MINUTES OF THE 2nd MEETING OF THE PROTECTION SUB-COMMITTEE
HELD ON 08th DECEMBER 2006.

The 2nd meeting of Protection Sub-Committee was held on 08th December 2006 in the Conference Hall of Southern Regional Electricity Board, Bangalore. The list of participants is at Annexure I.

Shri K. Srinivasa Rao, Member-Secretary, SRPC welcomed the participants to the 2nd meeting of the Protection Sub-Committee. He said that the first meeting of Protection Sub-Committee was held on 25th July 2006 wherein it was decided to have meeting of working group one day earlier to Protection sub-committee as was practiced earlier. For this members were requested to intimate the nominations for working group in respect of their organizations. Member-Secretary pointed out that when compared to earlier Protection Committee, the new Protection Sub-Committee would have additional Members from LDCs, DISCOMs, Traders and IPPs and would thus help in improved representation from Power Sector in the Region for interactive and useful solutions to the problems

He added that the agenda points included the islanding scheme for NTPC Ramagundam, NTPC Talcher TPS and Kaiga generating station and requested the Members for their active participation to achieve most optimal solutions. He requested the Members to accord their approval to the minutes of the last Protection committee meeting.

The Agenda items were then taken up for discussion and the proceedings are detailed as under:

1. **Confirmation of the minutes of the 1st meeting of Protection Committee held on 25th July 2006.**

   The Committee confirmed the minutes of the 1st meeting of Protection Sub-Committee held on 25th July 2006.

2. **SYSTEM OCCURRENCE:** Various system occurrences during the period were analysed. Details are as under: _
2.1  **System Occurrence in AP system on 27.07.2006  06.20 hrs.**

2.1.1 On 27.07.2006 at 0620hrs, B-Phase jumper between CT and line isolator of Tallapally – Srisailam 220 kV feeder –I got cut and created fault. Prior to the incident, the cable supplying DC supply to the relay panel of Tallapally – Srisailam feeder –I has got cut. So as a precautionary measure the Tallapally – Srisailam feeder –I was hand tripped at Srisailam end. It means that the feeder was ideally charged from Tallapally.

2.1.2 The non-clearance of fault due to DC supply failure resulted in tripping of all feeders and transformers at remote end except Tallapally-N’Sagar 220 kV feeder II.

2.1.3 The Tallapally-N’Sagar 220 kV feeder II connected to Bus-2 of N’Sagar did not open due to struck breaker condition. This caused operation of LBB protection of Bus-2 of N’Sagar and all the feeders connected to 220 kV Bus-2 of N’Sagar station got tripped.

2.1.4 During the above occurrence no interruption of supply to loads was reported. The system was normalised at 8.36 hrs on 27.07.2006.

   The committee analysed the above incident and appreciated the precautionary steps taken by APTRANCO. The committee suggested specially in cases of DC cable failure, hand tripping of breaker could be resorted for achieving better results.

2.2  **System Occurrence in Karnataka system on 9.08.2006 16:19hrs.**

2.2.1 On 09.08.2006 at 16.19hrs, the ‘B’ phase jumper of bus side breaker of Somanahalli-Yerandahalli line got cut and created fault on 220 kV Somanahalli substation.

2.2.2 As there is no Bus Bar protection at Somanahalli 220 kV substation the following elements tripped at from remote end on distance protection operation:
   - Somanahalli 400/220 kV ICT 1&2
   - Somanahalli- HSR Layout 220 kV line
   - Somanahalli- ITPL 220 kV line
   - Somanahalli- NRS 220 kV line
   - Somanahalli- T.K Halli-Hootagalli 220 kV line at Hootagalli and T.K Halli
   - Somanahalli- Subramanyapura-Peenya 220 kV line at Peenya

   Non-operation of relays at Subramanyapura was checked, tested and subsequently set right by KPTCL.
2.2.3 Due to sudden load throw of at Somanahalli the following elements tripped on overvoltage:

- Somanahalli- Nelangala 400 kV Line
- Nelangala-Mysore 400 kV Line I
- Nelangala-Talaguppa 400 kV Line I & II
- Nelangala-Hiriyur 400 kV Line I & II
- Guttur-Hiriyur 400 kV Line I & II
- Kaiga-Guttur 400 kV Line II
- Kaiga-Narendra 400 kV Line I
- N'Sagar-Mehboobnagar 400 kV Line

2.2.4 During the above incident Nelmanagala-Hoody line was under LC and Kaiga-Narendra line II was kept out of service to contain over voltage. Power Swing was observed by the relays on the Nelangala-Somanahalli 400 kV line.

2.2.5 The load affected in Karnataka system was about 225 MW. The system was normalised between 16.20 hrs and 19.24 hrs on 09.08.2006.

The committee analysed the incident and found that simultaneous operation of relays at T.K Halli and Hootagalli needed revision of relay settings and also that there were simultaneous trippings of double circuit at 400 kV level. The committee suggested that at 400 kV level wherever multi circuits were there, constituents can decide and implement appropriate time graded trippings of lines on over voltage.

2.3 System Occurrence in Karnataka system on 15.09.2006 16.52hrs.

2.3.1 On 15.09.2006 at 1652hrs, the B Phase PIR (Pre Insertion Resistor) of transfer bus breaker blasted which damaged the main contacts of B ph limp and due to this blasting petticoats of main contact of Y ph limp, petticoats of grading capacitor unit of R ph limp were damaged causing bus fault at Hoody 400 kV substation.

2.3.2 Prior to the incident Gooty bus voltage was 432 kV and to contain the over voltage, 400 kV Gooty-Hoody line was hand tripped at Gooty end. On receipt of direct trip from Gooty transfer bus breaker also tripped, but B phase PIR did not open due to some problem in the breaker. On that day transfer bus breaker was in service as Hoody-Gooty Line breaker (as main breaker was out of service).

2.3.3 DR print out of Hoody indicates current spikes (through PIR of the breaker) in B-phase of Hoody-Gooty line 700 msec after breaker tripping, which continued for about 20 seconds. Current spikes are irregular and of varying magnitude and the corresponding voltage waveforms are also irregular.

2.3.4 The prolonged conduction for about 20 seconds caused the failure of B phase PIR and it blasted creating a bus fault on 400 kV Hoody bus. Since the breaker has
already opened, LBB protection operated and tripped all the 400 kV lines and ICT breakers for clearing the fault.

2.3.5 But before LBB protection initiated trippings (LBB operation time is around 300 msec) could take, both the poles of HVDC Talcher-Kolar link tripped after sensing the fault on Kolar 400 kV AC bus for 240 msec, on commutation failure protection.

2.3.6 As per the existing inter-trip schemes in event of pole trippings, Stage I & Stage II inter-trip signals to identified locations was sent giving a load relief of 1155 MW in SR grid and Unit 4, 5 & 6 tripped at Talcher STPP.

2.3.7 During the incident 1887 MW of export was lost at Kolar and the frequency dipped from 49.71 to 49.29 htz.

2.3.8 The HVDC poles 1 & 2 were brought back into service at 17.32 hrs and 17.34 hrs respectively on 15.09.2006. Unit 3, 4 & 5 were synchronized at 18.22 hrs, 18.49 hrs and 19.04 hrs respectively on 15.09.2006.

The sub-committee analyzed the incident and issue of concern raised by the members was HVDC pole tripping within Zone 2 / LBB operation timings. SRTS II representative said in the existing setup, there were two systems (System I and System II) having time constant of 200msec for monitoring the commutation failure whenever phase to neutral voltages are about 0.5 p.u after which system is declared inactive which results in pole tripping. He further said the issue was referred to Seimens and two modifications were carried out in the existing scheme of detection of commutation failure

(i) In addition to phase to neutral voltage, phase-to-phase and multiphase voltages would be monitored.

(ii) The monitoring will be done by system I for 200 msec and the standby system II for 30 seconds.

After modifications the commutation failure would be observed for 1100 msec as compared to 200 msec earlier and after that only pole tripping would take place. These modifications were done 21.09.2006. Subsequent to this there was a bus fault on Hoody 400 kV station on 27.09.2006 that was cleared on LBB protection. That means the poles survived for an external fault in ac system for 460 msec.

2.4 System Occurrence in Karnataka system on 01.10.2006 09.26 hrs.

2.4.1 On 01.10.2006 at 09.26 hrs, insulator of C Phase bye pass isolator of 220 kV Varahi line-II has flashed over at Shimoga, creating a fault. As there is no bus bar protection at Shimoga the following elements tripped at Shimoga:
Sharavathi Line 3 on 67 N  
Davanagere Line 1 & 2 on 67 N  
A. Halli line DP  
K. Halli line on 67 N  
Kadur line on 67 N  
Mysore Line 2 on 67 N  
3X100 MVA transformer on 67 N

At far end of Shimoga following lines tripped
Shraravathi Line 1, 2, 4 on DP Z2  
Varahi Line 1, 2 on DP Z2  
Davanagere 1, 2 on DP Z2  
Hassan Line on DP Z2  
Mysore Line 1 on DP

Varahi Unit 2 tripped and Unit 1 continued feeding Mangalore load in radial mode.

2.4.2 The System was normalised on 01.10.2006 between 09.48 hrs and 10.02 hrs.

KPTCL representative informed that bus bar protection has been commissioned at Shimoga. All the controls except for one 100 MVA bay controls has been shifted to the new control room. The reason for DEFR operations at Shimoga is that some of panel wiring was not done as per the drawings supplied. This was set right subsequently and action is being taken to commission Bus Bar protection at the earliest.

2.5 System Occurrence at Neyveli TS II 400 kV switchyard on 29.10.2006 23.32hrs.

2.5.1 The station generation at NLC TPS-II was 270 MW with units 4 & 7 in service. The units 1, 2, 3, 5 and 6 were under shutdown. Madras feeder was on transfer bus.

2.5.2 On 29.10.2006 at 23.32 hrs, 400 kV B Phase CT of ICT-2 at 400/230 kV NLC TPS-2 substation exploded. ICT-2 tripped on differential protection. Unit-4 also tripped on differential protection simultaneously.

2.5.3 On the same day at 23.37 hrs, B/B protection operated at 400/230 kV NLC TPS-2 substation and all elements connected to Bus 1 & 2 tripped. Unit-7 went on house load initially but subsequently it also tripped.

2.5.4 The system was normalised by charging ICT-1 on 30.10.2006 at 01.20 hrs.

NLC representative informed that there was fire due to explosion and the flame has spread in front of the CT secondary side that was quenched by
The faulty B Phase CT was replaced with the new one and was normalised on 31.10.2006 at 19.00 hrs.

During the above incident the Disturbance Recorders and event loggers were not in service. Committee requested NLC and other constituents to take necessary steps to keep DRs and SERs always in service, lest the vital information for fault analysis do not become available.

