPP 'A' are generating, matching load will be provided by 220 KV GSS Debari, Dayra and part of 220 KV GSS Kota.

3. When both the units of RAPP – A are operating, the loads shall be regulated such that Debari load is equal to Unit-II generation minus 15 MW and RAPP-A- Kota –I load will match Unit-I generation minus 35 MW whereas if only one unit is operating the islanding load will match the generation minus 35 MW.

In the event of load crash, when one machine is generating and load of Debari alone is in-sufficient to match the islanding load, then islanding load will be extended to part load of Kota (Trf. No.4) and load of Dayra.

5. The following arrangements are to be kept at RAPP 'A', 220 KV GSSs of Debari, Sakatpura (Kota), Dayra and Banswara to ensure smooth functioning of the Islanding Scheme. The operating status of U/F relays like Block, Operative and Normally Open required to be kept for successful islanding has been also indicated below:

AT RAPP 'A'

The status of lines with setting of U/F Relays is kept as under:

S. No	Name of line	Status	Settings
1	220 kV RAPP 'A'-Kota-I	Operative/ Blocked #	47.5 Hz (Inst.)
2	220 kV RAPP 'A'-RAPP-'B'	Normally Open	-
3	220 kV RAPP 'A'-Kota-III	Operative	47.5 Hz (Inst.)
4	220 kV RAPP 'A'-Debari	Blocked	47.5 Hz (Inst.)

AT 220 KV GSS DEBARI

1. 132 kV loads from Debari will be regulated through under frequency relay set at 47.5 Hz and the trippings shall be blocked/operative as per the load requirement.

The status of lines with setting of U/F relays is kept as under.

S.No	Name of line	Status	Setting
1	220 kV Debari-RAPP 'A'	Block	47.5 Hz (Inst.)
2	220 kV Debari –RAPP 'B'	Operative	47.7 Hz (Inst.)
3	220 kV Debari –Chittor	Operative	47.7 Hz (Inst.)
4	220kV Debari –Banswara	No Relay	-
5	132 kV Debari –Sukher	Block/Operative #	47.5 Hz (Inst.)
6	132 kV Debari –Mavli-Dariba	Block/Operative #	47.5 Hz (Inst.)
7	132 kV Debari-HZL	Block/Operative #	47.5 Hz (Inst.)
8	132 kV Debari-Madri	No Relay	-
9	132 kV Debari- Nathdwara	Line-Normally open U/F relay-Operative*	47.5 Hz (Inst.)
10	132 kV Debari-Bhatewar	Line-Normally open U/F relay-Operative****	47.5 Hz (Inst.)

AT 220 kV GSS BANSWARA

Under frequency relays on all incoming feeders from Mahi PH-I & Mahi –PH-II, 132 KV Banswara- Bagidora and 132 KV Banswara – Pratapgarh feeders will be kept always operative. 132 kV Banswara – Pratapgarh feeder will be kept normally open at Pratapgarh.

The status of lines with setting of U/F relays is to be kept as under:-

S.No.	Name of line	Status	Setting
I	132 kV Banswara- Mahi PH-I – circuit I & II	Operative	47.5 Hz. (Instt.)
II	132 kV Banswara- Mahi PH-II – circuit I & II	Operative	47.5 Hz. (Instt.)
Iii	132 kV Banswara- Pratapgarh	Operative	47.5 Hz. (Instt.)
Iv	132 kV Banswara-Bagidora	Operative	47.5 Hz. (Instt.)

AT 220 KV GSS KOTA (SAKATPURA)

The following arrangements are being kept at 220 KV GSS Kota Sakatpura:-

1. 220 kV Bus ‘D’ is to be kept as dedicated for RAPP ‘A’ Island. 220 kV Bus Coupler between A to D will be operative at under frequency setting of 47.5 Hz, so that Bus D remains connected to RAPP ‘A’. 132 kV RPS-Kota Circuit (direct) will be kept on 132 kV Bus of Transformer No. 4 connected to Bus ‘D’, which will provide RPS Hydel support to the island, if required.

2. 100 MVA Transformer No. 4 and 220 KV Dayra shall be always kept on Bus ‘D’. Transformer No. 4 will provide load of 132 kV Bundi, 132 kV Lakheri, 132 KV Gopal Mill, 132/33 kV 20/25 MVA Transformer No. 1 and 2 for the Island. The U/F tripping on these loads will be set at 47.5 Hz and shall be kept operative/blocked as per load requirement to be monitored by L.D.

3. 220 kV Kota (I)-RAPP ’A’ connected on Bus ‘D’ will be Blocked/Operative at 47.5 Hz as per generation available at RAPP ‘A’.

4. 220 kV Kota (III) -RAPP ‘A’ will be on any Bus A, B or C with U/F relay operative at 47.5 Hz.

5. 220 kV RAPP ‘B’-Kota-II will also be on any Bus A, B or C with U/F relay operative at 47.7 Hz.

6. The synchronization of island may be done at RPS with MP Power on 132 KV Gandhi Sagar line-II or at Kota (S) with 220 kV Ujjain-Kota if required. MP power will be available through 220 kV Ujjain-Kota but this circuit will be normally open at Kota. In case of operation of 220 KV Ujjain-Kota lines as inter regional tie lines the same shall not be kept on Bus 'D' at Kota (s).

Status of lines with setting of U/F relays is to be kept as under:

S. No.	**Name of line**	**Status**	**Setting**
i)	220 kV Kota-RAPP 'A' Circuit-I	Block/Operative #	47.5 Hz (Inst.)
ii)	220 kV Kota-RAPP 'B' Circuit-II	Operative	47.7 Hz (Inst.)
iii)	220 kV Kota-RAPP 'A' Circuit-III	Operative	47.5 Hz (Inst.)
iv)	220 kV Bus coupler between BUS A to D	Operative	47.5 Hz (Inst.)
v)	132 kV Kota-Bundi	Operative/Block #	47.5 Hz (Inst.)
vi)	132 kV Kota –Lakheri	Operative/Block #	47.5 Hz (Inst.)
vii)	132 kV Kota-RPS (Direct)	Always Closed, No U/F to be Provided.	-
viii)	132/33 kV 20/25 MVA Trf. No.1	Operative/Block #	47.5 Hz (Inst.)
ix)	132/33 kV 20/25 MVA Trf. No.2	Operative/Block #	47.5 Hz (Inst.)
x)	132 kV Kota- Gopal Mill	Operative/Block #	47.5 Hz (Inst.)

AT RPS Hydel P.S.

1. One unit will be kept on main Bus 'B' which is Islanding Bus and 3 units on 132 kV main Bus 'A'. 132 kV Gandhi Sagar Circuit-II will be on Bus B and shall be kept normally open at RPS end. This may be utilized to further synchronise the Island with MP to stabilize the island system, if required.

2. 132 kV RPS-Kota (Direct ckt.) will also be on main Bus 'B' included in the Island.

3. 132 kV RPS-Bhilwara I & II and 132 kV RPS-Ind. Area Kota circuits will be on Bus 'A'.

The under frequency relay settings will be as under:-

S.No.	Name of line	Status	Setting
i	132 kV Bus Coupler	Operative	47.5 Hz (Inst.)
ii	132 kV RPS - Bhilwara-I & II	Operative	47.7 Hz (Inst.)

AT 220 KV DAYARA

All loads will be kept connected.

5.4 RAPP 'B' ISLANDING

A single line diagram of the scheme is placed at Annexure 4.2.

1. Islanding shall take place at 47.7 Hz with 5 sec. delay or 47.5 Hz instantaneous. At RAPP 'B' the total generation of Unit-III & IV is expected to be around 400 MW. RAPP-B machines will be islanded with matching load of 180-200 MW. This load is to be provided normally from 220 KV GSSs Chittor, Nimbahera & Bhilwara. In case of low load conditions, the islanding load will have to be extended to Bali and further to 220 kV GSS Pindwara.

2. Presently, no Under Frequency Relays are required for 220 kV Chittor-Nimbahera line and 220 kV RAPP 'B' –Chittor (Chittor end) on both the circuits. Loads of 132 kV GSS Hamirgarh, Sawa, M/s Aditya Cement, M/s BCW, M/s CCW & M/s HZL, if not injecting power, shall be fed from 220 kV Chittorgarh.

3. The operating status of UFR relay like Block, Operative and Normally Open required to be kept for successful islanding has also been indicated.

4. The settings of under frequency relays in the above Island are to be kept as under:

- **AT RAPP B END**

S.No.	Name of line	Status	Setting.
i)	220 kV RAPP 'B'-Kota-II	Operative	47.7 Hz (5 Sec.)
ii)	220 kV RAPP 'B'-Kota-II	Operative	47.5 Hz (Inst.)
iii)	220 kV RAPP 'B'-Debari	Operative	47.7 Hz (5 Sec.)
iv)	220 kV RAPP 'B'-Debari	Operative	47.5 Hz (Inst.)

v)	220 kV RAPP 'B' Chittor-I & II	Block	47.7 Hz (5 Sec.)
vi)	220 kV RAPP 'B'-Anta	Operative	47.7 Hz (5 Sec.)
vii)	220 kV RAPP 'B' – Anta	Operative	47.5 Hz (Inst.)
viii)	220 kV RAPP 'B'-RAPP 'A' Tie line.	Normally Open	**-**

- **AT 220 KV GSS CHITTORGARH**

The U/F Relays of 220 kV Chittorgarh-Bhilwara (both ends) will be made operative by LD if the requirement of load is indicated by RAPP authorities to be around 100- 120 MW (one unit), otherwise this relay will be kept blocked so as to provide islanding load of 180-200 MW.

S.No.	Name of line	Status	Setting
i.	220 kV Chittorgarh-Bhilwara	Normally Block	47.7 Hz (Inst.)
ii	220 kV Chittorgarh-Debari	Operative	47.7 Hz (Inst.)
iii	132 kv Chittor – HZL	Operative	47.7 Hz (Inst.)

