

**DRAFT REVISION**

**BLACK START  
& RESTORATION SCHEME  
FOR  
MEGHALAYA STATE**

**AUGUST 2013**

**STATE LOAD DESPATCH CENTRE  
MEGHALAYA POWER TRANSMISSION  
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## **PREFACE**

*This document has been prepared by SLDC, NEHU in accordance with the provisions stipulated under Indian Electricity Grid Code 2010 vide clause no: 5.8 (a-e) and Chapter 11.2 of the State Grid Code 2012.*

*The Black start procedures described in this document are based on practical experience gained during operation of existing Meghalaya grid under isolated conditions and in conjunction with the rest of NER grid and NEW grid. The increasing complexity of the power system entails that there are instances, during the real time restoration process, whereby certain deviations are necessitated / resorted to (in coordination with NERLDC and AEGCL, SLDC) for expediting security constrained restoration of the grid. Such deviations are kept out of the purview of this document, they being contingent with real time operations only.*

*Suggestions and additions for improving the content of this document are solicited.*

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## **CHAPTER-I**

### **(I) GENERAL**

1. As per IEGC Clause 5.8, the Recovery procedures are stated below:
  - a) Detailed plans and procedures for restoration of the regional grid under partial/total blackout shall be developed by RLDC in consultation with all Regional constituents/RPC Secretariat and shall be reviewed/updated annually.
  - b) Detailed plans and procedures for restoration after partial / total blackout of each constituent system within a Region will be finalized by the concerned constituent in coordination with RLDC. The procedure will be reviewed, confirmed and/or revised once every subsequent year. Mock trial runs of the procedure for the constituents shall carry out different sub-systems at least once every six months under intimation to the RLDC.
  - c) List of generating stations with black start facility, inter-state/inter regional ties, synchronizing points and essential loads to be restored on priority, shall be prepared and be available with RLDC/ SLDC.
  - d) The RLDC / SLDC is authorized during the restoration process following a black out, to operate with reduced security standards for voltage and frequency as necessary in order to achieve the fastest possible recovery of the grid.
  - e) All communication channels required for the restoration process shall be used for operational communication only till grid normalcy is restored.
2. Healthiness of communication system, including all auxiliaries, at SLDC, power stations and grid substations should be checked at least once every week to ensure availability of the communication system during periods of crisis.
3. A list of the PSTN and ULDC numbers and their status along with PLCC of the control rooms of SLDC, NERLDC, power stations, grid substations should be available at all control rooms. An updated list of such phone numbers with status is enclosed in Annexure-I.
4. SLDC will organize, as and when desired by the competent authority, a one-day appreciation course on power system restoration at the state level or may propose for it at least once in a year for:- (a) Top and middle management & (b) Power Station Operators and Grid Substation operators.
5. Power Station Operators and Grid Substation operators are expected to be thoroughly conversant with the 400KV/220KV and 132KV network of Meghalaya as well as the interconnected State / Power Grid lines and related ICT's.
6. Existing Line synchronizing facility available at Stage-I P/S should be checked periodically. A list of Power Stations and Grid Substations with line synchronizing facility and status is furnished in Annexure-II. Priority operation of the above is a pre-requisite for flexibility and smooth grid operation.
7. Priority wise loads to be dispatched in steps during the restoration process as envisaged in Chapter-II may be documented and provided separately for every Distribution Circle.

## **GENERAL GUIDELINES FOR RESTORATION**

### **1. Assumptions**

- Line synchronizing facility is available at all Powergrid Sub-stations and Central Sector Generating Stations in general and at 132KV Khliehriat (PG), 132KV Kahelipara S/S 220KV Misa S/S and 400KV Silchar S/S in relation to Meghalaya in particular.
- PLCC facility is available between Meghalaya stations as depicted in Annexure-I. Only NEHU, Mawlai and Khliehriat grid sub stations of Meghalaya's grid sub stations are linked with SLDC NEHU through PLCC (point-to-point).
- SCADA & Communication facilities under ULDC are available only for all of Meghalaya's power stations except MLHEP and the three grid substations stated above with extension of ULDC speech channels to 132KV NEIGRIHMS and EPIP-II sub stations.
- The restoration processes are contingent on healthy / operational condition of all power system elements following a system collapse.
- Identification of loads to be sequentially restored is to be provided by MePDCL. The same needs to be updated from time to time.

