Internal Operating Procedure for Uttarakhand grid, 2017-18 [Draft]

[In compliance with Regulation 6.1.1(4) of State Grid Code regulation 2016 of UERC]

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SOME ACRONYMS

CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
NLDC	National Load Despatch Centre
NPC	National Power Committee
RLDC	Regional Load Despatch Centre
RPC	Regional Power Committee
UERC	Uttarakhand Electricity Regulatory Commission
ATC	Available Transfer Capability
STU	State Transmission Utility
AVR	Automatic Voltage Regulator
CB	Circuit Breaker
CT	Current Transformer
CTU	Central Transmission Utility
CVT	Capacitive Voltage Transformer
DR	Disturbance Recorder
ERS	Emergency Restoration System
FGMO	Free Governor Mode of Operation
HVDC	High Voltage Direct Current
ICT	Inter Connecting Transformer
IEGC	Indian Electricity Grid Code
IaSTS	Intra-State Transmission System
IPP	Independent Power Producer
ISGS	Inter State Generating Stations
ISTS	Inter State Transmission System
LA	Lightening Arrestor
MCR	Maximum Continuous Rating (MCR)
LTOA/LTA	Long Term Open Access/Long Term Access
MTOA	Medium Term Open Access
STOA	Short Term Open Access
OA	Open Access
OCC	Operation Coordination Sub Committee
PG	Power Grid Corporation of India Limited
PoC	Point of Connection

CC	Commercial Coordination Sub Committee
PCC	Protection Coordination Sub Committee
RGMO	Restricted Governor Mode of Operation
SLDC	State Load Despatch Centre
SPS	System Protection Schemes
SVC	Static VAR Compensator
TRM	Transmission Reliability Margin
TCC	Technical Coordination Sub Committee
TTC	Total Transfer Capability
UFR	Under Frequency Relay
UI	Unscheduled Interchange
DSM	Deviation settlement Mechanism
WT	Wave Trap
PTCUL	Power Transmission Corporation of Uttarakhand Ltd

CHAPTER – 1

1. General

1.1 Introduction

SLDC aims at optimum scheduling and despatch of electricity in the state, monitor grid operations and exercise supervision, control over the intra-State transmission system and responsible for carrying out real time operations for grid control and despatch of electricity within the State through secure and economic operation of the State grid in accordance with the Grid Standards and the State Grid Code. To achieve the aims and objectives, the Internal Operating procedures is prepared in line with Clause 32 of Electricity Acts, 2003.

Regulation 6.1.1(f) of the Uttarakhand Electricity Regulatory Commission (State Grid Code) Regulations, 2016, stipulates that a set of detailed internal operating procedure for each state grid shall be developed, documented and maintained by State Despatch Centres, in consultation with the state constituents. In compliance with the above regulations, this document viz. "Internal Operating Procedures for Uttarakhand grid" has been prepared by the State Load Despatch Centre in consultation with the state constituents of the Uttarakhand.

These internal operating procedures shall include the following Structure:

i. Black start procedures.
ii. Load shedding procedure.
iii. Islanding procedure.
iv. Any other procedure considered appropriate by the State Load Despatch Centre.

Words and expressions used in this procedure and not defined herein but defined in various regulations of UERC/CERC/CEA, orders and procedures of UERC/CERC, rules and policies of MOP, Govt. of India and Electricity Act, 2003 shall have the meaning assigned to them under these regulations, orders, procedures, rules, policies & the IE Act, 2003.

Uttarakhand power system covers a geographical area of all the thirteen (13) districts of the State viz. (i) Almora District (ii) Bageshwar District (iii) Chamoli District (iv) Champawat District (v) Dehradun District (vi) Haridwar District (vii) Nainital District (viii) Pauri Garhwal District (ix) Pithoragarh (x) Rudraprayag District (xi) Tehri Garhwal (xii) Udham Singh Nagar (xiii) Uttarkashi District.

At present, Power Transmission Corporation of Uttarakhand Ltd (STU) is responsible for Transmission and Uttarakhand Power Corporation Ltd is responsible for Distribution of electricity, UJVNL and some private generating companies for generation within the state.

There are about 100 Open Access Customers in the State. Uttarakhand power system at present comprises of 10 (Ten) major Hydro generating stations (1281.85 MW) of UJVNL, One privately owned Hydro generating station of BHPL (24 MW), Two Gas based power plants viz GIPL (225 MW) & SEPL (450 MW). In transmission State is having 3 (Three) sub-stations of 400/220kV level (1815 MVA), 8 (eight) sub-stations of 220/132 or 220/33 (2200 MVA) and 29 sub-stations of 132/33 kV owned by PTCUL. The intra-state system has 3 (Three) 400 kV line, two of which are owned by PGCIL. The state is served by a network of inter-state transmission lines at 400kV level by 6 lines and at 220 kV level it is connected to ISTS by 6(six) lines, two of which are inter-state. Also state is connected with ISTS with 15 (Fifteen) lines of 132 kV level.

1.2 Objective

The objective of this procedure is to compile various provisions in the statute and regulations for the guidance of the staff of the SLDCs and State entities in Uttarakhand.

1.3 Scope

The "Internal Operating Procedures for Uttarakhand grid" applies to the power system in Uttarakhand state. These procedures are to be read in conjunction with the Uttarakhand Electricity Regulatory Commission (State Grid Code) Regulations, 2016 and Central Electricity Regulatory Commission (Indian Electricity Grid Code) Regulations, 2010 amended from time to time. The Operating Procedures are without prejudice to the SLDC's power to give directions and exercise supervision and control as stated under Sections 28 and 29 of the Electricity Act, 2003.

This document would come in force with immediate effect.

1.4 STRUCTURE OF INTERNAL OPERATING PROCEDURE

The Operating Procedures for Uttarakhand state consists of the following chapters.

1.4.1. Chapter-1: General

This chapter describes the objective, scope and structure of the Internal Operating Procedures for Uttarakhand state.

1.4.2. Chapter-2: New Element Connectivity to Grid

This chapter details the procedure to be followed for charging of new element connectivity to IaSTS.

1.4.3. Chapter-3: Planned Outage Coordination

This chapter enumerate the procedure for coordination of planned outage

1.4.4. Chapter-4: Switching Coordination

This chapter describes the protocol to be followed while coordinating switching operation in the State grid.

1.4.5. Chapter-5: Frequency Control

This chapter elaborates the procedures for frequency control to ensure compliance to security Standards prescribed in the CEA (Grid Standards) Regulations, 2010 and UERC (State Grid Code) Regulations, 2016. It also covers the frequency linked despatch guidelines.

1.4.6. Chapter-6: Voltage Control

This chapter explains the procedures for voltage control to ensure compliance to security Standards prescribed in the CEA (Grid Standards) Regulation, 2010 and UERC (State Grid Code) Regulations, 2016.

1.4.7. Chapter-7: Congestion Management and Alleviation

This chapter elaborates on the congestion management philosophy and procedure in line with the CERC (Measures to relieve congestion in real time operation) Regulations, 2009, Detailed Procedure for relieving congestion in real time operation as approved by CERC vide its order dated 22.04.2013

1.4.8. Chapter-8: Demand Management

The demand estimation & control is under the purview of the State Load Despatch Centres (SLDCs). This chapter describes the SLDC's interface with NRLDC with respect to demand estimation and control. **1.4.9. Chapter-9: Scheduling and Despatch**

This chapter details the procedures for day-ahead and same day scheduling as implemented in Uttarakhand.

1.4.11. Chapter-11: Energy Settlement System

This chapter gives a broad outline of the settlement system, which is an important post-despatch activity. This activity can commence immediately after special energy meters have been commissioned at the different interface points.

1.4.12. Chapter-12: Defence Mechanism for the System

This chapter elaborates on the various defence mechanisms adopted for Security and reliability of the Uttarakhand Grid.

1.4.13. Chapter-13: Grid Incident, Grid Disturbances and Revival

This chapter describes the criteria for categorizing grid events as specified in the Central Electricity Authority (Grid Standards), Regulations, 2010. The general precautions to be observed and steps taken during restoration are also included in this chapter.

1.4.14. Chapter-14: Event Information & Reports

Timely and accurate reporting of events and exchange of information plays an extremely vital role in an integrated system. The protocol to be followed in such cases is indicated in this chapter.

1.4.15. Chapter-15: Data acquisition and communication System

This chapter briefly explains the system for data acquisition and communication system. This chapter also dwells on the Procedures on matters related with cyber security.

This document does not cover the procedure to be followed in case power supply to be regulated to any utility on account of non-payment of dues. The same would be implemented by SLDC in line with the regulations and orders issued by CERC & UERC from time to time.

The details indicated in this document may not be exhaustive. They are intended to serve only as a guideline for efficient system operation. In particular, these procedures do not cover the tools required for efficient and effective system operation and analysis viz. Communication Systems, Supervisory Control & Data Acquisition Systems (SCADA), Energy Management Systems (EMS), and other recording and control equipment. It is expected that these requirements would be provided by all concerned to enable efficient system operation.

1.5 Operating Manpower

The control rooms of the State Load Despatch Centre including Area- Load Despatch Centres, power plants, substations of 132 kV and above and any other control centres of Transmission Licensees and Users shall be manned round the clock by qualified and adequately trained personnel who would remain vigilant and cooperative at all the times so as to maintain the system safety and security and operate it in a most optimum manner.
[SGC 6.1.1(5)]

1.6 Management of Internal Operating Procedure

The Internal Operating Procedure shall be maintained by SLDC and would be reviewed annually or earlier in case significant changes taking place in the system warrant a review. Comments and suggestions on the document may be sent to the following address:

Superintending Engineer
State Load Despatch Centre
Vidhyut bhavan, near ISBT crossing

Majra, Dehradun, Uttarakhand

2. New Element connectivity to Grid

2.1 Introduction

A new transmission/Generating element before connecting to Grid would follow the procedure as per different regulations of UERC. If a transmission element or Generator comes in the jurisdiction of SLDC as per UERC guideline, that agency has to first register itself with STU. First time switching of new element of any agency or Transmission Licensees intending to commission any transmission element, which is a part of intra-state transmission system, would be co-ordinated as per procedure laid down by STU in line with chapter 5 of SGC.

STU, Transmission Licensees & Users shall comply with CEA (technical Standards for connectivity to the Grid) Regulations, 2007 and open access customers shall also comply with UERC (Terms and Conditions of the Intra-State Open Access) Regulations, 2015 as amended from time to time for connectivity to the Grid.

The Connection Code specifies the minimum technical and design criteria which shall be complied with by STU and any User/Transmission Licensee connected to, or seeking connection to IaSTS. They also set out the procedures by which STU shall ensure compliance by any agency with the above criteria as pre-requisite for the establishment of an agreed connection

2.3 Application for arrangement/modification

Application for establishing new arrangement or modifying existing arrangement of connection to and/or use of the IaSTS shall be submitted by the concerned Transmission Licensee or User to the State Transmission Utility.

Application formats shall be as developed by STU. [SGC5.6 (2)]

The State Transmission Utility shall forward a copy of the application to State Load Despatch Centre. [SGC 5.6 (4)]

New element connectivity to IaSTS shall be as per Chapter 5 of SGC and as per connection agreement with STU.

State Load Despatch Centre shall also be provided with a copy of the Connection Agreement by the Appropriate Transmission Licensee. [SGC 5.6 (10)]

Open Access customers shall also comply with UERC (Terms and Conditions of the Intra-State Open Access) Regulations, 2015 as amended from time to time for connectivity to the Grid.

2.3.1. Data to be submitted by different constituents to SLDC

All Constituents/generator/STU/Transmission Licensees shall furnish following details to SLDC for new connection:

- A copy of the application for establishing new arrangement or modifying existing arrangement of connection to and/or use of the IaSTS to State Load Despatch Centre. [SGC 5.6 (4)]
- Single Line Diagram for each connection point indicating the point of connection with IaSTS [SGC 5.14 (1)] and updated Single Line Diagram in the event of change of any equipment by concerned user or Transmission Licensee [SGC 5.14 (3)].
- Connection Agreement signed by the applicant with STU [SGC 5.6 (10)]
- All agencies connected to or planning to connect to IaSTS would ensure providing of Remote Terminal Unit (RTU) and other communication equipment, as specified by SLDC, for sending real-time data to SLDC at least before date of commercial operation of the generating stations or sub-station/line being connected to IaSTS [SGC 5.13 (4)].
- Power Purchase Agreement signed by the applicant (in case of generator) with the long term beneficiaries.

2.4 Switching of New Transmission Element

In line with Regulation 6 (1) of the Central Electricity Authority (Grid Standards) Regulations 2010, no entity shall introduce an element in the IaSTS of Uttarakhand without the concurrence of SLDC in the form of an operation code.

Following information (along with check list) have to be submitted to SLDC before charging of new elements by Constituent/STU/Transmission Licensee/ Generator (as per different clauses of SGC):

Checklist before charging of any new transmission/generation asset

1	List of elements to be charged along with the details of approval of the transmission scheme from Standing Committee/CTU/STU	☐
2	Single line Diagram for each connection point (of changes/modifications)/sub stations, along with status of completion of each dia/bus/breaker [SGC 5.14 (1)]	☐
3	Availability of real time data and communication to the SLDC [SGC 5.13 (4)]	☐
4	Installation of Special Energy Meter complying with CEA's Regulations (Serial Number/Meter Number, CT/PT ratio to be indicated)	☐
5	Charging instructions by STU	☐
6	Schedule and Sequence of charging of elements	☐
7	Connection Agreement (along with all Annexure with STU) [SGC 5.6 (10)]	☐
8	Copy of Power Purchase Agreement (PPA)	☐
9	All statutory clearances have been obtained (Copy of safety clearances from concerned Electricity Inspector along with undertaking)	☐

Note: Each document mentioned in the above checklist from S no 1 to 8 must be attached for the sake of completeness and emailed as consolidated document to SLDC well before the new element commissioning dates.

It shall be the responsibility of the state entity to comply with all the statutory obligations.

SLDC shall issue test charging code after submission of above documents/information and after providing real time SCADA data and other communication facilities up to SLDC.

Also, in the event of a proposal to change any equipment, the concerned User or Transmission Licensee shall intimate the necessary changes to **State Load Despatch Centre**. When the changes are implemented, Single Line Diagram shall be updated appropriately by the concerned Users or Transmission Licensee and a copy of the same shall be provided to the State Transmission Utility and **SLDC.**

Note: Formats for undertakings/information to be provided to SLDC under point No. 1, 4, 6 &9 of above table are enclosed as Annexure-A, B, C and D.

3. Planned outage coordination

3.1 Overview

All electrical equipment may require to be taken out of service for routine or emergency maintenance to prevent damage and failure. Outage of power system elements may also be required to facilitate network augmentation related activities. Since outages in the system have an effect on the network adequacy and security, they need to be planned and coordinated carefully. Planning of outage is to be done in line with regulation 6.8 of the SGC. This chapter elaborates the procedure for availing outage of important elements in the system.

3.2 Planned outage coordination process

Requisitions for planned shutdown shall be routed through SLDC as given in Regulation 5.8.4 of UERC, State Grid Code 2016.

Shutdown requisitions approved by NRPC/OCC shall be forwarded to NRLDC at least 3 days prior to the date on which the shutdown is to be availed. If any deviation is required, the same shall be with prior permission of NRLDC. Requisitions for shutdown timing shall be planned properly and works shall be completed within approved shutdown timings. In continuation with above all

3.2.1. Re-scheduling of approved outage plan

In the event of any requirement to re-schedule any planned shutdown or to avail an emergency / unforeseen shutdown not anticipated earlier, the concerned entity shall forward a request to SLDC indicating the nature of emergency or the reason for deferment. SLDC would approve such unforeseen outages / re-scheduling of an already planned outage based on the exigency of the case vis-à-vis system conditions.

On daily basis, SLDC would review the outage schedule for the next two days and in case of any contingency or conditions described in regulation 6.8.4 (6 & 7) of the SGC, defer any planned outage as deemed fit clearly stating the reasons there of SLDC is authorized to defer the planned outage, in case of any of the following, taking into account the statutory requirements:

(a) Major grid disturbances (total black-out in State)

(b) System isolation

(c) Black-out in a Constituent System

(d) Any other event in the system that may have an adverse impact on the system security by the proposed outage.