- **AT 220 kV GSS DEBARI**

S.No.	Name of line	Status	Setting
I.	220 kV Debari-RAPP 'B'	Operative	47.7 Hz (Inst.)
ii.	220 kV Debari-Chittorgarh	Operative	47.7 Hz (Inst.)
iii.	220 kV Debari- RAPP 'A'	Normally block	47.5 Hz (Inst.)

- **AT 220 kV GSS SAKATPURA KOTA**

The under frequency relay on 220 kV Kota-RAPP 'B' (II circuit) which will normally remain on Bus 'C', will be set at 47.7 Hz (Inst.) and will remain operative.

- **AT 220 kV GSS NIMBAHERA**

Loads of 132 Kv Bhatewar, Bhinder, Mangalwad, Chhoti Sadri and Pratapgarh shall be fed from Nimbahera and shall not be transferred to other GSSs without approval of SE(SO&LD). 132 kV loads from Nimbahera will be regulated through under frequency relay set at 47.7 Hz. (Instt.) and the trippings shall be blocked/ operative as per load requirement.

The status of feeders with setting of U/F relay to be kept as under :

S.No.	Name of feeder	Status	Setting
1	132 kV Mangalwad	Operative / Block #	47.7 Hz (Inst.)
2	132 kV Chhoti Sadri	Operative / Block #	47.7 Hz (Inst.)

- **AT 220 kV GSS BHILWARA**

Bus arrangement on 220 kV side will be as under:

<u>On 220 kV Main Bus (A+D).</u>

220 kV Bhilwara-Kota-I
220 kV Bhilwara-Kota-II
220 kV Bhilwara-Kankroli-Sirohi
220 kV Bhilwara-Anta-I
220 kV Bhilwara-Anta-II
220 kV Bhilwara-Beawar
220 kV Bhilwara-Pali

<u>On 220 kV Main Bus (B+C) (Islanding bus).</u>

220 kV Side of 220/132 kV, 100 MVA Transformer No.1.
220 kV Side of 220/132 kV 100 MVA Transformer No.2
220 kV Bhilwara-Chittorgarh
220 kV Bhilwara-Bali

The status of lines with setting of under frequency relay (s) to be kept as under :-

S.No.	Name of line	Status	Setting
(i)	220 kV Bus Coupler A to B	Operative	47.7 Hz (Inst.)
(ii)	220 kV Bhilwara – Bali.	Operative/Block #	47.7 Hz (Inst.)
(iii)	132 kV Bhilwara- Kharchi	Operative/Block #	47.7 Hz (Inst.)
(iv)	132 kV Bhilwara – Rayla	Operative/Block #	47.7 Hz (Inst.)
(v)	132 kV Bhilwara Gangapur	Operative/Block #	47.7 Hz (Inst.)

(vi)	132 kV Bhilwara – Hamirgarh	Line-Normally open U/f relay – operative	47.7 Hz (Inst.)
(vii)	132 kV Bhilwara-Mandalgarh	Operative/Block #	47.7 Hz (Inst.)

- **AT 220 KV GSS BALI**

132 kV Pali-Falna will remain normally open at Pali end.

The status of lines with setting of U/F relay to be kept as under :-

S.No.	Name of line	Status	setting
(i)	220 kV Bali-Bhilwara	Operative / Block #	47.7 Hz (Inst.)
(ii)	220 Kv-Bali Sirohi	Operative	47.7 Hz (Inst.)
(iii)	220 kV Bali-Pindwara	Operative/Block #	47.7 Hz (Inst.)
(iv)	132 kV Bali-Sumerpur	Operative / Block #	47.7 Hz (Inst.)
(v)	132 kV Bali-Falna	Operative / Block #	47.7 Hz (Inst.)
(vi)	132 kV Bali-Rani	Operative / Block #	47.7 Hz (Inst.)

- **AT 220 KV GSS PINDWARA**

132kV Abu Road will be fed from Pindwara and 132 kV Abu Road- Reodar will remain normally open at Abu Road GSS.

The status of lines with setting of U/F relay to be kept as under :-

S.No.	Name of line	Status	Setting
(i)	220 kV Pindwara – Bali	Operative / Block #	47.7 Hz (Inst.)
(ii)	132 kV Pindwara –Debari	Line-Normally open U/f relay – operative	47.7 Hz (Inst.)
(iii)	132 kV Pindwara –Sirohi (Both circuits)	Line-Normally open U/f relay – operative	47.7 Hz (Inst.)
(iv)	132 kV Pindwara –Abu Road	Operative/Block #	47.7 Hz (Inst.)

- **AT 220 KV GSS SIROHI**

132 kV Sumerpur-Sirohi will remain normally open at Sumperpur end.

The status of lines with setting of U/F relay to be kept as under ;-

S.No.	Name of line	Status	Setting
(i)	220 kV Sirohi - Bali	Operative	47.7 Hz (Inst.)
(ii)	132 kV Sirohi-Sumerpur	Line-Normally open U/f relay – operative	47.7 Hz (Inst.)

- **AT RPS POWER STATION**

132 kV RPS-Bhilwara-I & II will be connected on Bus A as indicated for RAPP-'A' isalnding.

i).	132 kV RPS Bus Coupler A-B	Operative	47.5 Hz (Inst.)
ii).	132 kV RPS-Bhilwara-I & II	Operative	47.7 Hz (Inst.)

- **AT 220 KV GSS BEAWAR**

i.	132 kV Beawar- Bhilwara Via Asind	Operative	47.7 Hz (Inst.)

- **AT 132 kV GSS KHARCHI**

i.	132 kV Kharchi-Pali	Operative	47.7 Hz (Inst.)

4.4 Caution in islanding process

1. RAPP- 'B' shall be synchronised at 220 kV Kota (s) GSS.

2. One machine of 43 MW will start generation at RPS when frequency falls below 48.0 Hz, if required it shall run on condenser mode till system stabilised.

3. Start up power from island shall be extended to 220 KV GSS Kota (S), Anta and JS Power Station.

4. Island will be extended in phases as per system restoration procedure.

5. On request from RAPP 'B', UFR of 220 kV Chitttor – Bhilwara will be made operative when generation at RAPP 'B' is low (100 –120 MW). Otherwise UFR will be blocked to provide upto 200 MW islanding load.

6. While restoring the system, load generation balance is to be maintained in each subsystem and all efforts to be carried out by all the constituent to maintain the parameters

within the subsystem near nominal values for security of operation of the restored subsystem as well for ease of synchronization.

7. The power system operation is a dynamic situation, the SLDC shall keep on monitoring the system status at least once in every shift and ensure that status of UFRs be kept suitably operative / blocked with correct settings as per system requirements, so that in the event of major grid disturbance, Islanding takes place smoothly.

***** The feeder will remain open under normal grid conditions, whereas the UFR for the said feeder will always remain operative. However, in the event of transmission constraint, the feeder may have to be closed to cater the load requirement of a particular area but the UFR will continue to be always operative

To be made operative/blocked by L.D. as per generation/load pattern.

4.5 Islanding Scheme Review

Existing islanding scheme described at 4.3 above relates to current system conditions and parameters. The frequency settings of Under Frequency Relays, Blockage/operation and time settings etc. needs to be checked and adjusted from time to time based on changed system conditions and configuration.

Chapter 5

Demand Estimation and Control

5.1 Overview

Demand estimation plays a very important role in system operation. In the long term, it constitutes important input for generation and transmission network planning. In the medium term, say one year, it constitutes an important input for outage planning of generating units and transmission lines and short term bilateral agreements for power purchase. In the short term, it is an important input for generation and drawal scheduling, load shedding & bilateral power purchase agreements. Variation in demand in real time operation from the estimated values could either be absorbed by the grid or affect it adversely. Even if the estimates are accurate, the generation could vary from scheduled values adversely affecting the grid. Demand control thus play an important role in arresting these adverse effects on the grid

5.2 Demand estimation

5.2.1 The long-term demand estimation/ load forecast (for more than 1 year) shall be done by STU in accordance with the provisions of REGC chapter V. Accordingly STU shall estimate the unrestricted as well as restricted demand (in MW) and energy requirement (in MWh) and its availability for next 5 years and 10 years in consultations with RVUN and Discoms. RVUN and Discoms shall furnish necessary data to STU. STU shall modify these estimates periodically based on RERC's order and power availability including bilateral agreements. Discoms shall enter into long term, medium and short-term power purchase agreements (including bilateral agreements). SLDC shall be provided with a copy of the same as and when it is finalised. Demand estimation for period unto 1 year ahead shall be done by SLDC.

5.2.2 Discoms shall provide estimates of month-wise demand for ensuing financial year by 31ST October each year to the SLDC.

5.2.3 Discoms shall provide to SLDC estimates of load that may be shed when required, in discrete blocks with the details of arrangements of such load shedding.

5.2.4 Discoms shall also furnish realistic category-wise demand and energy requirement for their respective companies along with details of essential loads, supply hours to be maintained in rural areas, details of power cuts imposed or to be imposed and specific requirements, if any.

5.2.5 The demand estimation shall cover active power as well as reactive power requirements forecasted for each substation. The reactive power planning exercise will be carried out by STU in consultation with NRPC and

Discoms as per RERC's directives. Programme for installation of reactive compensation equipment by RVPN & Discoms would take care of these requirements.

5.2.6 The SLDC would update the demand forecast (in MW as well as MWh) on quarterly, monthly, weekly and ultimately on daily basis on the basis of requirement received from Discoms, which would be used in the day-ahead scheduling of Rajasthan as a whole. Attention shall also be paid by SLDC in demand forecasting for special days such as important festivals and National Holidays having different crests and troughs in the daily load-curve as compared to normal weather conditions & days, The Discoms may negotiate short term & spot power purchase as per their requirement.

5.2.7 No demand shed by operation of under frequency relays shall be restored without specific directions from SLDC.

5.2.8 STU and SLDC would maintain a historical database for the purpose and shall be equipped with the state-of-the-art tools such as Energy Management System (EMS) for demand forecasting.

5.2.9 SLDC shall furnish data for and participate in deliberations of load generation balance, Annual Demand, 'availability' and shunt capacitors requirement studies of NRPC. It shall take into consideration their reports for demand estimation.