2.6 System Occurrence in Karnataka system on 1.11.2006 14.08hrs.

2.6.1 Prior to the occurrence the following were the generation in Karnataka system:

<table>
<thead>
<tr>
<th>Generation</th>
<th>MW</th>
</tr>
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<tbody>
<tr>
<td>SGS</td>
<td>650</td>
</tr>
<tr>
<td>NPH</td>
<td>560</td>
</tr>
<tr>
<td>Varahi</td>
<td>115</td>
</tr>
<tr>
<td>Kadra</td>
<td>NIL</td>
</tr>
<tr>
<td>Kodasalli</td>
<td>NIL</td>
</tr>
<tr>
<td>RTPS</td>
<td>1356</td>
</tr>
<tr>
<td>Kaiga</td>
<td>310</td>
</tr>
</tbody>
</table>

2.6.2 The following 400/220 kV lines & ICTs were not in service in Karnataka system prior to the occurrence:

- Nagjhari-Ambewadi 220 kV line-1 was opened on L/C at 0905 hrs
- Ambewadi – Narendra 220 kV line-1 was opened for limiting overloading of Nagjhari-Ambewadi line-2

2.6.3 On 01-1-2006 at 14.08 hrs jumper between breaker isolator and CT of Narendra-Ambewadi line-1 got cut and created a bus fault. Since there was no bus bar protection available at 220 kV Narendra station, the following lines tripped at remote end:

- Hubli – Narendra line 1&2 on DP.
- Guttur-Narendra 220 kV line on DP.
- Ambewadi-Narendra 220 kV line 2 on DP.
- Belgaum-Narendra 220 kV line 1 & 2 on DP

2.6.4 After the above tripping the fault was being fed at Narendra through 2X315 MVA, 400/220 kV ICTs at Narendra 400 kV substation.

2.6.5 At Kaiga generators 1 and 2 were continuously feeding the fault for about 1.8 seconds through Kaiga-Narendra 400 kV DC line. The back up earth fault protection of generator transformer-I&II picked up causing tripping of both the
GTs. The Units went on house load operation. In Unit 1 of KGS there was AVR auto pulse failure and AVR went in manual mode and the generator finally tripped on over voltage and got poisoned out.

2.6.6 With the GTs tripping there was a reversal of power flow on Kaiga-Guttur 400 kV line from 148 MW to (-) 35 MW.

2.6.7 The 400/220 kV ICT 1 & 2 at Narendra 400 kV substation tripped on HV side over current & earth fault current protection after feeding the fault for about 2.6 seconds. The Kaiga-Narendra Line 1 & 2 tripped at Kaiga on over voltage protection and on receipt of direct trip at Narendra end. Kaiga- Kadra 220 kV line and Kaiga- Kodasalli 220 kV tripped on back up over current protection at Kaiga.

2.6.8 During the incident loads of Belgaum, Narendra and Chikkodi 220 kV stations were affected.

2.6.9 The system was normalised by synchronising Unit-2 of KGS at 14.26 hrs. The 400 kV Kaiga-Narendra Line-1 was normalised at 17.06 hrs and line II kept open due to high voltage prevailing in that area.

While analysing the incident it was found that Event Logger and Disturbance recorder at 400 and 220 kV was not time synchronised at Kaiga. So the exact sequence of events could not be arrived at. Kaiga representative suggested change of setting for DEFR/DOCR of Narendra ICTs and Back up earth fault setting of Kaiga-Narendra 400 kV line so that fault feeding time can be minimised as an interim solution (as there was no bus bar protection at Narendra 220 kV substation). After deliberation on the issue it was decided that relay settings in Kaiga-Nagjhari –Narendra corridors needs to be looked into in totality for arriving at proper relay coordination. Relays at Kaiga are set to see faults beyond 100% to avoid fault feeding due to resistive fault in the Kadra-Kodasalli-Nagjhari corridor as the relays at the KPCL stations do not have resistive reach feature, which KPCL was proposing to replace it by new relays having resistive reach by February 2007.

For reviewing the relay settings in Kaiga-Nagjhari –Narendra corridors it was decided a special group can be formed having representation from all the members. The group will visit Kaiga and the review the settings and submit its report within a month’s time. Member secretary requested AGM SRLDC Shri P.R. Raghuram to coordinate in this regard.

3. **Minor Trippings.**
Details of minor trippings in the region subsequent to the 1st meeting of the Protection Sub-Committee are furnished at Annexure – II.

4. **Issues related to evacuation of power from Kaiga Generating Station:**
4.1 **Tripping of transmission lines connected to Kaiga generating station.**
Details of tripping of lines connected to Kaiga generating station are furnished at Annexure – III.

4.2 **Review of the progress on the remedial measures in Kaiga - Kadra - Kodasalli -Nagjhari block.**
The status on the follow-up points discussed in the last Protection Committee meeting was reviewed by the Committee and is as given below:

4.2.1 KPTCL and KPCL had agreed to coordinate mutually and implement the carrier protection scheme for all the lines interconnecting Kaiga, Kadra, Kodasalli and Nagjhari stations. In this connection, Carrier protection has been commissioned on Kaiga – Guttur circuit - 2 with its up-gradation to 400kV level. For other lines, all necessary materials were available with KPTCL and award towards labour portion was already approved and Work order was to be issued by CE (LD). In the last meeting, KPTCL representative informed the committee that they could not award the contract owing to restrictions on the cost and they were processing for issuing NIT. KPTCL intimated vide letter-dated 19.06.2006 that the work would be taken up in a week’s time and completed in 15 days there afterwards.

In the 1st meeting of Protection Sub-Committee KPTCL representative informed the Committee that they have completed all the jobs pertaining to other stations and were awaiting for the clearance from Kaiga, as Kaiga is to cooperate for completing the works at Kaiga end. Responding to this Kaiga representative informed the committee that they wanted the carrier protection scheme to be commissioned only after the replacement of distance protection relays with new ones, with resistive reach cards, in all the connected KPCL generating stations. He expressed his concern of Kaiga Units feeding un-cleared faults in this corridor and getting poisoned out. In the above circumstances the committee requested KPTCL to commission the carrier aided distance protection scheme between Kadra – Kodasalli – Nagjhari stations and KPTCL agreed to complete the works in about 15 days time.

KPTCL vide their letter dated 24.08.2006 have intimated that Carrier Protection in the Kaiga corridor (Nagjhari-Kodasalli on 17/08/2006, Kadra-Kodasalli on
18.08.2006, Kaiga-Kadra & Kaiga-Kodasalli on 19.08.2006) have been installed successfully. But at Kaiga end it is disabled after commissioning.

The committee took note on the above.

4.2.2 In regard to the replacement of relays in place of the existing Quadra Mho relays on the lines at Nagjhari, Kodasalli & Kadra stations by KPCL, the proposal for procurement of relays was finalised and the budget allocations were tied up station-wise. NIT was issued in Feb 2006 and in response to it, firms have furnished the documents for pre-qualification requirements. CE, KPCL informed in the 1st Protection Sub-Committee that they have scheduled to open bids on 30th August 2006 and they expected processing time for placement of orders to take about 4 months time.

In regard to the present status, EE, KPCL informed the committee that within one week the order for the relays will be placed and they expect the relays to be supplied within three months time.

4.2.3 Regarding the status on the removal of trees in the corridor between Kaiga and Nagjhari stations, KPTCL representative informed the committee that trees between Kodasalli-Nagjhari corridor has already been marked by forest department for cutting. In the Kaiga-Kodasalli KPTCL has asked the Forest department to take up the work of marking the trees for cutting.

4.2.4 In the 77th meeting of the PCC it was concluded on the System Occurrence in Karnataka system, on 01.11.2005 at 10.45hrs, that the operation of the selective tripping scheme at Nagjhari vis-à-vis that of reverse power protection provided at Kaiga would be reviewed after gaining operational experience on these schemes. The Committee also requested Kaiga authorities to restore the settings provided on reverse power protection at Kaiga to its original values so that both the schemes at Kaiga and Nagjhari will be operational as intended by the Committee.
Kaiga vide letter dated 23rd June 2006 have intimated that the settings provided on reverse power protection at Kaiga were reverted back to its original values. However they have again requested the committee to review the issue to enable to lower the settings.

In the 1st meeting of Protection Sub-Committee held on 25-07-2006, Kaiga agreed with committee opinion of not reducing the settings provided on reverse power protection in view of the system improvements that had taken place over the period. Sub-Committee also suggested Kaiga to restore the scheme for house load operation to save its units during contingencies.

In the meeting the Kaiga representative informed that there is no change in the status of the scheme for house load operation of unit to avoid of tripping of Kaiga –Guttur 200 kV line on overloading. As explained earlier the scheme is very much available (i.e., selector switch position is NONE out of Unit1/ Unit2/ NONE) and further it will be reviewed after conversion work of the Kaiga- Guttur circuit I to 400 kV level is completed.

4.2.5 In the 1st meeting of Protection Sub-Committee, the issue of similar time delay of power relays of 0.2 sec in both schemes (selective tripping scheme at Nagjhari and reverse power protection) was discussed. The sub-committee suggested that KPCL could consider reduction of the time setting for selective tripping scheme at Nagjhari, so that the selective tripping scheme at Nagjhari could operate first and save its Units for which KPCL agreed.
KPCL vide their letter dated 19th August 2006 had intimated the revision of settings to 0.1 seconds of reverse power relays of Kodasalli lines at Nagjhari Power House w.e.f 10.08.2006. The details of the scheme are at Annexure IV. The committee took note of the above.

4.3 **Up-gradation of Kaiga – Guttur line I & II for 400kV operation:**
The 400kV Kaiga – Guttur circuit II has been put into regular operation after changing all the defective insulators from 14.07.2006.

Regarding the present status KPTCL representative informed the committee that the L/C was issued for circuit – I on 1st December 2006 to take up the work of replacing insulators in circuit-I and is likely to be completed by end of December 2006.

NPCIL representative said that at present the main power evacuation route from Kaiga was Kaiga-Guttur ckt. II as circuit I was under shutdown for replacement of insulators. During peak hours with generation at Kaiga and Kodasalli picking up power flow on Kaiga-Kadra and Kaiga- Kodasalli lines towards Kaiga was reaching upto 270 MW. So there was a chance of 400 kV Kaiga-Guttur ckt. II tripping on overloading thus affecting evacuation from KGS. He requested KPCL to regulate the generation in the Kali-Kadra-Kodasalli complex during shutdown period of circuit I. SLDC, Karnataka representative informed they are taking one unit at Supa and one unit at Kodasalli under shutdown for annual maintenance.

NPCIL and KPTCL informed the committee that after replacing insulators on Kaiga-Guttur ckt.I, the line will be charged at 220 kV level. It was noted that Narendra-Haveri corridor augmentation was required for charging of Kaiga- Guttur ckt.I, at 400 kV level. KPTCL was requested to expedite the augmentation.

4.4 **Islanding scheme for Kaiga generating station:**

NPCIL vide their letter dated 7th October 2005 proposed an Islanding scheme for Kaiga 1 & 2 taking into consideration 250 MW of KPTCL load. The Islanding scheme proposed by NPCIL and concurred by KPTCL was
discussed in detail in the 77th PCC. The following points were identified for further study and tie up:

i) NPCIL to decide on the setting of frequency for Islanding operation since the setting of 47.8 Hz proposed by NPCIL was left with a very small margin with the Under frequency trip setting for Kaiga generators set at 47.77Hz/4sec & 47.5 Hz instantaneous.

ii) KPTCL to provide the details on peak and off-peak variations in loads on the identified loads of 250 MW incident at Narendra bus.

iii) KPTCL to confirm the tripping of Tata Diesel generation injection during the operation of islanding scheme.

iv) KPTCL may indicate the quantum of radial load in Western Region incident on Chikkodi-Kolhapur link to assess the load availability during islanding.

In the 1st meeting of Protection Sub-Committee,

- Referring to point i) pertaining to Kaiga, Kaiga representative informed the committee that they have referred the issue to their higher authorities and would respond in about a month.