### **2. Initial course of action**

- Assess the extent of black out; whether any sub station / power station is alive, whether any interconnection with the neighbouring state / entity is still there and, if yes, then what loads are being catered to etc.
- Open designated circuit breakers at the specified Stations as envisaged in the Restoration Scheme in Chapter-II and any other circuit breaker at any station in case of any single phasing etc.
- Assess the start-up power requirement by employing units that were operating prior to the system collapse.
- Also check whether any critical equipment at any power station or grid sub station has suffered damage or developed a snag.
- Chalk out the optimum path for restoration based on real-time conditions and healthiness of related power system elements.

### **3. Some DON'TS**

- Do not panic
- Do not load any generator beyond 80% of its capacity.
- Do not load any line beyond 80% of its capacity.
- Do not hastily connect loads and ensure that the isolated frequency is within sustainable range.
- No commercial disputes should be raised during the restoration period.
- Till the restoration process is over, SLDC NEHU should not be disturbed in any undesirable manner while discharging their duties and it should not be expected to function as Management Information System.
- Communication links should not be made unduly busy during the start-up process. It is quite likely for SLDC NEHU and other stations to remain busy during the period of crisis.

## CHAPTER-II

***This Chapter takes into consideration closed loop connectivity of Meghalaya power system (wholly or partially segregated) with NER system with the following real time assumptions/conditions:***

**A. Pre-requisites for synchronization with either 400KV/220KV system at Killing S/S following short duration isolation of NER grid from NEW grid:**

**This entails early extension of power from ER in the event of collective tripping and immediate availability of any of the ER-NER links. Meghalaya grid can then be subsequently synchronously connected with NER grid following extension of synchronized power via 400KV Silchar-Killing link or 220KV Misa-Killing D/C line.**

**B.**

**(I) Restoration of Meghalaya grid during total and prolonged collapse of NER grid:**

**(1) Development of Meghalaya system in isolation followed with synchronization with Khliehriat(PG) / Badarpur (PG) after development of 132KV pocket**

**A.** Immediately after total collapse of NER grid and with no support from 400 or 220 KV NER system, the following manual operations in respect of opening of feeders are to be carried as per table below:

<b>Name of Power Station/ Grid Sub Station</b>	<b>Name of lines / feeders</b>	<b>Operation</b>
Stage-I	132KV Sumer-Umiam & 132KV Sumer-Mawngap D/C lines	To open
Stage-III	132KV KPS-Umtru D/C line	
	33 KV local feeder(s)	
Stage-IV	132KV Stage-IV UPS D/C line	
Umtru	132KV EPIP-I & -II, 132KV Sarusajai line I & II and 132KV Kahilipara line I & II	
Norbong	132/33KV 50MVA Transformer and all 132 KV industrial feeders	
EPIP –I	All 132 KV Consumers & 2x20 MVA Transformers	
Mawlai	132KV Mawlai-NEHU, 132KV Mawphlang, 132KV Sohra and all 33KV feeders including 33KV Mawlai-NEHU tie line	
NEHU	132KV NEHU-Khliehriat 1, 132KV NEHU- NEIGRIHMS line and all 33KV feeders	
Khliehriat	132KV Khliehriat (PG) lines I & II, 132KV Khliehriat-Lumshnong (if the line is closed at Lumshnong S/S) and all 33KV local feeders	
Lumshnong	132KV Panchgram line, 132KV Khliehriat line (if the line is closed at Khliehriat S/S) and all industrial / local feeders.	
NEIGRIHMS	All local feeders	
Nongstoin	All Local feeders	
Nangalbibra	132KV Nangal-Agia S/C line & All Local feeders	
Rongkhon	All Local feeders	
Mawphlang	All Local feeders	
Sohra	All Local feeders	
Killing	132KV Norbong D/C line	
Umiam	2X20MVA transformers and 132KV RNB feeder	