5.3 Demand control

5.3.1 Primarily the need for demand control would arise on account of the following conditions:-

- Variations in demand from the estimated or forecasted values, which cannot be absorbed by the grid, and
- Unforeseen generation / transmission outages resulting in reduced power availability, and
- Heavy reactive power demand causing low voltages, and
- Commercial reasons.

5.3.2 As per REGC and section 6.4.5 of the IEGC, the SLDC shall regularly carryout the necessary exercises regarding short-term and long term demand estimation to plan in advance as to how the load would be met without overdrawing from the grid. The following deviations from the schedule and other violations would be controlled by the SLDC.

- Over drawls at frequencies below threshold frequencies as determined by SLDC. The SLDC shall identify the feeders drawing heavily and instruct

the controlling authorities to regulate the drawls. The feeders of 132 KV & higher voltage shall be disconnected only as a last resort, under emergent condition .

- Under drawls at frequencies above threshold frequencies, as determined by SLDC.
- Reactive power drawls/injections causing low/high voltage respectively.

5.3.3 NRPC Secretariat formulates under frequency load shedding scheme for the Northern Region in consultation with all the constituents and NRLDC. The scheme considers the largest single credible contingency occurring in the system and load shedding is based on tripping by fixed under frequency as well as fixed frequency and rate of change of frequency relays.

5.3.4 Demand control so exercised under these conditions by the SLDC, could be done manually or through the under frequency relays including those working on rotational / sequential basis or through direct circuit breaker tripping effected from SLDC/ Sub LDC using RTUs on under frequency detection by SLDC/Sub-LDC computer or through telephonic instructions.

5.3.5 Each user shall endeavour to restrict their drawal within their drawal schedule whenever the system frequency is below 49.5 Hz. When the frequency falls below 49.0 Hz. requisite load shedding (manual) shall be done by the concerned Discom to curtail the over- drawal.

5.3.6 During the demand control by manual disconnection of loads by staggering among different groups, the changeover from one group to another shall be carried out in a gradual and scientific manner so as to avoid excursions in the system parameters.

5.3.7 The SLDC would also identify feeders drawing heavy quantum of reactive power and disconnect the same under low voltage conditions. Necessary metering arrangements/transducers for identifying such feeders shall be provided by the RVPN.

5.4 Load Crash

In the event of load crash in the system due to weather disturbance or any other reasons, the situation would be controlled by the SLDC by the following methods :

(i) Back down or close down of generating units of SGS except CPP & non conventional sources commensurate with system frequency & transmission constraints by giving SLDC Code.
(ii) Lifting of the load restrictions, if any.

While implementing the above, it shall be ensured that the provisions in IEGC / REGC shall not be violated. Further, in case of Hydel generation linked with irrigation requirements, the actual back down or close down of such Hydel units shall be subject to limitations on such account & to avoid spillage of water.

Chapter -6

Network Security and System Operation

6.1 System Operation

The system has to be continuously operated as per the Security Standards and criteria covered in the Indian Electricity Grid Code (IEGC), or in REGC. There may be certain contingencies, which would be beyond SLDC's system Operator's control wherein some deviations from the IEGC/ REGC may have to be accommodated. However, while taking any such action, it shall be ensured by the SLDC System Operator that such deviations do not result in weakened network configuration vis-a-vis what was envisaged during system planning. Situations outside the SLDC System Operator's control and leading to un-even demand shall also be tackled by the SLDC's System Operator to the best of his capability.

6.2 Outage plan

For outage planning, RVPN as well as SLDC would regularly conduct power system studies. SLDC shall also conduct such studies periodically during the year simulating operating conditions and various single or multiple outages to assess the stability of the network. The outage plan of various elements in the power system would be finalised based on such studies.

Opening of 132KV & above rated transmission elements shall be carried out only with prior approval from SLDC except in case of emergency. However, SLDC shall be informed of such operation within a reasonable time of say 10 minutes indicating the likely time of restoration.

6.3 Special Care Areas:

(i) Stations where Bus bar protection scheme is operative, it shall be ensured that segregation of feeders on each bus are uniform. In case a substation is interconnected with more than one source/ interconnecting lines, then it shall be ensured that these are connected on different buses to minimise the impact of break down or bus bar protection tripping.

(ii) In the cases where Main-I and Main-II bus arrangements are available, the changeover of the feeders/ transformer from one bus to the other would be carried out uninterruptedly, wherever PTs are installed on all the feeders. To avoid inadvertent tripping of bus-coupler on earth fault (E/F) due to contact resistance or opening time of different poles of the isolators being different, the tripping of bus couplers on earth fault would be blocked during changeover.

(iii) At 400 kV sub-station which is having a breaker and a half scheme, it shall be ensured that the two buses remain connected at least by two parallel paths so that any line / bus fault does not result in inadvertent multiple outages. In case any element, say a line or an ILT, is expected to remain out for a period say beyond eight hours, the main and tiebreakers of such elements shall be closed after opening the line side isolator. This should be done after taking all suitable precautions to avoid inadvertent tripping.

(iv) The substation operators shall ensure the above condition even when any lightly loaded line is opened to control over voltage as opening of lines, superimposed over other line outages (on account of faults created by adverse weather conditions), may result in reduced security of the system.

(v) Single pole auto-reclose facility on 400 kV lines shall always be in service. NRLDC's approval would be obtained for taking this facility out of service.

6.4 Under Frequency Load Shedding Scheme

The SLDC would review under frequency load shedding scheme of NRPC and formulate the scheme in detail as per requirements of NRPC and update such scheme as per system requirement. **From the viewpoint of system security, it shall ensure that there would be no overlapping between areas covered by under frequency relay load shedding and those covered by the manual load shedding plan as part of demand control**. SLDC would ensure that the automatic load relief through under frequency relays would be available to the system under low frequency conditions. Effectiveness of the scheme would be monitored periodically by SLDC and also by NRLDC/ NRPC in line with clause 5.2(m) of the IEGC. The same shall be monitored in the meetings of State level Technical Committee and also in the Operation Co-ordination Committee (OCC) of NRPC.

The guidelines for under frequency load shedding shall be prepared by the Technical Committee and approved by the State Power Committee in terms of clause No.9.3 of REGC.

The particulars of feeders or group of feeders at a sub-station which shall be tripped under under-frequency load shedding scheme whether manually or automatic on rotational basis or otherwise shall be placed on Notice board and will also be available at the GSS for information of the consumers(s)

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The Technical Committee shall deliberate and prepare the Under Frequency Load Shedding Schemes at various sub-stations to ensure that the frequent tripping of same feeder is avoided.

6.5 Protection Schemes

6.5.1 Islanding scheme

The islanding schemes for RAPP-A and RAPP-B are in operation as detailed in Chapter 4. SLDC shall ensure that load-generation balance of each islanding scheme is maintained continuously.

SLDC shall monitor & follow-up the procurement and installation of Under Frequency relays, any other Relays & apparatus of RVPN required for under frequency load shedding and system islanding. It shall also take steps to modify the settings as and when required. The scheme with modifications shall be circulated periodically to all utilities.

6.5.2 Special Protection scheme

STU shall formulate special protection schemes in consultation & coordination with generating companies and SLDC for the following contingencies:-

i) Loss of generation at generating stations in the state having installed capacity of 800 MW or above, as per direction from NRPC and also to ensure that in the event of tripping of transmission line, cascaded tripping of generating units / transmission lines is avoided automatically.

ii) Under voltage load shedding (UVLS) Scheme to avoid voltage collapse for designated 400/220 KV Grid Sub-Stations whenever the voltage at a node drops below 380 KV for 400 KV level and 209 KV for 220 KV level as per directions of NRPC.

6.6 Recording Instruments and communication facilities

All the recording instruments, SCADA system, Disturbance Recorders etc. available at each Station and state/sub-Load Despatch Centers shall be kept in good working condition. Adequate and reliable communication facilities shall be maintained with NRLDC, sub load despatch Centres and all EHV stations in the grid.

6.7 System Management & Control

The Grid discipline requires that SLDC, RVPN and Discoms make all possible efforts to ensure the maintenance of grid frequency within the

normal band of 49.0 to 50.5 Hz. This would be ensured by adhering to the following steps:

(i) Each generating station of RVUN shall provide to SLDC their estimates of monthly availability on the year ahead basis for the next financial year by end of October each year. Each station shall also provide to SLDC daily availability for the month ahead by end of 25th day for the next month.

(ii) The SLDC shall regulate the load and generation of Discoms and SGS so that state may not draw more than its schedule during low frequency conditions and less than schedule during high frequency conditions.

(iii) The SLDC shall ensure that each of Generating Stations of SGS shall maintain its generation schedule during low frequency conditions and not more than its generation schedule during high frequency conditions.

(iv) In case of low system demand from Discoms during normal system operations, generating units can be backed down/shut down, **in order of merit,** if so required by SLDC for optimum utilisation of available entitlements. Wherever the State is likely to face power shortage situation despite requisitioning its full entitlement from Central Sector, Discoms would be advised by SLDC to shed loads.

(v) Discoms shall endeavor to enter into a bilateral agreement with constituents of any region/ IPPs/ CPPs/ generating company/ trading licensees on long term basis, short term basis, day ahead basis and real time basis.

(vi) **In any case, during low frequency conditions (below 49 Hz), no over drawls shall be affected.**

(vii) Except under an emergency condition or to prevent an imminent damage to the equipment, sudden reduction in generator output by more than 40% of capacity of each generating unit or one hundred (100) MW shall not be permitted by SLDC and shall be avoided by power station operator, particularly when frequency is below 49 Hz.

(viii) Sudden increase in load by more than 100 MW, particularly when frequency is falling below 49.0 Hz and reduction in load by such quantum when frequency is rising above 50.5 Hz. Shall not be permitted by SLDC and shall be avoided by the EHV substation operator.

6.8 Preventive measures during high frequency conditions and during low frequency:

(i) While the grid frequency is higher than 50.5 Hz, the MW generation at no generating station (irrespective of type and ownership) shall be increased.