Provided that the State Load Despatch Centre shall inform the concerned State constituents about the revised outage plan, with appropriate reasons for revisions in the outage plan, as soon as possible.

Deviations from planned outages /shutdown shall also be compiled on monthly basis along with reason for deviations.

3.2.2. Final approval from SLDC

In line with the regulation 6.8.4 (9) of state grid code 2016 of UERC, each state constituent shall obtain the final approval in the form of an "operation code" from SLDC prior to availing an outage. All preparatory works for maintenance must be done well in advance before availing the code so as to avoid any idling time. Such requests shall be forwarded to the SLDC control room sufficiently in advance so as to provide adequate time for carrying out the adjustments in the network/despatch (if required) for facilitating the outage.

Similarly, an 'operation code' would have to be obtained from SLDC before reviving the element after shut down.

3.2.3. Safety measures and switching operations during outage

The operation code issued by SLDC for opening / revival of the transmission 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 opening / closing of any element to avoid any threat to operating personnel and equipment.

3.2.4. Timely return of shutdown

During the period of shutdown, the User/STU/ licensee shall keep SLDC apprised regarding the status of work and the likely time of return of the shutdown. All efforts shall be made by the constituents for timely return of shutdowns and delays if any shall immediately be reported to SLDC along with the reasons and likely time of return of shut down. Where it is foreseen that return of Permit To Work (PTW) could be delayed due to physical distance involved in case of a transmission line, mobile phones shall be used for communication with the substation to minimise the outage period. It shall be the responsibility of utility requesting the shutdown to ascertain that all work has been completed within the stipulated time and the transmission element can be safely taken back into service.

3.2.5. Maintenance work on opportunity basis

Any maintenance work on opportunity basis proposed to be carried out by related agencies/divisions during the period of shutdown already approved by SLDC would need the approval of SLDC. The same if approved would also be intimated by SLDC to the agency, which initially applied for the planned shutdown. On a monthly basis, a list of all shutdowns that have been taken on opportunity basis shall be compiled. The delay or extension in returning the shutdown attributable to such opportunity shutdown shall also be indicated separately.

3.2.6 Time Line planning of outages for next financial year (SUMMARY)

Activity	Time Schedule
The STU and generating plants shall provide the SLDC their proposed outage programs in writing for the next year.	By **31st October** of each year; SGC-2016 clause 6.8.4 (2)
SLDC shall come out with a Draft outage program for the next year.	By **15th December** of each year; SGC-2016 clause 6.8.4 (3)
SLDC shall send its draft outage plan to RPC secretariat.	By **15th December** of each Year. SGC-2016 clause 6.8.4 (3)
RPC Secretariat shall then come out with a draft outage programme for the next financial year taking into account the available resources in an optimal manner and to maintain security standards.	By **31st December** of each year for the Regional grid. IEGC 2010 clause 5.7.4 (c)

Note: - **The above annual outage plan shall be reviewed by SLDC on quarterly and monthly basis in coordination with all parties concerned, and adjustments made wherever found to be necessary.** [SGC 6.8.4 (5)]

3.2.7 Time lines for planned outage coordination with SLDC (SUMMARY)

Activity	Time schedule
Requisitions for planned shutdown for OCC approved outages from constituents to SLDC	5 (five) working days before the date of shutdown and for further submission to NRLDC
Requisitions for planned shutdown for other than OCC approved outages from constituents to SLDC	4 (four) working days before the date of shutdown.

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4. Switching Coordination

4.1 Overview

Coordination of switching operations in the grid is important for ensuring safety of personnel and equipment as well as for ensuring adequacy and security of the grid. Before any operation of important elements of the Uttarakhand Grid is carried out on a User/STU system, the Users, STU, licensee shall inform SLDC.

4.2 Switching of important elements

No part of the State Grid shall be deliberately isolated from the rest of the State Grid, except (i) under an emergency and conditions in which such isolation would prevent a total grid collapse and/or would enable early restoration of power supply, (ii) for safety of human life (iii) when serious damage to a costly equipment is imminent and such isolation would prevent it and (iv) when such isolation is specifically instructed by SLDC. Complete synchronization of grid shall be restored as soon as the conditions again permit it. The restoration process shall be supervised by SLDC, in coordination with RLDC, as per operating procedures separately formulated by SLDC. However, the same shall be communicated to SLDC at the earliest possible time after the event.

A list of Important elements of the State grid, which have a bearing on the network security, is compiled by SLDC in compliance of SGC 6.2 (3) and is enclosed as Annexure-I. The State entities, users, STU, licensee shall obtain "operation code" from SLDC before carrying out any switching operation on any of the important elements of the Uttarakhand grid. Shutdown of any 400 kV bus at substation needs approval of NRLDC through SLDC.

In respect of double main and transfer switching scheme at 400 kV substations, NRLDC through SLDC shall be informed whenever the 400 kV transfer breaker at any substation is utilized for switching any line/ICT. In a 400 kV substation/power station switchyard having breaker and a half switching scheme, outage within the substation (say main or tie circuit breaker) not affecting power flow on any line/ICT can be availed by the constituents under intimation to NRLDC through SLDC.

However, while availing such shutdowns or carrying out switching operations it must be ensured that at least two Dias are complete even after such outage from the view point of network reliability. Any outage not fulfilling the above conditions needs the approval of NRLDC through SLDC.

In line with the recommendations of the NRPC Protection Sub-committee vide "Summary Record of Discussion of the 13th protection sub-committee meeting" held on 28th January 2011, whenever any protection system such as Bus Bar protection, LBB protection, Auto reclose etc. at generating station or grid substation is required to be taken out of service for any maintenance work, an operational code shall be taken from SLDC/NRLDC.

Emergency switching if any have to be carried out and immediately informed to SLDC within a reasonable time, of ten minutes. Likewise, tripping of any of these important elements should also be informed to SLDC within a reasonable time indicating the likely time of restoration. In case of single phase to ground fault (with low fault current level say <4 kA) one attempt to close the line would be taken by the transmission utility without waiting for an operation code from SLDC. However, the tripping and restoration would be intimated to SLDC immediately. Before charging, all necessary precaution shall be taken care by substation and in coordination with other end substation.

4.3 Other precautions to be taken during switching

In addition to the above, it is necessary that special attention be paid to maintaining the reliability of the system. The following areas need careful implementation by the concerned constituents / stations:

(i) The utility shall inform the switching layout of switchyard e.g. One and half breaker scheme, Single/Double main bus transfer scheme etc. along with the current status of transmission elements.

(ii) In case of a two-bus system at any substation it must be ensured that the segregation of feeders on the different buses is uniform. This would help in minimizing the number of elements lost in case of a bus fault. This is assuming the availability of bus-bar protection at such substation(s).

(iii) In 400 kV substations having a breaker and a half scheme, it must be ensured that the two buses at such substation 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 ICT or a bus reactor, is expected to remain out for a period say beyond two hours at such substation, the main & tie breakers of such elements should be closed after opening the line side isolator. This should be done after taking all suitable precautions to avert inadvertent tripping. This of course assumes that no maintenance is planned on such breakers / isolators.

(iv) In case when circuit breaker controlling the line is under lockout it is not advisable to interrupt the changing current through an isolator the following practice to be adopted in such cases (Refer Annexure-II):

a) De-energise the bus connecting the line with lockout CB and then open the isolator.

b) If due to some reason it is not possible to open the isolator in above mentioned way then open the isolator so that no charging current is interrupted through the isolator and the charging current is diverted to other parallel path. Such switching sequence could be possible in case of breaker and half scheme or Double breaker Scheme, which is as follows:

- Open the line from remote end first with direct trip (DT) disabled. With this now line remains charged from the end where CB has problem.
- In case of breaker and half scheme open the isolator so that charging current is diverted to the parallel path and after that open the CB of parallel path. □□In case of double breaker scheme open the isolator of the lockout breaker diverting the charging current to other CB and then open the CB.
- In case of double main and transfer scheme open the isolator of lockout breaker so that divert the charging current through transfer bus coupler and then open the line through TBC circuit breaker.

It is also recommended that while vacating a bus in such cases, the operators need to check the switching arrangement for individual feeders so as to avoid unintended loss of any feeder.

(v) The substation operators must ensure the above condition even when any lightly loaded line is opened to control overvoltage. Such opening of lines is generally superimposed over other line outages on account of faults created by adverse weather conditions resulting in reduced security of the system.

(vi) Single pole auto-reclose facility on 400 kV / 220 kV lines should always be in service. NRLDC"s through SLDC approval would be required for taking this facility out of service. Likewise, in case any transfer breaker at any 400 kV and 220 kV substations having two main and transfer bus scheme is engaged, the same would be informed to NRLDC through SLDC and SLDC respectively.

(vii) All precautions should be taken to avoid switching on to fault particularly in case of Interconnecting Transformers. In order to avoid fault current through costly equipment generally, the line shall be charged from the far end, wherever possible.

(viii) A transmission line side shall preferably be charged from the grid substation. Dead line charging by a generator shall normally be avoided except during system restoration, black start, or in case where both ends of the transmission line are terminating at a generating station.

(ix) During test charging of transmission line for the first time, all safety precautions shall be taken and the transmission utility owning/operating the line shall satisfy the substation utility at either ends with regards to statutory/safety clearances. During test charging if the line does not

hold even after two attempts, thorough checking of protection settings and line patrolling shall be carried out.

(x) Operation code issued by SLDC for switching shall become invalid if the switching is not completed within half an hour of issue of code. In case the switching operation is not completed within half an hour of the issue of operation code from SLDC, and if there is a probability of further delay same code could be revalidated by SLDC within that half an hour. The utility obtaining code at one end shall intimate the other end utility

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5. Frequency control

5.1 Overview

The nominal frequency of operation in Indian grid is 50.0 Hz. All the state entities would make all possible efforts to ensure that the grid frequency is maintained within the band 49.90-50.05 specified in Indian Electricity Grid Code, 2010 and State Grid Code, 2016. The state entities shall regulate their generation and/or consumer's load so as to maintain their actual interchange with the grid close to the schedule.

Except under an emergency or to prevent an imminent damage to costly equipment, no constituent shall suddenly reduce his generating unit output / injection by more than 30MW without prior intimation to and consent of the SLDC. Similarly, no User shall cause a sudden variation in its drawl by more than 30MW without prior intimation to and consent of the SLDC. All State constituents shall ensure that temporary over voltage due to sudden load rejection and the maximum permissible values of voltage unbalance shall remain within limits specified under CEA (Grid standards) Regulations, 2010.

5.2 PRIMARY RESPONSE

All regional entities shall ensure that the generating units synchronised with the grid provide primary response in line with sections 6.2 (6), 6.2 (7), 6.2 (8), 6.2(9), 6.2(10) and 6.2(11) of SGC.

5.3 SUPPLEMENTARY CONTROL

All state entities shall provide supplementary control in line with regulation 6.2 (11) of SGC. In line with regulation 7.4.4 of SGC, the state grid shall be operated as power pools with decentralized scheduling and despatch, in which the users shall have operational autonomy and Users, through their concerned ALDCs, shall have the total responsibility for:

(a) Scheduling/dispatching their own generation (including generation of their embedded licensees)

(b) Regulating the demand of their customers

(c) Scheduling their drawal from the IaSGS (within their share in the respective plant's expected capability)

(d) Permitting long term access, medium term and short term open access transactions for embedded generators / consumers in accordance with the contract and

(e) Regulating their net drawal from the State Grid as per these Regulations amended from time to time.

Further in line with regulation 7.4.5 of SGC, maximum inadvertent deviation by the Distribution licensee/User shall be in limits as specified in the UERC (Deviation Settlement Mechanism and related matters) Regulations, 2017 and such deviations should not cause system parameters to deteriorate beyond permissible limits and/or do not lead to unacceptable line loading.

State entities shall regulate their generation and /or consumer's load so as to maintain their actual drawl from the state grid close to the schedule. Maximum inadvertent deviation allowed during a time block shall not exceed the limits specified in the UERC (Deviation Settlement Mechanism and related matters) Regulations, 2017.

5.4 TERTIARY RESPONSE

In line with IEGC regulation 6.5.1 (1) SLDC/state constituents/distribution licensee and bulk consumer shall initiate action to restrict the drawal of its control area, from the grid, within the net drawal schedule. Each SLDC/SEB/distribution licensee and bulk consumer shall regulate the load / own generation under its control area so that there is no over-drawal. State entity generating stations shall maintain generation such that it may not generate less than its generation schedule during low frequency conditions and more than its generation schedule during high frequency conditions. In any case, during low frequency conditions no state would carry out over-drawal.

Each State constituent shall formulate contingency procedures and make arrangements that will enable demand disconnection to take place, as instructed by the SLDC, under normal and/or contingent conditions.

The measures taken to reduce the Constituents drawal from the grid shall not be withdrawn as long as the frequency/voltage remains at a level lower than the limits specified in Regulation 6.2 or congestion continues, unless specifically permitted by the SLDC.

5.5 STAGGERING OF TIMING OF LOAD CONNECTION/DISCONNECTION TO AVOID FREQUENCY EXCURSIONS

As per SGC Regulation 6.2(12), except under an emergency or to prevent an imminent damage to a costly equipment, no constituent shall cause a sudden variation in its load by more than thirty (30 MW) without prior intimation to and consent of the SLDC. Such large sudden load changes may lead to frequency excursions and voltage fluctuations. These frequency excursions may be seen especially at hourly boundaries. To avoid these excursions, the timing of connection/disconnection of load needs to be staggered and also, the flexing of generation during such short period (even within a 15 minutes time block) may be done.

All State constituents shall ensure that temporary over voltage due to sudden load rejection and the maximum permissible values of voltage unbalance shall remain within limits specified under CEA (Grid standards) Regulations, 2010.

5.6 PREVENTIVE MEASURES DURING HIGH FREQUENCY CONDITIONS

In case the frequency is high (above 50.05 Hz) and is in increasing trend then the following actions may be taken in order of priority:

1. Lifting of planned load shedding, curtailments, if any
2. Generation reduction at hydro stations having storage capability
3. Generation backing down in Gas station within state control area (in case it is under drawing) as per merit order based on variable charges.
4. Downward revision of requisitions from ISGS as per merit order on request of beneficiaries.
5. Downward revision of generation schedule in thermal stations by SLDC to technical minimum
6. Reduction in generation in nuclear stations to the extent possible. In case of hydro generation linked with irrigation requirements, the actual backing down or closing down of units shall be subject to limitations on such account.

While the grid frequency is higher than 50.05 Hz, the MW generation at no generating station (irrespective of type and ownership) shall be increased. Provided that when the frequency has risen from a previous lower level to 50.05 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 the MW output may be increased to the lowest level: At which oil support is not required, and at which the unit can operate in a stable and safe manner.

Similarly, no generating unit shall be synchronised with the grid while the grid frequency is above 50.05 Hz. or higher, except with the specific concurrence of SLDC.

In line with regulation 6.3 of SGC, SLDC shall make all efforts to evacuate the available solar and wind power and treat as a must run station. However, SLDC may instruct the solar/wind generator (in case it is a State constituent) to back down generation on consideration of grid security or safety of any equipment or personnel is endangered and solar/wind generator shall comply with the same.

SLDC may direct a wind farm to curtail its VAr drawl/injection in case the security of grid or safety of any equipment or personnel is endangered.

During the wind generator start-up, the wind generator shall ensure that the reactive power drawl (inrush currents in case of induction generators) shall not affect the grid performance.

High frequency conditions in the grid are generally accompanied by high voltage. Requisite measures to control over voltage may also have to be taken. The chapter on voltage control may be referred for this.

5.7 PREVENTIVE MEASURES DURING LOW FREQUENCY CONDITIONS

There are detailed provisions in the SGC with regard to demand control. All efforts must be made to avoid situation of low frequency. The chapter on demand estimation and control may be referred for this purpose. However, in case the frequency is low (below 49.9 Hz) and is in decreasing trend then the following actions may be taken:

1. Increase in generation wherever margins are available
3. Increase in generation by coal/gas fired stations within State control area (if it is over drawing) as per merit order based on variable charges
4. Suo moto increase in despatch schedule of State Generating Stations (in case un-despatched) by SLDC
5. Suo moto demand curtailment by SLDC.
7. Low frequency conditions are generally associated with low voltage. Requisite measures to control low voltage may also have to be taken. The chapter on voltage control may be referred for this.

