भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
प्रणाली योजना एवं परियोजना मूल्यांकन प्रभाग
System Planning & Project Appraisal Division
सेवा भवन, आर. के. पुरम, नई दिल्ली–110066
Sewa Bhawan, R. K. Puram, New Delhi-110066
वेबसाइट / **Website: www.cea.nic.in**

[ISO: 9001:2008]

No. 1/9/SP&PA-2013 /

Dated: 22.07.2013

-As per list enclosed-

Sub: Additional Agenda for 32nd meeting of the Standing Committee on Power System Planning of Northern Region

Sir,

In continuation to our earlier letter of even no. dated 10.07.2013, it is intimated that the additional agenda for the 32nd Standing Committee Meeting on Power System Planning in Northern Region has been uploaded on CEA website : www.cea.nic.in (path to access – Home Page - Wing specific document /power system related reports / standing committee on power system planning / Northern region).

The venue and date of meeting shall be intimated separately.

Yours faithfully,

(B. K.Sharma) 22/7/13
Director (SP&PA)

Additional agenda for 32nd Standing Committee Meeting on Power System Planning in NR

1. Evacuation of Renewable Energy generations located in WR and NR to Northern Region states

CEA convened a meeting in May'13 for assessing RES (Renewable Energy Source) capacity additions in the states of Rajasthan, Himachal Pradesh,J&K,Gujrat, Maharashtra, Tamilnadu, Karnataka & Andhra Pradesh by the end of 12th Plan period. As per the assessment, the RES generation of about 32 GW is expected by the end of 12th Plan period is given as under:

(i) Rajasthan	-	5694 MW
(ii) Himachal Pradesh	-	1281 MW
(iii) J&K	-	476 MW
(iv) Gujrat	-	4729 MW
(v) Maharashtra	-	4063 MW
(vi) Andhra Pradesh	-	4827 MW
(vii) Karnataka	-	4290 MW
(viii) Tamil Nadu	-	7353 MW

As mentioned above, Rajasthan has envisaged 5694 MW Renewable capacity addition during 12th Plan period, increasing total RE capacity to about 8100 MW. Out of the above envisaged capacity, about 2000 MW (35%) is envisaged near Bhadla (distt. Jodhpur), Jaisalmer belt etc. In addition RRECL has also informed about development of a solar park near Bhadla of about 2000 MW additional capacity in future.

Similarly, Gujarat and Maharashtra have envisaged 4729 MW & 4063 MW RE capacity addition in 12th Plan period. With above envisaged capacity addition, total RE capacity in Gujarat & Maharashtra shall be about 8300 MW and 7700 MW respectively. With above quantum of envisaged Renewable capacity addition, it is expected that some of the RE rich state including Gujarat, Rajasthan may witness availability of more RE capacity than the capacity required for fulfilling their Renewable Purchase Obligations (RPO). Further, such RE rich host state may also not absorb RE energy locally particularly during the other than peak hour condition. Inherent characteristics of renewable like volatility necessitates requirement of adequate balancing generation reserves to take care of Intermittency/variability.

As the IEGC stipulates, renewable energy plants to have “MUST RUN” status and shall not be subjected to “merit order dispatch” principles. In order to meet all above challenges in high RE penetration scenario, an integrated transmission planning approach would need to be followed so that renewable generation not have to be backed down during various scenario as well as local load centres are provided an uninterrupted supply even when renewable generation is not available.

Renewable usually have very short gestation period viz. Wind generation projects (12-16 months) & Solar Generation projects (9-12 months) as compared to development of transmission infrastructure (30-36 months). Therefore, in view of the concentration of renewable potential in some of such locations and short gestation period, RE pooling station in such complexes must be established which shall encourage development of renewable generation.

In order to address various issues of grid integration of renewable, enlarging of power balancing area is a must requirement. Strengthening/expansion of grid interconnection through Inter State Transmission system (ISTS) shall enlarge much needed power-balancing area. For such large interconnected system, variation in frequency would be lesser for a given variation in generation/demand as well as it will help in reaping out the benefits of diversity in terms of spinning reserve and utilizing quick-start hydro/ gas generation capacity in different parts of the grid for power-balancing.

The inter-state transmission system in NR and WR has also been identified for integrating ISTS with the intra-state evacuation system of respective state of NR & WR for any incidental outflow of power and mutual reliability for both, intra-state as well as inter-state grids.