(ii) In case, frequency has risen from a previous lower level to 50.5 Hz. or higher, and due to normal governor action, the MW output of a generating unit has fallen to a level requiring oil support or which results in unstable operation of the unit, then MW output will be increased by operator to a level, such that no oil support is required, and the unit can operate in a stable and safe manner. This event shall be reported to SLDC, who shall convey whether status quo to be maintained or unit to be taken for shut down.

(iii) **No generating unit shall be synchronised with the grid while the grid frequency is above 50.5 Hz. or higher, except with the specific concurrence of NRLDC/ SLDC.** This will not apply in case of nuclear units, which may have to be re-synchronised to prevent poisoning out of the reactor. Frequency linked despatch guidelines issued by NRLDC will be followed by each power station.

(iv) SGS shall comply with the instructions of SLDC for backing down or picking-up additional generation not detrimental to generating unit (i.e. ramp-up/ramp-down rate as specified by generating unit supplier /RVUN). Any non-compliance will be referred to Commission.

6.9 VAR Exchange

The SLDC shall take action in regard to VAR exchange with the northern grid, keeping in view the voltage profile at the exchange points. It shall endeavour that local VAR compensation at each substation is so regulated that the VAR drawl at exchange point when the voltage at that point is below nominal value is minimum and VARs are not injected when the voltage at exchange point is above the nominal value. Discoms shall ensure that their VARs drawls are maintained as per the directives of RERC.

6.10 VAR Generation / Absorption by Generating Units

In order to improve the overall voltage profile, the generators shall run in a manner so as to have counter balancing action corresponding to low / high grid voltage and to bring the system voltage towards the nominal value. In order to achieve the same, **all generators shall generate reactive power during low voltage conditions and absorb reactive power during high voltage conditions as per the capability limits of the respective**

generating units. The On-Load Tap Changers (OLTCs) -on the generator transformers wherever available, shall also be used to achieve this. Off load tap changers shall be so set as to take care of seasonal variations in the voltage profile. SGS shall make available to SLDC the update capability curves for all the generating units indicating any restrictions, to enable accurate system studies and effective operation of system.

6.10.1 Transformer taps

The transformer tap position may alter reactive power flow so any change will be effected only on the instruction from SLDC. In respect of transformers declared as important elements of Regional Grid by NRLDC, NRLDC shall advise SLDC, the settings of transformer tap positions. SLDC shall carry out any change in tap positions of such transformers only on advice of or after consultation with NRLDC.

6.11 Control at Grid Substations / Generating Stations

6.11.1 In the event of high system voltage i.e. voltage going beyond upper permissible limit (e.g., 400 KV Bus voltage going above 410 KV and 220 kV bus voltages going above 245 kV), the following specific steps would be taken by the respective grid substations / generating station at their own, unless specifically instructed otherwise by SLDC:

- The bus reactors will be switched in.
- The manually switchable shunt capacitor banks shall be taken out.
- The switchable line/ tertiary reactors be taken in.
- Synchronous condensers shall be operated for VAR absorption.
- Hydel generators shall be operated as synchronous condenser wherever feasible for VAR absorption, with the consent of SLDC.
- Lightly loaded EHV lines shall be opened keeping in view the security of the balance network with the consent of SLDC for 220 KV and NRLDC through SLDC for 400 KV.

6.11.2 In the event of low system voltage, i.e. voltage going below lower permissible limit (e.g., 400 KV bus voltage going below 390 KV and 220 kV bus voltages going below 200 kV), the following specific steps shall be taken by the respective grid substations / generating stations at their own, unless specifically instructed otherwise by SLDC:

- The bus reactors (if ON) shall be switched OFF.
- The shunt capacitor banks will be switched in.
- The switchable line/ tertiary reactors be taken out.
- Synchronous condensers shall be operated for VAR generation
- Hydel generators shall be operated as synchronous Condenser for VAR generation wherever feasible with the consent of SLDC

- EHV lines, which were opened to control high voltage or otherwise, shall be switched on with the consent of SLDC for 220 KV and NRLDC through SLDC for 400 KV.

6.12 Load management for controlling the voltage

SLDC shall identify the radial feeders which have significant reactive drawals and which can be disconnected in order to improve the voltage conditions in the event of voltage dropping to low levels. The details of all such feeders shall be kept handy in the respective control rooms and standing instruction shall be issued to the operating personnel to obtain the requisite relief in the hour of crisis by disconnecting such feeders on equitable and rotational basis..

6.13 Regulatory measures by SLDC to prevent voltage collapse

In case the Discoms do not take the requisite measures by regulating their VAR drawls and the system voltage drops down to low levels (say below 120 kV at 132 kV bus), then SLDC may resort to regulatory measures by opening of tie lines including those, feeding radial loads in the areas of defaulting Discoms. While taking such action, SLDC would duly consider that the same does not adversely affect the evacuation system from existing generation, voltage profile and system security.

6.14 Switching-off of the lines in case of high voltage

In the event of persistent high voltage conditions when all other reactive control measures as mentioned earlier have been exhausted, selected 132 KV or 220 kV lines shall be opened for voltage control measures. The opening of lines and in such an event reviving them back would be carried out as per the instructions issued by SLDC in real time and as per the standing instructions issued by SLDC from time to time. While taking such action, SLDC would duly consider that the same does not lead to constraints in evacuation of generated power and adversely affect voltage profile & system security.

6.15 Line loading

In accomplishing the frequency & voltage control measures outlined above, the system operator would take into consideration the thermal loading limits, surge impedance loadings and the loading permitted from stability considerations for each line. The system operator at SLDC or substations would endeavour to keep the line / ILT loadings within limits and take corrective action in case of overloading of any element. Special emphasis would be laid by the system operator on identifying credible system contingencies & continuously evaluating the system under his control against these contingencies.

6.16 Operating manpower

The control rooms of the SLDC, power plants, grid substations as well as any other control centers of RVPN shall be manned round the clock by qualified and adequately trained manpower who would remain vigilant and cooperative at all the times with SLDC so as to maintain the system safety and security and operate it in a most optimum manner.

6.17 System Studies

Preventive measures to control frequency and voltage detailed above shall be based on planning studies conducted by RVPN and operational studies conducted by SLDC. Operational studies by SLDC shall be based on actual system conditions, preferably on real time data extracted from SCADA, with appropriate corrections for errors to achieve convergence.

6.18 Recording of Messages

6.18.1 SLDC shall ensure that the entries in the log books must be made immediately after the conversation. Each person in the Control Room who is giving instructions, may note down the time and instructions and transfer them immediately into the log book. Such entries would not be left to be done at later stage. This practice shall be followed meticulously to avoid inaccuracies in the messages actually given and those recorded in the SLDC

6.18.2 The SLDC is maintaining a voice recorder system for recording and storing in all messages, conversation and exchange of information through telephone between SLDC and NRLDC.

6.18.3 The operational messages shall be given by the shift engineer (LD) to the shift engineer (EHV stations/ generating stations) with specific reference to the equipment to be operated, in a sequential manner.

Chapter- 7

Outage Planning

7.1 Overview

The preventive and capital maintenance of system is essential to maintain optimum availability/efficiency levels. Such maintenance has to be planned in advance so that they do not adversely affect the continuity and reliability of supply and network security. The outage planning has to take into consideration, availability/outage of the generating units, transmission lines and ILTs. This would be done in line with Clause 5.7 of the IEGC and Chapter VIII of REGC.

7.2 Outage Planning Process

7.2.1 Outages in the system have an effect on the network security. Power system studies shall be done by RVPN annually and by SLDC for annual outage planning as well as day-to-day operations to assess the effect of outages on the grid security. Planning studies carried out by RVPN and operational studies carried by SLDC in this respect shall be exchanged between them.

7.2.2 Scheduled outage of power stations of capacity 25 MW & above and all EHV transmission lines, will be subject to annual planning.

7.2.3 Provided that scheduled outage of power station of 50 MW and above and EHV lines notified as important elements by NRLDC, will also be subject to annual planning by NRPC Secretariat to be coordinated by SLDC.

7.2.4 SGS shall provide SLDC with proposed outage programme in writing for the next financial year by 31ST October each year. The outage programme shall indicate identification of unit, reason for outage, availability affected due to outage, start date and duration.

7.2.5 SLDC shall also obtain from Chief Engineer of each T&C zone of RVPN, the proposed outage programme for Transmission lines, equipments and sub-stations etc. for next financial year by 31ST October each year. RVPN outage programme shall contain identification of lines/ substations, reason for outage, outage start date and duration of outage.

7.2.6 Scheduled outage of power stations and EHV transmission lines vide sub-section 7.2.2 & 7.2.5 shall be effected only with the approval of SLDC or NRLDC as the case may be. NRLDC approval shall be conveyed by SLDC.

7.2.7 Scheduled outage of power stations of capacity 5 MW and above, and all EHV lines and HV lines (i.e. 33 KV and 11 KV lines) forming interconnection between two EHV substations (if notified by SLDC) shall be approved by SLDC, 24 hours in advance based on prevalent operating conditions.

7.2.8 SLDC shall formulate a calender for annual outage planning in respect of scheduled outage referred in subsection 7.2.2 & 7.2.4 for the ensuing financial year which will be finalised by Technical Committee. However, power stations & EHV lines specified at proviso to sub-clause 7.2.3 shall be decided by OCC of NRPC.

7.2.9 SLDC shall release final outage plan for generating stations, RVPN and Discoms in respect of schedule outage referred in Sub section 7.2.2, 7.2.4. & 7.2.7 by 31ST Dec. each year. However, power station & EHV lines specified at proviso to sub clause 7.2.3 shall be released latest by 15th March each year on the basis of agreed outage plan received from NRPC. This shall include load generation balance as well as load shedding schedules as may be required.

7.3 Quarterly and monthly reviews

The annual outage plans formulated as above shall be reviewed on quarterly and monthly basis by SLDC as per following program.

(i) In the months just preceding each quarter, i.e. during March, June, September and December, the outage plans for the balance part of the financial year shall be reviewed at the level of Technical Committee.

(ii) Monthly review of the outage plan for the current month and the consecutive month would be done by the SLDC.