5.8 NORMAL, ALERT & EMERGENCY MESSAGES ISSUED BY NRLDC

SLDC shall issue Normal, Alert and Emergency messages on Frequency, Voltage & Loading violation based on values appearing in SCADA. In addition, Zero crossing violation & deviation from schedule violation message would also be issued by SLDC time to time based on the SCADA data.

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6. VOLTAGE CONTROL

6.1 OVERVIEW

As defined in the SGC 6.2 (22), IEGC section 5.2 (s), and para 5.3 of the Manual on Transmission Planning Criteria (Jan 2013), the operating range of the voltage at various voltage levels of grid is as
Follows:

Table 1: Voltage operating range

Voltage in kV(rms)				
	Normal rating		Emergency rating	
Nominal	Maximum	Minimum	Maximum	Minimum
765	800	728	800	713
400	420	380	420	372
220	245	200	245	194
132	145	120	145	119
110	121	99	123	97
66	72	60	72.5	59
33	36	30		

The maximum and minimum values in the above table are the outer limits and all the constituents would endeavour to maintain the voltage level well within the above limits.

6.2 VAR INTERCHANGE BY DRAWEE UTILITY

The drawee utilities/state constituents shall take action in regard to VAR exchange with the grid looking at the topology and voltage profile of the exchange point. In general, the beneficiaries shall endeavour to minimise the VAR drawl at interchange point when the voltage at that point is below nominal value and shall not return VARs when the voltage is above the nominal value. In fact, the beneficiaries are expected to provide local VAR compensation so that they do not draw any VARs from the grid during low voltage conditions [SGC 7.6.1] and do not inject any VARs to the grid during high voltage conditions.

6.3 SHUNT CAPACITOR BANK SWITCHING

The switching of capacitor banks shall be as per the guidelines for switching capacitor banks formulated by the Operation Coordination subcommittee. These are enclosed as Annexure-III. However, if the voltage at the bus on which capacitor is connected is 1.1 per unit or higher the capacitor shall necessarily be switched off.

6.4 SWITCHING OF BUS REACTORS AND SWITCHABLE LINE REACTORS

Bus reactors at 400 kV shall be taken into service whenever bus voltage exceeds 405 kV and they shall be taken out of service when voltage is below 395 kV. Standing instruction may be issued to the operating personnel at the substation. There may be exception with permission of NRLDC through SLDC. SLDC (with prior consent of NRLDC in the form of operating code) shall issue operating code for switching of switchable line reactors.

Switching in/out of all 400 kV bus and line Reactors throughout the grid shall be carried out as per instructions of SLDC. [SGC 7.6.5]

6.5 VAR GENERATION / ABSORPTION BY GENERATING UNITS

In order to improve the overall voltage profile, the state generators shall run in a manner so as to have counter balancing action corresponding to low / high super grid voltage and to bring it towards the nominal value. In order to achieve the same, all IaSGS 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. No payments shall be made to the generating companies for such VAr generation/absorption [SGC 7.6.6].

The On-Load Tap Changers (OLTCs) or Off load tap changers on the generator transformer would also be used to take care of seasonal variations in the voltage profile.

6.6 CHANGING TRANSFORMER TAP POSITION

The transformer tap positions on different Inter-connecting transformers forming important Elements of State Grid shall be changed as per requirements in order to improve the grid voltage. SLDC shall coordinate the settings of 220/132 kV and below ICTs tap positions and any change in their positions shall be carried out only after consent and consultation with SLDC [SGC 7.6.5].

For changing tap positions of 400/220 kV ICTs, SLDC shall consult to and take operating code from NRLDC [IEGC 6.6.5].

6.7 LOAD MANAGEMENT FOR CONTROLLING THE LOW VOLTAGE

All the distribution licensee (presently UPCL) shall identify the radial feeders in their areas which have significant reactive drawal and which can be disconnected (manually or through Under Voltage relay) 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 would remain with the operating personnel to obtain the requisite relief in the hour of crisis by disconnecting such feeders.

In case the state constituents do not take the requisite measures and the voltage drops down to critically low levels (say 380kV and below at 400kV bus), then SLDC may resort to regulatory measures by opening of lines including those, feeding radial loads in the areas of defaulting constituents [SGC 7.6.3]. While taking such action, SLDC would duly consider that the same does not result in affecting IaSGS generation.

6.8 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 lines shall be opened for voltage control measures. The opening of lines and reviving them back in such an event would be carried out as per the instructions issued by SLDC/NRLDC (nodal for selected line) in real time and as per the standing instructions issued from time to time. While taking such action, reliability of system shall also be considered.

6.9 SUMMARY

The following specific action at Grid Substations / Generating Stations shall be taken in the event of voltage going high / low. In the event of high voltage (e.g., 400kV bus voltages going above 410kV), the following specific steps would be taken by the respective grid substations / generating station at their own, unless specifically mentioned by SLDC/NRLDC otherwise;

- The bus reactors be switched in
- The manually switchable capacitor banks be taken out
- The switchable line/ tertiary reactors be taken in
- Operate synchronous condensers for VAR absorption

- Operate hydro generators / gas turbines as synchronous condenser for VAR absorption wherever possible
- Opening of the lightly loaded lines in consultation with SLDC/NRLDC, keeping in view the security of the balance network.

In the event of low voltage, (e.g. 400kV bus voltages going down below 390kV), the following specific steps would be taken by the respective grid substations / generating station at their own, unless specifically mentioned by SLDC/NRLDC otherwise;

- The bus reactors be switched out
- The capacitor banks be switched in
- The switchable line / tertiary reactors be taken out
- Operate synchronous condensers for VAR generation
- Operate hydro generators / gas turbines as synchronous condenser for VAR generation, wherever possible
- Closing of lines which were opened to control high voltage, in consultation with SLDC/NRLDC.

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7. CONGESTION MANAGEMENT AND ALLEVIATION

7.1 GENERAL

The system planner generally designs a power system, which complies with the various transmission security standards and associated criteria mentioned in section 4.4 of Operating the system securely, within its design and limitations, is a fundamental requirement if security of power supply is to be maintained. This chapter describes the actions required on the part of the system operator to keep the network secured at all times against contingencies.

7.2 PERMISSIBLE EQUIPMENT LOADING

As per the CEA Manual on Transmission Planning Criteria, Jan 2013 all the system parameters line voltages, loadings, frequency shall be within permissible normal limits even under N-1 or single contingency. The loading limit for a transmission line shall be its thermal loading limit. The loading limit for an inter-connecting transformer (ICT) shall be its name plate rating. Under N-1-1 conditions some equipment may be loaded up to their emergency limits. To bring the system parameters back within their normal limits, load re-scheduling of generation may have to be applied either manually or through automatic system protection schemes (SPS). Such measures shall be applied within one and a half hour (1 ½) after the disturbance. The emergency thermal ratings represent equipment limits that can be tolerated for a relatively short time which may be one hour or two hours. The maximum permissible thermal line loading of different types of line configurations, employing various types of conductors are enclosed as Annexure-IV.

Each system operator at substations would endeavour to keep the line/ ICT loadings within operating limits (Reliable under N-1 & N-1-1 contingency /As per CEA Planning criteria Jan 2013) and inform SLDC in case of overloading of any element. Special emphasis would be paid by each system operator in identifying credible system contingencies & continuously evaluating the system under his control against these contingencies.

In line with regulation 7.4.11 of SGC, SLDC may direct the beneficiaries/ALDCs/IaSGSs/other state entities to increase/decrease their drawal/generation in case of contingencies e.g. overloading of lines/transformers, abnormal voltages, threat to system security. Such directions shall immediately be acted upon. In case the situation does not call for very urgent action and SLDC has some time for analysis, it shall be checked whether the situation has arisen due to deviations from schedules, pursuant to short-term open access. These shall be terminated first, before any action, which would affect the scheduled supplies to the long term and medium term customers, is initiated in accordance with Uttarakhand Electricity Regulatory Commission (Terms and Conditions of Intra-state Open Access) Regulations, 2015 as amended from time to time. In case Short Term/Medium Term Open Access or Long Term Access are curtailed, SLDC shall submit a report within three days to the defaulting open access consumer, regarding the reasons due to which it was not able to curtail deviations from Schedule and agencies which had not taken necessary actions.

7.3 ASSESSMENT OF TRANSFER CAPABILITY

As per the "Revised Congestion Management Procedure in Real-Time System Operation" approved by the CERC, State Load Despatch Centre (SLDC) shall assess the Total Transfer capability (TTC), Transmission Reliability Margin (TRM) and Available Transfer Capability (ATC) on its inter-State transmission corridor considering the meshed intra State corridors for exchange (import/ export) of power with inter-State Transmission System (ISTS). These figures along with the data considered for assessment of TTC would be forwarded to the respective RLDC for assessment of TTC at the regional level. The details of anticipated transmission constraints in the intra State system shall also be indicated separately.

Assessment of Total Transfer Capability (TTC), Transmission Reliability Margin (TRM) and Available Transfer Capability (ATC) for import and export of power within Uttarakhand as

required for reliable system operation and for facilitating non-discriminatory open access in transmission shall be carried out by SLDC in coordination with NRLDC. The „Detailed Procedure for Relieving Congestion in Real Time Operation" as approved by the CERC vide order dated 22.04.2013 may be referred for further details.
The assessed TTC, TRM and ATC shall be posted on SLDC website in the formats as enclosed in Annexure-V. Real time power flow in the corridor for which TTC has been declared shall be displayed alongside for comparison. The voltage of the important nodes in the grid downstream/ upstream of the corridor shall also is displayed.

7.4 MAJOR CORRIDORS/FLOW GATES IN UTTARAKHAND GRID

List of lines in the major corridors/flow gates in Uttarakhand have been enclosed as Annexure-VI.

7.5 GENERATION RESCHEDULING

SLDC may revise the interchange schedule as allowed by SGC regulation 7.4.11, 7.5.5 and 7.5.18.

7.6 CURTAILMENT OF SCHEDULED TRANSACTIONS

The transactions already scheduled may be curtailed by SLDC in the event of transmission constraints; congestion in the grid, or in the interest of grid security. In line with regulations 7.4.11, 7.5.31, 7.5.32, 7.5.34 and 7.5.35 of SGC the transactions shall generally be curtailed in the following sequence:

a. Deviation from Schedule
b. Short term bilateral transactions
c. Short term collective transactions
d. Medium term transactions
e. Long-term transactions

When for the reason of transmission constraints e.g. congestion or in the interest of grid security, it becomes necessary to curtail power flow on a transmission corridor, the transactions already scheduled may be curtailed by the State Load Despatch Centre.

The short-term customer shall be curtailed first followed by the medium-term customers, which shall be followed by the long-term customers and amongst the customers of a particular category, curtailment shall be carried out on pro rata basis.

Collective Transaction through Power Exchange(s) would normally be curtailed subsequent to the Short Term Bilateral Transaction(s).

In case of curtailment of a transaction by RLDC, SLDC shall incorporate the inter-se curtailment of intra-State Entities to implement the curtailment.

7.7 PROCEDURE FOR RELIEVING CONGESTION

Congestion Management shall be as per the detailed procedure for relieving congestion in real time operation as approved by CERC vide its order dated 22.04.2013. It is important to note that the congestion charge could be applied both upstream and downstream of the congested corridor irrespective of the frequency. Whenever actual flow on inter/ intraregional link/ corridor exceeds Available Transfer Capability and security criteria are violated for continuously two time blocks, the National Load Despatch Centre may issue a warning notice. In case SLDC observes congestion within the Intra State, grid it shall take appropriate action and inform the respective RLDC, which in turn shall inform the NLDC.
The notice for congestion shall be communicated to all the Regional entities telephonically or through fax/ voice message/ e-mail and through postings on website and making the same available on the common screen at NLDC/ RLDCs/ SLDCs. The various formats may be referred in the detailed procedure for relieving congestion in real time operation under

regulation 4 (2) of the Central Electricity Regulatory Commission (Measures to relieve congestion in real time operation) Regulations, 2009.

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8. DEMAND MANAGEMENT

8.1 OVERVIEW

Demand management plays a very important role in system operation. Long-term demand estimation (five years and beyond) is an important input for generation planning. In the medium term, say one year, it constitutes an important input for outage planning of generating units and transmission lines. In the short term, say within one week, it is an important input for generation scheduling. 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 then plays an important role in arresting these adverse effects on the grid. Demand estimation and control is essentially the responsibility of SLDCs. NRLDC would give instructions to SLDCs on demand control whenever the same has a bearing on the security of the regional grid & such instructions would have to be complied forthwith by all SLDCs.

8.2 DEMAND ESTIMATION [SGC 6.4]

The SLDCs would forecast active and reactive demand (MW peak, MW off-peak & energy in MWh/MVArh) on an annual, quarterly, monthly, weekly and ultimately on daily basis, which would be used in the day-ahead scheduling. SLDC shall maintain a historical database for the purpose and be equipped with the state-of-the-art tools such as Energy Management System (EMS) for demand forecasting. Ideally, the forecasts should be on hourly basis (8760, 720 & 168 values respectively in the annual, monthly and weekly forecasts) rather than mentioning only the peak MW and energy requirements for the period.

It is also desirable to have substation wise demand (Nodal MW / MVAr) forecasts. (i) In line with the SGC regulation 6.4 (3), the SLDC shall plan demand management measures like load shedding, power cuts etc. based on the demand estimate and the estimated availability from different sources and shall ensure that the same is implemented by the distribution licensees. All distribution licensees shall abide by the demand management measures of the SLDC and shall also maintain historical database for demand estimation.

(ii) The annual, quarterly and monthly demand forecasts would be used in the outage plan prepared by NRPC Secretariat in consultation with all the constituents. In line with SGC regulation 6.4 (6) and 6.4 (8), the demand forecasts by the SLDC shall be provided to NRLDC and NRPC for operational planning and computation of total transfer capability. (iii)Attention would also be paid by SLDCs 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 days.

(iv) It is also important that, the reactive power requirements are forecasted right from substation level by SLDC. The reactive power planning exercise and programme for installation of reactive compensation equipment should take care of these requirements also.

8.3 DEMAND CONTROL

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.
- Unforeseen generation / transmission outages resulting in reduced power availability.
- Network congestion (voltage levels beyond normal operating limits, violation of TTC, network element load beyond operating limit etc.)
- Heavy reactive power demand causing low voltages.
- Commercial reasons.
- In the interest of system security due to any other contingency in Uttarakhand or neighbouring regions.

Demand management measures shall be taken by SLDCs /distribution licensee/User bulk open access consumer in line with the regulation 6.5 of SGC. Further sub-regulation 5 of Regulation 7.4 of SGC mandates that

"The system of each beneficiary shall be treated and operated as a notional control area. The algebraic summation of scheduled drawal from IaSGs/ISGS and from contracts through long– term access, medium-term and short–term open access arrangements shall provide the drawal schedule of each beneficiary, and this shall be determined in advance on day- ahead basis. The beneficiaries shall regulate their embedded generation and/or consumers' load so as to maintain their actual drawal from the State Grid close to the above schedule. The beneficiaries may, at their discretion, deviate from the drawal schedule, as long as such deviations do not cause system parameters to deteriorate beyond permissible limits and/or do not lead to unacceptable line loading. Inadvertent deviations, if any, from net drawal schedule shall be priced through the Deviation Settlement Mechanism Regulations. Every beneficiary shall ensure reversal of sign of deviation from schedule at least once after every twelve time blocks."

The SLDC, distribution licensee shall always restrict the net drawal of the State from the grid within the drawal schedules keeping the deviations from the schedule within the limits specified in the Deviation Settlement Mechanism Regulations. The concerned User and SLDC shall ensure that their Automatic Demand Management Scheme mentioned in clause (1) and (2) sub-Regulation 6.5.1 of SGC acts to ensure that there is no over-drawal. If the Automatic Demand Management Scheme (ADMS) has not yet been commissioned, then action shall be taken as per manual demand management scheme to restrict the net drawal from grid to within schedules and all actions for early commissioning of ADMS shall be initiated.