- Referring to point ii), iii) & iv) KPTCL representative informed the committee that they have furnished the load particulars for peak / off-peak at Narendra bus during the formation of island. He added that Tata Diesel generator is set to trip at 47.6 Hz on under frequency and would take up with them for revising this setting once after taking a decision on the islanding frequency so as to trip Tata Diesel Unit before the formation of island.

- Regarding identification of UFR load relief at some other locations in the system, as the UFR relays set for flat UFR load shedding scheme at Narendra, Chikkodi and Belgaum stations would be disabled for giving necessary loads in the Island, KPTCL representative informed the committee that they would identify locations suitably for UFR relief purposes once after firming up the scheme.
NPCIL representative said that with Unit-III is likely to be commissioned shortly they have requested KGS to include it in the islanding scheme. Kaiga representative informed that during the formation of island finally two out of the four units will go on house load operation (One unit each from stage I & II) and other two (One unit each from stage I & II) will be a part of island. So at present Unit 3 and Unit 1 or Unit 2 will be part of the island. They have done the studies with load details provided by KPTCL and have found that load needs to be augmented for a stable island. They requested KPTCL to identify more load for the island. He further informed that islanding frequency is still not decided and they will do it once the additional load is identified by KPTCL.

EE, KPTCL informed that with termination of Narendra-Haveri 220 kV line at Haveri an additional load of 60 to 80 MW could be added to the island. They expected to complete the works at Haveri in three months time.

Finally the committee decided to request Kaiga to workout the details of the islanding scheme taking into account the additional load of Haveri and come out with islanding frequency and related details to SRPC secretariat for consideration in the next Protection sub-committee meeting.

5. **Review on the operation of df/dt relays in the constituent systems:**
5.1 The df/dt protection system is in operation in the constituent systems with the following two settings:
   - 49.5Hz with rate of fall of 0.3Hz / sec. - for alarm &
   - 49.3Hz with rate of fall of 0.3Hz / sec. instantaneous - for trip.
5.2 The details on the df/dt relays installed in the constituent systems, along with feeder-wise load relief is furnished at Annexure V. Constituents were requested to furnish in case of change, if any, in feeder / load relief with respect to their system.
5.3 In the last Protection committee meeting constituents were requested to furnish the details as and when the alarms get initiated at 49.5Hz on the operation of df/dt relays to enable to review the upward revision of alarm setting from the present setting of 49.5Hz with rate of fall of 0.3Hz / sec. based on the data. The constituents have reported no df/dt tripping.

5.4 The committee requested the constituents to ensure that the load relief obtained from the identified feeders for UFR and df/dt relays are nearer to projected load relief, with respect to their system.

6. **SPS for 2x1000 MW Kudankulam project:**

SPS for Kudankulam project (2X1000 MW) was discussed in the 77th PCC held on 30.01.2006. The matter was further deliberated in the 1st meeting of Protection Sub-Committee and various issues such as PLC inputs, requirement of load relief for different loss of power, transmission of signal, time required for operation, CT / PT inputs or through Transducers, communication through PLCC or any other link and the cost implications etc was discussed. After detailed interaction on the above points the committee decided the following:

- The committee agreed to implement Proposal #1 in principle furnished in the concept paper, which envisages generation of two trip signals. First trip signal trips a load of about 700 MW and the second trip signal trips a load of about 800 MW.
- A committee comprising the Members from the Constituent systems was entrusted to finalise the design of the logic scheme for SPS with various micro level engineering options, which will put up its proposal in the next meeting for approval of the Protection Sub-Committee.
- The committee agreed to connect the same load feeders for the load relief, (700MW + 800 MW through trip signal 1 & 2) identified for the operation of load shedding scheme during tripping of Talcher – Kolar HVDC link.
and PGCIL SRTS -II would confirm the feasibility of paralleling these two trip signals at appropriate point

- SRLDC would further review the Start-up power for Kudankulam SPS during the meeting for black start procedure in association with TN and Kerala

The special working group met on 24th November 2006 at SRLDC Bangalore and the recommendations made are in Annexure VI. The sub-committee after discussion agreed to the recommendations, except on the implementing agency for the scheme.

As can be seen, the special working group as well as the Protection Sub-Committee could not arrive at a consensus regarding roles of various organizations in implementing the scheme. The special group recommendations on roles of organizations was:

NPCIL – Implementation and extending potential free contacts for trip transfer upto communication panels and maintenance of PLCs and communication eqpt. at Kudankulam. **NPCIL not agreeable.**

SRTS-II – Communication logistics for transmitting trip signals from Kudankulam through wideband point to Kolar and maintenance of the communication equipments beyond Kudankulam up to Kolar including interface equipments at Kolar. **SRTS-II agreeable.**

NPCIL representative said that communication is not their area of expertise so the work of implementation and extending potential free contacts for trip transfer upto communication panels and maintenance of PLCs and communication eqpt. at Kudankulam should be given to some other agency.

GM SRLDC said that with the past trends in implementation of various special protection schemes and in view of the provisions of IEGC clauses, NPCIL is the agency to carry out work.
Other members of the sub-committee were also of the same opinion.

Member Secretary, SRPC said that considering the unanimous opinion of the sub-committee and in the larger interest of integrated operation, NPCIL can reconsider their stand on the issue and respond back within a weeks time.

The committee decided to put up the issue for consideration of TCC.

7. **Islanding scheme for NTPC, Ramagundam STPS:**

In the 76th Protection Committee meeting, the Committee was apprised of earlier deliberations on islanding scheme / house load operation of Units for NTPC, Ramagundam STPS. SRLDC informed the Committee that while reviewing black-start procedure it was felt that an islanding scheme for NTPC, RSTPS could help in survival of 1 or 2 units and avoidance of total shutdown during grid disturbances. Improved levels of frequency of operation would justify providing islanding schemes for operation during emergent low frequency situations.

During the above meeting APTRANSCO informed the Committee that a load of 400 – 500 MW could be identified for islanding with the ICTs at Ramagundam STPS and NTPC informed that the suggested scheme of islanding with ICTs would involve splitting of Bus I & Bus II at RSTPS by tripping all the Tie breakers and the issue will have to be referred to NTPC authorities before proceeding further on this.

As no representation was available from NTPC during 77th PC meeting, the agenda point could not be taken up for discussion.

In the 1st Protection Sub-Committee meeting the committee agreed on the islanding frequency at 47.6Hz with 2.0 sec time delay or df/dt at 46.6 Hz 0.3Hz/sec, instantaneous. APTRANSCO furnished the details of loads for the island and said the 62.5MW Unit of RTS - B station would be available in the island. The committee requested NTPC to firm up the scheme in coordination with APTRANSCO and implement it at the earliest. NTPC agreed on the above and informed that they have to procure necessary relays and would try to implement by November 2006.
Regarding the present status NTPC representative gave the details of the finalised scheme. He said that UFR of ABB make (expected by March 2007), AREVA make trip relays and selector switches (already received) will be used.

Member secretary informed the committee that Secretary (Power) in a review meeting had suggested that each Metropolitan Cities should able to meet its emergency requirements without depending upon the imports of power from other States of the Region and should be able to island in case of emergency. Each islanded metropolitan city should have enough power to meet its emergency power requirements for hospitals, railways network, airports, water works and the likes. In view of that out of the three metropolitan cities in SR (Hyderabad, Bangalore and Chennai) only Chennai has got an operating islanding scheme. And as per information made available by APTRANSCO they are envisaging an islanding scheme for Hyderabad with Ramagundam generators.

In view of the above development, a revised islanding scheme for Ramagundam could be worked out by including Hyderabad loads in the island.

Committee discussed the various alternatives/ issues and requested NTPC and APTRANSCO to work out the details and feasibility/viability of formation of (i) Ramagundam Island with local loads, (ii) Ramagundam Island with Hyderabad loads, (iii) A single island comprising of local loads and Hyderabad loads. SRLDC suggested that instead of UFR trippings, a signal could be generated at Ramagundam and sent via communication channel to trip the various elements identified for the formation of the island.

8. **Operation of inter-trip scheme in the event of tripping of Talcher – Kolar HVDC Transmission system**

**Operation of Inter-trip scheme:**

8.1 The details on the operation of inter trip scheme during the period under review is furnished at Annexure –VII.

8.2 KPTCL vide their letter dated 03.07.2006 have intimated about the non-receipt of Inter-trip signals at Somanahalli station during tripping of Talcher – Kolar HVDC link on 31.05.2007 at 06.34 hrs. In the last meeting AGM, HVDC Kolar, PGCIL
informed the committee that they would verify the problem along with KPTCL at the earliest. In this connection AGM, SRLDC suggested that PGCIL might verify the transmission of signal to all the identified stations periodically, in coordination with the respective constituents to confirm its readiness.


The periodicity of trip trials was discussed and it was agreed that periodicity of trip trials would be six months from the day of last operation of inter trip scheme.

9. **Islanding scheme for NTPC, Talcher STPS:**

GM (OS), NTPC, SRHQ intimated vide Fax message dated 11.07.2006 that an islanding scheme had been proposed for Talcher STPS during under frequency conditions and sought the comments of SR constituents.

The issue was discussed in the 1st meeting of Protection Sub-Committee. Considering varying time constants of different associated subsystems the committee sought the clarification on the points such as

- time required for changeover from power control to frequency control in HVDC system
- the ramp up of power level in HVDC system during various level of power transfer to ER through Stage-II – Stage-I Inter connection
- the limit of additional injection to SR on islanding, during which time the power transfer was taking place towards ER
- the response time of governor & any other logics to be developed for the survival of Units on islanding for different conditions of generation level.

After deliberations on the above the committee requested that the Engineering groups of both NTPC and PGCIL can jointly firm up the scheme with due
consideration to all the points emerged during the discussion and to put up for further discussion in the Protection sub-committee.

In regard to present status, NTPC representative said that the issue of Sub-Synchronous Resonance (SSR) when the Talcher machines separate from ER grid was still to be addressed. Leaving that apart NTPC was ready for implementation of the scheme.

PGCIL representative informed that in the past tests were done with HVDC SSR damper controller on but ER grid intact with Talcher machines. But with Talcher machines separated from ER grid, SSR issue has to be addressed for which interactions were on between POWERGRID and NTPC.

MS, SRPC commended the efforts being made by PGCIL and NTPC and requested them to also consider other issues of concern raised by the sub-committee in its first meeting and keep the SPRC secretariat informed about the developments in this regard.

10. Additional agenda points as given by the constituents:

I. SRTS-I

a. 220 kV Bus bar protection at substation adjacent to 400 kV Munirabad SS

   KPTCL representative informed that they have initiated action in this regard.

b. Retrofitting / replacement of 220 kV bus bar schemes at Ghanapur, Tallapalli, Chinakampalli.

   APTRANSCO representative informed that they are in process of replacing old relays with numerical relays at Ghanapur and Tallapalli. Regarding Chinakampalli they still have to initiate action.

c. Special scheme to keep FSC in service alternately one each at Kadapah and Gooty

   Sub-committee suggested that the issue may be taken up in the OCC.
d. Taking actions to contain high voltage during off peak hours at Nellore, Vijayawada and Gooty substation from a voltage level of 425 kV onwards.

Sub-committee suggested that the issue may be taken up in the OCC.

II. SRTS-II

a. Provision of suitable protection system at KPTCL Narendra station in order to avoid tripping of ICTs at POWERGRID Narendra station on back up protection.