(iii) In the event of any requirement to re-schedule any planned shutdown or to avail an emergency / unforeseen shutdown not anticipated earlier, the concerned agency shall forward such request to SLDC indicating the nature of emergency or the reason for deferment. SLDC, where required shall in consultation with NRLDC, would approve such unforeseen outages/ re-scheduling of planned outage based on the exigency of the case vis-à-vis system conditions.

7.4 Availing of shutdowns schedule

7.4.1 SLDC would review on daily basis the outage schedule for the next two days and in case of any contingency or conditions described in Sec.5.7.4(g) of the IEGC, or section 8.1.7 of REGC,defer any planned outage as deemed fit clearly stating the reasons thereof. The revised dates in such cases would be finalized in consultation with the utilities.

7.4.2 Each user shall obtain final approval of SLDC, prior to availing an outage. SLDC while releasing any circuit for outage shall issue specific code. Similarly no intra-state circuit shall be connected back to the State Transmission System without specific code/ approval by SLDC. This restriction shall however not be applicable to individual Generating unit of a CPP.

7.5 Scheduled Outage of Transmission Lines or substation equipment

7.5.1 Approval or deferment for outage of transmission line or sub-station equipment affecting more than one utility shall be communicated to concerned utilities.

7.5.2 The PTW issued by SLDC/NRLDC for tripping / revival of any element signifies such approval only from the system point of view notwithstanding anything contained in respect of safety measures and other switching operations to be carried out locally. The related line / substation personnel would be responsible for ensuring all safety precautions to be followed while tripping / closing of any element to avoid any threat to operating personnel and equipment.

7.5.3 Except for hot line maintenance, all works would be undertaken only after earthing the work section.

7.5.4 All preparatory works for maintenance would be done well in advance before availing the PTW so as to avoid any idling time. Said PTW would be returned before reviving the element after shut down.

7.5.5 During the period of shutdown, the utility availing PTW shall keep SLDC apprised regarding the status of work and the likely time of return of the PTW. All efforts shall be made for timely return of PTW and delays if any shall immediately be reported to SLDC/NRLDC, as the case may be, along with the reasons and likely time of return of shut down/PTW.

7.5.6 Where in case of a transmission line maintenance, it is foreseen that return of Permit To Work (PTW) could be delayed due to physical distance involved, mobile or satellite phones or telephone would be used for communication with the substation to minimize the outage period. In all such cases, SLDC will effect cross check of return of PTW before effecting energisation of the transmission line.

7.5.7 Any maintenance work on opportunity basis proposed to be carried out by a utility during a EHV line / ILT shut down would need the approval of SLDC.

7.5.8 In respect of 400 kV line/ILT, SLDC shall seek approval of NRLDC. The same if approved, would also be intimated by SLDC to the utility, which initially applied for the planned shut down.

Chapter- 8

Scheduling and Despatch Procedure

8.1 Overview

8.1.1 Scheduling implies drawing up a generation program to cater to forecast power demand at a minimum cost subject to transmission system constraints, capability of generating units & other factors (e.g. voltage profile, system security & system sustainability under grid disturbance). If adequate generation is available to cater to the demand at all times, then scheduling involves decision on which unit would have to be scheduled for how many time periods and if not, then scheduling involves curtailing load demand commensurate with available generation.

8.2 Entitlement

Northern Regional Grid shall operate on the concept of loose power pool as per Clause 6.4(1) & (2) of IEGC. NRLDC indicates station-wise entitlement of the state in each ISGS at 15-minute intervals on day ahead basis. Discoms shall submit their requirement to SLDC and SLDC will submit the requirement of state as a whole to NRLDC.

8.3 Drawal Schedules:

8.3.1 The net drawal schedule of the State would be the sum of the allocated ex-power plant schedules from different ISGS, its shares from partnership/joint sector projects, any bilateral exchange agreed with other constituent states in Northern or any other region and any purchase (+) / sale (-) through collective transactions less estimated transmission losses.

8.3.2 For the purpose of scheduling, each day would be divided into 96 interval of 15 minutes duration each. For each 15 minutes block NRLDC would finalise and intimate to SLDC, the net drawal schedule and to each ISGS the generation schedule a day in advance.

8.3.3 SLDC shall have responsibility for the following:

(i) Scheduling/ despatching generating stations/other than ISGS, within the state, and

(ii) Scheduling their drawl from ISGS including bilateral exhanges (within their allocations/share in respective power plant's expected capability), and

(iii) Regulating the demand of distribution licensees /customers.

8.3.4 The SLDC would, therefore, be required to maintain the actual drawal from the Northern grid close to such 'net drawal schedule' by regulating within the state generation (other than from ISGS) and/or consumer's

load. For this purpose, the Discoms shall regulate their own drawls as per the schedules conveyed to them by the SLDC every day on 15 minutes basis. Under ABT overdrawal/ under-drawal are billed at a UI rate corresponding to average frequency during the 15 minutes interval.

8.3.5 For economising the cost of purchase, the SLDC shall endeavour to maintain the drawals in such a manner that there is no overdrawals from the northern grid during low-frequency condition and no under-drawal during high -frequency conditions. Similarly, each SGS shall also endeavour to maintain the generation in such a manner that they do not generate above schedule during over-frequency condition and do not generate below schedule, during under-frequency condition.

8.3.6 Operating Procedure for Northern Region prescribed under IEGC shall be used for generation schedule for the ISGS and drawal schedules for the State.

8.4 Scheduling and despatch procedure

8.4.1 Time line for various activities under Scheduling and despatch procedure are as under :

S. No.	Time	Activity
1	1000	Each SGS having capacity of 10 MW or above shall intimate to SLDC the station wise ex-power plant MW and MWh capabilities foreseen for the next day i.e. between 00.00 to 24.00 hrs of the following day, either as one figure for the whole day in case of fixed generation or as different figures for different periods of the day. While making or revising its declaration of capability, the generator shall ensure that the declared capabilities during peak hours is not less than that during other hours except in case of tripping/ re-syncronisation of units as a result of forced outage
		Each Discom shall intimate SLDC the overall requirement in MW and MWh for the next day at 15 minutes interval.
		The ISGS shall advice the NRLDC, the station-wise ex-power plant MW and MWH capabilities foreseen for the next day.
		Each Open Access Customers having commercial obligation for import/export from/to intra-state Transmission system shall provide an advance declaration of their MW import/export for each 15 minutes time block for the next day.
2	1100	The generation scheduling for the stations under Bhakra Beas Management Board (BBMB) would be coordinated and finalized by BBMB in accordance with the requirements of the beneficiary

		states viz. Punjab, Haryana, Rajasthan, Himachal Pradesh and UT Chandigarh and subject to the irrigation and Hydellogy constraints.
		The above information of the foreseen capabilities of the ISGS shall be compiled by NRLDC and the MW and MWh entitlements available to each state for the next day shall be intimated by NRLDC to SLDC
3	1200	After receipt of information in regard to the availability from different sources i.e. ISGS & BBMB from NRLDC and SGS and other sources, the SLDC shall forward the same to all Discoms.
4	1330	Discoms will send their requirement to SLDC against their share.
5	1500	The SLDC shall review aggregate demand of generating capability of SGS and RVPN (NES and other power stations) and the bilateral interchanges between Discoms, if any, vis-à-vis Discoms requirements. and finalise (i) generation schedule of SGS and (ii) drawl schedule of each Discom. It shall accordingly advise each Discom of their drawl schedule and will workout and convey to NRLDC for drawl schedule in each of the ISGS along with the bilateral exchanges agreed or intended to be had with the other state / states. SLDC while finalizing the requisition from ISGS (including BBMB power stations), shall also consider estimated losses that would be deducted from its ex-power plant schedules in ISGS and BBMB stations.
6	1700	NRLDC shall convey to each ISGS the generation schedule (i.e. ex-power plant despatch schedule) and to SLDC the net drawl schedule (i.e. the ex-power plant schedule for Rajasthan after deducting the apportioned estimated transmission losses).
7	1730	SLDC shall convey to SGS, the generation schedule and to each Discom the finalised drawl schedule.
8	2130	The SGS and each Discom may inform the modifications / changes to be made, if any, in the above schedules to SLDC.
9	2200	SLDC after considering modifications / changes received from Discoms/ SGS, if any, shall convey revised requirement to NRLDC.
10	2300	On receipt of information and after due consultations, the NRLDC shall issue the final generation / drawl schedule immediately there after. SLDC shall inform the final generation / drawl schedule to all concerned thereafter.

8.4.2 Each SGS having capacity 1MW and above but less than 10 MW & all generating station based on non-conventional sources shall submit weekly schedules to SLDC.

8.5 Specific points:

RERC regulations for power purchase and procurement procedure and instructions/directions thereunder shall be generally considered for Operational Planning. The following aspects would be taken into consideration while preparing and finalising the schedules:

(i) As per RERC's directives, SLDC shall ensure to despatch entire available generation from Hydel stations and shall ensure that specified generation capacity presently (of 50% of peak load) shall be operational within the State. Accordingly economic power system operation in terms of provision of IEGC shall be considered separately for power stations within the state and outside state power stations with due consideration to voltage profile, contingency to meet outage/islanded operation, stable operation of generating unit and no loss of generation of renewal non-conventional energy sources power plants.

(ii) RERC's regulation in respect of power purchase and procurement procedures and instructions/directions conveyed there under will not be violated.

(iii) The resulting power flows do not give rise to any transmission constraints. In case, any constraints are foreseen, then SLDC shall moderate the schedule to the extent as required, under intimation to the concerned utility.

(iv) Schedules shall be operationally reasonable particularly in terms of ramping up / ramping down rates and ratio between minimum and maximum generation levels. If it is found to be not meeting these requirements, then SLDC shall moderate the schedule to the required extent under intimation to the concerned utility. The ramping up / ramping down rates in respect of different categories of stations would be based on the technical data as substantiated by the generating stations and as mutually agreed by the utilities.

(v) SLDC may subject any SGS's power station to test for generation upto its declared capability. Procedure for the same and penalty for wrong declaration shall be as decided by State Power Committee and approved by RERC.