RE generation in Rajasthan, is mainly confined in western part of Rajasthan in Jaisalmer, Jodhpur, Bikaner and Barmer districts. To disperse and absorb green energy, a Comprehensive transmission scheme has been formulated by RVPN at intra - state level, details of which are as under:

S.No.	Proposed Transmission System for Power Evacuation Scheme of Solar Power Projects in Rajasthan
1	**400 kV GSS at Banswara (Upgradation of approved 220 kV switching station at Banswara)**
i	2x500 MVA , 400/220 kV GSS at Banswara
ii	2x160 MVA , 220/132 kV & 2x40/50 MVA , 132/33 kV transformers at proposed 400/220 kV GSS Banswara
iii	125 MVAR, 400 kV bus type shunt reactor at Banswara
iv	400 kV D/C Banswara-Chittorgarh line (Quad Moose conductor) with 2x50 MVAR line reactors at Both ends of line (Estimates for 2 Nos.400kV bays at Chittorgarh & Line reactors cost included in estimates of 400/220 kV GSS Banswara)
v	220 kV interconnections (D/C) at proposed 400 kV GSS Banswara (To be identified)
vi	132 kV interconnections (D/C) at proposed 400 kV GSS Banswara (To be identified)
vii	Additional 220 kV bays at 400 kV GSS Banswara(14 bays considered in 400kV GSS estimate)
viii	Additional 132 kV bays at 400 kV GSS Banswara(16 bays considered in 400kV GSS estimate)
ix	Additional 33 kV bays at 400 kV GSS Banswara(20 bays considered in 400kV GSS estimate)
2	**220 kV GSS at Undoo (Upgradation) (Distt. Barmer)**
i	220/132kV,2x160 MVA & 132/33kV, 2X40/50 MVA GSS at Undoo (New Location)
ii	220 kV D/C line from proposed 220 kV GSS Undoo to proposed 400/ 220 kV GSS Pokaran
iii	132 kV interconnections (D/C) at proposed 220 kV GSS Undoo (To be identified)
iv	Additional 220 kV bays at 220 kV GSS Undoo (6 bays considered in 220kV GSS Undoo estimate)
v	Additional 132 kV bays at 220 kV GSS Undoo (10 bays considered in 220kV GSS Undoo estimate)
vi	Additional 33 kV bays at 220 kV GSS Undoo (10 bays considered in 220kV GSS Undoo estimate)

System Studies :

In order to identify transmission requirement for transfer of RE power from the RE rich potential States to other States, studies have been carried out for the 2016-17 time frame considering 18th EPS demand for Seasonal Light Load condition (Monsoon off peak) in which renewable is maximized. In such scenario, maximized renewable

dispatch scenarios (Wind-70%, Solar-80%) has been considered in other than the peak demand hours (80% of EPS peak demand for WR/SR/ER) for studies. As per the analysis of historical trends of NR demand during monsoon season, demand of Northern region is considered as 95% of the peak demand as the region has a typical flat load profile over the day due to its agricultural load during the monsoon periods when renewable is maximized. In this scenario, special area despatch i.e. full despatch from Kutch complex generations viz. Mundra UMPP (4150 MW) as well as Adani Mundra (4620 MW) is considered.

In view of the envisaged RE capacity addition in Kutch complex in Gujarat and existing/planned capacities of conventional generation, it is proposed that a 765/400kV pooling station near Bhuj may be established. Bhuj pool substation may be interconnected to a pooling station in northern part of Gujarat viz. Banaskantha/Sankhari at 765kV level an upcoming Solar generation hub. This substation is also proposed to be anchored with existing 400kV Sankhari (GETCO) substation, a major Solar Pooling hub.

Considering the requirement of onward dispersal of power outside Gujarat to other states, a High capacity transmission corridor is being proposed right from the Gujarat (WR) to Punjab in NR via Rajasthan. Towards this, Banaskantha/Sankhari substation is proposed to be connected to southern/central part of Rajasthan at Chittorgarh & Ajmer in Rajasthan at 765kV level.