SLDC may give instructions for demand disconnection under normal and/or contingent conditions. Demand control would have to be exercised under these conditions by the Distribution licensee/User/bulk consumer, which could be done by either of the following methods or a combination thereof:

- Manual demand disconnection.
- Shutting off or reconnecting bulk power consumers having a special tariff structure linked to number of interruptions in the day.
- PC based system for rotational load shedding with facilities for central programming and uploading of the disconnection schedule for the day from the SLDC / Sub-LDC to the substations.

In order to maintain the frequency within the stipulated band and maintaining the network security, the interruptible loads shall be arranged in four groups of loads:

(a) For scheduled power cuts/load shedding

(b) Loads for unscheduled load shedding

(c) Loads to be shed through under frequency relays/ df/dt relays

(d) Loads to be shed under any system protection scheme identified at the RPC level.

The aforesaid loads shall be grouped in such a manner, that there is no overlapping between different groups of loads. During the demand control by manual disconnection of loads by staggering in different groups, the roster 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. UPCL would also identify feeders drawing heavy quantum of reactive power and disconnect the same under low voltage conditions. The necessary metering arrangements for identifying such feeders would be provided by UPCL.

8.4 PROTOCOL FOR HANDLING SUDDEN REDUCTION IN DEMAND

During the event of sudden load throw off in the system suitable measures to control High frequency & High Voltage may be taken as elaborated in Section 4.5 and Section 5.10

respectively of this document. Depending on the quantum of demand reduction, it may be segregated into A, B, C and D as under:

- Category-A: Demand reduction = Up to 20 %
- Category-B: Demand reduction = Between 20 to 30 %
- Category-C: Demand reduction = Between 30 to 40 %
- Category-D: Demand reduction = More than 40%

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9. SCHEDULING AND DESPATCH

9.1 OVERVIEW

As per section 32(2)(a), the Electricity Act 2003, the SLDCs shall be responsible for optimum scheduling and despatch of electricity within a State, in accordance with the contracts entered into with the licensees or generating companies operating in that State. The system of each beneficiary shall be operated as a notional control area and the regional grids shall be operated as power pools with decentralized scheduling and despatch [SGC- 7.4.4 and 7.4.5].

The approval for connectivity, long term Access, Medium term Open Access and Short term Open Access (Bilateral as well as Collective) shall be in line with the appropriate Regulations and procedures approved by UERC. This chapter illustrates the procedure for scheduling the approved contracts and the treatment to be accorded for special situations.

9.2 JURISDICTION OF SLDC

The jurisdiction of SLDC for scheduling and energy settlement is governed by regulation 7.4.2, 7.4.3 of the SGC. A list of registered users shall be available on the website of SLDC. The list of Entities whose scheduling shall be coordinated by the SLDC is given as Annexure-VII.

SLDC shall be the Nodal Agency for processing of applications for Short Term Open Access where the drawal and injection point lies in the Intra-State Transmission system.

9.3 SCHEDULING OF LONG TERM AND MEDIUM TERM CONTRACTS

In line with Regulation 50 of UERC (Terms and Conditions for Determination of Multi Year Tariff) Regulations, 2015, the Uttarakhand State Load Despatch Centre shall finalise the schedules for the hydro generating stations, in consultation with the beneficiaries, for optimal utilization of all the energy declared to be available, which shall be scheduled for all beneficiaries in proportion to their respective allocations in the generating station.

The Uttarakhand State Load Despatch Centre shall certify the declared capacity of the generating stations on daily basis and shall also issue a Certificate at the end of the year, validating the PAFM during the year, to the generating company.

The algebraic summation of scheduled drawal from contracts through a long term, medium term and short term open access arrangements and from UPCL shall provide the drawal schedule of each state constituent, and this shall be determined in advance on day-ahead basis.

9.4 SCHEDULING OF HYDRO STATION:

Scheduling of Hydro station shall be done as per various provisions in SGC 7.5 and UERC Tariff regulation.

9.5 SCHEDULING OF SHORT TERM CONTRACTS

Processing of applications for Short Term Open Access in Intra-State shall be carried out in line with the procedures prepared under UERC (terms and conditions of Intra-state open access), regulations, 2015 and related matter time to time.

9.6 TIME LINE FOR INFORMATION EXCHANGE FOR SCHEDULING

The procedure for day-ahead scheduling has been elaborated under regulation 7.5 of the SGC. The time line for exchange of information between NRLDC, NLDC, SLDC and various Regional Entities for the purpose of scheduling is summarised in the table below:

Table 2: Time line for information exchange

S	Information particulars	From	To	To be sent

No.				by(time in hours)
1	Station-wise ex-power plant MW and MWh capabilities foreseen for the next day i.e 00:00 hrs to 24:00 hrs for 96 blocks of 15 minutes duration each of the following day.	IaSGS (State Generator)	SLDC	1000
2	MW and MWh entitlements available to each beneficiary during the following day at 15 minutes interval	SLDC	Each beneficiary	1100
3	Modifications/ changes to be made if any in the above entitlements	State beneficiaries	SLDC	1300
4	Despatch schedule and net drawal schedule to each beneficiary	SLDC	Each beneficiary	1800
5	Modifications/ changes to be made in despatch schedule or in net drawal schedule	Each beneficiary	SLDC	2100
6	Final despatch schedule and final net drawal schedule	SLDC	Each beneficiary	2330

Run-of-river power station with pondage and storage type power stations are designed to operate during peak hours to meet system peak demand. Maximum capacity of the station declared for the day shall be equal to the installed capacity including overload capability, if any, minus auxiliary consumption, corrected for the reservoir level. The State Load Despatch Centers shall ensure that generation schedules of such type of stations are prepared and the stations despatched for optimum utilization of available hydro energy except in the event of specific system requirements/constraints. [SGC 7.5.13]

The Declared Capability of the IaSGS (except in case of run-of-the-river with up to three hours of pondage) during peak hours should not be less than that during other hours. However, exception to this rule shall be allowed in case of tripping/re-synchronisation of units as a result of forced outage of units [SGC 7.4.15].

9.7 RAMP RATE

IaSGS /State constituent generators in Uttarakhand shall be expected to capable of ramping rate of up to 200 MW/hour. Hydroelectric generating stations may be expected to provide a higher ramp rate [SGC 7.5.15].

During fuel shortage scenario IaSGS shall also declare the possible ramping up/ramping down [SGC 7.4.14].

9.8 CURTAILMENT

In the event of contingencies, transmission constraints, congestion in the network, threat to system security the transactions already scheduled by SLDC may be curtailed for ensuring safety and reliability of the system [SGC 7.5.31]. This is further discussed in Chapter on Congestion Management and alleviation.

9.9 REVISION OF SCHEDULES REQUESTED BY State constituents

Revision in the day-ahead schedule would be allowed as per the various provisions in the Grid Code. The time from which the revised scheduled would be effective have been summarised in the table below.

Table 3: Revision of Schedule by regional entity

S No.	Particulars of request for revision in schedule	Time block from which the revised schedule would be effective	Remarks
1	Revision in Declared Capability by an IaSGS having two part tariff with capacity charge and energy charge.	Fourth	Time block in which the request for revision was received by SLDC would be considered as first one
2	Revision in Declared Capability by an IaSGS in case of forced outage.	Fourth	Time block in which the request for revision was received by SLDC would be considered as first one
3	Revision in Declared Capability by run-of-the river hydro and poundage based hydro generating stations	Fourth	
4	Revision of Declared Capability by renewable generators (Except collective transactions)	Fourth	Time block in which the notice was given shall be considered as first. There may be one revision for each time slot of one and half hours starting from 00:00 hours of a particular day subject to maximum of 16 revisions during the day.
5	Revision of Short term Open Access (Bilateral) injection schedule by Seller under forced outage of generator of capacity 30 MW and above.	Fourth	Time block in which the forced outage is declared shall be considered as first.
6	Revision in Requisition by a Regional Entity in ISGS having two part tariff	Fourth	Time block in which the request for revision was received by NRLDC would be considered as first

Note: To discourage frivolous revisions, SLDC may, at its sole discretion, refuse to accept schedule/ capability changes of less than two (2) percent of the previous schedule/capability.

The schedule of thermal generating stations indicating fuel shortage while intimating the Declared Capacity to the SLDC shall not be revised except in case of forced outage of generating unit. Provided that in case of gas based IaSGS, for optimum utilization of gas, this shall be permitted, i.e. in case of tripping of a unit, this gas may be diverted to another unit using the same gas.

9.10 REVISION IN SCHEDULE INITIATED BY SLDC

SLDC may initiate revision in schedule under various provisions of SGC.

Table 4: Revision in Schedule by SLDC

S No.	Particulars of revision in schedule by SLDC	Revised Schedule Would be effective from	Remarks
1	In the event of bottleneck in evacuation of power due to any constraint, outage, failure or limitation in the transmission system, associated switchyard and sub- stations owned by the State Transmission Utility or any other transmission licensee involved in intra-state transmission (as certified by the SLDC) necessitating reduction in generation	Fourth	Time block in which the bottleneck in evacuation of power has taken place to be the first one. The schedule in the first, second and third block shall be deemed to be equal to actual generation and the scheduled drawals of the beneficiaries shall be deemed to have been revised to be equal to their actual drawals. [SGC 7.5.18]
2	Transmission constraint	Fourth	Fourth Time block in which the revised schedule was issued by SLDC
3	In the interest of better system operation	Fourth	Time block in which the revised schedule was issued by SLDC to be the first one. [SGC 7.5.24]
4	Grid Disturbance*		In case of any grid disturbance, scheduled generation of all the IaSGS and scheduled drawal of all the beneficiaries shall be deemed to have been revised to be equal to their actual generation/ drawal for all the time blocks affected by the grid disturbance. Certification of grid disturbance and its duration shall be done by the SLDC. [SGC 7.5.19]

Note: Generation schedules and drawal schedules issued/revised by the State Load Despatch Centre shall become effective from designated time block irrespective of communication success. [SGC 7.5.28]

9.11 MODERATION OF SCHEDULE BY SLDC

The SGC allows SLDC to moderate the interchange schedule of the State Constituents under certain conditions. These are summarised below:

Table 5: Moderation of Schedule by SLDC

S No.	Particulars of moderation carried out by SLDC	Rational for moderation/ condition under which moderation to be carried out

1	Generation schedule of run-of river hydro power station with poundage and storage type hydro power stations	For optimum utilization of available hydro energy to meet system peak demand except in the event of specific system requirements/constraints. [SGC 7.5.15]
2	Interchange schedule of State Constituents	Transmission constraints foreseen while finalising the interchange schedule or in the event of bottleneck in evacuation of power necessitating reduction in generation [SGC 7.5.16 and 7.5.18]
3	Requisition from different state constituents	For making schedule operation all areas enable particularly in terms of ramping up / ramping down rates and ratio between minimum and maximum generation levels [SGC 7.5.15]

9.12 STANDING INSTRUCTIONS BY BENEFICIARIES TO SLDC

Regulation 7.5.6 of the SGC allows the beneficiaries to give standing instruction to SLDC such that SLDC itself may decide the best drawal schedule for the beneficiaries. However, in the spirit of de-centralised scheduling market mechanism, it is expected that such beneficiaries should convey to SLDC at least the following information on 15-minute time block basis:

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

Based on such above information, SLDC would moderate the Hydro generator schedule as per system conditions.

9.13 IMPLEMENTED SCHEDULE ISSUED BY SLDC

After the operating day is over at 24:00 hours, the schedule finally implemented during the day (taking into account all before-the-fact changes in despatch schedule of generating stations and drawal schedule of the beneficiaries) shall be issued by SLDC. These schedules shall be the datum for commercial accounting. The average ex-bus capability for each IaSGS shall also be worked out based on all before-the-fact advice to SLDC. The procedure for scheduling and the final schedules issued by SLDC shall be open to all Constituents for any checking/verification, for a period of 5 days. In case any mistake/omission is detected, the SLDC shall forthwith make a complete check and rectify the same [SGC 7.5.33 and SGC 7.5.37].

The schedule of solar generators which are State constituents shall be given by the generator based on availability of the generator, weather forecasting, solar insolation/irradiance, season and normal solar generation curve. [SGC 7.5.27(d)]

Forecasting shall be done by wind and solar generator as well as the SLDC. The SLDC may engage forecasting agency (ies) and prepare a schedule for such generating stations. The forecast by the SLDC shall be with the objective of ensuring secure grid operation. The forecast by the wind and solar generator shall be generator centric. The wind and solar generators which are State constituents will have the option of accepting SLDC's forecast for preparing its schedule or provide the SLDC with a schedule based on its own forecast. Any commercial impact on account of deviation from schedule based on the forecast chosen by the wind and solar generator shall be borne by it. [SGC 7.5.27(b)]

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10. SETTLEMENT SYSTEM

10.1 OVERVIEW

The settlement system involves metering, data collection and processing, energy accounting and raising of bills by the different constituents. This chapter indicates the roles and responsibilities of the different constituents in making the settlement system operative.

10.2 SETTLEMENT PERIOD

For the purpose of scheduling and settlement the entire day shall be divided into 96 time blocks of 15 minutes duration each.

The SLDC shall be responsible for computation of actual net MWh injection of each IaSGS and actual net drawal of each beneficiary, 15 minute-wise, based on the above meter readings and for preparation of the State Energy Accounts as per UERC (Deviation Settlement Mechanism and related matters) Regulations, 2017 as amended from time to time. [SGC 7.4.20]

10.3 INTERFACE METERING AND CONTROL AREA BOUNDARY

The STU shall install special energy meters on all interconnections between State Constituents and other identified points for recording of actual net MWh interchanges and MVArh drawals. The installation, operation and maintenance of special energy meters shall be in accordance with CEA (Installation and Operation of Meters) Regulations, 2006 as amended from time to time [SGC 7.4.19].

The locations for installation, specifications and accuracy limits for the meters shall be as per Metering Communication & Data Acquisition Requirements (MCDAR) developed by The State Transmission Utility and approved by the Commission. [SGC 8.1]

10.4 TIME CORRECTION AND METER CALIBRATION

The concerned entities in whose premises interface meters are installed shall take suitable measures for time correction and energy meter calibration.

Time correction and meter calibration shall be as per the MCDAR developed by STU and approved by The Commission. [SGC 8.1]

10.5 DATA PROCESSING

The SLDC shall be responsible for computation of actual net MWh injection of each IaSGS and actual net drawal of each beneficiary, 15 minute-wise, based on the above meter readings and for preparation of the State Energy Accounts as per UERC (Deviation Settlement Mechanism and related matters) Regulations, 2017 as amended from time to time. [SGC 7.4.20]

Whenever there is a change in the location of interface meters or there is a change in the CT/PT ratios, the concerned entities shall promptly inform SLDC. The concerned entities shall coordinate with SLDC in case of any problems in data collection and its transmission to SLDC.

10.6 ENERGY ACCOUNTING

The SLDC shall be responsible for computation of actual net MWh injection of each IaSGS and actual net drawal of each beneficiary, 15 minute-wise, based on the above meter readings and for preparation of the State Energy Accounts as per UERC (Deviation Settlement Mechanism and related matters) Regulations, 2017 as amended from time to time. [SGC 7.4.20]

State Energy Accounts shall be prepared on monthly basis and the statement of Deviation charges and Reactive Energy Charges shall be prepared by the SLDC on a weekly basis based on the data provided by the SLDC and these shall be issued to all state constituents by Tuesday for the seven-day period ending on the previous Sunday mid-night. [Regulation 10.1 0f UERC (Deviation Settlement Mechanism and related matters) Regulations, 2017]

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11. DEFENCE MECHANISMS FOR THE SYSTEM

11.1 GENERAL

Well designed and healthy defence mechanism is a pre requisite for secure operation of the interconnected system. The safety net envisaged in the Uttarakhand is elaborated ahead.

11.2 UNIT PROTECTION SYSTEM

In line with the regulation 3 (e) of the CEA (Grid Standards) regulation 2010 all regional entities shall provide standard protection systems having reliability, selectivity, speed and sensitivity to isolate the faulty equipment and protect all components from any type of faults, within the specified fault clearance time. The protection philosophy specified by the Northern Regional Power Committee is enclosed as Annexure-VIII. As agreed in the Protection Coordination Sub-committee all the regional entities shall submit a certificate of healthiness of protection system at their respective substations. The certificate should also confirm that that the protection settings are as per the protection philosophy specified by NRPC.