8.6 Priorities in scheduling of generation.

Subject to RERC regulations for power purchase and procurement procedure and instructions/directions thereunder, as may be issued by the Commissions from time to time, the following specific points would be taken into consideration while preparing and finalising the schedules:

(i) SLDC shall regulate the overall state generation in such a manner that generation from following types of power stations where energy potential, if unutilized, goes as a waste shall not be curtailed:

- Run of river or canal based Hydel stations.
- Hydel-station where water level is at peak reservoir level or expected to touch peak reservoir level (as per inflows).
- Wind power stations.
- Solar power stations (Other than hybrid).
- Hybrid solar power stations with minimum generation from conventional fuel required to utilize available solar power.
- Nuclear power stations (to avoid poisoning of fuel).

(ii) SLDC will issue despatch instructions required to regulate all generation and imports from IPPs / CPPs according to the hourly day ahead generation schedule, unless rescheduling is required due to unforeseen circumstances.

(iii) In absence of any despatch instruction by SLDC, SGS shall generate/ export according to the day ahead generation schedule.

8.7 Despatch instructions

Despatch instructions shall be in standard format. These instructions will recognize declared availability and other parameters that have been made available by the SGS to SLDC. These instructions shall include time block, Power Station, Generating Units, (Total export in case of CPP), name of operators sending and receiving the same. Standard despatch instructions may include:

(i) To switch a SGS into or out of Service.
(ii) Details of reserve to be carried on a unit.
(iii) To increase or decrease MVAR generation as per capability curve of unit so as to assist voltage profile.
(iv) To begin pre-planned Black Start procedures.
(v) To hold spinning reserve.
(vi) To hold Generating Units of SGS on standby.
(vii) To control MW/MVAR Drawl by Distribution Companies.

8.8 Revision of schedules

8.8.1 In case of forced outage of a ISGS unit, NRLDC will revise the schedules on the basis of revised declared capability. The revised schedule will become effective from the 4th time block, counting from the time block in which the revision is received by the NRLDC to be the first one.

8.8.2 In case of forced outage of RVUN unit, SLDC will revise the schedule on the basis of revised declared capability. The revised schedule will become effective from the 4th time block, counting the time block in which the revision is received by the SLDC to be the first one.

8.8.3 In the event of a situation arising due to bottleneck in evacuation of power due to transmission constraint in inter state system, the NRLDC shall revise the schedule which shall become effective from the 4th time block, counting the time block in which the transmission constraint has been brought to the notice of NRLDC as the first one. During the intervening three time blocks also, the schedule shall deem to have been revised to be equal to the actual generation by the ISGS.

8.8.4 On receipt of an intimation, under section 8.8.1 and 8.8.3 above, SLDC shall effect corresponding revision in generation and load drawl schedule and shall convey to concerned constituents, the time from which schedule will be effective.

8.8.5 In the event of a situation arising due to bottleneck in evacuation of power due to transmission constraint in intra-State Transmission System, the SLDC shall revise the schedule of the concerned entity (ies) which shall become effective from the 4th time block counting the time block in which the transmission constraint has taken place to be the first one. During the first three time blocks also the schedule shall deem to have been revised to be equal to the actual generation and drawl.

8.8.6 In case of any grid disturbance, the schedule generation of all the generating stations and schedule drawl of all the beneficiaries shall be deemed to have been revised to be equal to their actual generation/drawl for all the time blocks affected by the grid disturbance. The exact duration of such grid disturbance would be declared by NRLDC/SLDC as the case may be.

8.8.7 SLDC shall permit the revision of declared capability by RVUN Generating Units and revision of drawl schedule by Discom for RVUN stations for the remaining period of the day/block. Revised declared capability shall become effective from the 6th time block, counting the time block in which the request for revision has been received in SLDC to be the first one. The revision shall be not less than 10 MW.

8.8.8 SLDC shall permit the revision of drawl requisitions of ISGS already made by Discoms for remaining period of the day which shall become effective

from the 6th time block counting the time block in which requests for revision has been received by NRLDC from SLDC.

8.8.9 If, at any point of time, the SLDC of its own or at the instance of NRLDC observes that there is need for revision of the schedule of RVUN in the interest of better system operation, it may do so on its own and in such cases, the revised schedule shall become effective from the 4th time block.

8.8.10 On completion of the operating day (i.e. after 2400 hrs), the final schedule as implemented shall be issued by NRLDC after incorporating all before the fact changes during the day of operation. Based on the same SLDC will issue such schedule to all intra-state utilities.

8.8.11 Various steps involved in the scheduling and the final scheduling by NRLDC shall be open to all the constituents for any checking / verification for a period of 5 days. Any mistake / omission in schedule and final schedule issued by NRLDC or SLDC, as the case may be, shall be brought to the notice of SLDC by concerned agency. SLDC shall check and effect rectification or where required, take up with NRLDC for rectification.

8.9 Special situations related to scheduling

8.9.1 There would be certain situations needing special treatment while scheduling. These would be taken care of as per agreed methodologies from time to time between constituents & NRLDC within the framework of IEGC. Prevalent methodology is mentioned hereunder and at clause 8.10 and 8.11.

8.9.2 Standing instructions by SLDC to NRLDC for deciding the best drawl schedule.

SLDC under clause 8.4.1 would convey to the NRLDC, at least, the following information on 15-minute time block basis:

- Total MW required from the grid at its periphery and
- MW schedule for bilateral exchanges

8.9.3 Based on the above information, NRLDC would work out the requisitions from each Interstate Generating Stations (ISGS) considering the merit order of energy charges in respect of ISGS stations after translating the above MW values to ex- power plant (considering an estimated level of transmission losses).

8.10 Scheduling of the ISGS Hydel stations

8.10.1 In respect of Hydel power stations where the MWh generation for the day is fixed depending on the water inflows, MWh entitlement of each beneficiary state is also fixed for the day. In case the beneficiaries are

allowed full freedom to requisition on 15-minute time block basis restricted to their MWh entitlement for the day, it may result in an ISGS schedule not practicable for the generator to follow (due to part load or high cavitations zone operation on sustained basis). Accordingly based on SLDC requisition of its proposed total requirement from the grid, for the next day under section 8.4.1 to NRLDC by 15.00 hrs, an interim schedule would be worked out by NRLDC adding this forecasted requirement for each state with a weightage corresponding to percentage entitlement of the state in the ISGS Hydel stations. This interim schedule would be rounded off to the nearest feasible MW for the ISGS Hydel station to get the final schedule of the ISGS Hydel stations. With this procedure, the generation schedule would adequately reflect the weightage according to MW demand of each beneficiary in the ISGS Hydel stations.

8.10.2 The entitlement for each beneficiary would then be worked out by NRLDC based on such interstate Hydel generating station schedule and percentage entitlement of the beneficiary. The above general procedure will be followed except in case of extremely low water inflows, when the Hydel stations would be scheduled for operation only during the peak hours.

8.11 Scheduling of the SGS Hydel stations

8.11.1 In respect of state sector Hydel stations, where the MWh generation for the day is fixed depending on the water inflows, SLDC shall schedule the generation depending upon frequency pattern and availability of state.

8.11.2 SGS Hydel stations where MWh generation is not fixed scheduling is done as per the availability given by SGS and requirement given by the Discoms.

8.12 Exchange of information

8.12.1 With the implementation of ABT, the generation schedules and drawls schedules would have a bearing on payment to ISGS for the energy charge and for unscheduled interchange. Therefore, the timely and accurate exchange of information in regard to schedule is of paramount importance. This aspect gains extra importance particularly in view of the CERC order of ABT dated 4.1.2000 wherein under “schedule 1.0” it is stated that 'generation schedule and drawl schedules issued/revised by NRLDC shall become effective from designated time block irrespective of communication success'. In order to avoid any adverse effect commercially on the state the need for a reliable and fast communication arrangement for exchange of information in respect of scheduling cannot be overemphasized.

8.12.2 Considering the large volume of information needed to be exchanged in a time bound manner, the transfer of information between NRLDC and other constituents i.e. states and ISGS, shall be preferably carried out on PC-to-PC communication link through Internet / public switched telephone

network (PSTN). Matching system will be developed at the State level for communication between SLDC and NRLDC & between SLDC & SGS/ Discom control centres. In order to have fast access on the network, RVPNL shall also endeavour to have fast/dedicated connectivity on internet/ other media as appropriate between SLDC & SGS/ Discoms.

8.12.3 For this purpose NRLDC has a dedicated Internet connection on a leased circuit. The ISGS and SLDC upload the information to NRLDC site in regard to scheduling at the agreed time and download the generation schedules and drawl schedule from NRLDC site at the designated times. Similarly SLDC shall upload the information regarding scheduling on its website and Discoms & SGS shall download the same at designated time.

8.12.4 In respect of any desired change in schedule, SLDC shall contact NRLDC and also notify the requisite information by e-mail / fax / coded message immediately. The clock timings of NRLDC at which the e-mail/fax/coded message information is received, would be reckoned as the starting block for schedule revision.

8.12.5 The information, in regard to revision of schedule shall be flashed by NRLDC to the constituents by e-mail or fax or coded message. Accordingly SLDC shall receive/download the revised schedule from NRLDC site.

8.12.6 In case NRLDC wants to revise the schedule due to transmission constraints or otherwise, then the required intimation will be flashed by NRLDC to the SLDC by fax/ coded message and accordingly, SLDC shall receive/download the revised schedule from NRLDC site.

8.12.7 The information received/downloaded as per subsection 8.12.4 to 8.12.6 shall be converted to revised schedule by SLDC and may be uploaded on its website for information of SGS/ Discoms.

8.12.8 Each message sent by SLDC to NRLDC & SLDC to SGS/ Discom Control centres and vice versa shall be duly numbered. The date and time of issue shall be invariably stamped along with the subject and revision number etc.

8.12.9 The conventional voice / fax arrangement would act as back-up in case of failure of PC to PC communication link through Internet.