B Meghalaya has to start its own generation with the help of its black start power and build up its state grid connecting Stage-I/II/III/IV Power Stations as follows:

1. Immediate initial starting of two machines of Stage-I P/S and one machine of Stage-III/IV P/S following system failure.
2. Subsequent charging of 132KV bus at Stage-I/II/III/IV P/S and 132KV Mawlai bus by Stage-III/Stage-I machines.
3. Subsequent to operation of the following charging sequence of local feeders, special care should be taken to closely co-ordinate the load pick-ups with the generation ramping rate and to ensure that the isolated system frequency to be within sustainable range.
4. 33KV Mawprem feeder is to be charged following isolation of pre-identified loads at 33KV Keatinge Road S/S depending on power flow from Stage-I P/S.
5. Synchronization of other machines after connectivity of some pre-identified loads from 132KV Mawlai S/S.
6. 132KV Umiam & NEHU buses are then to be charged from Stage-I P/S.
7. Subsequent to synchronization of one unit of Stage-III/IV P/S followed by increase in generation, 33KV local feeders from Stage-III P/S are to be charged followed by closing of 132KV KPS-Umtru D/C line.
8. Extension of power will be made from 132KV NEHU S/S up to 132KV Khliehriat S/S and MLHEP P/S and accordingly to 132KV Khliehriat (PG) S/S which then would have been charged from Badarpur (PG) S/S for necessary synchronization with the 132KV pocket from Badarpur (PG) S/S and 132KV Khliehriat (PG) S/S is remotely operated from Badarpur S/S. However, local loads from 132KV Khliehriat S/S are to be still kept in isolated condition pending synchronization from Khliehriat (PG) / Badarpur (PG) ends.
9. On synchronization with 132KV pocket, 132KV Mawlai-NEHU line is to be closed following which the sequence for charging feeders is to be carried out in line with point No.3 above and will be as follows:
  - (i) 33KV GSWS from 132KV Mawlai S/S
  - (ii) 33KV Air-Force-I from 132KV Mawlai S/S
  - (iii) 33KV Nongthymmai from 132KV Mawlai S/S
  - (iv) 33KV S E Falls from 132KV NEHU S/S
  - (v) 33KV Air-Force-II from 132KV Mawlai S/S
  - (vi) 33KV Mawlai
  - (vii) 33KV Happy Valley from 132KV NEHU S/S
  - (viii) 33KV NEHU-Mawiong from 132KV NEHU S/S
  - (ix) 132KV Mawphlang\_Nongstoin from 132KV Mawlai and Mawphlang S/S with all loads isolated.

**With synchronization of one unit of Stage-IV P/S:-**

- (x) 33KV Nongstoin-Mairang line from 132KV Nongstoin S/S
- (xi) 33KV Tura-I & II from 132KV Rongkhon S/S after normally opened 132KV Nangalbibra\_Nongstoin line is closed.
- (xii) 33KV Jowai (for 11KV Jowai Town-1, 2 & 3 only) and 11KV local feeder from 132KV Khliehriat S/S
- (xiii) 132KV Cherra from 132KV Mawlai S/S
- (xiv) 33KV feeders from 132KV Nangalbibra S/S

10. Subsequent to synchronization with 132KV pocket and sufficient own generation, all remaining outgoing feeders from all grid and 33KV sub stations are to be charged as pre-determined accordingly taking into account safe loading of inter state and associated intra state lines.
11. 132KV Khliehriat –Lumshnong line is to be charged from 132KV Khliehriat S/S or from Panchgram end.
12. On normalcy of NER grid, Meghalaya system will then be connected with 220KV NER system via Misa-Killing links and 400KV system via 400KV Silchar-Killing S/C line while Garo Hills load will be catered via 132KV Agia-Nangalbibra line.