Protection audit of the substations shall be carried out by the respective utilities on a regular basis as advised in Protection coordination committee meetings. As per 3 (e) of CEA (Grid Standard) regulation 2010, the fault clearance time shall be within the time mentioned in table below:

Table 6: Fault Clearance time

S no.	Nominal System voltage (kV rms)	Maximum Time (in milliseconds)
1	765 and 400	100
2	220 and 132	160

All substations of 220 kV and above shall be equipped with breaker fail protection and bus bar protection scheme. Non clearance of the fault by a circuit breaker within the time limit, the breaker fail protection shall initiate tripping of all other breakers in the concerned bus section to clear the fault in next 200 milliseconds.

11.3 FLAT FREQUENCY AND RATE OF CHANGE OF FREQUENCY RELAY LOAD SHEDDING SCHEME

As per the Indian Electricity Rules 1956 (amended up to 25th Nov 2000) the permissible range for grid frequency is +/- 3 % of nominal i.e. 48.5 Hz to 51.5 Hz. The permissible frequency ranges (by manufacturers) for operation of various makes of Steam Turbine as extracted from "Report of the NREB Task Force on Frequency Control", Dec 1992 is enclosed as Annexure-IX. Under-frequency and rate of change of frequency (UFR & df/dt) are envisaged to take care of sudden contingencies arising out of outage of generation stations or separation of intra-State lines. UFRs setting are for steady state operation of the grid at considerably low frequency and df/dt settings are for fast change in frequency due to large generation outage. The settings of UFRs as decided in NRPC are 49.2Hz, 49.0 Hz and 48.8 Hz & 48.6 Hz with the State wise load relief enclosed in Annexure-X.

The df/dt setting envisaged is as follows.

- The df/dt is to protect the individual regional grid/ state grid from loss of generation in the event of isolation. The setting and quantum of relief through df/dt relay as decided in NRPC is enclosed in Annexure-XI.

In line with regulation 6.5.1 (5) of SGC, the interruptible loads in a control area shall be arranged in four groups of load,

- for scheduled power cuts/load shedding,
- loads for unscheduled load shedding,
- loads to be shed through under frequency relays/(df/dt) relays and
- Loads to be shed under any System Protection Scheme identified at the RPC level.

These loads shall be grouped in a manner, that there is no overlapping between different groups of loads. This would ensure that the automatic relief through these relays would be available to the system under all conditions.

11.4 UNDER VOLTAGE LOAD SHEDDING SCHEME

To insulate the Regional Grid from the exigencies due to low voltage problem, Under Voltage Load Shedding Scheme has been implemented as per the decision of 3rd NRPC meeting held on 10.11.2006 at Mussoorie.

- Uttarakhand has one UVR installed at Rishikesh set with 190 kV. Planned relief is 30-60 MW.

11.5 SYSTEM PROTECTION SCHEME

Outage of a large capacity link between two distant nodes in a synchronously interconnected system may result into excessive loading on parallel AC lines, severe drop in voltage profile, power oscillations and finally leading to a major blackout or brown out in the system, in case instantaneous corrective actions are not in place. On the other hand, similar outage in an asynchronously connected system may result into load – generation imbalance on either side of the link. In view of the above few System Protection Schemes have been implemented in Uttarakhand.

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12. GRID INCIDENT, GRID DISTURBANCE AND REVIVAL

12.1 GENERAL

This chapter is in compliance with the regulation 6.5.26 of the SGC that mandates the SLDC to formulate the procedure for meeting contingencies both in long run and the short run (Daily scheduling). It describes the guidelines for classification of grid events into different categories, for the purpose of analysis and reporting. The milestone to be reached so as to consider the system as normal is also indicated. The general precautions to be observed, while restoring a disturbed system are also covered in this chapter.

12.2 DEFINITION OF GRID INCIDENT AND GRID DISTURBANCE

The Grid Incident and Grid Disturbance as defined in the CEA (Grid Standards) Regulation 2010 is as under-

"A Grid Incident means tripping of one or more power system elements of the grid like a generator, transmission line, transformer, shunt reactor, series capacitor and Static VAR Compensator, which requires re-scheduling of generation or load, **without total loss of supply at a substation or loss of integrity of the grid** at 220 kV and above (132 kV in the case of North-Eastern Region)."- [CEA Regulation 2 (j)]

"A Grid Disturbance means tripping of one or more power system elements of the grid like a generator, transmission line, transformer, shunt reactor, series capacitor and Static VAR Compensator, **resulting total failure of supply at a sub-station or loss of integrity of the grid**, at the level of transmission system at 220 kV and above."- [CEA Regulation 2 (i)]

In the event of a grid incident/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 for the voltage and frequency as necessary in order to achieve the fastest possible recovery of the grid [SGC 6.9 (4)].

12.3 DECLARATION OF GRID DISTURBANCE

Declaration of Grid disturbance shall be done by the SLDC at the earliest (SGC 7.5.19). A notice to this effect shall be posted at its website by the SLDC of the area in which the disturbance occurred. Issue of the notice at SLDC web site shall be considered as declaration of the disturbance by SLDC. All State constituents shall take note of the disturbance and take appropriate action at their end.

12.4 CATEGORISATION OF GRID DISTURBANCES

The criteria for classifying grid incidents and grid disturbances as described in the Central Electricity Authority (Grid Standards) Regulation, 2010, is indicated in the Table below.

12.4.1. CATEGORISATION OF GRID INCIDENT

Table 7: Type of Grid incident

Category	Description
GI-1	Tripping of one or more power system elements of the grid like a generator, transmission line, transformer, shunt reactor, series capacitor and Static VAR Compensator, which requires rescheduling of generation or load, without total loss of supply at a substation or loss of integrity of the grid at 220 kV

12.4.2. CATEGORISATION OF GRID DISTURBANCE

Table 8: Type of Grid disturbance

Category	Generation or Load lost as a percentage of antecedent generation or load in the regional grid
GD-1	Less than 10 %
GD-2	More than 10 % but Less than 20 %
GD-3	More than 20 % but Less than 30 %
GD-4	More than 30 % but less than 40 %
GD-5	More than 40 %

For the purpose of categorisation of grid disturbances percentage loss of generation or load, whichever is higher shall be considered.

12.5 DEFERMENT OF PLANNED OUTAGE DURING GRID DISTURBANCE

SLDC is authorized to defer the planned outage, in case of any of the following, taking into account the statutory requirements:

(a) Major grid disturbances (total black-out in State).

(b) System isolation.

(c) Black-out in a Constituent System.

(d) Any other event in the system that may have an adverse impact on the system security by the proposed outage.

Provided that the State Load Despatch Centre shall inform the concerned State constituents about the revised outage plan, with appropriate reasons for revisions in the outage plan, as soon as possible. [SGC 6.8.4(7)]

12.6 RESCHEDULING DURING GRID DISTURBANCE

In case of any grid disturbance, scheduled generation of all the IaSGS and scheduled drawal of all the beneficiaries shall be deemed to have been revised to be equal to their actual generation/drawal for all the time blocks affected by the grid disturbance. Grid disturbance and its duration shall be done by the SLDC for this purpose. [SGC 7.5.19]

12.7 SYSTEM REVIVAL

In compliance with regulation 6.9.1 of State Grid Code of UERC, SLDC shall develop detailed plans and procedures for restoration of the State Grid under partial/total blackout in consultation with all State Constituents and shall be reviewed / updated annually.

Detailed plans and procedures for restoration after partial/total blackout of each Constituent's system within the State will be finalized by the concerned Constituent in co-ordination with the SLDC. The procedure will be reviewed, confirmed and/or revised once every subsequent year. Mock trial runs of the procedure for different sub-systems shall be carried out by the Constituents at least once in every six months under intimation to the SLDC. Diesel Generator sets for black start would be tested on weekly basis and test report shall be sent to SLDC on quarterly basis. [SGC 6.9.2]

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 by and be available with SLDC. [SGC 6.9.3]

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

(i) While building up the system, it would be ensured that the voltage at the charging end remains within limits. A small amount of essential load should be connected at each substation before extending the network. However, the ultimate objective viz. building up of the network should not be lost sight of, while connecting the loads.

(ii) Security of the network being built up would be strengthened at the earliest by closing the parallel lines available in the restoration path while system parameters to be maintained.

(iii) Priority would be accorded for extending supplies to railway traction and installations where safety is of paramount importance such as nuclear power stations.
(iv) All switching instructions for a particular system have to emanate from a single agency viz. SLDC/CPCC as the case may be. For synchronisation of two systems, NRLDC would be the co-ordinating agency. Wherever a communication problem is foreseen, proper standing instructions would be issued to the substation engineers for implementation.
(v) During revival of the system, only authorised personnel would be present in control rooms of substations / power stations / SLDCs / NRLDC so as to expedite restoration of the system.
(vi) In line with Section 6.9(5) of SGC and 5.8 (e) of IEGC, all communication channels required for restoration process shall be used for operational communication only, till grid normalcy is restored.
(vii) All generating units would be on free governor operation and the excitation controlled to maintain proper voltage profile.
(viii) Synchronising facility should be available at major grid substations so as to have maximum flexibility in choosing the point of synchronisation.

12.8 DECLARATION OF SYSTEM NORMALISATION POST GRID DISTURBANCE

After a Grid Disturbance of category GD-1, GD-2, GD-3, GD-4, „the system would be deemed to have been normalised if all subsystems have been synchronised and 80% of the total loss of generation/load, during the incident, has been revived.
After a Grid Disturbance of category- GD-5, the system would be deemed to have been normalised if, all subsystems have been synchronised; Power has been extended to each affected grid substation; At least one unit at the affected power station has been synchronised (subject to a maximum of three hours of receipt of start-up power). SLDC shall inform the constituents in this regard.

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13. EVENT INFORMATION AND REPORTING

13.1 OVERVIEW

Timely and accurate reporting and exchange of information plays a very important role in system operation. This is particularly important during a grid incident/disturbance or a crisis situation. Timely and accurate information flow under such conditions would greatly reduce an element of uncertainty and help people in making an informed decision. In case system restoration 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 at all cost. This chapter describes the information to be exchanged between the constituents and SLDC and its periodicity.

13.2 EVENT INFORMATION

Any tripping, whether manual or automatic, of any of the important elements (List as prepared by SLDC is enclosed as Annexure-I) of State Grid shall be precisely intimated by the concerned ALDC/agency to SLDC as soon as possible, say within ten minutes of the event. The reason (to the extent determined) and the likely time of restoration shall also be intimated. All reasonable attempts shall be made for the elements' restoration as soon as possible. SLDC shall inform the tripping of the important elements of the State Grid, to RLDC. [SGC 6.2 (4)]. Such intimation can be on telephone or fax or e-mail.

Maintenance of their respective power system elements shall be carried out by Users, STUs in accordance with the provisions in CEA (Grid Standards) Regulations, 2010. Any prolonged outage of power system elements of any User/STU, which is causing or likely to cause danger to the State Grid or sub-optimal operation of the State Grid, shall regularly be monitored by SLDC. SLDC shall report such outages to RLDC. [SGC 6.2(5)]

Any operation planned to be carried out by a constituent which may have an impact on the State grid, or on any of the "Important Element of Uttarakhand Grid", shall be reported by the constituents to SLDC in advance.
Any operations planned to be carried out on the instructions of SLDC which may have an impact on the system of a constituent / constituents shall be reported by SLDC to all such constituents in advance. The intimation and the exact time of revival of an element falling under the category of "Important Elements of Uttarakhand Grid" whether revived after a tripping or after a prolonged outage shall be intimated to SLDC immediately.

13.3 REPORTING SYSTEM

The details of the Event Reports and the Periodic Reports to be prepared and issued by Constituents / SLDC are as follows:

13.3.1. Event Report (State Constituents to SLDC).

In the case of an event, which was initially reported by a State Constituent or an ALDC to SLDC orally, the Constituent/ALDC will give a written report to SLDC in accordance with this part.
In the case of an event, which was initially reported by SLDC to a Constituent/ALDC orally, the SLDC will give a written weekly report to the Constituent/ALDC in accordance with this part.
In the event of tripping of any element falling under the category of "Important Elements of Uttarakhand Grid" the "EVENT REPORT" shall be sent by the concerned constituent to SLDC within a period of four (4) hours of the occurrence of the event in the form Annexure-XII detailed under regulation 6.10.6 of SGC. Such report shall follow the telephonic / flash reporting the constituent would do in a reasonable time, say within ten (10) minutes of the occurrence of the event.

Events affecting a generation capacity of more than 300 MW or load of more than 500 MW for more than 3 hours shall be reported in writing to the Commission by the State Load Despatch Centre, Transmission Licensee or User, as the case may be. Provided that a summary document including brief detail of the event, extent and probable causes of the event shall be sent across to the Commission within 24 hours of occurrence of such event. [SGC 6.10.6 (4)]

13.3.2. Grid Incident/Disturbance Report (SLDC/Constituent / User/ STU/ CTU/ inter-state transmission licensee to NRLDC):

In the event of a grid Incident/disturbance the State Constituents shall send information/data including disturbance recorder/sequential event recorder output etc., within 24hrs to SLDC for the purpose of analysis of any grid disturbance/event. No State constituent shall block any data/information required by the SLDC for maintaining reliability and security of the grid and for analysis of an event. [SGC 6.2.21]

13.3.3. Grid Incident/Disturbance Report (SLDC to Constituents/ALDCs):

In the event of a grid incident/disturbance SLDC shall issue a brief preliminary report in prescribed format (Enclosed as Annexure-XIII), indicating the affected area or system, extent of outage and likely cause of initiation. The preliminary report for a grid disturbance would be issued within three hours of the occurrence of the disturbance. This would be followed by a detailed report in the following manner.

(i) Grid Disturbance Category –GD-5: Flash report followed by a detailed report within ten (10) working days.

(ii) Grid Disturbance Category- GD-1, GD-2, GD-3 and GD-4: Flash report followed by a detailed report within a period of seven (7) working days.

(iii) Grid Incident (GI-1 and GI-2): Flash report followed by a detailed report within a period of four (4) working days.

13.3.4. Automatic load shedding through SPS/ Under Frequency/(df/dt)/Under Voltage Relay Operations (Constituents to SLDC and SLDC to, RPC)

In line with the regulation 6.2 (16), 6.2 (17) & 6.2 (18) of the SGC, automatic load shedding (including inter tripping and run back) would be initiated as result of operation of SPS/UFR / (df/dt)/UVLS relays. In order to check and ascertain their operation as per approved plans, State Transmission Utility shall carry out periodic inspection of the under frequency relays and produce the report to State Load Despatch Centre. State Load Despatch Centre shall maintain the record of under frequency relay and/or df/dt relay operation and shall furnish monthly report of under frequency relay and df/dt relay operation in their system to the RPC as per SGC regulation 6.2 (17).

13.3.5. Daily Report

In line with SGC regulation 6.6.1, a daily report covering the performance of the State grid shall be prepared by SLDC based on the inputs received from constituents and shall be put on its website. This report shall also cover the wind / solar power generation and injection into the grid.

13.3.6. Weekly Report (SLDC to Constituents)

A weekly report shall be issued by SLDC to all Constituents of the State and shall cover the performance of the State Grid for the previous week, in line with regulation 6.6.2 of SGC. Such weekly report shall be available on the website of the SLDC for at least 12 weeks. The weekly report shall contain the following:

(a) Frequency profile;

(b) Voltage profile of selected substations and substations normally having low/high voltages;

(c) Demand and Supply Situation;

(d) Major Generation and Transmission Outages;

(e) Transmission Constraints;

(f) Instances of persistent/significant non-compliance of SGC.

(g) Instances of congestion in transmission system
(h) Instances of inordinate delays in restoration of transmission elements and generating units.
(i) Non-compliance of instructions of SLDC by State constituents, to curtail drawal resulting in non-compliance of SGC

13.3.7. Quarterly Report (Constituent to NRLDC and NRLDC to constituents)
The SLDC shall prepare a quarterly report which shall bring out the system constraints, reasons for not meeting the requirements, if any, of security standards and quality of service, along with details of various actions taken by different agencies, and the agencies responsible for causing the constraints [SGC 6.6.3 (1)] and in line with regulation 4.4 (2) (e) of SGC.