8.12.10 At the end of the day the final schedule as implemented after incorporating all 'before the fact changes' during the day of operation shall be made available by NRLDC on the network and accordingly shall be downloaded by the SLDC. Based on the same, at the end of the day, SLDC will upload the final schedule as implemented after incorporating all ‘before the fact changes’ during the day of the operation on its website for information to SGS/Discoms.

Chapter - 9

Grid Disturbances and Revival

9.1 Overview

This chapter describes the guidelines for classification of Grid disturbances into different categories, for the purpose of analysis and reporting. The milestones to be reached, so as to consider the restored system as normal, is also indicated. The general precautions to be observed, while restoring a disturbed system is also covered in this chapter. This chapter is based on and incorporates 'Black Start Procedures for Northern Region' brought out by NRLDC.

9.2 Definitions

Total System Blackout:

The system is said to be under total blackout when all generation is ceased in the system and there is no supply from external inter-connections to the State Transmission System. It is not possible for the total system to function again without black start procedure.

Partial System Blackout:

A situation when a part of the State Transmission System is under blackout when all the generation within that part ceased to function and there is no external interconnections, so as to be possible for that part of State transmission system /Central Generating Station to function again without agreed procedures.

Black Start:

Procedure necessary for recovery from total /partial system blackout. The procedure for a partial system blackout is same as that for a total system blackout except that it applies only to the affected portion of the State Transmission System.

Grid Disturbance:

Grid Disturbance is the situation where disintegration and collapse of grid either in part or full takes place in an unplanned and abrupt manner, affecting the power supply in a large area of the region.

System Island:

In case a part of the system is separated from the main Regional Grid System due to intentional implementation of under frequency relay schemes and operates independently is called System Islanding. Normal operation of the total system will require system islands to be re-synchronised at some appropriate time.

System Split:

In case part or whole of State Transmission System is separated on operation of protective relays and operate independently is called system split.

9.3 Classification of grid disturbances

The criteria for classifying grid disturbances are indicated in the table below.

Classification of grid disturbances			
S. No.	Category No.	Severity	Description
1	A	Major	Total blackout in the state OR Loss of 40% or more of the antecedent generation in the state system OR Separation into two or more subsystems and loss of 30% or more of the antecedent generation
2	B	Moderate	Loss of 20 - 40% of the antecedent generation in the State system OR Separation into two or more having antecedent load in each of the first two subsystems equivalent to thirty percent (30%) or more of the antecedent generation OR Instantaneous loss of load corresponding to more than 15% of the antecedent generation

3	C	Minor	Loss of 10 - 20% of the antecedent generation in the system OR Total loss of power supply at a power station contributing 5% or more to the antecedent generation OR Total loss of power supply at a 220 kV or above substation catering to load corresponding to 5% or more of the antecedent generation OR Separation into two or more subsystems having antecedent load in each of the first two subsystems equivalent to five percent (5%) or more of the antecedent generation.

The above is a general guidelines for the purpose of analysis and reporting. The generation schedules for SGS and net drawl schedules for Discoms would remain suspended for the first two categories viz. A & B while for category C, it would be on case-to-case basis as decided by SLDC. However, if only one Discom system or one SGS is affected, the schedules would not be suspended even for category-B disturbances but only schedules would be revised.

The classification of grid disturbance in case of RVPN grid shall be termed in the same way as for NR grid.

9.4 System restoration

The restoration of the system shall be carried out as mentioned in the document 'System Restoration Procedure for Northern Regional Grid' prepared by NRLDC in consultation with all constituents and amended from time to time extract of which has been incorporated in chapter 3 of this code.

9.5 Declaration of system normalization

9.5.1 When a system is restored after a grid disturbance, SLDC shall notify to all affected users for normalisation of the system.

9.5.2 After a category 'A' or 'B' disturbance, the system would be declared by SLDC to have been normalized if :

i) All subsystems have been synchronized, and
ii) 80% of the total loss of generation at SGS stations, during the incident, has been revived.

9.5.3 After a category-C disturbance, the system would be declared by SLDC to have been normalized, if

a. All subsystems have been synchronized.
b. Power has been extended to each affected grid substation.
c. At least one unit at the affected power station has been synchronized (subject to a maximum of three hours of receipt of start-up power).

9.6 Inter regional support

In case of grid disturbance or any other contingency, support of neighbouring state/region shall be availed under such contingency. . Such exchanges shall be limited to that needed to meet the essential load, start-up-power, railway traction and other such emergent requirements for the duration of such contingencies.

9.7 Derivations from agreed procedures.

9.7.1 In real time situation, depending upon the actual system conditions certain deviations from the documented procedure may be essential to achieve the ultimate objective of speedy recovery and normalisation. Therefore, during system revival, the SLDC Control Staff shall have to act judiciously and any such deviation which is required for achieving the speedy revival may be carried out in consultation and as per instructions of the NRLDC. Procedure so adopted will be documented and discussed in next meeting of Technical Committee for incorporation in LD&SOM.

9.7.2 Since the generating stations with black start facility, inter-state/inter-regional ties, synchronising points and essential loads to be restored on priority determine the system restoration sequence, the procedure shall be reviewed every subsequent year with the objective to achieve fastest possible recovery of the grid.

Chapter - 10

Energy Account and Settlement System

10.1 Energy Accounting

10.1.1 SLDC shall prepare every month, the accounts of active & reactive power drawal/ injections as well as energy supplied to:-

(i) Jaipur, Jodhpur & Ajmer Vidhyut Vitaran Nigams or any other distribution licensees and
(ii) SGS from various sources through transmission of RVPN.
(iii) ISGS from various levels as received from NRLDC

10.1.2 The energy accounts so prepared by SLDC, shall be sent to the users.

10.1.3 In the preparation of such energy accounts, SLDC shall take into consideration:-

(i) Bulk Supply Agreements for supply and/or transmission of power, bilateral agreements, short term and spot purchases effected by any licensee, and
(ii) Policy guidelines or decisions of State Power Committee, and
(iii) Decisions/directives of RERC, and
(iv) Such accounts by BBMB and NRPC, and
(v) Open access transactions

10.1.4 For the purpose of preparation of energy accounts, the joint meter reading taken at 0000 Hrs. on 1st of every month at points of supply between RVPN and RVUN or any generating company or CPP or between RVPN and Discoms or any distribution licensee shall be conveyed to SLDC on respective website or email by 1 st of every month followed by hard copy by 5th of every month

10.1.5 Energy accounts shall be prepared by SLDC of previous month by 25th of every month and shall be conveyed to all concerned. Such energy accounts shall be subject to inspection/verification/checking and raising any objection within 10 days of date of issue. If no objection is raised, energy accounts shall be finalized. In case, any objection is raised, same shall be deliberated in Commercial Engineers committee and finalized as per their decision.

10.1.5 In case energy accounts prepared/finalized by SLDC, require any change on account of revisions of energy accounts by BBMB or NRPC, SLDC shall suo-moto or on the request of any member of the Commercial Engineers Committee shall effect changes following the provisions of clause 10.1.4.

10.2 SLDC System Operation Charges:

10.2.1 The SLDC as per provisions of the sub-section 3 of section 32 of the Electricity act 2003 shall levy a System Operation Charges as may be determined by RERC from the constituents using the State Transmission System.

10.2.2 SLDC shall serve to each utility on 1st of every month the bills of its fees and charges. These charges shall be payable on 30th of every month. Delay in payment of SLDC system operation charges will be subject to levy of late payment surcharge. Besides this SLDC regulate their supply/despatches or may direct disconnection of the utility from the Grid and may approach competent authority for levy of fines.

Chapter - 11

Event Information and Reporting

11.1 Overview

Timely and accurate reporting and exchange of information plays a very important role in system operation. This is particularly important during a grid disturbance or a crisis situation. Timely and accurate information flow under such conditions would greatly reduce an element of uncertainty and help in making an informed decision. If the system restoration after a grid disturbance is likely to get delayed, it is important that the general public is also well informed to avoid any unrest. Such instances could result in a major credibility crisis for the Electricity Supply Industry (ESI) and has to be avoided. This chapter describes the information to be exchanged between SLDC and NRLDC, SLDC and users and their periodicity.

11.2 Event information [to NRLDC]

11.2.1 Under Clause 5.9.5 of IEGC, SLDC shall report following events to NRLDC :

(i) Violation of security standards
(ii) Grid indiscipline
(iii) Non-compliance of NRLDC's instructions
(iv) System islanding/ system split.
(v) Blackout/partial black out of EHV Grid
(vi) Protection failure on any element of interstate transmission system and "agreed list of" intrastate transmission system
(vii) Power system instability
(viii) Tripping of any element of interstate transmission system and 'agreed list of intrastate transmission system'

11.2.2 Any tripping of an element falling under Sr. No. (iv), (v), (vi) & (viii) whether manual or automatic, shall have to be intimated by SLDC to NRLDC in a reasonable time not exceeding ten (10) minutes of the occurrence of the event. Along with the tripping intimation, the reason for tripping (to the extent determined) and the likely time of restoration shall also be intimated. Such intimation can be on telephone or fax or e-mail. This should be followed by a detail report in four (4) hours. Any other event shall be reported within 30 minutes.

11.2.3 Any operation planned to be carried out by SLDC, which may have an impact on the regional grid, or on any of the "important element of northern regional grid", shall be reported by SLDC to NRLDC in advance.

11.2.4 The details and the exact time of revival of an element falling under the category of "important elements of northern regional grid" whether revived after a tripping or after a prolonged outage, shall be also intimated to NRLDC immediately.

11.2.5 Besides immediately orally reporting of events to NRLDC, a detailed report in writing shall also be sent under Clause 5.9.5 of IEGC to NRLDC within 4 hours with following details of the event : -

(i) Time & date of event
(ii) Location
(iii) Plant and/or equipment directly involved

(iii) Description and cause of event
(iv) Antecedent conditions
(v) Demand and/or generation (in MW) interruption and duration of interruption
(vi) All relevant system data including copies of records of all recording instruments (including disturbance recorders event logger, DAS etc.)
(vii) Sequence of tripping with time
(viii) Details of relay flags
(ix) Remedial measures.