Acordingly following system has been considered :

Rajasthan (Northern region)

- Chittorgarh – Ajmer(New) 765kV D/c
- Ajmer (New)- Ajmer (RVPN) 400kV D/c (Quad)
- Chittorgarh (New)- Chittorgarh (RVPN) 400kV D/c (Quad)
- Establishment of 2x1500 MVA, 765/400kV S/s at Chittorgarh
- Establishment of 2x1500 MVA, 765/400kV S/s at Ajmer (New)
- Associated reactive compensation (Bus reactors & Line reactors) at Ajmer and Chittorgarh

Gujarat (Western Region)

1. Bhuj Pool – Banaskanta/Sankhari 765kV D/c
2. Banaskanta/Sankhari – Chittorgarh 765kV D/c
3. Banaskanta – Sankhari 400kV D/c
4. Establishment of 2x1500 MVA, 765/400kV S/s at Bhuj Pool
5. Establishment of 2x1500 MVA, 765/400kV S/s at Banaskanta/Sankhari
6. Associated reactive compensation (Bus reactors & Line reactors)

Result of simulation studies are as follows :

- Base Case: From the studies in base case scenario, it is observed that loading on the proposed system is as follows. Result of simulation is plotted in **Exhibit-Base** :

  765 kV Banaskanta – Chittorgarh line : 711 MW/Ckt
  765 kV Chittorgarh-Ajmer line : 566 MW/Ckt
  Trf drop at Ajmer : 1129 MW

- Under outage of one circuit of Bhadla-Bikaner 400kV the other circuit gets loaded to **937MW.** Simulation result shown in **Exhibit-Base-01**. Load flow studies with n-1-1 criteria outage of Bhadla-Bikaner 400kV D/c has also been considered, **Exhibit-Base-02**. Studies indicate that Jodhpur-Merta gets loaded to **848MW/ckt** and Bhadla-Merta gets loaded to **808MW/ckt**. Here it may be mentioned that out of the above envisaged capacity of 5694 MW in Rajasthan, about 2000 MW (35%) is envisaged near Bhadla (distt. Jodhpur), Jaisalmer belt etc in 12th plan period. With already existing generation and low power demand in the area there is a need for strengthening to transfer power out of the area. RRECL has also informed about development of a solar park near Bhadla of about 2000 MW additional capacity in future.
- In view of above Establishment of 765/400kV substation at Bhadla with Bhadla-Ajmer 765kV D/c and 400kV interconnection to Bhadla and Pokhran(new-RVPN) has been considered. Simulation results with proposed system is plotted in **Exhibit-Case1.** It is seen that with this, total injection at Ajmer is about **1615MW.**

- To study the effect of contingency, outage of Ajmer-Jaipur 400kV D/c has been considered, **Exhibit-Case1-01**. It is seen that with reduced outlet the injection as Ajmer reduces to about **1280MW**. With the outage of Ajmer-Jaipur 400kV D/c the line, about **500MW** of power from Ajmer is found to be wheeling all the way to Deedwana from where it flows toward Jaipur.

- With above proposed interconnections, 765kV Ajmer, a major power pooling point, shall aggregate power from WR/Gujarat through Banaskantha/Chittorgarh as well as Bhadla(Jodhpur) in Rajasthan. With above proposed system, power injected at Ajmer is being stepped down to 400kV and are evacuated to Jaipur over 400kV lines. At Jaipur, the power is stepped up at 765kV for evacuation out of Rajasthan. Considering this, there is a need for providing a low impedance corridor for evacuation of power beyond Ajmer, for onward dispersal of above power outside Rajasthan.

- In view of the above, for onward dispersal of power outside rajasthan, a 765kV High capacity transmission corridor is proposed towards Moga in Punjab, a major load centre in NR, via Suratgarh pooling station in Rajasthan over 765kV network. Moga is also connected to Kishenpur in J&K, which is large hydro pocket in Jammu & Kashmir. In this manner, this shall facilitate integration of Renewable with hydro complex, enabling supply side balancing thourgh Hydro resources.

- Accrodingly load flow studies with proposed Ajmer-Suratgarh-Moga 765kV transmission corridor has been considered. The result of simulation studies with this corridor is plotted in **Exhibit-Case2.** It is seen that with the provision of the corridor power available at Ajmer is about **2400MW.**

- To study the effect of contingency outage of Bhadla-Bikaner 400kV D/c and Ajmer-Jaipur 400kV D/c has been considered. Result of simulation study are

plotted in **Exhibit-Case-2-01 & Case-2-02** respectively. It is seen that with the proosed strengthenings, all line loadings are within limits.