KPTCL representative informed that letter has been written to concerned authorities to initiate providing Bus Bar protection at Narendra 220 kV substation.

b. Repeated tripping of ICTs at POWERGRID Somanahalli station due to problem in Bus Bar protection at KPTCL Somanahalli station.

KPTCL representative informed that the Bus Bar protection at Somanahalli was commissioned on 08.09.2006 but it was mal operating, so it was kept out of service. Finally it was put into operation on 29.10.2006 at 17.35 hrs.

c. Review of tripping of Talcher units in event of Talcher-Kolar HVDC pole blocking, due to commissioning of Tala system

NTPC representative informed the committee that they have suggested a revised tripping scheme at TSTPP to CEA in view of the synchronous link established between ER and NR under Tala Transmission scheme. Salient features of the scheme are

- It is based on a maximum power injection of 1100 MW in to the ER/NR system.
- Unit Tripping done only on outage of both poles of Talcher-Kolar HVDC link.

  NTPC representative also informed the issue of power measurement point (GT HV terminals under present scheme) is also being looked into.

III. KAIGA

a. Revision of back up earth fault settings of Kaiga- Narendra 400 kV lines from 40%, 1500 mSec to 20%, 800 mSec at KGS

b. Tripping scheme for Kaiga-Kadra & Kaiga-Kodasalli lines subsequent to the conversion of Kaiga-Guttur 2nd circuit to 400 kV operation

  Sub-Committee advised the special group formed for this purpose to consider the issue while reviewing the relay settings in the Kaiga-Kadra-Kodasalli- Nagjhari corridor.

IV. SRLDC, BANGALORE

a. Review of Directional over current settings on 400/220 kV ICTs.

  In this regard it was decided that members would study DOCR settings in detail and would be taken up in the next meeting.

b. Modification of inter-trip scheme of NTPC Talcher Stage II during tripping of Talcher – Kolar HVDC tripping.

  Same as explained in 10.II(c).

c. Somanahalli Bus bar protection – status.

  Same as explained in 10.II (b)

11. Furnishing the data on the status of availability of Bus bar protection, SERs, DRs & time synchronization through GPS in 400kV & 220kV grid substations:
Constituents were requested to furnish the data on the status of availability of Bus bar protection, SERs, DRs & time synchronization through GPS in 400kV & 220kV grid sub- stations with respect to their system. Constituents were also requested to furnish the relay/protection data, as and when there is an addition of station / feeder in their system.

Member Secretary, SRPC said that in absence of the SOE and DR details it becomes very difficult to analyse and conclude recommendations on system occurrences. He requested the members to ensure the readiness of SERs, DRs & time synchronization through GPS in 400kV & 220kV grid sub- stations with respect to their system. He further said that the members could present the action taken report in this regard from the next meeting onwards.

12. ISLANDING SCHEMES IN METROPOLITAN CITIES – BANGALORE, CHENNAI AND HYDERABAD

Secretary (Power) in a review meeting had suggested that each Metropolitan Cities should able to meet its emergency requirements without depending upon the imports of power from other States of the Region and should be able to island in case of emergency. Each islanded metropolitan city should have enough power to meet its emergency power requirements for hospitals, railways network, airports, water works and the likes.

The information on Islanding Schemes in Bangalore, Chennai and Hyderabad was collected from the constituents and sent to GM Division, CEA as requested. As on date, Islanding Scheme exists only for Chennai. For Hyderabad, it is still in proposal stage. For Bangalore, there is no proposal as of now.

TNEB representative informed that the existing islanding scheme for chennai has been working well whenever the need has arisen.

Hyderabad Islanding scheme has been discussed at Item No.7
13. **Follow up points:**

a) KPTCL was to install B/B protection at 220kV Somanahalli substation. KPTCL had placed the orders for providing Bus bar protection at 220kV Somanahalli station in June 2003 itself but there has been delay. KPTCL representative informed in the last meeting, that they have completed all the works of Bus bar protection including testing except for the isolator contact. They expect to complete these jobs in about a month.

In regard to the provision of Bus bar protection for 220kV Hoody station he said that they are following it up.

Regarding present status KPTCL representative said that Bus bar protection at Somanahalli has been commissioned and regarding Hoody work is yet to start. The issue has been taken up with management.

b) KPTCL was to provide B/B protection at 220kV Hubli substation and also in all other 220kV grid substations.

KPTCL have acquired necessary land for shifting 220kV Hubli station to the new location. They have also replaced the distance relays with new ones in all the 220kV lines at 220kV Hubli station and were replacing ABCBs & BOBVs with SF6 circuit breakers in a phased manner as per requirement. In the last meeting KPTCL informed that the Hubli station works were awarded to L&T and works were under progress.

In Shimoga station the works were completed.

Mangalore station was under consideration of KPTCL management. Peenya station works were being proposed under R&M works and they have replaced some of the Relays and Breakers considering the priority. The revised proposal for Mangalore and the revised estimate for Peenya station were sent to corporate office and they are following it up for approval.

Regarding present status KPTCL representative said that
- Hubli new substation is expected to be completed by February 2007.
- At Shimaga Bus Bar protection is yet to be commissioned. All the controls, except for one 100 MVA bay controls has been shifted to the new control room and action is being taken to service Bus Bar protection at the earliest.
- The revised proposal for Mangalore has been sent to corporate office and they are following it up for approval.
- The revised estimate for Peenya is yet to be furnished to corporate office.
c) KPCL & KPTCL were to segregate the loads on both the buses wherever double bus bar arrangement was provided in their system. They have expressed difficulty in segregating the loads on both the buses and preferred to maintain single bus operation and to use the other as reserve bus. To meet the requirements of Grid disturbance enquiry Committee's recommendation KPCL & KPTCL were requested to adopt double bus operation at least in their 400kV stations immediately.

KPTCL have already taken both buses into service at 400kV Hoody & 220kV Hoody stations and in the case of 400kV Nelamangala & 400kV Talaguppa stations they were provided with one and half breaker system. As some equipments were still under repairs they were unable to take both the buses into service at 400kV Guttur station. KPTCL representative informed the Committee in the last meeting that they have taken up the overhauling / repairs of breakers at Guttur and expect to complete it in about two months.

KPCL informed that at 400kV Raichur station it was of one and half breaker system and wherever they have the facility of the sectionaliser breaker it was used to enable double bus operation. They were unable to use both the buses at 220kV Raichur station as they were using the other bus as reserve bus due to non-availability of bay equipments. In the last meeting KPCL informed the committee as intimated earlier that they have completed all the works and still they were following up with the site authorities to implement double bus operation.

Regarding present status KPTCL representative informed that overhauling / repairs of breakers at Guttur is still not complete.

KPCL representative informed that the Bus Coupler breaker is used as main breaker when there is some problem in the main breakers. Due to this they were not able to segregate the loads at Raichur 220 kV substation. Sub-Committee requested that whenever the BC is free the scheme could be implemented.

d) KPCL was arranging to replace the obsolete relays at Sharavathy and Nagjhari generating stations. KPCL have already replaced the relays on all the four Sharavathy – Shimoga lines and in the generators II & IX.

The proposal for procurement of relays was made and the budget allocations were tied up station-wise. NIT was issued in Feb 2006 and in response to it, firms have furnished the documents for pre-qualification requirements. CE, KPCL informed in the 1st Protection Sub-Committee that they have scheduled to open bids on 30th August 2006 and they expected processing time for placement of orders to take about 4 months time.

In regard to the present status, EE, KPCL informed the committee that within one week the order for the relays will be placed and they expect the relays to be supplied within three months time.
e) KPCL was to implement a scheme for automatic reduction of generation, by tripping / by taking on house load, one of the selected generators in the 400kV side at Raichur generating station by sensing over load conditions with time delay on the 400kV Raichur – N'sagar line, so as to avoid over loading of the 400kV Raichur – N'sagar line due to tripping of evacuation facility in the 400kV Raichur - Guttur - Nelamangala - Hoody & Munirabad sections.

KPCL have referred the matter to their Thermal design and to Raichur TPS authorities and the same was under examination. As an interim measure KPCL have implemented a scheme for audiovisual alarm in the UCBs when loading on 400kV Raichur – N'sagar line reached 600MW with 1.0secs time delay so that the operator could reduce the generation in their Units without awaiting instructions of LDC.

The committee requested KPCL for early implementation of permanent scheme. In the last meeting KPCL informed that they are following it up with Raichur station authorities.

The Sub-Committee felt that the overloading situation on Raichur-N’Sagar may not arise with commissioning of Raichur –Gooty 400 kV DC with Quad conductors.

f) KSEB was to install Bus bar protection at 220kV Sabarigiri generating station and other grid substations viz Edamon, Madakkathara and Brahmapuram stations, as recommended by the Protection committee.

KSEB had already commissioned bus bar protection at Madakkathara, Brahmapuram and Edamon stations.

In regard to the bus bar protection at 220kV Sabarigiri generating station it was informed that the renovation and modernization works at 220kV Sabarigiri generating station was in progress with which the bus bar protection works would also be completed. In the last meeting KSEB representative informed the committee that the renovation and modernization works at 220kV Sabarigiri generating station is in progress and they would complete the bus bar protection works along with R&M in about one year period.

KSEB representative informed that they expect to complete the work by mid of 2007.

g) PGCIL was to commission the bypass arrangement for LV breakers of the 500 MVA ICTs at Somanahalli (so as to duplicate the protection function of the LV breaker whenever the LV breaker was not in service), in coordination with KPTCL. KPTCL/POWERGRID informed the committee in the 77th PCC meeting that they have completed the work on ICT 1 on 21.12.2005 and are planning to take up the works on ICT-2 shortly. KPTCL/POWERGRID representative informed the committee in the last meeting that they have completed the works on ICT – 2 and are awaiting for a shutdown.
PGCIL representative informed that the work was completed on 11.10.2006.

14. **Nominations to the working group of Protection Sub-Committee of SPRC.**

The nominations for the working group of Protection Sub-Committee of SPRC is yet to be received from KPTCL, BESCOM, SLDC-KPTCL, Puduchery, NTPC, NLC, MAPS and CEA. Members were requested to expedite the nominations to the working group.

15. **Dates and Venue of the 2nd Meeting of the Working Group on Protection & 3rd Meeting of the Protection Sub-Committee.**

It was decided to hold the above meetings during March 2007
ANNEXURE I

2nd MEETING OF PROTECTION SUB-COMMITTEE OF SRPC HELD AT
BANGALORE
ON 8th DECEMBER 2006

APTRANSCO
Shri M. Jaganmohan Rao Asst. Divisional Engineer (Prot.)
Shri M. Koteswara Rao Chief Engineer (Power Systems)

APGENCO
Shri M. Srinivasulu Asst. Engineer (Prot.)

KPTCL
Shri K.N. Srinath Executive Engineer, SLDC
Shri K.R.Ratan Kumar Executive Engineer (E), RT Circle
Shri H.Ramesh Asst. Engineer, RT Circle

KPCL
Shri U.C.Ramesh Superintending Engineer

KSEB
Smt. T.Jalaja Executive Engineer (Tech.)
Shri Aswini Kumar J. Executive Engineer (Relay)

TNEB
Shri G.Srivatsan Chief Engineer (P&C)
Shri N.Shahul Hameed Executive Engineer (Prot.)