As per 6.9 (2) of the SGC Mock trial runs of the procedure for different sub-systems shall be carried out by the Constituents at least once in every six months under intimation to the SLDC. Diesel Generator sets for black start would be tested on weekly basis and test report shall be sent to SLDC on quarterly basis.

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14. DATA ACQUISITION AND COMMUNICATION SYSTEM

14.1 OVERVIEW

In line with regulation 5.10 and 6.2 (20) of the SGC each State Constituent shall provide and maintain adequate and reliable communication facility internally and with other Constituents/ SLDC to ensure exchange of data/information necessary to maintain reliability and security of the grid. Wherever possible, redundancy and alternate path shall be maintained for communication along important routes, e.g. ALDC to SLDC.

CERC vide its order dated 26.09.2012 in petition 168/MP/2011 with IA No. 39/2012 has directed as under:

"Under the grid code, it is the responsibility of all users, STUs and CTU to provide systems to telemeter power system parameters in line with interface requirements to telemeter power system parameters in line with interface requirements and other guidelines made available by RLDC and associated communication system to facilitate data flow up to appropriate data collection point on CTUs system. In view of the critical importance of telemetry and associated communication system for ensuring reliability in operation of the grid and optimum utilization of the transmission system, there is an imperative need for all users to establish the telemetry and associated communication system in time bound manner so that the power system operation may be most reliable and optimum. Moreover, in view of the requirement of communication system for generating station and sub-station, the planning should be done in advance by the generating company and transmission licensee to ensure that necessary system is in place before commissioning of generating station or substation to take care of the communication requirements even at the time of injection of inform power by a generating station and sub-station during testing."

14.2 RECORDING INSTRUMENTS AND COMMUNICATION FACILITIES

The recording instruments such as Data Acquisition System, Disturbance Recorder, Event Logger, Fault Locator, Time Synchronisation Equipment, and any other such equipment in each generating station / substation / control centre / SLDCs shall be kept in good working condition in order to record the events and their sequences. All such places shall have a common time reference so that any event can be coordinated with respect to different locations having common time base.

Each State constituent shall provide adequate and reliable communication facility with SLDC as well as internally and with other constituents in order to ensure exchange of data / information necessary to maintain reliability and security of the grid.

14.3 CYBER SECURITY

14.3.1. Overview

In line with regulation 5.16 of SGC, all utilities shall have in place, a cyber-security framework to identify the critical cyber assets and protect them so as to support reliable operation of the grid. Cyber security is important to protect sensitive and critical data. Compliance to Cyber security standards is essential to protect against identity theft and malware threats.

14.3.2. Recommended practices

Recommended practices for ensuring cyber security are listed below:

- **Physical Security**

– Computer Locks

– BIOS (Basic Input Output System) Security

- **Account & Password Management**

– Only authorized personnel should have access to the computers

– Enforce appropriate/Strong passwords
– Appropriate permissions to access folders /files

- **Data Backup and Restoration**

– Periodical backup individual and organisation's data
– Test restoring data from backup media
– Keep backups offsite
– Keep onsite back up in a secure, fire proof area

- **Operating Systems**

– Check the operating systems we use on our workstations and servers updated with current security "patches" and service packs

- **Application Software**

– Check our common applications (e.g. databases, accounts package) configured for security

- **Confidentiality of Sensitive Data**

– Protect sensitive data under our control

- **Disaster Recovery**

– Prepare disaster recovery plan & test it regularly

- **Network and server security**

– Adopt safe computing policies and procedures
– Providing information about computer security to our staff

- **Hardware failure**

– Keep contact list /resource person in case of hardware failure
– Check whether the contract for service support is good enough to withstand a serious hardware failure

- **Hosted services**

– Keep our website account secure/password protected
– Check whether the website is backed up by the host provider

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- **Government of India legislation and policy**
  - o Electricity Act, 2003
  - o National Electricity Policy, 2005
  - o Tariff Policy, 2006
- **Central Electricity Authority Regulations/Criteria**
  - o Manual on Transmission Network Planning Criteria, January 2013
  - o Grid Standards, Regulations, 2010
  - o Installation and Operation of Meters, Regulations, 2010
  - o Connectivity to the Grid, Regulations, 2007
  - o Technical Standards for Construction of Electric Plants and Electric Lines, 2010
- **Uttarakhand Electricity Regulatory Commission Regulations**
  - o Uttarakhand Electricity Regulatory Commission (Terms and Conditions of Intra-State Open Access) Regulations, 2015
  - o Uttarakhand Electricity Regulatory Commission (Terms and Conditions for Determination of Multi Year Tariff) Regulations, 2015
  - o Uttarakhand Electricity Regulatory Commission (Deviation Settlement Mechanism and related matters) Regulations, 2017
  - o Uttarakhand Electricity Regulatory Commission (State Grid Code) Regulations, 2016
- **Central Electricity Regulatory Commission Regulations**
  - o Open Access in inter-State Transmission Regulations, 2015.
  - o Revised Procedure to 'Measures to relieve congestion in real-time operation', 2013
  - o Indian Electricity Grid Code, 2010
  - o Deviation Settlement Mechanism, Regulation, 2014
  - o Procedure for Scheduling of Bilateral Transaction, June 2009
  - o Detailed Procedure for relieving Congestion in real-time operation, 2013
- NRLDC: Operating Procedure for Northern Region

Format A

List of elements to be charged and Element Rating details

I. List of Elements to be charged:

II. Element Ratings

a. Transmission Line

1	From Substation	
2	To Substation	
3	Voltage Level (kV)	
4	Line Length (km)	
5	Conductor Type	
6	No of sub Conductors	

b. ICT

1	Voltage (HV kV / LV kV)	
2	Capacity (MVA)	
3	Transformer Vector group	
4	Total no of taps	
5	Nominal Tap Position	
6	Present Tap Position	
7	Tertiary Winding Rating and Ratio	
8	% Impedance	

c. Shunt / Series Reactor

1	Substation Name / Line Name	
2	Voltage 3 MVAR Rating	
3	MVAR Rating	
4	Switchable / Non Switchable	
5	In case of Bus Reactor, whether it can be taken as line reactor	

(Name and Designation of the authorized person with official seal)

Format B

< Name and Address of Transmission Licensee>

Undertaking by Transmission Licensee in respect of Protective systems

The following transmission element is proposed to be charged on_____ <date> tentatively around_____ hours.

S no and Name of transmission element

1.0 It is certified that all the systems as stipulated in Part-III of the Central Electricity Authority (Technical Standards for Connectivity to the Grid) Regulations, 2007 (as amended from time to time) have been tested and commissioned and would be in position when the element is taken into service.

2.0 The protective relay settings have been done as per the guidelines of the Regional Power Committee (RPC) as per section 5.2 I of the Indian Electricity Grid Code (IEGC) and section 5.5 of SGC. The necessary changes have also been made/would be made appropriately for the following lines at the following substations:

Sl No	Name of the substation	Name of the line

Place:

Date:

(Name and Designation of the authorized person with official seal)

Format C

< Name and Address of Transmission Licensee>

Undertaking by Transmission Licensee in respect of Energy metering

The following transmission element is proposed to be charged on _____<date> tentatively around_____ hours.

S no and Name of transmission element:

Special Energy Meters (SEMs) conforming to CEA (Installation and Operation of Meters) Regulations, 2006 have been installed and commissioned. The SEMs are calibrated in compliance of regulation 9 of Part-I of CEA (Technical Standard for Grid Connectivity) Regulations 2007 as per the following details:

S no	Name of substation	Feeder name	Make of meter	Meter no	CT Ratio	PT/CVT Ratio
1	Sending end					
2	Receiving end					

Data Format Conformity: Yes / No

Polarity as per Convention: Yes / No

Time Drift Correction carried out: Yes/No

The data from the above meters would be forwarded on weekly basis to the SLDC.

Place:

Date:

(Name and Designation of the authorized person with official seal)

Format D

< Name and Address of Transmission Licensee>

Undertaking by transmission licensee in respect of statutory clearances

It is hereby certified that all statutory clearances in accordance with relevant UERC/CERC Regulations and CEA standards/regulations for charging of_____ have been obtained from the concerned authorities.

Place:

Date:

(Name and Designation of the authorized person with official seal)

Annexure-I

Important Grid Element in Uttarakhand

(In compliance to SGC 6.2 (3))

Table of contents

400 kV HVAC Transmission Lines

S No	Name of the line	Tower Configuration (S/C or D/C)	Type of conductor	Agency at		O & M by	Owned by
				End-I	End-II		
1	Kashipur-Moradabad	S/C	Twin Moose	PTCUL	UPPTCL	PTCUL	PTCUL
2	Rishikesh- Kashipur	S/C	Twin Moose	PTCUL	PTCUL	PTCUL	PTCUL
3	Rishikesh-Roorkee(Puhana)	S/C	Twin Moose	PTCUL	PGCIL	PTCUL	PTCUL
4	Srinagar- VK(Alaknanada) I	D/C	Twin Moose	PTCUL	GVK	PTCUL	PTCUL
5	Srinagar-GVK (Alaknanada) II	D/C	Twin Moose	PTCUL	GVK	PTCUL	PTCUL
6	Kashipur-Bareilly(PGCIL 765 kv)-I	D/C	Quad Moose	PTCUL	PGCIL	PGCIL	PGCIL
7	Kashipur-Bareilly(PGCIL 765 kv)-II	D/C	Quad Moose	PTCUL	PGCIL	PGCIL	PGCIL
8	Kashipur-Roorkee(Puhana)-I	D/C	Quad Moose	PTCUL	PGCIL	PGCIL	PGCIL
9	Kashipur-Roorkee(Puhana)-II	D/C	Quad Moose	PTCUL	PGCIL	PGCIL	PGCIL
10	Roorkee(PGCIL)-Muzaffarnagar	S/C	Twin Moose	PGCIL	UPPTCL	PTCUL	PTCUL/ UPPTCL

220 kV HVAC Transmission Lines

S No	Name of the line	Tower Configuration (S/C or D/C)	Type of conductor	Agency at		O & M by	Owned by
				End-I	End-II		
1	Roorkee-Roorkee(Puhana)	S/C		PTCUL	PGCIL	PTCUL	PTCUL
2	Sidcul-Roorkee(Puhana)	S/C		PTCUL	PGCIL	PTCUL	PTCUL
3	Roorkee-Nara	S/C		PTCUL	UPPTCL	PTCUL	PTCUL
4	Jhajhra-Sherpur(DDN PGCIL)-I	D/C		PTCUL	PGCIL	PTCUL	PTCUL
5	Jhajhra-Sherpur(DDN PGCIL)-I	D/C		PTCUL	PGCIL	PTCUL	PTCUL
6	Khodri-Saharanpur-I	S/C		UJVNL	UPPTCL	UPPTCL	UPPTCL

7	Khodri-Saharanpur-II	S/C		UJVNL	UPPTCL	UPPTCL	UPPTCL
8	Pantnagar-Bareilly	S/C		PTCUL	UPPTCL	PTCUL	PTCUL
9	Kashipur-Mahuakheraganj-I	D/C		PTCUL	PTCUL	PTCUL	PTCUL
10	Kashipur-Mahuakheraganj-II	D/C		PTCUL	PTCUL	PTCUL	PTCUL
11	Kashipur-Pantnagar-I	D/C		PTCUL	PTCUL	PTCUL	PTCUL
12	Kashipur-Pantnagar-II	D/C		PTCUL	PTCUL	PTCUL	PTCUL
13	Pantnagar-Haldwani	S/C		PTCUL	PTCUL	PTCUL	PTCUL
14	Jhajhra-Rishikesh	S/C		PTCUL	PTCUL	PTCUL	PTCUL
15	Jhajhra-Khodri	S/C		PTCUL	UJVNL	PTCUL	PTCUL
16	Rishikesh-Dhrasu-I	S/C		PTCUL	UJVNL	PTCUL	PTCUL
17	Rishikesh-Dhrasu-II	S/C		PTCUL	UJVNL	PTCUL	PTCUL
18	Rishikesh-Chamba	S/C		PTCUL	PTCUL	PTCUL	PTCUL
19	Chamba-Dhrasu	S/C		PTCUL	UJVNL	PTCUL	PTCUL
20	Dhrasu-Maneri-I	S/C		UJVNL	UJVNL	PTCUL	PTCUL
21	Dhrasu-Maneri-I	S/C		UJVNL	UJVNL	PTCUL	PTCUL
23	Chamba-Ghuttu	S/C		PTCUL	BHPL	PTCUL	PTCUL
24	Chibro-Khodri-I	S/C		UJVNL	UJVNL	PTCUL	PTCUL
25	Chibro-Khodri-II	S/C		UJVNL	UJVNL	PTCUL	PTCUL
26	SIDCUL-Rishikesh	S/C		PTCUL	PTCUL	PTCUL	PTCUL

132 KV HVAC Transmission lines

S No	Name of the line	Tower Configuration (S/C or D/C)	Type of conductor	Agency at		O & M by	Owned by
				End-I	End-II		
1	Roorkee-Laksar	S/C		PTCUL	PTCUL	PTCUL	PTCUL
2	Roorkee-Manglour	S/C		PTCUL	PTCUL	PTCUL	PTCUL
3	Roorkee-Chudiyala	S/C		PTCUL	PTCUL	PTCUL	PTCUL
4	Roorkee-LSM	S/C		PTCUL	PTCUL	PTCUL	PTCUL
5	Chudiyala-Bhagwanpur	S/C		PTCUL	PTCUL	PTCUL	PTCUL
6	Roorkee-SIDCUL	S/C		PTCUL	PTCUL	PTCUL	PTCUL
7	Roorkee-Jwalapur	S/C		PTCUL	PTCUL	PTCUL	PTCUL

8	SIDCUL-Jwalapur	S/C		PTCUL	PTCUL	PTCUL	PTCUL
9	Jwalapur-Rishikesh	S/C		PTCUL	PTCUL	PTCUL	PTCUL
10	Jwalapur-Bhupatwala	S/C		PTCUL	PTCUL	PTCUL	PTCUL
11	Jwalapur-Chilla	S/C		PTCUL	UJVNL	PTCUL	PTCUL
12	Mahuakheraganj - Thakurdwara	S/C		PTCUL	UPPTCL	PTCUL	PTCUL
13	Kashipur(4)-Jaspur	S/C		PTCUL	PTCUL	PTCUL	PTCUL
14	Kalagarh-Jaspur	S/C		PTCUL	PTCUL	PTCUL	PTCUL
15	Rishikesh-Sri Nagar line	S/C		PTCUL	PTCUL	PTCUL	PTCUL
16	Rishikesh-Sri Nagar	S/C		PTCUL	PTCUL	PTCUL	PTCUL
17	Kotdwar-Satpuli	S/C		PTCUL	PTCUL	PTCUL	PTCUL
18	Kashipur(400)-Kashipur Ckt-I	S/C		PTCUL	PTCUL	PTCUL	PTCUL
19	Kashipur(400)-Kashipur Ckt-II	S/C		PTCUL	PTCUL	PTCUL	PTCUL
20	Kashipur-MKJ (220) line	S/C		PTCUL	PTCUL	PTCUL	PTCUL
21	Kashipur(400)-Bazpur	S/C		PTCUL	PTCUL	PTCUL	PTCUL
22	Kashipur-Bazpur	S/C		PTCUL	PTCUL	PTCUL	PTCUL
23	Kashipur(400)-Ramnagar	S/C		PTCUL	PTCUL	PTCUL	PTCUL
24	Kalagarh-Ram Nagar Line	S/C		PTCUL	PTCUL	PTCUL	PTCUL
25	Kulhal - Jhajhra	S/C		PTCUL	PTCUL	PTCUL	PTCUL
26	Kulhal Majra	S/C		PTCUL	PTCUL	PTCUL	PTCUL
27	Kulhal-Dhalipur	S/C		PTCUL	PTCUL	PTCUL	PTCUL
28	Bindal- Majra	S/C		PTCUL	PTCUL	PTCUL	PTCUL
29	Bindal-Rishikesh	S/C		PTCUL	PTCUL	PTCUL	PTCUL
30	Purukul-Majra	S/C		PTCUL	PTCUL	PTCUL	PTCUL
31	Khodri-Dhakrani	S/C		PTCUL	PTCUL	PTCUL	PTCUL
32	Majra-Laltapper	S/C		PTCUL	PTCUL	PTCUL	PTCUL