**(2) Restoration of collapsed Meghalaya system with isolation of 132 KV Pocket from NER grid :**

**(A) Restoration of Meghalaya system by extension of power from Kahelipara S/S /Sarusajai S/S in the event of problems from 400KV Silchar or 220KV Misa ends:**

§ In the event of collapse of isolated Meghalaya system subsequent to black start operations, a request will be made in coordination with NERLDC and AEGCL for extension of power from Kahelipara / Sarusajai for bus energizing in steps up to 132KV Mawlai bus for development of Meghalaya system. The manual operations in respect of opening of feeders to be carried out in Meghalaya's grid sub stations will be the same as in (I) above while at the same time ensuring that Ferranti effect is minimized.

§ The steps pertaining to immediate starting of machines will be the same as in (B)(I) above.

§ Once Umtru, Stage-III and Stage-IV buses are made live, Stage-I and 132KV Mawlai buses can then be charged by closing 132KV Stage-I Stage-III D/C line

§ The steps relating to development of Meghalaya system will then be the same as in (B)(II) above in addition to SLDC NEHU overseeing possible drawal of power in consultation with Kahelipara SLDC.



**ANNEXURE-I**

Sl. No.	Power Stations Grid Stations	Communication			SCADA Facility
		PSTN	PLCC (Point to Point)	ULDC	
1.	SLDC, NEHU	2551967 & 2550020		523142, 523143	A
2.	NERLDC	2537482 & 2537486		Not working	A
3.	Stage-I P/S	9089226042	A	523120 & 523128	A
4.	Stage-II P/S	8575703619	A	523121	A
5.	Stage-III P/S	953638-292006	A	523127	A
6.	Stage-IV P/S	N.A.	A	523125	A
7.	Umtru P/S	N.A.	A	523129	A
8.	Mawlai S/S	2547599 & 2548402	A	523140	A
9.	NEHU S/S	2550116	A	523145	A
10.	NEIGHRIHMS S/S	2004667	A	523131	A
11.	Khliehriat S/S	953655-230162	A	523145	A
12.	Sohra S/S		A	N.A.	N.A.
13.	Nongstoin S/S	953654-202103	A	N.A.	N.A.
14.	Nangalbibra S/S		A	N.A.	N.A.
15.	Rongkhon S/S	953651 -223847& 224670	A	N.A.	N.A.
16.	EP-IP-I S/S	94367 07477	N.A.	N.A.	N.A.
17.	Norbong S/S	94367 07478	A	523119	N.A.
18.	Lumshnong S/S	9402198231	A	N.A.	N.A.
19.	Umiam S/S	0364 2570207	A	523130	A
20.	Killing S/S	98561 81308	A	N.A.	A
21.	Misa S/S	03674 – 287692		Not working	A
22.	Kahelipara SLDC	0361-2382263/2387929 & 09935550850		Not working	A
23.	Sarusajai S/S	0361-2236563 & 09954192089		N.A.	A
24.	Khliehriat(PG) S/S	953655-230018		Not working	A
25.	Mawphlang S/S	9485102497	A	N.A.	N.A.

Note:

\* A :- Available

\* N.A.:- Not Available

VOIP communication is also available at the following locations:

1. SLDC \_\_\_\_\_ #03 192.168.1.3
2. NEHU S/S \_\_\_\_\_ #05 192.168.1.5
3. Norbong S/S \_\_\_\_\_ #11 192.168.1.11 & #13 192.168.1.13
4. Killing S/S \_\_\_\_\_ #15 192.168.1.15 & #17 192.168.1.17

**MEGHALAYA STATIONS WITH SYNCHRONIZING FACILITY AND  
CORRESPONDING STATUS**

<b>Name of Power Station/ Grid Sub-Station</b>	<b>Provision for Line Synchronizing facility</b>	<b>Status of line synchronizing facility</b>
Stage-I P/S	Available	Functional
Stage-III P/S	Not Available	-
Stage-IV P/S	Not Available	-
NEHU S/S	Not Available	-
Umtru P/S	Not Available	-
Khliehriat S/S	Not Available	-
Lumshnong S/S	Not Available	-
Killing	Available	Functional
MLHEP	Available	Functional