NPCIL
Shri Sandeep Sarwate SO (F) NPCIL HQ
Shri H.N. Bhat SO (H), KGS
Shri K.Pavanan STE (E&I), KGS

PGCIL
Shri V.K. Agrawal General Manager, SRLDC
Shri P.R. Raghuram Addl. General Manager, SRLDC
Shri M.R.V Holla Dy. General Manager, SRTS-II
Shri Abraham Varghese
Manager, SRLDC
Shri P.Ranga Rao
Chief Manager, HVDC, Kolar
Shri T.V.Venkiteswaran
Chief Manager (OS), SRTS-II
Shri S.R.K. Raju
Manager (OS), SRTS-I

NTPC
Shri S.Nayak
Dy. General Manager (EMD), TSTPP
Shri Abhijit Sen
Dy. General Manager (PE)
Shri P.P.Francis
Dy. General Manager (OS)
Shri G. Yella Reddy
Senior Superintendent (EM), RSTPS

ELECTRICITY DEPARTMENT, PUDUCHERRY
Shri S. Jagadish
Executive Engineer

NLC
Shri K. Kanagarajan
Dy. General Manager (Ele.)

SRPC
Shri K. Srinivasa Rao
Member Secretary
Shri A. Magudapathi
Superintending Engineer
Shri Rakesh Goyal
Executive Engineer
Shri A.K.Yadav
Executive Engineer

***
### 3. MINOR TRIPPINGS:

<table>
<thead>
<tr>
<th>Date</th>
<th>Time (hrs)</th>
<th>Tripping Details</th>
<th>Causes</th>
<th>Normalisation Date</th>
<th>Time (hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25.07.2006</td>
<td>10.35</td>
<td>Varahi-Mangalore line 1&amp;2 and Varahi UGPH Unit 1&amp;2 tripped.</td>
<td>Units (feeding radially to Mangalore) hand tripped due to frequency variation. Lines also hand tripped</td>
<td>25.07.2006</td>
<td>11.05</td>
</tr>
<tr>
<td>25.07.2006</td>
<td>19.43</td>
<td>Varahi UGPH Unit 1 tripped.</td>
<td>Units 1 (feeding radially to Mangalore) tripped due to sustained over voltage.</td>
<td>25.07.2006</td>
<td>20.25</td>
</tr>
<tr>
<td>25.07.2006</td>
<td>21.09</td>
<td>Varahi UGPH Unit 2 tripped.</td>
<td>Units 2 (feeding radially to Mangalore) tripped due to sustained over voltage.</td>
<td>27.07.2006</td>
<td>19.43</td>
</tr>
<tr>
<td>26.07.2006</td>
<td>11.25</td>
<td>Varahi UGPH Unit 1 tripped.</td>
<td>Units 1 (feeding radially to Mangalore) tripped due to sustained over voltage.</td>
<td>26.07.2006</td>
<td>12.22</td>
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<tr>
<td>27.07.2006</td>
<td>18.16</td>
<td>220 kV Narendra-Ambewadi line 1 &amp;2 tripped</td>
<td>Tripped due to R-N fault at Narendra.</td>
<td>27.07.2006</td>
<td>19.03</td>
</tr>
<tr>
<td>31.07.2006</td>
<td>15.28</td>
<td>220 kV Narendra-Ambewadi line 1 tripped</td>
<td>Tripped due to R-N fault at both ends.</td>
<td>01.08.2006</td>
<td>15.02</td>
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<tr>
<td>28.07.2006</td>
<td>07.52</td>
<td>400 kV Ramagundam-Hyderabad line 3 tripped</td>
<td>Tripped due to mal-operation of O/V relay</td>
<td>28.07.2006</td>
<td>09.09</td>
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<tr>
<td>03.08.2006</td>
<td>12.24</td>
<td>400 kV Nelamangala- Hoody line tripped</td>
<td>Tripped due to CVT secondary voltage failure at Nelamangala</td>
<td>12.08.2006</td>
<td>16.30</td>
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<tr>
<td>07.08.2006</td>
<td>09.49</td>
<td>220 kV Neyveli- Vilianoor line tripped</td>
<td>Tripped on DP Z-3</td>
<td>07.08.2006</td>
<td>10.25</td>
</tr>
<tr>
<td>07.08.2006</td>
<td>14.28</td>
<td>400 kV Vijayawada- Srisailam line 2 tripped</td>
<td>Tripped on R-N fault</td>
<td>10.08.2006</td>
<td>15.02</td>
</tr>
<tr>
<td>10.08.2006</td>
<td>18.20</td>
<td>220 kV Chittor-Thiruvalam line tripped</td>
<td>Tripped on over load</td>
<td>28.08.2006</td>
<td>11.10</td>
</tr>
<tr>
<td>19.08.2006</td>
<td>09.47</td>
<td>400/230 kV ICT-1 at Trichy tripped</td>
<td>Tripped due to IDMT relay operation</td>
<td>19.08.2006</td>
<td>10.38</td>
</tr>
<tr>
<td>19.08.2006</td>
<td>09.47</td>
<td>400/230 kV ICT-2 at Trichy tripped</td>
<td>Tripped on overflux relay mal-operation due to DC supply failure.</td>
<td>19.08.2006</td>
<td>10.38</td>
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<tr>
<td>19.08.2006</td>
<td>13.36</td>
<td>400 kV Madurai-Udumalpet line tripped</td>
<td>Tripped B-N fault</td>
<td>19.08.2006</td>
<td>14.01</td>
</tr>
<tr>
<td>Date</td>
<td>Time</td>
<td>Details</td>
<td>Cause</td>
<td>Date</td>
<td>Time</td>
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</tr>
<tr>
<td>25.08.2006</td>
<td>09.08</td>
<td>400/220 kV ICT-2 at Trichur tripped</td>
<td>Tripped during CVT testing &amp; replacement of burnt jumper.</td>
<td>25.08.2006</td>
<td>13.58</td>
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<tr>
<td>26.08.2006</td>
<td>21.14</td>
<td>220 kV Sedam- Tandur line tripped</td>
<td>Line tripped with heavy sound. No fault found after inspection.</td>
<td>27.08.2006</td>
<td>07.05</td>
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<td>27.08.2006</td>
<td>16.06</td>
<td>400/230 kV ICT-3 at N’Sagar tripped</td>
<td>Tripped due to mal-operation of</td>
<td>27.08.2006</td>
<td>17.26</td>
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<tr>
<td>31.08.2006</td>
<td>14.00</td>
<td>220 kV Edamon-Kayathar line tripped</td>
<td>Tripped on operation of Distance protection</td>
<td>31.08.2006</td>
<td>22.20</td>
</tr>
<tr>
<td>02.09.2006</td>
<td>14.43</td>
<td>400 kV Almathi-Madras line2 tripped</td>
<td>Tripped due to phase to ground fault</td>
<td>02.09.2006</td>
<td>15.28</td>
</tr>
<tr>
<td>02.09.2006</td>
<td>18.28</td>
<td>HVDC Bhadravathi Pole 1 tripped</td>
<td>Tripped due to Aux. supply breaker malfunction</td>
<td>02.09.2006</td>
<td>18.42</td>
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<td>02.09.2006</td>
<td>18.28</td>
<td>HVDC Bhadravathi Pole 2 tripped</td>
<td>Tripped due to Aux. supply breaker malfunction</td>
<td>02.09.2006</td>
<td>18.43</td>
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<td>06.09.2006</td>
<td>08.17</td>
<td>400 kV Kalpakka-Vemagiri line 1 tripped</td>
<td>Tripped due to Bus coupler CT blast at Kalpakka end</td>
<td>09.09.2006</td>
<td>12.08</td>
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<td>06.09.2006</td>
<td>08.17</td>
<td>400 kV Kalpakka-Simadari line 1 tripped</td>
<td>Tripped due to Bus coupler CT blast at Kalpakka end</td>
<td>07.09.2006</td>
<td>19.00</td>
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<td>07.09.2006</td>
<td>12.27</td>
<td>220 kV Gummudipundi-Sulurpet line tripped</td>
<td>Tripped in zone-1 for a R-Phase to earth fault in Sulurpet-Nellore line</td>
<td>07.09.2006</td>
<td>13.07</td>
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<tr>
<td>07.09.2006</td>
<td>18.00</td>
<td>220 kV Chittor-Thiruvalam line tripped</td>
<td>Tripped on over load</td>
<td>04.10.2006</td>
<td>06.50</td>
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<tr>
<td>11.09.2006</td>
<td>16.43</td>
<td>400/220 kV ICT-1 at Bangalore tripped</td>
<td>Tripped on mal operation of Bus Bar protection</td>
<td>11.09.2006</td>
<td>17.47</td>
</tr>
<tr>
<td>11.09.2006</td>
<td>16.43</td>
<td>400/220 kV ICT-2 at Bangalore tripped</td>
<td>Tripped on mal operation of Bus Bar protection</td>
<td>11.09.2006</td>
<td>17.56</td>
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<td>13.09.2006</td>
<td>18.25</td>
<td>400 kV Srisailam-Mamidipalli line 1 tripped</td>
<td>Tripped on distance protection.</td>
<td>13.09.2006</td>
<td>19.06</td>
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<tr>
<td>21.09.2006</td>
<td>04.50</td>
<td>400 kV Ramagundam-Chandrapur line 2 tripped</td>
<td>Tripped on Phase to Phase (R-B) fault</td>
<td>21.09.2006</td>
<td>07.49</td>
</tr>
<tr>
<td>21.09.2006</td>
<td>19.56</td>
<td>400 kV Ramagundam-Chandrapur line 2 tripped</td>
<td>Tripped on Phase to Phase (R-B) fault</td>
<td>21.09.2006</td>
<td>10.26</td>
</tr>
<tr>
<td>24.09.2006</td>
<td>13.00</td>
<td>400 kV Vijayawada-Gazuwaka line 1 tripped</td>
<td>Tripped on B-N transient fault.</td>
<td>24.09.2006</td>
<td>14.00</td>
</tr>
<tr>
<td>26.09.2006</td>
<td>02.46</td>
<td>400/220 kV ICT-1 at Hoody tripped</td>
<td>Tripped on overfluxing.</td>
<td>26.09.2006</td>
<td>03.05</td>
</tr>
<tr>
<td>27.09.2006</td>
<td>09.41</td>
<td>400 kV Kolar-Hoody line 1 tripped</td>
<td>On operation of Busbar protection</td>
<td>27.09.2006</td>
<td>10.23</td>
</tr>
<tr>
<td>27.09.2006</td>
<td>09.41</td>
<td>400 kV Gooty-Hoody line 1 tripped</td>
<td>On operation of Busbar protection</td>
<td>27.09.2006</td>
<td>10.33</td>
</tr>
<tr>
<td>Date</td>
<td>Time</td>
<td>Event Description</td>
<td>Reason</td>
<td>Date</td>
<td>Time</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>--------------------------------------------------------</td>
<td>---------------------------------------------</td>
<td>------------</td>
<td>-------</td>
</tr>
<tr>
<td>27.09.2006</td>
<td>09.41</td>
<td>400 kV Hoody-Nelamangala line tripped</td>
<td>On operation of Busbar protection</td>
<td>27.09.2006</td>
<td>10.10</td>
</tr>
<tr>
<td>27.09.2006</td>
<td>09.41</td>
<td>400/220 kV ICT-1 at Hoody tripped</td>
<td>On operation of Busbar protection</td>
<td>27.09.2006</td>
<td>10.20</td>
</tr>
<tr>
<td>27.09.2006</td>
<td>09.41</td>
<td>400/220 kV ICT-2 at Hoody tripped</td>
<td>On operation of Busbar protection</td>
<td>27.09.2006</td>
<td>10.27</td>
</tr>
<tr>
<td>04.10.2006</td>
<td>09.00</td>
<td>220 kV Chittor-Thiruvalam line tripped</td>
<td>Tripped on over load</td>
<td>15.11.2006</td>
<td>05.43</td>
</tr>
<tr>
<td>05.10.2006</td>
<td>12.44</td>
<td>HVDC Bhadravathi Pole 2 tripped</td>
<td>Tripped due to Aux. Power supply failure</td>
<td>05.10.2006</td>
<td>18.25</td>
</tr>
<tr>
<td>10.10.2006</td>
<td>11.45</td>
<td>400 kV Khammam-Kalpakka line 1 tripped</td>
<td>Tripped on Y phase to earth fault</td>
<td>10.10.2006</td>
<td>15.06</td>
</tr>
<tr>
<td>12.10.2006</td>
<td>11.29</td>
<td>HVDC Bhadravathi Pole 2 tripped</td>
<td>Tripped due to Aux. Power supply failure</td>
<td>12.10.2006</td>
<td>11.41</td>
</tr>
<tr>
<td>12.10.2006</td>
<td>13.26</td>
<td>400/220 kV ICT-5 at RSTPS tripped</td>
<td>Tripped due to cooling fans/pumps problem</td>
<td>12.10.2006</td>
<td>19.15</td>
</tr>
<tr>
<td>13.10.2006</td>
<td>05.22</td>
<td>400 kV Khammam- Mamidipally line 1 tripped</td>
<td>Tripped on Phase-to-Phase fault</td>
<td>13.10.2006</td>
<td>18.49</td>
</tr>
<tr>
<td>17.10.2006</td>
<td>00.30</td>
<td>HVDC Bhadravathi Pole 2 tripped</td>
<td>Tripped on Y-phase converter transformer differential protection</td>
<td>25.10.2006</td>
<td>15.41</td>
</tr>
<tr>
<td>18.10.2006</td>
<td>07.10</td>
<td>220 kV Sedam –Tandur line tripped</td>
<td>Tripped on fault. Charged from Tandur end only due to breaker problem at Sedam</td>
<td>19.10.2006</td>
<td>17.37 Pole 1 18.09 Pole 2</td>
</tr>
<tr>
<td>28.10.2006</td>
<td>01.23</td>
<td>400 kV N’Sagar-Cuddapah line 2 tripped</td>
<td>Tripped on Y-N fault</td>
<td>28.10.2006</td>
<td>14.22</td>
</tr>
<tr>
<td>28.10.2006</td>
<td>15.00</td>
<td>400/220 kV ICT 1 &amp; 2 at Bangalore tripped</td>
<td>Tripped on KPTCL side while testing protection.</td>
<td>28.10.2006</td>
<td>17.22 ICT 1 16.29 ICT 2</td>
</tr>
<tr>
<td>30.10.2006</td>
<td>15.20</td>
<td>HVDC Bhadravathi Pole 2 tripped</td>
<td>Tripped on Bucholz operation</td>
<td>08.11.2006</td>
<td>14.34</td>
</tr>
<tr>
<td>31.10.2006</td>
<td>09.56</td>
<td>220 kV Edamon-Kayathar line tripped</td>
<td>Tripped on earth fault</td>
<td>31.10.2006</td>
<td>22.15</td>
</tr>
<tr>
<td>02.11.2006</td>
<td>16.45</td>
<td>220 kV Varahi-Mangalore line-1 &amp; 2 tripped.</td>
<td>Tripped on DP in Z1 due to temporary fault due to lightening.</td>
<td>02.11.2006</td>
<td>17.38 VM1 17.24 VM2</td>
</tr>
</tbody>
</table>
05.11.2006  20.03  220 kV Varahi-Mangalore line-1 & 2 tripped. Tripped on DP in Z1 due to temporary fault due to lightening. 05.11.2006  20.18  VM1 20.20 VM2