33	Dhalipur-Dhakrani	S/C		PTCUL	PTCUL	PTCUL	PTCUL
34	Purkul-Dhalipur	S/C		PTCUL	PTCUL	PTCUL	PTCUL
35	Jhajhra-Majra	S/C		PTCUL	PTCUL	PTCUL	PTCUL
36	Rishikesh-Lalthaper	S/C		PTCUL	PTCUL	PTCUL	PTCUL
37	Kamluaganj-Haldwani	S/C		PTCUL	PTCUL	PTCUL	PTCUL
38	Kamluaganj-Bazpur	S/C		PTCUL	PTCUL	PTCUL	PTCUL
39	Haldwani-Bhowali	S/C		PTCUL	PTCUL	PTCUL	PTCUL
40	Haldwani-Pant Nagar	S/C		PTCUL	PTCUL	PTCUL	PTCUL
41	Bhawali-Almora	S/C		PTCUL	PTCUL	PTCUL	PTCUL
42	Almora-Pithgarh-Chandak	S/C		PTCUL	PTCUL	PTCUL	PTCUL
43	Almora-Ranikhet	S/C		PTCUL	PTCUL	PTCUL	PTCUL
44	Chandak-Pithoragarh	S/C		PTCUL	PTCUL	PTCUL	PTCUL
45	Sitarganj-Eldico	S/C		PTCUL	PTCUL	PTCUL	PTCUL
46	Kichha-Rudrapur	S/C		PTCUL	PTCUL	PTCUL	PTCUL
47	Pant Nagar-Rudrapur	S/C		PTCUL	PTCUL	PTCUL	PTCUL
48	Kichha-Sitarganj	S/C		PTCUL	PTCUL	PTCUL	PTCUL
49	Khatima-Sitarganj	S/C		PTCUL	PTCUL	PTCUL	PTCUL
50	Piliphit-Sitarganj	S/C		PTCUL	PTCUL	PTCUL	PTCUL
51	Pilibhit - Khatima	S/C		PTCUL	PTCUL	PTCUL	PTCUL
52	PGCIL-Sitarganj - I	S/C		PTCUL	PTCUL	PTCUL	PTCUL
53	PGCIL-Sitarganj - II	S/C		PTCUL	PTCUL	PTCUL	PTCUL
54	Jwalapur-Bhoopatwala	S/C		PTCUL	PTCUL	PTCUL	PTCUL
55	Jwalapur-Rishikesh	S/C		PTCUL	PTCUL	PTCUL	PTCUL
56	Jwalapur-Chilla	S/C		PTCUL	PTCUL	PTCUL	PTCUL
57	Chilla-BPT-	S/C		PTCUL	PTCUL	PTCUL	PTCUL

	Rishikesh						
58	Kotdwar-Najibabad	S/C		PTCUL	PTCUL	PTCUL	PTCUL

400 KV Bus reactors

S No	Bus	Base voltage	Rating (MVAR)	Configuration	Remark
1	Rishikesh	400 kV	50	3-phase	

220 kV and above ICTs

S No	Name	Voltage ratio	MVA rating	Total MVA	Configuration
1	Rishikesh	400/220	315	315	3-phase unit
2	Rishikesh	400/220	240	240	3-phase unit
3	Kashipur	400/220	2*315	630	3-phase unit
4	Srinagar	400/220	2*(3*105)	630	1-phase units
5	Roorkee	220/132	2*160	320	3-phase units
6	Kashipur	220/132	2*160	320	3-phase units
7	SIDCUL	220/132	2*160	320	3-phase unit
8	Pantnagar	220/132	2*160	320	3-phase unit
9	Rishikesh	220/132	2*160	320	3-phase unit
10	Jhajhra	220/132	2*160	320	3-phase unit
11	Srinagar	220/132	2*160	320	3-phase unit
12	Mahuakheraganj	220/132	2*100	200	3-phase unit
13	Haldwani	220/132	2*100	200	3-phase unit

Voltage Ratio	No of ICTs	Total Installed MVA Capacity
400/220	6	1815
220/132	18	2640

GENERATIG UNIT (≥30MW)

S No	Station	Unit No	Fuel Type	Installed capacity (MW)	Effective Capacity (MW)	Total Installed Capacity (MW)
1	Dhrasu	1	Hydro	76	76	304
		2	Hydro	76	76	
		3	Hydro	76	76	
		4	Hydro	76	76	
2	Chibro	1	Hydro	60	55	240
		2	Hydro	60	55	
		3	Hydro	60	55	
		4	Hydro	60	55	
3	Kalagarh	1	Hydro	66	55	264
		2	Hydro	66	55	
		3	Hydro	66	55	
		4	Hydro	66	55	
4	Chilla	1	Hydro	36	36	144
		2	Hydro	36	36	
		3	Hydro	36	36	
		4	Hydro	36	36	
5	Khodri	1	Hydro	30	25	120
		2	Hydro	30	25	
		3	Hydro	30	25	
		4	Hydro	30	25	
6	Maneri	1	Hydro	30	30	90
		2	Hydro	30	30	
		3	Hydro	30	30	
7	GIPL	GT-1	Gas	75	75	225
		GT-2	Gas	75	75	
		GT-3	Gas	75	75	
8	SEPL	GT-1	Gas	225	225	450
		GT-2	Gas	225	225	

Annexure-II

C.4.Best Practices for interrupting charging current when breaker controlling the transmission line is under lockout.

(Extract from Minutes of meeting of NRPC 13th Protection Sub Committee meeting)

SE(O) requested representative of NRLDC to brief the sub committee about the issue. Representative of NRLDC stated that several incidents of multiple lines outages while de-energising the line through isolator have been witnessed in the northern region.

Such requirement arises usually when the circuit breaker controlling the line is under lockout. PSC members agreed that when breaker controlling the transmission line is under lock out. it is not advisable to interrupt the changing current through an isolator.

PSC recommended the following practice to be adopted in such cases.

1. De-energise the bus connecting the line with lockout CB and then open the isolator.

2. If due to some reason it is not possible to open the isolator in above mentioned way, then open the isolator so that no charging current is interrupted through the isolator and the charging current is diverted to other parallel path. Such switching sequence could be possible in case of breaker and half scheme or Double breaker Scheme, which is as follows:

    - Open the line from remote end first with direct trip (DT) disabled. With this now line remains charged from the end where CB has problem.

    - In case of breaker and half scheme open the isolator so that charging current is diverted to the parallel path and after that open the CB of parallel path.

    - In case of double breaker scheme open the isolator of the lockout breaker diverting the charging current to other CB and then open the CB.

    - In case of double main and transfer scheme open the isolator of lockout breaker so that divert the charging current through transfer bus coupler and then open the line through TBC circuit breaker.

PSC also recommended that while vacating a bus in such cases, the operators need to check the switching arrangement for individual feeders so as to avoid unintended loss of any feeder.

The Members agreed to implement the protocol as recommended in PSC meeting.

GUIDELINES FOR SWITCHING OF CAPACITOR BANKS

Appendix-1

GUIDE LINES FOR SWITCHING OF SHUNT CAPACITORS

1. INTRODUCTION

The Operating Committee of NREB has recently made a review of the instructions in vogue in the various systems regarding switching of the shunt capacitors. It is seen that some of the States have the practice of switching OFF the capacitor banks when the power factor of the bus on which the capacitor is connected is higher than 0.95 lagging irrespective of the voltage level. Some are using a thumb rule by which the capacitors are switched ON only when the MW loading on each of the step down transformers at the substation is higher than 2.5 times the MVAR rating of the capacitor bank connected to the LV side of the transformer. Conversely the capacitor bank is switched OFF when the loading on the transformer is less than 2.5 times the MVAR rating of the bank. Some States are following the practice of keeping the capacitors ON except when the voltage on the bus on which the capacitors are connected exceeds the permissible limit even after fully exploiting the on-load tap changes on the transformers. All States have instructions to switch OFF the capacitors when the voltage on the bus on which the capacitors are connected exceeds the permissible value (normally 1.1 per unit) for the safety of the capacitors.

It has been observed that a number of capacitor banks remained OFF even though the EHV voltage in the grid is below the normal level. There is also reluctance to change taps on transformers which are provided with OLTC due to which some times the capacity of the shunt capacitors connected to LV bus is not fully utilized even though the voltage on HV is low. It was felt by the Operating Committee that NREB should prepare uniform guidelines for switching ON/OFF the capacitor banks.

NREB took up the matter with BHEL seeking their advice regarding operation of shunt capacitors when power factor is higher than 0.95 lagging and linking the switching instructions to voltage only. BHEL in their reply (Annex-A) have said that there is no problem for operation of transformers at leading power factor. However, it has to be ensured that the voltage should not exceed 1.1 per unit. Copy of clause 5.2.1 table II of IS 2834, referred in BHEL's letter in this respect is also enclosed at Annex-B.

In view of the above, guide lines for switching ON/OFF capacitor banks have been formulated. In the operating instructions the status of capacitor is based on two factors viz. (i) Loading Factor i.e. Ratio of MVA load on the bus at which the capacitor is installed to the MVAR rating of the capacitor bank and (ii) voltage of the highest voltage bus at the substation (lower voltages including the one at which the capacitor is connected are to be controlled using transformer taps; subject to the maximum permissible voltage at the bus on which the capacitor bank is connected.) The purpose of relating the status of capacitor to the above two factors is to get the full benefit of capacitors in voltage regulation as well as to avoid flow of leading MVAR from LV to HV system under normal and high voltage conditions. Also to limit the number of switching operations, a dead band has been kept between the OFF and ON status of the banks where status-quo is to be maintained.

2. GUIDE LINES/INSTRUCTIONS FOR SWITCHING ON/OFF CAPACITOR BANKS

(1) The status of the capacitor would be determined by the voltage at the highest voltage bus available at the substation, subject to the maximum permissible voltage at the bus on which the capacitor bank is connected and the Loading Factor i.e. Ratio of the total MVA load on the bus at which the capacitor is installed to the MVAR rating of the capacitor.

(2) Accordingly, the switching ON\OFF of the capacitor bank would be done as per the table-1:

(3) Notwithstanding the above if the voltage at the bus on which the capacitor is connected is 1.1. per unit or higher the capacitor will be switched off.

* * *

TABLE-1

Voltage of highest level at the substation

	Above.	Between			Below	
	230	230-220	220-215	215-205	205	for 220 kV level
	140	140-132	132-128	128-122	122	for 132 kV level
	70	70-68	68-65	65-60	60	for 66 kV level
Loading factor	35	35-34	34-32	32-30	30	for 33 kV level
Above 2	OFF	Status-quo	ON	ON	ON	
Between 2-1	OFF	OFF	Status-quo	ON	ON	
Be Below 1	OFF	OFF	OFF	Status-quo	ON	

LV BUS VOLTAGE SHOULD BE CONTROLLED BY CHANGING TRANSFORMER TAPS.

Loading Factor = Ratio of MVA load on the bus at which the capacitor is installed to the MVAr rating of the capacitor bank.

ANNEX-A
(Page 1 of 2)

भारत हेवी इलेक्ट्रिकल्स लिमिटेड भोपाल
Bharat Heavy Electricals Limited Bhopal
Capacitor Engineering Division

Shri Rakesh Nath,
Superintending Engineer (C-IV),
G.O.I., Ministry of Energy
(Deptt. of Power)
Central Electricity Authority,
Northern Regional Elecy. Board,
18-A, Shaheed Jit Singh Sansanwal Marg,
Katwaria Sarai, New Delhi-110 016.

YOUR REF.:

OUR REF.: CPE/AKB/6.1/

DATE: September 19, 1992.

Dear Sir,

Sub.: Operating Instructions of Capacitors.

...

This has reference to your letter No.50/22/NREB/92/9558-59 dt. 28/29-7-1992 addressed to Shri D. Suryanarayana, Sr. DGM., Corp. R&D, who has in turn sent the letter to us for the reply. We have noted the contents of the referred letter and we are of the view that there is no problem for operation of transformers at leading power factor, however, the voltage not to exceed 1.1 per unit. Please note we have been recommending not to operate capacitors in case of leading power factor as this will not result in any saving. Further, if the contention is to operate capacitors at leading power factor and also upto voltage of 1.1 per unit, the restrictions imposed in I.S. 2834 clause 5.1, Table II should be maintained. We hope, we have clarified the points as desired in your letter.

Thanking you,

Yours faithfully,

(A. K. Bhattacharya)
Dy. Gen. Manager, CPE

ANNEX-A
(Page 29)

overloads shall not exceed any one of the limits given in 5.2 to 5.3 and calculated in accordance with Appendix A.

5.2 **Maximum Permissible Voltage** — The shunt capacitors shall be suitable for requirements given in 5.2.1 and 5.2.2.

5.2.1 *Long Duration Voltages* — Capacitor units shall be suitable for operation at maximum permissible voltage levels in accordance with Table 2.

TABLE 2 MAXIMUM PERMISSIBLE VOLTAGES

Operation on	Voltage Factor (Multiple of Rated Voltage V_n)	Maximum Duration	Observation
(1)	(2)	(3)	(4)
Power frequency	1·00	Continuous	Highest average value during any period of capacitor energization. For energization periods less than 24 h exceptions apply in accordance with the values below (*see* B-2)
do	1·10	12 h in every 24 h	System voltage regulation and fluctuations
do	1·15	30 minutes in every 24 h	System voltage regulation and fluctuations
do	1·20	5 min	Voltage rise at light load [*see* B-2.4 (b)]
do	1·30	1 min	
Power frequency having harmonics	Such that the current does not exceed the value specified in 5.3 (*see* B-5 and B-6).		

The amplitude of the overvoltages that may be tolerated without significant deterioration of the capacitor depends on their duration, their total number and the capacitor temperature (*see* B-2). It is assumed that the over voltages given in Table 2 and having a value higher than 1·15 V_n occurs not more than 200 times in the capacitor's life.

5.2.2 *Switching Voltages* — The residual voltage on a capacitor prior to energization shall not exceed 10 percent of the rated voltage. The energization of a capacitor bank by a re-strike-free circuit-breaker usually causes a transient overvoltage, the first peak of which does not exceed $2\sqrt{2}$ times the appplied voltage (rms value) for a maximum duration of $\frac{1}{4}$ cycle.