11.2.6 Exceptional reporting (SLDC to NRLDC)

The above reporting schedules are to be strictly followed. However, in case of any contingency such as an industrial unrest, natural calamity in any part of the region etc., there could be additional reporting requirements not covered in the above schedule. SLDC and its constituents would extend the necessary co-operation in this regard.

11.3 Event information from generating or EHV substation to SLDC

11.3.1 In-charge EHV substation or generating station shall report all events falling under section 11.2. and the following to SLDC within 10 minutes of the occurrence :-

(i) All EHV trippings at substation or generating station.
(ii) Failure of under frequency relay affecting system islanding schemes
(iii) Switching in/off of shunt capacitor bank or synchronous condenser or shunt reactor
(iv) Non-compliance of SLDC's instructions

Any such events reported on telephone shall be confirmed in writing. Detailed report on tripping will be sent within 3 hours of the occurrence.

11.3.2 Under frequency relay operations

In line with the clause 5.2 (m) of the IEGC, all state constituents have to provide automatic under frequency load shedding scheme in their respective systems as per plans approved by NRPC to arrest frequency decline that could result in collapse / disintegration of the grid. In order to check and ascertain their operation as per approved plans, the details of all such trippings in their areas shall be intimated by each SLDC to NRLDC whenever required by the latter. In-charge GSS shall report the trippings effected by such schemes to SLDC within 30 minutes of operation.

Form for reporting event/tripping shall be as per section 11.2.5. Irrelevant items shall be omitted and physical loss/damage, if any, shall be reported.

11.4 Event information from SLDC to Utilities

11.4.1 Any operations planned to be carried out on the instructions of NRLDC which may have an impact on the State system and which shall be reported by NRLDC to SLDC in advance, shall be brought to the notice of concerned users of State.

11.4.2 SLDC shall also send report to its Discoms, if due to any failure or trippings, the power supply is effected by 20% of the schedule or in 20% of the area served by the licensee. For such events, SLDC shall also issue press release.

11.4.3 In the event of a grid disturbance SLDC shall issue a flash report to the Discoms, followed by a detailed report in the following manner.

(i) Grid disturbance category - A (major disturbance):

Flash report within a period of six (6) hours followed by a detailed report within ten (10) working days.

(ii) Grid disturbance category - B (moderate disturbance):

Flash report within a period of five (5) hours followed by a detailed report within a period of seven (7) working days.

(iii) Grid disturbance category - C (minor disturbance):

Flash report within a period of four (4) hours followed by a detailed report within a period of four (4) working days.

11.5 Weekly Reports (NRLDC to constituents)

11.5.1 Weekly report shall be issued by NRLDC to all constituents of the region covering the performance of the regional grid during the previous week, in line with Clause 5.5.1 of IEGC.

11.5.2 A quarterly report shall be issued by NRLDC to all the constituents elaborating the power supply position during the last quarter, quality of supply, the system constraints and other relevant information in line with Clause 5.5.2 of IEGC.

11.5.3 SLDC shall send relevant extract of these reports to utilities within a week of its receipt from NRLDC.

11.6 Periodic Reports

11.6.1 A daily report of provisional drawls from various sources shall be issued by SLDC by 8.00 AM of next day to RVUN, RVPN and Discoms.

11.6.2 A weekly report shall be issued by SLDC to all utilities. It shall cover the performance of the State Grid for previous week and shall contain:

(a) Frequency profile - Maximum & minimum frequency and frequency variation index of the grid

(b) Voltage profile – Maximum & minimum voltage & voltage profile of substations as decided by State Power Committee.

(c) Major generation and transmission system outages.

(d) Transmission system constraints, if any, observed in system operation.

(e) Instances of significant non-compliance of IEGC and REGC.

(f) Extracts from weekly/quarterly report issued by NRLDC, to the extent relevant to constituents of the state's system operation.

11.6.3 SLDC shall issue quarterly report covering above aspects and in addition the violation of security standards, if any, and reports of action taken by the respective utilities to mitigate constraints, avoid violation of Grid Codes and Security Standards.

11.7 Accident Reporting

All accidents fatal or non-fatal shall be promptly reported by the Shift-in-Charge of the concerned RVPN sub-station/line where accident occurred to the SLDC. Intimation of accidents shall be given by the In-charge of GSS/Generating Station in accordance with the governing Electricity Rules.

11.8 Operating manpower

The control rooms of the SLDC, power plants, grid substations as well as any other control centres of RVPN shall be manned round the clock by qualified and adequately trained manpower who would remain vigilant and abide by SLDC instructions at all the times, so as to maintain the system safety and security and operate it in a most optimum manner.

Chapter-12

Management of Load Despatch & System Operation Manual

12.1 Load Despatch & System Operation Manual

12.1.1 The load dispatch and System Operation Manual, issued with the approval of RERC shall be binding on SLDC, RVPN, RVUN, Discoms and any other licensee or generating station (other than of interstate generating stations & transmission lines) in Rajasthan.

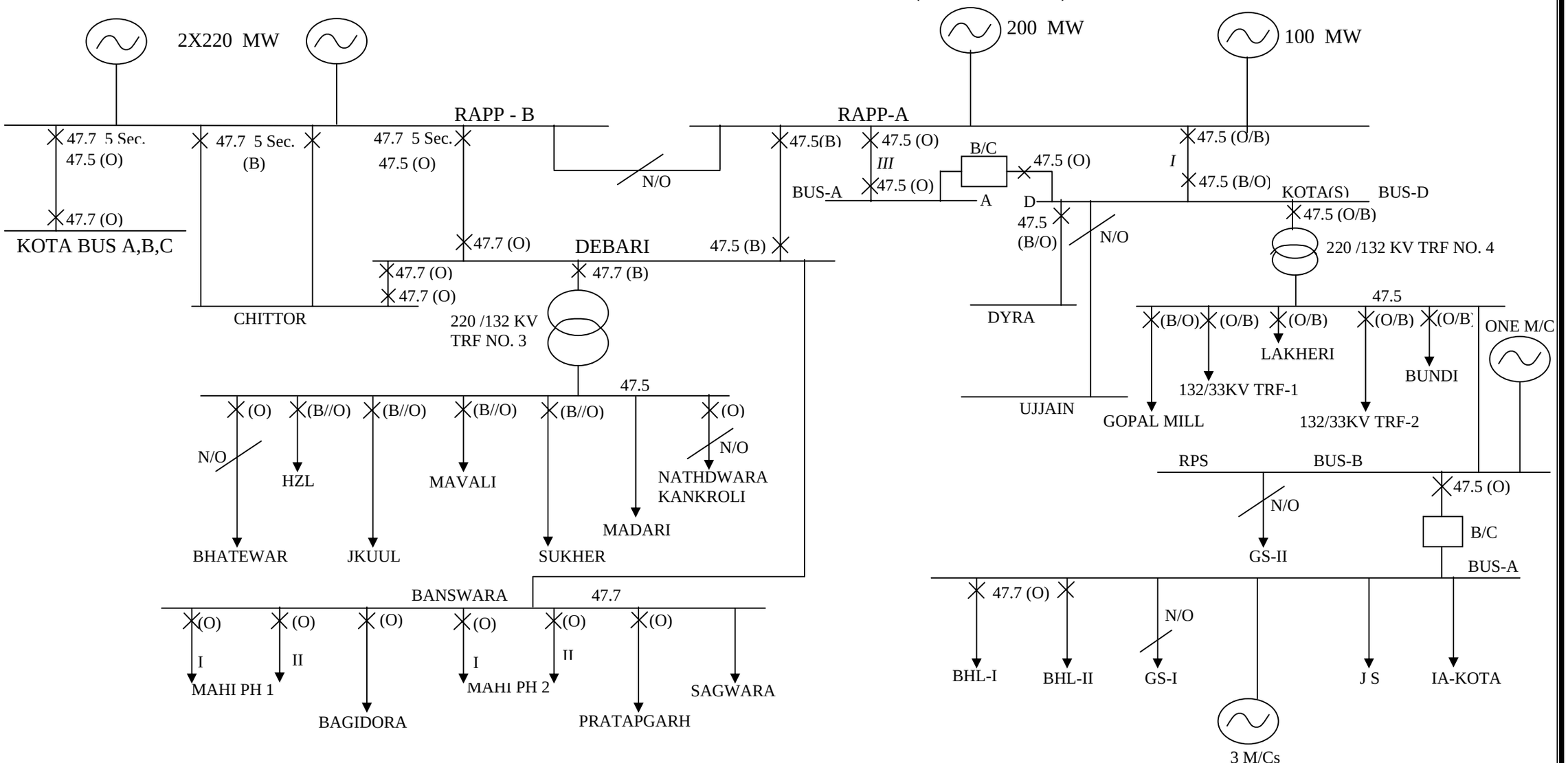
12.1.2 The Load Despatch and System Operation Manual can be updated by SLDC with the approval of RERC as per clause 2.1.1 of REGC .

12.1.3 However, where provisions of IEGC have been referred to or reproduced in this Code, and relevant provision of IEGC is amended, the amendment to such reference or reproduction will be immediately effected by SLDC under intimation to all utilities.

12.1.4 The State Power Committee shall deliberate on the proposal mooted by any of its member or licensee or Captive Power Plant Operator or generating company (other than of interstate generating stations & transmission lines), operating within the state. The recommendations of the Committee shall be by majority of members of the committee. Provided that where proposal is deliberated by correspondence and general consensus of all members is not reached, it shall be decided only through meeting. The proposal of the SPC will be sent to RERC for approval.

ANNEXURE – 4.1

ISLANDING SCHEME OF RAPP-A (AT 47.5HZ)



LEGEND

B- BLOCK **O-** OPERATIVE **N/O-** NORMALLY OPEN **X-** U/F RELAY

B/O- Relays are to be made Operative / Blocked by LD as per generation / load pattern

ANNEXURE – 4.2

ISLANDING SCHEME OF RAPP-B (AT 47.7 HZ)

LEGEND

B- BLOCK **O**- OPERATIVE
N/O- NORMALLY OPEN
X- U/F RELAY
B/O- Relays are to be made Operative / Blocked by LD as per generation / load pattern