06.11.2006  13.43  Varahi-Mangalore line 2 tripped Tripped on DP at Varahi but at Kemar. VM1 & 2 tripped on EFR 06.11.2006  14.10

07.11.2006  06.34  All 400 kV lines connected to Guttur tripped. Mal-operation of Bus bar protection at Guttur. 07.11.2006  07.37 onw.

08.11.2006  10.00  220 kV Varahi-Mangalore line-2 tripped. Tripped on DP at Kavoor while charging KIOCL lines KIOCL end 08.11.2006  10.18

09.11.2006  01.12  220 kV Varahi-Shimoga line-2 tripped. Tripped on DP in Z1 on both ends due to bamboo tree touching the line. 09.11.2006  11.51

09.11.2006  12.38  VS1 220 kV Varahi-Shimoga line-1 & 2 tripped. Tripped on DP and backup O/C & E/F operation on Shimoga and Varahi end 09.11.2006  12.55 VS1

09.11.2006  12.44  VS2 220 kV Varahi-Shimoga line-1 & 2 tripped. Tripped on DP at Shimoga end only. 09.11.2006  12.54 VS2

09.11.2006  18.41  220 kV Varahi-Mangalore line-2 tripped. Tripped on DP in Z1 due to temporary fault. 09.11.2006  18.57

11.11.2006  16.55  VUGPH Unit 2 tripped Tripped on negative sequence relay mal operation 11.11.2006  17.28

11.11.2006  14.57  Varahi-Mangalore line 2 tripped Tripped on DP on Phase to neutral fault 11.11.2006  15.42

12.11.2006  05.46  400 kV Gooty – Hoody line tripped Tripped on Y-N fault 12.11.2006  06.15

13.11.2006  10.08  VUGPH Unit 2, VM2, VS1 and VS2 tripped. VM1 and Unit 1 under shutdown. On operation of Bus differential protection 14.11.2006  00.06 onwards


13.11.2006  12.12  400/220 kV ICT 1 & 2 at Hoody tripped Tripped due to fault in 220 kV system 13.11.2006  12.49 ICT 1 12.40 ICT 2

14.11.2006  09.03  Varahi-Mangalore line 2 tripped Tripped on DP on temporary fault 14.11.2006  09.16

19.11.2006  03.30  400 kV Gooty – Nelamangala line tripped Tripped on B-N transient fault. A/R successful at Nelamangala end. 19.11.2006  06.47

19.11.2006  17.06  Varahi-Mangalore line 1 tripped Tripped on DP on temporary fault 19.11.2006  17.35
<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Event Description</th>
<th>Trip Reason</th>
<th>Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.11.2006</td>
<td>14.20</td>
<td>VUGPH Unit 2 and Varahi-Shimoga line 1 tripped</td>
<td>Tripped on DP on phase to ground fault</td>
<td>20.11.2006</td>
<td>14.44</td>
</tr>
<tr>
<td>20.11.2006</td>
<td>19.54</td>
<td>Varahi-Mangalore line 1 &amp; 2 tripped</td>
<td>Tripped on DP.</td>
<td>20.11.2006</td>
<td>20.01</td>
</tr>
<tr>
<td>23.11.2006</td>
<td>13.21</td>
<td>400 kV Gooty – Hoody line tripped</td>
<td>Tripped on distance protection</td>
<td>23.11.2006</td>
<td>06.55</td>
</tr>
<tr>
<td>23.11.2006</td>
<td>13.21</td>
<td>400 kV Gooty – Nelmangala line tripped</td>
<td>Tripped on distance protection</td>
<td>23.11.2006</td>
<td>14.08</td>
</tr>
<tr>
<td>28.11.2006</td>
<td>00.45</td>
<td>400 kV Gooty-Nelmangala line tripped</td>
<td>Tripped on transient fault.</td>
<td>28.11.2006</td>
<td>01.17</td>
</tr>
</tbody>
</table>
4. Issues regarding evacuation of power from Kaiga Generating Station.

4.1 Trippings of transmission lines connected to Kaiga generating station.

<table>
<thead>
<tr>
<th>Tripping Date</th>
<th>Time</th>
<th>Tripping Details</th>
<th>Causes</th>
<th>Normalisation Date</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>01.08.2006</td>
<td>08.10</td>
<td>220kV Kaiga – Kadra line tripped.</td>
<td>Tripped on backup protection due to line fault in Kaiga-Karwar line</td>
<td>01.08.2006</td>
<td>08.44</td>
</tr>
<tr>
<td>08.08.2006</td>
<td>20.34</td>
<td>220kV Kaiga – Kadra line tripped.</td>
<td>Tripped on backup over-current protection</td>
<td>08.08.2006</td>
<td>22.03</td>
</tr>
<tr>
<td>08.08.2006</td>
<td>15.49</td>
<td>220kV Kaiga – Kodasalli line tripped.</td>
<td>Tripped on reverse power protection. Kaiga-Kadra line was on outage</td>
<td>08.08.2006</td>
<td>16.10</td>
</tr>
<tr>
<td>08.08.2006</td>
<td>18.55</td>
<td>220kV Kaiga – Kodasalli line tripped.</td>
<td>Tripped on reverse power protection. Kaiga-Kadra line was on outage</td>
<td>08.08.2006</td>
<td>22.03</td>
</tr>
<tr>
<td>09.08.2006</td>
<td>09.29</td>
<td>220kV Kaiga – Kadra line tripped.</td>
<td>Tripped on reverse power protection. Kaiga-Kodasalli line was in service</td>
<td>09.08.2006</td>
<td>18.32</td>
</tr>
<tr>
<td>07.09.2006</td>
<td>22.37</td>
<td>220kV Kaiga – Guttur line 1 tripped</td>
<td>Tripped on distance protection in zone-1 (Phase C) at Kaiga and Guttur SS due to line insulator failure</td>
<td>07.09.2006</td>
<td>23.10</td>
</tr>
<tr>
<td>07.09.2006</td>
<td>23.10</td>
<td>220kV Kaiga – Guttur line 1 tripped</td>
<td>Tripped on distance protection in zone-1 (Phase C) at Guttur SS due to line insulator failure.</td>
<td>09.09.2006</td>
<td>14.45</td>
</tr>
<tr>
<td>16.09.2006</td>
<td>13.21</td>
<td>220kV Kaiga – Guttur line 1 tripped</td>
<td>Tripped on distance protection in Phase B due to line insulator failure.</td>
<td>16.09.2006</td>
<td>19.32</td>
</tr>
<tr>
<td>18.09.2006</td>
<td>12.28</td>
<td>220kV Kaiga – Guttur line 1 tripped</td>
<td>Tripped on distance protection in Phase A due to line insulator failure.</td>
<td>20.09.2006</td>
<td>13.19</td>
</tr>
<tr>
<td>27.09.2006</td>
<td>18.52</td>
<td>220kV Kaiga – Kodasalli line tripped.</td>
<td>Tripped on back up over-current protection</td>
<td>27.09.2006</td>
<td>20.03</td>
</tr>
<tr>
<td>06.10.2006</td>
<td>11.21</td>
<td>220kV Kaiga – Kadra line tripped</td>
<td>Tripped on distance protection in Z1, Phase C</td>
<td>12.10.2006</td>
<td>16.11</td>
</tr>
<tr>
<td>Date</td>
<td>Time</td>
<td>Event Description</td>
<td>Trip Reason</td>
<td>Date</td>
<td>Time</td>
</tr>
<tr>
<td>------------</td>
<td>-------</td>
<td>--------------------------------------------</td>
<td>--------------------------------------</td>
<td>------------</td>
<td>-------</td>
</tr>
<tr>
<td>06.10.2006</td>
<td>11.21</td>
<td>220kV Kaiga – Kodasalli line tripped</td>
<td>Tripped on Back up earth fault protection at Kaiga</td>
<td>06.10.2006</td>
<td>12.12</td>
</tr>
<tr>
<td>06.10.2006</td>
<td>18.59</td>
<td>220kV Kaiga – Kodasalli line tripped</td>
<td>Tripped on Back up OC protection</td>
<td>06.10.2006</td>
<td>21.35</td>
</tr>
<tr>
<td>07.10.2006</td>
<td>18.41</td>
<td>220kV Kaiga – Kodasalli line tripped</td>
<td>Tripped on Back up OC protection</td>
<td>07.10.2006</td>
<td>21.00</td>
</tr>
<tr>
<td>07.10.2006</td>
<td>21.21</td>
<td>220kV Kaiga – Kodasalli line tripped</td>
<td>Tripped on Back up OC protection</td>
<td>08.10.2006</td>
<td>11.14</td>
</tr>
<tr>
<td>08.10.2006</td>
<td>18.36</td>
<td>220kV Kaiga – Kodasalli line tripped</td>
<td>Tripped on Back up OC protection</td>
<td>08.10.2006</td>
<td>19.04</td>
</tr>
<tr>
<td>08.10.2006</td>
<td>19.04</td>
<td>220kV Kaiga – Kodasalli line tripped</td>
<td>Tripped on Back up OC protection</td>
<td>08.10.2006</td>
<td>20.19</td>
</tr>
<tr>
<td>10.10.2006</td>
<td>08.45</td>
<td>220kV Kaiga – Kodasalli line tripped</td>
<td>Tripped on Back up OC protection</td>
<td>10.10.2006</td>
<td>10.31</td>
</tr>
<tr>
<td>22.10.2006</td>
<td>14.59</td>
<td>220kV Kaiga – Guttur line 1 tripped</td>
<td>Tripped on distance protection in Z1 in Phase B&amp;C due to fault at 220 kV Guttur SS</td>
<td>22.10.2006</td>
<td>16.25</td>
</tr>
<tr>
<td>16.11.2006</td>
<td>18.14</td>
<td>220 kV Kaiga-Kodasalli line tripped</td>
<td>Tripped on back up over current protection at Kaiga</td>
<td>06.11.2006</td>
<td>18.29</td>
</tr>
<tr>
<td>17.11.2006</td>
<td>08.47</td>
<td>220 kV Kaiga-Kadra line tripped</td>
<td>Tripped on back up over current protection at Kaiga</td>
<td>07.11.2006</td>
<td>09.26</td>
</tr>
</tbody>
</table>
No CEED/SE-1/SREB/EE6/ 12.71