Thermal Loading/Limits of Lines as per CEA

Annex- IV

Extracts from CEA **'Manual on Transmission Planning Criteria- Jan 2013'**

Thermal Loading Limits for ACSR Zebra equivalent Conductors

Conductor Type (metallic area) and Dimension	Ambient Temperature (deg C)	AMPACITY FOR Maximum Conductor Temperature (deg C)					
		65	75	85	95	120	150
ACSR Zebra (484 Sq.mm) Dia:28.62mm	40	473	643	769	NA	NA	NA
	45	346	560	703	NA	NA	NA
	48	240	503	661	NA	NA	NA
	50	128	462	631	NA	NA	NA
Conductor Type (metallic area) and Dimension	Ambient Temperature (deg C)	AMPACITY FOR Maximum Conductor Temperature (deg C)					
		65	75	85	90	95	120
AAAC (479.00 sq mm) Dia:28.42 mm	40	471	639	765	818	866	NA
	45	345	557	700	758	811	NA
	48	240	501	657	720	776	NA
	50	130	460	627	693	751	NA

Thermal Loading Limits for ACSR Moose equivalent Conductors

Conductor Type (metallic area) and Dimension	Ambient Temperature (deg C)	AMPACITY FOR Maximum Conductor Temperature (deg C)					
		65	75	85	95	120	150
ACSR Moose (597 Sq.mm) Dia:31.77mm	40	528	728	874	NA	NA	NA
	45	378	631	798	NA	NA	NA
	48	247	565	749	NA	NA	NA
	50	83	516	714	NA	NA	NA
Conductor Type (metallic area) and Dimension	Ambient Temperature (deg C)	AMPACITY FOR Maximum Conductor Temperature (deg C)					
		65	75	85	90	95	120
AAAC (570.00 sq mm) Dia:31.05 mm	40	509	699	839	898	952	NA
	45	366	606	766	831	890	NA
	48	243	543	719	789	851	NA
	50	96	497	686	759	825	NA

Thermal Loading Limits for Snowbird conductor

Conductor Type and Dimension	Ambient Temperature (deg C)	AMPACITY FOR Maximum Conductor Temperature (deg C)					
		65	75	85	95	120	150
ACSR Snowbird 552.23sq mm Dia:30.57mm	40	529	726	870	NA	NA	NA
	45	382	630	795	NA	NA	NA
	48	256	565	746	NA	NA	NA
	50	110	517	712	NA	NA	NA

Thermal Loading Limits for Bersimis equivalent conductors

ACSR Bersimis

Conductor Type and Dimension	Ambient Temperature (deg C)	AMPACITY FOR Maximum Conductor Temperature (deg C)					
		65	75	85	95	120	150
ACSR Bersimis 724.69sq.mm Dia:35.04 mm	40	606	848	1024	NA	NA	NA
	45	423	732	933	NA	NA	NA
	48	256	653	874	NA	NA	NA
	50		594	833	NA	NA	NA

AAAC BERSIMIS

Conductor Type and Dimension	Ambient Temperature (deg C)	AMPACITY FOR Maximum Conductor Temperature (deg C)					
		65	75	85	90	95	120
AAAC Bersimis 766.86Sq.mm Dia:36 mm	40	562	788	953	1022	1085	NA
	45	388	679	868	945	1014	NA
	48	228	605	813	896	969	NA
	50		550	774	861	938	NA

Thermal Loading Limits for Lapwing conductor

ACSR LAPWING

Conductor Type and Dimension	Ambient Temperature (deg C)	AMPACITY FOR Maximum Conductor Temperature (deg C)					
		65	75	85	95	120	150
ACSR Lapwing 863.47Sq.mm Dia:38.22 mm	40	635	899	1090	NA	NA	NA
	45	430	773	992	NA	NA	NA
	48	234	686	928	NA	NA	NA
	50		622	883	NA	NA	NA

The above data has been calculated based on following assumptions:

- Solar radiations = 1045 W/m^2.
- Wind Speed = 2 km/hour
- Absorption Coefficient = 0.8
- Emissivity Coefficient = 0.45
- Age > 1 year

Format of monitoring TTC/ATC

Annex-V
Format-I

State Load Despatch Centre, Dehradun

TOTAL TRANSFER CAPABILITY FOR mmmm, yyyy

Issue Date: Issue Time: Revision No.

Corridor/ Control Area	Date	Time Period	Total Transfer Capability (TTC) (MW)	Reliability Margin (RM) (MW)	Available Transfer Capability (ATC) (MW)

Assumptions:

A. Load (MW)

Region / Entity Name	Peak Load	Off Peak Load
Total		

B. Generation(MW)

	Thermal		Hydro	
	Peak	Off Peak	Peak	Off Peak
ISGS				
State				

C. Major Transmission Line Outages

	Element	Voltage (kV)	Remarks
Central Sector			
State Sector			

D. Generation Outages

	Generating Unit	MW	Remarks
Central Sector			
State Sector			

E. HVDC Settings

Name	Setting (MW)

F. Constraints

G. Miscellaneous

Note: Format may be changed as per requirement with prior approval of the Commission.

List of lines in major corridors/flow gates

Flowgate 1: UP-Uttarakhand (Garhwal region)

1. 400 kV Roorkee(Puhana)-Muzaffarnagar
2. 400 kV Roorkee(Puhana)-Saharanpur
3. 400 kV Dehradun(Sherpur)-Baghpat
4. 220 kV Roorkee-Nara

Flowgate 2: UP-Uttarakhand (Kumaon region)

1. 400 kV Kashipur-Moradabad
2. 400 kV Kashipur-Bareilly-I
3. 400 kV Kashipur-Bareilly-II
4. 220 kV Pantnagar-Bareilly
5. 132 kV Pilibhit-Khatima
6. 132 kV Pilibhit-Sitarganj
7. 132 kV Kalagarh-Afzalgarh
8. 132 kV Kalagarh-Dhampur

Flowgate 3: PTCUL-PGCIL (Garhwal region)

1. 400 kV Roorkee(Puhana)-Rishikesh
2. 220 kV Roorkee(Puhana)-Roorkee
3. 220 kV Roorkee(Puhana)-SIDCUL
4. 220 kV Jhajhra-Dehradun(Sherpur)-I
5. 220 kV Jhajhra-Dehradun(Sherpur)-II

Flowgate 4: PTCUL-PGCIL (Kumaon region)

1. 400 kV Roorkee(Puhana)-Kashipur-I
2. 400 kV Roorkee(Puhana)-Kashipur-II
3. 132 kV Sitarganj-Sitarganj(PGCIL)-I
4. 132 kV Sitarganj-Sitarganj(PGCIL)-II
5. 132 kV ELDECO-Sitarganj()
6. 132 kV Almora-Pithoragarh(PGCIL)
7. 132 kV Pithoragarh-Pithoragarh(PGCIL)

Annexure-VII

List of Entities in Uttarakhand whose schedules to be coordinated by SLDC

S No	Entity name	Installed Capacity (MW)	Organization	Fuel type
1	Dhrasu	4*76	UJVN Ltd	Hydro
2	Chibro	4*60	UJVN Ltd	Hydro
3	Kalagarh	4*66	UJVN Ltd	Hydro
4	Chilla	4*36	UJVN Ltd	Hydro
5	Khodri	4*30	UJVN Ltd	Hydro
6	Maneri	3*30	UJVN Ltd	Hydro
7	Dhalipur	3*17	UJVN Ltd	Hydro
8	Dhakrani	3*11.25	UJVN Ltd	Hydro
9	Kulhal	3*10	UJVN Ltd	Hydro
10	Pathri	3*6.8	UJVN Ltd	Hydro
11	Mohammedpur	3*3.1	UJVN Ltd	Hydro
12	BHPL	3*8	BHPL	Hydro
13	GIPL	2*75	GIPL	Gas
14	SEPL	2*225	SEPL	Gas

Annexure-VIII

Protection Philosophy agreed for implementation in Northern Region

S.No	Protection Setting	Reach & Time
1.	**Long lines Zone-1**	80% of the Protected line, Instantaneous
	Zone-2	100% of the Protected line + 50% of the shortest line emanating from the far end bus bar or 120% of the Protected line which ever is higher. Time Setting: 350ms for short lines (≤ 100km) and 500ms for long lines > 100km.
	Zone-3	120% of the protected line + 100% of the longest line emanating from the far end bus bar or 100% of the Protected line + 100% of the longest line emanating from the far end bus bar + 25% of the longest line emanating from the far end of the second line considered, which ever is lower. The zone setting to be limited such that it will not reach into the next voltage level. Time Setting: 1000m sec.
	Zone- 3R	25% of the Zone-1 reach. Time Setting: 1000m sec
2.	**Lines with Series and other compensations in the vicinity of Substation**	80% of the Protected line. 100ms-time delay for allowing correct distance measurement after the series capacitor is bypassed.
3.	**Power Swing Blocking**	Block tripping in all zones, all lines. Out of Step tripping to be applied on all inter regional tie lines Deblock time delay = 2s
4.	**Protection for broken conductor**	Negative Sequence current to Positive Sequence current ratio more than 0.2(I2/I1 ≥ 0.2) Only for alarm: Time delay = 3-5 sec
5.	**Carrier Protection**	To be applied on all 400kV and 220kV lines with the only exception of radial feeders.
6.	**Back up Protection**	1) On 400 & 220kV lines with 2 Main Protections, back up Earth Fault protections alone to be provided. No Over current protection to be applied. 2) On 220kV and lower voltage lines with only one Main protection Back up protection by IDMT O C and E F to be applied.
7.	**Auto Re-closing with dead time.**	Single pole trip and re-closing Dead time = 1.0s. Reclaim time = 25.0s
8	**LBB Protection and bus bar protection**	To be applied on all 400kV and 220kV sub stations with the only exception of 220kV radial fed bus bars. LBB Current sensor I > 20% In LBB time delay = 200ms

Annexure-IX

PERMISSIBLE FREQUENCY RANGE FOR OPERATION OF VARIOUS MAKES OF STEAM TURBINE

PERMISSIBLE FREQUENCY RANGES FOR OPERATION OF VARIOUS MAKES OF STEAM TURBINES			
S.NO.	TURBINE	FREQUENCY(HZ.)	TIME FOR OPERATION
1	100 MW,200 MW,210 MW of Russian Design	49 0 to 50 5	Continous unrestricted operation
		50 5 to 51 0	3 minutes at a stretch and 500 minutes in whole life
		48 0 to 49 0	3 minutes at a stretch and 500 minutes in whole life
		47 0 to 48 0	1 minute at a stretch and 180 minutes in whole life
		46 0 to 47 0	10 seconds at a stretch and 30 minutes in whole life
2	210 MW , 500 MW of KWU design	47 5 to 51 5	Continous unrestricted operation
		Below 47 5	2 hours in whole life
		Above 51 5	2 hours in whole life
3	200 MW of GE (ANSALDO) design	48 5 to 50 5	Continous unrestricted operation
		50 5 to 51 0	90 minutes in whole life
		48 0 to 48 5	90 minutes in whole life
		51.0 to 51 5	15 minutes in whole life
		47 5 to 48 0	15 minutes in whole life
		51 5 to 52 0	1 minute in whole life
		47 0 to 47 5	1 minute in whole life
4	RAPS/NAPS 2x220 MW English Electric	48 5-Operating Frequency	Summation in lifetime t<= 3 minutes where 't' is the operating time for incidents of frequency excursion below 48 5 Hz
		>51 5	Not recommended
5	110 MW of Skoda Design	49 0 - 51 0	Continous unrestricted operation
		48 0 - 49 0	2 hours at a stretch and 30 hours in a year
		47 0 - 48 0	30 minutes at a stretch and 2 hours in a year

Source : Extracts from the report of "Task Force on Frequency Control" NREB,1992 in the PSEB letter dated 06-10-1998

Annex-X

Fax & Ph. : 26865206 & 26513265

E-mail : nrebops@yahoo.com

भारत सरकार
Government of India
उत्तर क्षेत्रीय विद्युत समिति
Northern Regional Power Committee
18-ए शहीद जीत सिंह मार्ग, कटवारिया सराय, नई दिल्ली- 110016
18-A, Shaheed Jeet Singh Marg, Katwaria Sarai, New Delhi-110016

No. NRPC/OPR/105/07/2622-41

Dated: 31.07.2013

To,

MD, PTCUL, Dehradun, (Fax- 0135-2764496)	Chairman, BBMB, Chandigarh, (Fax-0172-2549857/2652820)
CE, UT Chandigarh, (Fax-0172-2740276)	CMD, DTL, New Delhi, (Fax-011-23234640)
MD, HVPNL, Panchkula, (Fax-0172-2560640)	CMD, HPSEB Ltd, Shimla, (Fax-0177-2658984)
Principal Secretary to Govt. of J&K, PDD, J&K (Fax-0191- 2545447/ 0194-2452352)	CMD, PSTCL, Patiala, (Fax-0175-2307779)
CMD, RRVPNL, Jaipur, (Fax -0141-2740168)	CMD, UPPTCL, Lucknow, (Fax-0522-2287792)
C.E. (SLDC), UPPTCL, Lucknow, (Fax-0522-2287792)	Development Commissioner (P), PDD, Srinagar, J&K, (Fax-0194-2452173)
GM(SLDC), DTL, New Delhi, (Fax-011-23221012)	CE (SO&C), SLDC, Panchkula, Fax-0172-2560622
SE, SLDC, HP LDS, Shimla, (Fax-0177-2837543)	Managing Director, SLDC, PTCUL , Rishikesh, (Fax-0135-2451160)
Chief Engineer (SLDC), PSTCL, Fax – 0175-2365340	CE (LD), RVPNL, Fax- 0141-2740920

Subject: **Revised scheme for automatic load shedding through Under Frequency Relays (UFR)**

Sir,

In the 2nd meeting of National Power Committee (NPC) held on 16.07.2013, following setting were decided for four stage automatic load shedding scheme through UFRs for NEW grid. It was further decided that the complete revised scheme would be implemented within 3 months.

Frequency (Hz)	Required Load Relief (MW)				
	NR	WR	ER	NER	Total
49.2	2160	2060	820	100	5140
49.0	2170	2070	830	100	5170
48.8	2190	2080	830	100	5200
48.6	2200	2100	840	100	5240
Total	**8720**	**8310**	**3320**	**400**	**20750**

2. The issue of segregating the regional target into target for individual states/UT was discussed in the 89th meeting of Operation coordination sub-committee (OCC) held on 19th July 2013 and it was agreed that this segregation would be done pro-rata to the peak met of the states/UT for the year 2012-13. It was further agreed that this calculation would be done by NRPC Secretariat and would be conveyed to all states/UT. Accordingly, the target of automatic load shedding for individual states/UT has been worked out as under:

S.No.	State/UT	Peak Met during 2012-13 (MW) (Source:CEA)	Load shedding Target for four stages (MW)- Based on maximum load on the feeders			
			49.2 Hz	49.0 Hz	48.8 Hz	48.6 Hz
1	Chandigarh	340	16	16	16	16
2	Delhi	5642	258	259	262	263
3	Haryana	6725	308	309	312	314
4	Himachal Pradesh	1672	77	77	78	78
5	Jammu & Kashmir	1817	83	84	84	85
6	Punjab	8751	400	402	406	408
7	Rajasthan	8515	390	392	395	397
8	Uttar Pradesh	12048	551	554	559	561
9	Uttarakhand	1674	77	77	78	78
	Total	**47184**	**2160**	**2170**	**2190**	**2200**

3. As the scheme is to be implemented within 3 months, it is requested that immediate action for identification of feeders and procurement of relays may be initiated. Further, while procuring the relays, the functional requirement indicated by POWERGRID for ensuring that the relays are able to communicate with control centres, should be ensured.

Yours faithfully,

P.K. Pahwa 31/7/13

(P.K. Pahwa)
Member Secretary

Copy to:

1. Member (GO&D), CEA, New Delhi
2. General Manager, NRLDC, New Delhi

State wise load relief of df/dt relays is as given below.

STATES	Load relief in MW			
	Stage-I	Stage-II	Stage-III	Total
	49.9Hz& 0.1 Hz/sec	49.9Hz&0.2 Hz/sec	49.9Hz&0.3 Hz/sec	
Punjab	430	490	490	1410
Haryana	280	310	310	900
Rajasthan	330	370	370	1070
Delhi	250	280	280	810
UP	500	280	280	1060
Uttarakhand	70	70	70	210
HP	50	70	70	190
J & K	90	90	90	270
Chandigarh	0	50	50	100
TOTAL	2000	2010	2010	6020

(c) Form of Written Reports:

A written report shall be sent to NLDC, RLDC, ,a User, STU,CTU ,SLDC, as the case may be, in the reporting formats as devised by the appropriate load despatch Centre and will confirm the oral notification together with the following details of the event:

I Time and date of event

ii Location

iii Plant and/or Equipment directly involved

iv Description and cause of event

v Antecedent conditions of load and generation, including frequency, voltage and the flows in the affected area at the time of tripping including Weather Condition prior to the event

vi Duration of interruption and Demand and/or Generation (in MW and MWh) interrupted

vi All Relevant system data including copies of records of all recording instruments including Disturbance Recorder, Event Logger, DAS etc

vii Sequence of trippings with time.

viii Details of Relay Flags.

ix Remedial measures.

(Signature).

Annexure - XII

Format for Preliminary Report

State Load Dispatch Center, Dehradun

Priliminary Report

Date and Time of Event			
Introduction of Event			

Weather	
Loss of Gen (MW)	
Name of Plant Affected	
Loss of Load (MW)	
Area Affected	
Substations Affected	
Antecedent Condition:-	
Frequency (Hz)	
Uttarakhand Demand Met (MW)	
Total Import by Uttarakahnd (MW)	
400 KV Kashipur- Bareilly line I & II Flow (MW)	
400 KV Muzaffarnagar- Puhana Line Folw (MW)	
400 KV Kashipur- Mordabad Line Flow (MW)	

Tiggering incident:-	

Description	

It is requested to kindly forward the details of tripping in your area, during above incident for further analysis. Disturbance Records/ Event Logger output and analysis associated with above incident may kindly be forwarded in line with Section 6.10.6 of the State Grid Code (SGC)

Signature