Member Secretary,
SREB, 29, Race Course Cross Road,
Bangalore-560 001.

Sir,
Sub: Reduction of reverse power relay setting for Kodasalli lines at Nagjahi end-
reg

As per the discussions had in the Protection Sub Committee meeting of SRPC held on 25th July 2006, the revision of settings of reverse power relays of Kodasalli lines at Nagjahi Power House end have been effected on 10.08.2006 at 09.30 Hrs as under:

<table>
<thead>
<tr>
<th>Lines</th>
<th>Description</th>
<th>Existing Settings</th>
<th>Revised Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nagjahi–Kodasalli line 1 &amp; 2</td>
<td>Low set forward Power 150 MW</td>
<td>T1-0.2Sec, T2-0.4Sec, T3-0.6Sec, T4-0.8Sec</td>
<td>T1-0.1Sec, T2-0.2Sec, T3-0.3Sec, T4-0.4Sec</td>
</tr>
<tr>
<td>Nagjahi–Kodasalli line 1 &amp; 2</td>
<td>High Set forward Power</td>
<td>T-0.2Sec</td>
<td>T-0.1Sec</td>
</tr>
</tbody>
</table>

With the adoption of the above settings, tripping of Units takes place as follows:
1. When the export through each line is 150 MW and less than 250 MW, Units 1, 2, 4 & 5 will be tripping sequentially with 0.1 Sec delay between each units. In 0.4 Sec all four auxiliary units will trip and reduce the load on Kodasalli line.
2. When the export through each line exceeds 250 MW, then the high set forward Power contact will trip Units 3&6 simultaneously with 0.1 Sec delay. Unit 1 would also trip in 0.1 Sec through low set Power contact. Thus total load relief of 400 MW by tripping of three units would be achieved when lines exceeds 250 MW.

Thanking you,

Yours faithfully,

for Karnataka Power Corporation Ltd.,

Chief Engineer (Elec. Designs)
Annexure V

df/dt Relays installed in Southern Region as on December 2006
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>220 KV Station</th>
<th>Feeder</th>
<th>Df/dt Relay setting</th>
<th>Expected load relief (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>220 KV Siddipet</td>
<td>132/33 KV Transformers</td>
<td>49.3 Hz, 0.3 Hz/Sec, Instantaneous</td>
<td>65</td>
</tr>
<tr>
<td>2</td>
<td>220 KV Boothpur</td>
<td>132 KV Puttapahad</td>
<td>-do-</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>220 KV Durshed</td>
<td>132 KV Sircilla &amp; Mallaram 132 KV Husnabad &amp; Manakonduru</td>
<td>-do-</td>
<td>95</td>
</tr>
<tr>
<td>4</td>
<td>220 KV Nirmal</td>
<td>132 KV Bhainsa</td>
<td>-do-</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>220KV Bhimgal</td>
<td>100 MVA, 220/132 KV Transformer</td>
<td>-do-</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>220 KV Budidampadu</td>
<td>132 KV Khammam-1&amp;2</td>
<td>-do-</td>
<td>70</td>
</tr>
<tr>
<td>7</td>
<td>132 KV Tadikonda</td>
<td>31.5 MVA, 132/33 KV Transformer</td>
<td>-do-</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>220 KV Ongole</td>
<td>132 KV Kanigiri &amp; Kandukuru</td>
<td>-do-</td>
<td>88</td>
</tr>
<tr>
<td>9</td>
<td>132 KV Navalak Garden</td>
<td>132/33 KV Transformers</td>
<td>-do-</td>
<td>54</td>
</tr>
<tr>
<td>10</td>
<td>132 KV K.V. Kota</td>
<td>132 KV Jangareddygudem 132 KV Aswaraopet 132/33 KV Transformers</td>
<td>-do-</td>
<td>107</td>
</tr>
<tr>
<td>11</td>
<td>220 KV Nandyal</td>
<td>132 KV Allagadda</td>
<td>-do-</td>
<td>35</td>
</tr>
<tr>
<td>12</td>
<td>220 KV Kadapa</td>
<td>132 KV Ontimitta 132/33 KV Transformers</td>
<td>-do-</td>
<td>80</td>
</tr>
<tr>
<td>13</td>
<td>220 KV Kalikiri</td>
<td>132 KV Rompicherla 132 KV Madanapalli-1&amp;2 132/33 KV Transformers</td>
<td>-do-</td>
<td>158</td>
</tr>
<tr>
<td>14</td>
<td>220 KV Rajampet</td>
<td>132 KV Timmayyagaripalli</td>
<td>-do-</td>
<td>18</td>
</tr>
<tr>
<td>15</td>
<td>220 KV Medchel</td>
<td>33 KV Keshavaram 33 KV Aliabad 33 KV Bandamadharam</td>
<td>-do-</td>
<td>30</td>
</tr>
<tr>
<td>16</td>
<td>220 KV Chandrayanagutta</td>
<td>33 KV Maheswararam 33 KV Shapurkalan</td>
<td>-do-</td>
<td>29</td>
</tr>
<tr>
<td>17</td>
<td>220 KV Garividi</td>
<td>132 KV Bobbili</td>
<td>- do -</td>
<td>29</td>
</tr>
<tr>
<td>18</td>
<td>132 kV Cumbum SS</td>
<td>i) 132 kV Giddalur ii) 132/33 kV Transformers</td>
<td>- do -</td>
<td>40</td>
</tr>
<tr>
<td>19</td>
<td>132 kV Nidadavolu</td>
<td>132/33 kV Transformers</td>
<td>- do -</td>
<td>60</td>
</tr>
<tr>
<td>20</td>
<td>132 KV Bhimavaram SS</td>
<td>132 kV Narsapuram</td>
<td>- do -</td>
<td>26</td>
</tr>
<tr>
<td>21</td>
<td>220 kV Minpur/Dichpally</td>
<td>132 kV Kamareddy-1 &amp;2</td>
<td>- do -</td>
<td>45</td>
</tr>
<tr>
<td>22</td>
<td>220 kV RSS</td>
<td>220 kV Jagityal</td>
<td>- do -</td>
<td>60</td>
</tr>
<tr>
<td>23</td>
<td>220 kV Chillakallu</td>
<td>132/33 kV Transformers</td>
<td>- do -</td>
<td>55</td>
</tr>
<tr>
<td>24</td>
<td>132 kV Nuziveedu</td>
<td>132/33 kV Transformers</td>
<td>- do -</td>
<td>54</td>
</tr>
<tr>
<td>25</td>
<td>132 kV Kanumolu</td>
<td>132/33 kV Transformers</td>
<td>- do -</td>
<td>30</td>
</tr>
</tbody>
</table>
SOUTHERN REGIONAL LOAD DESPATCH CENTRE
POWER GRID CORPORATION OF INDIA LTD.
29, Race Course Cross Road, Bangalore-560 009.

Ref: AGM/SRLDC/2006/  
27th November 2006

From: Addl. General Manager  
SRLDC

To: Member Secretary, SRPC, 
Bangalore.

Copy To: Shri V. Shankaranarayanan, DCE, 
NPCIL, Mumbai
Shri T.N. Subbaraju, AEE, 
KPTCL, B'l'ore
Shri N. Shahul Hameed, (EE, P&C), 
TNEB, Chennai.
Shri M. R. V. Holla, DGM, 
POWERGRID, SRTS-II, 
Bangalore.
Shri Awadesh Kumar Yadav, EE, 
SRPC, B'l'ore

Sub: Report of Special Group on System Protection Scheme of Kudankulam.

Enclosed please find the Report of Special Group on System Protection Scheme of Kudankulam. Shri M.M. Patro of NPC participated in all the deliberations except for the last meeting and presently he is out of the country. In view of this, Shri V. Shankaranarayanan, DCE represented NPC in the Committee for the last meeting.

(P. R. RAGHURAM)

Encl: as above
Report of the Special working group on System Protection Scheme for 2 X 1000 MW Kudankulam project

1. Background

Two Numbers of 1000 MW generators are being constructed at Kudankulam by NPC and the first unit is likely to be commissioned by December 2007 and the second unit is likely to be commissioned by December 2008. 1000 MW generators at Kudankulam Atomic Power Plant will be the biggest size generators in the Southern Region Power System and as well as in the country. The outage of anyone or both of these generators may pose frequency instability in the Southern Region. This issue was discussed in the Protection Committee meeting of SREB held on 30th Jan 2006 and to take care of this situation it was agreed to envisage a Special System Protection Scheme (SPS) to take care of the contingency of loss of generation at the station, due to tripping of one / both units operating at various levels.

2. Gist of discussions held in First PCC meeting of SRPC

As per the discussions held in the Protection Committee meeting held on 30th Jan 2006 a concept paper in respect of the logics for the Special System Protection Scheme (SPS) was prepared by SRLDC and circulated to the constituents (Copy enclosed as annexure I to this report). This concept paper was further discussed in the 1st PCC meeting of SRPC held on 25th July 2006 and the following decisions were taken:

i) The committee agreed in principle, to implement Proposal No.1 of the concept paper.

ii) The committee decided that, as the design of the logic scheme is to be finalized with various micro-level engineering options, it will be entrusted to a Special Working group comprising the following Members from the Constituent systems:

- Shri P.R. Raghuram, AGM, SRLDC, Bangalore (Convener for the committee)
- Shri M.M. Patro, Dy CE, NPCIL Mumbai, now represented by Shri V. Sankaranarayanan, Dy CE NPCIL, Mumbai
- Shri T.N. Subbaraju, Asst. Executive Engineer, KPTCL, Bangalore
- Shri N. Shahul Hameed, Executive Engineer, P&C, TNEB, Chennai
- Shri M.R.V. Holla, DGM, PGCIL, SRTS II, Bangalore
- Shri Awadesh Kumar Yadav, EE, SRPC, Bangalore
The Special Working group would firm up the proposal and put up for approval of the committee during the next Protection Sub-Committee meeting, to be held during December 2006.

iii) For the load relief, (700MW + 800 MW through trip signal 1 & 2), the committee agreed to connect the same load feeders identified for load relief under SPS scheme of Talcher – Kolar HVDC line contingency. After finalizing the SPS for Kudankulam, PGCIL, SRTS II would workout the cost / Technical details associated with the engineering of the scheme to take approval from SRPC.

3. Deliberations of the Special Working group

As per the above decision Special Working group members deliberated the following issues by exchanging notes through emails, telephonic discussions and meetings and are submitting this report for further consideration by the Protection sub-committee of SRPC.

3.1 Location of Logic panel and communication panel

The Special Working group was given to understand that the two generating units have independent control systems and summing up the generation at unit level will be difficult. Also, communication signals have to be transmitted to different locations of the constituents.

Recommendation 1

Considering the above special group recommends that the Logic panel and communication panel be located in the switchyard control room.

3.2 Type of the logic scheme to be used - PLC based or Power relay based?

The proposal I of the concept paper has been accepted by the protection committee for implementation. As per this proposal following Power level and frequency levels are to be detected:
Further external logic to be built to consider various combinations of power and frequency of operation.

The group considered both the options of building up the logics using Power relays and Programmable logic controllers (PLCs). The advantages and the challenges in using the two methods are detailed below:

<table>
<thead>
<tr>
<th>Power relays</th>
<th>Advantages</th>
<th>Challenges</th>
</tr>
</thead>
</table>
| - Familiar to Power Engineers  
  - Simple to understand and use  
  - Easy to maintain. | More relays required to meet the requirement of the logic  
  Flexibility in setting not available.  
  May become an issue when the logics are to be modified  
  External logics are to be built to achieve the required logic outputs | |

| PLC | Input to PLC will be a transducer hence smooth settings possible.  
Flexible in settings-only software changes  
All logics can be internally built in PLC itself  
Modification of logics can also be done through software changes | Not very commonly used in Power system protection but widely used in process industry.  
Specialised training required in operation and maintenance of PLC |
Power relay based logic may not give that flexibility and may be required to be changed under a changed scenario.

Recommendation 2:

Therefore special group recommends that the logic should be PLC based

3.3 Method of measurement to detect absolute loss of generation

Initial suggestion was to detect the loss of generation by measuring absolute power flow on HT side of both the generator transformer and summing up to find the total power injection into the Kudankulam 400KV bus every second.

NPC expressed its difficulty in such measurements since the generating unit controls are independent. However, signals are being wired to switchyard control room from each generating units for SCADA purpose and suggested for using this signal for the logic.

Concept paper covered the various power loss levels, starting from 500MW to 2000MW. This was done considering reduction of power outputs by generators on various process problems and tripping of generators while ramping up. During the discussions in the 1st Protection Committee meeting of SRPC protection committee meeting NPC informed that during the process problems generation cannot be reduced all of a sudden with in a second. Therefore, tripping of the units after restart while ramping up is only to be considered. This can be considered by including the Breaker position with the power flow.

The logic can be as follows:

\[ P = \text{Total Power generated from KKNPP} \]
\[ P_1 = \text{Active Power Generated from unit #1 of KKNPP} \]
\[ P_2 = \text{Active Power Generated from unit #2 of KKNPP} \]
\[ MF_1 = \text{Generator circuit breaker of unit #1 contact} \]
\[ = 1 \text{ if Breaker is closed} \]
\[ = 0 \text{ if Breaker is opened} \]
\[ MF_2 = \text{Generator circuit breaker of unit #2 contact} \]
\[ = 1 \text{ if Breaker is closed} \]
\[ = 0 \text{ if Breaker is opened} \]

\[ P = P_1 \times MF_1 + P_2 \times MF_2 \]

- \( P_1, P_2 \) - Signal is 4-20 mA signal generated from a transducer having a accuracy class of 0.5%
- \( MF_1 \) - Generator circuit breaker #1 potential free contacts NO/NC
- \( MF_2 \) - Generator circuit breaker #2 potential free contacts NO/NC
The signals $P_1$, $P_2$, $MFI$ and $MF2$ will be feed into a PLC system, where $P$ is computed. Whenever the change in power level $P$ with respect to the power level one second previous to the present time, is more than 500MW, then it will initiate the logic through the energisation of the auxiliary relays. The contacts of the auxiliary relays will be feed through communication system as a input to do the needful.

The measurement window should be of one second i.e at any instant the change in power level should be checked with the power level one second previous to the present time. The number of samples in a second can be as high as possible. Considering the breaker opening time, measurement system; response time, transients, etc. sampling of power measurement done once in 300ms should be adequate (PLC should have the flexibility of changing the sampling rate and based on further studies the sampling rate may be modified).

Recommendation 3

Therefore the special group recommends the following:

- Power level measurement will be done in the Switchyard using the signal derived for the SCADA.
- The tripping of the units after restart will be determined by including the breaker position information with the power flow.
- The measurement window should be of one second.
- Power measurement sampling is to be done once in 300ms.

3.4 Security and stability of the proposed System Protection Scheme

To increase the security and stability of the proposed System Protection Scheme the Special group considered three numbers of independent logic circuits to be built and the trip signal will be generated based on two out of three logic operation.

NPC representative suggested using only one set of measuring CT and PT. Considering the failure rate of CT and PT the suggestion is accepted by the group. However the breaker contacts should not be multiplied.

Recommendation 4

Therefore special group recommends the following:

- The logic built should be built on 2 out of 3 logic. However the measurement inputs taken from CT and PT can be the same for all the logics.

3.5 Communication

The loads identified for SPS of Talcher -Kolar will be used to give relief during operation of SPS of Kudankulam. Therefore dedicated communication
channels should be planned between Kudankulam and Kolar, to transmit the TRIP SIGNAL I and II. The communication proposal of SRTS II is placed at annexure II. The proposal is adequate and provides path diversified signal transmission up to Erode. Between Erode and Kolar alternate channel is proposed through leasing from Powergrid Telecom wherever ULDC link is not available.

Therefore special group recommends the proposal of SRII

3.6 Roles of Various organizations in implementing the Scheme

A detailed discussion was held on the initial proposal of the committee which is detailed below:

<table>
<thead>
<tr>
<th>SI No</th>
<th>Action</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Development of Logic, implementation and extending potential free contacts for trip transfer up to the communication panels</td>
<td>NPC</td>
</tr>
<tr>
<td>2</td>
<td>Communication logistics for transmitting trip signals from Kudankulam through the wide-band point to Kolar (including providing protection couplers at both ends)</td>
<td>POWERGRID SRTSII</td>
</tr>
<tr>
<td>3</td>
<td>Maintenance of the PLCs and the communication equipments at Kudankulam</td>
<td>NPC</td>
</tr>
<tr>
<td>4</td>
<td>Maintenance of the communication equipments beyond Kudankulam up to Kolar, including interface equipment at Kolar</td>
<td>POWERGRID SRTSII</td>
</tr>
</tbody>
</table>

All members of the group except the representative from NPCIL agreed with the above proposal. NPCIL was of the view that the responsibility of item nos. 1 & 3 cannot be taken by NPCIL, that it should be implemented by a central nodal agency and that NPCIL shall extend all possible support only. It was brought to the notice of the NPCIL, that as per clause 4.10 and 5.2 (ii) & (p) of IEGC each constituent should provide and maintain reliable communication.
facility. Also, considering the requirement of a reliable operation and reduced breakdown time, NPCIL was requested by other members to agree for the above proposal. Since no convergence could be arrived on this issue, this matter needs to be taken up at PCC level and resolved.

4 Approximate cost of the project

Based on the various feedbacks obtained, following will be the approximate cost of the project:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Item</th>
<th>Approximate cost in Lakh (excl. Cess) (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Providing PLC's to meet 2 out of three logs</td>
<td>9*</td>
</tr>
<tr>
<td>2</td>
<td>Providing communication equipments</td>
<td>50 **</td>
</tr>
</tbody>
</table>

* Based on the cost of PLC used in SPS of Kolar (Rs 2.5 Lakhs + taxes per PLC)

**Based on the cost estimate provided by SRTS II for communication requirement without path diversified communication between Salem and Kolar. It may change if path diversified communication is planned.
Annual recurring expenditure for hiring link is Rs 5.0 Lakhs
<table>
<thead>
<tr>
<th>Description</th>
<th>Cause / Remarks</th>
<th>Restoration</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVDC Kolar Pole-1 blocked.</td>
<td>Pole I blocked due to sudden failure of control device (output relay burnt) at Talcher end. This created DC earth fault in the system and two nos. main filter breakers also tripped during this incidence. Due to AC filter limitation power on Pole 2 in metallic return mode ramped down to 350 MW.</td>
<td>29.07.2006 21.24 Pole-1</td>
</tr>
<tr>
<td>HVDC Kolar Pole-1 &amp; Pole-2 blocked.</td>
<td>Commutation failure due to AC system disturbance caused by blasting of B Phase PIR (Pre Insertion Resistor) of transfer bus breaker of Hoody-Gooty 400 kV line, resulting in bus fault at Hoody 400 kV substation</td>
<td>15.09.2006 17.32 Pole-1 17.35 Pole-2</td>
</tr>
<tr>
<td>Load relief obtained: AP 172 MW KER 158 MW KAR 449 MW TN 613 MW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVDC Kolar Pole 2 blocked at Talcher. Pole-1 was under LC from 14.10.2006 10.04 hrs.</td>
<td>Pole switched off due to heavy fire in neutral yard (Melting of isolator at Talcher)</td>
<td>14.10.2006 20.24 Pole 2 20.49</td>
</tr>
</tbody>
</table>
(Power flow of Pole 2 was about 880 MW prior to the blocking. Frequency was 49.18 Hz before blocking and 48.95 Hz after blocking)

(Inter trip signal 1 was sent to the constituent systems)

Unit 4 & 5 at TTPS tripped due to blocking of Pole 2

Load relief reported:
AP    121 MW
KAR   397 MW
TN    429 MW

<table>
<thead>
<tr>
<th>Pole 1</th>
</tr>
</thead>
</table>