Based on the above, inter-state transmission system in NR and WR has been identified for integrating ISTS with the intra-state evacuation system of respective state of NR & WR for any incidental outflow of power and mutual reliability for both, intra-state as well as inter-state grids.The details of the proposed ISTS are given as under:

Rajasthan (Northern region)

- Chittorgarh – Ajmer(New) 765kV D/c
- Ajmer(New) - Suratgarh(New) 765kV D/c
- Suratgarh(New)-Moga(PG) 765kV D/c
- Bhadla(New)- Ajmer(New) 765kV D/c
- Chittorgarh (New)- Chittorgarh (RVPN) 400kV D/c (Quad)
- Ajmer (New)- Ajmer (RVPN) 400kV D/c (Quad)
- Suratgarh (New)- Suratgarh (existing) 400kV D/c (Quad)
- Bhadla (New)- Bhadla (RVPN) 400kV D/c (Quad)
- Bhadla (New)- Pokaran (new-RVPN) 400kV D/c (Quad)
- Establishment of 2x1500 MVA, 765/400kV S/s at Chittorgarh
- Establishment of 2x1500 MVA, 765/400kV S/s at Ajmer (New)
- Establishment of 2x1500 MVA, 765/400kV S/s at Bhadla (new)
- Establishment of 2x1500 MVA, 765/400kV S/s at Suratgarh (New)
- Associated reactive compensation (Bus reactors & Line reactors).

Gujarat (Western Region)

- Bhuj Pool – Banaskanta/Sankhari 765kV D/c
- Banaskanta/Sankhari – Chittorgarh 765kV D/c
- Banaskanta – Sankhari 400kV D/c
- Establishment of 2x1500 MVA, 765/400kV S/s at Bhuj Pool
- Establishment of 2x1500 MVA, 765/400kV S/s at Banaskanta/Sankhari
- Associated reactive compensation (Bus reactors & Line reactors)

Members may deliberate and concur.

2. Development of Analytics as part of Unified Real Time Dynamic State Measurement (URTDSM) scheme

Implementation of Unified Real Time Dynamic State Measurement (URTDSM) scheme as system strengthening consists of installation of Phasor Measurement Unit(PMU) at existing State, ISTS and IPP stations and lines at 400kV and above including that

coming up by 2014-15, generation switchyard at 220kV and above, Phasor Data Concentrator(PDC) at all SLDC, RLDC & NLDC along with OPGW communication links was agreed in the Joint meeting of all the five(5) Regional Standing committees on Power System Planning held on 05.03.2012.

In URTDSM, the user interface application software is proposed to visualize and analyze the real time phasor data. It was also decided that following analytics are to be developed in parallel with implementation of the URTDSM scheme in association with premier academic institutions like IIT using PMU based measurement.

- Line Parameter Estimation
- Vulnerability analysis of distance relays
- Linear state estimator
- Supervised Zone-3 distance protection scheme to prevent unwanted tripping of backup distance relays
- CT/CVT calibration
- Control Schemes for improving system security (based on angular, voltage and frequency instability)

Purpose and deliverables for above analytics is enclosed at ***Annexure-I***.

Based on the discussion, development of above analytics in association with IIT Bombay progressively in three(3) years has been undertaken which will be installed at all SLDC, RLDC, NLDC, RPC, CEA and CTU.

This is for information to members.

3. Evacuation of Power from Malana-II HEP (100 MW)

For evacuation of power from Parbati-II & Parbati-III Hydroelectric projects of NHPC and Koldam Hydroelectric project of NTPC, a composite transmission scheme was evolved. In a meeting held on 23.02.04 in CEA it emerged that Parbati-II evacuation system would be available during the time frame of commissioning of Allain Dhuangan / Malana-II. HEPs. Accordingly power of Allain Duhangan HEP (192 MW) and Malana-II (100 MW) was also planned to be evacuated through the same corridor by pooling at Parbati Pooling Station.

Considering the above, following scheme was discussed and finalized in 14th and 16th Standing Committee Meeting of Power System Planning of Northern Region held on 30/12/02 and 24/03/2004 respectively:

Parbati-II (800 MW)

- *Parbati II- Koldam 400 kV (Quad) 2*S/C*
- *Parbati II – Koldam 400 kV (Quad) S/C with Realignment at Koldam*

Koldam (800 MW)

- *Koldam – Nalagrh 400 kV D/c (Quad)*
- *Koldam – Ludhiana 400 kV D/c (Triple)*

Parbati-III (520 MW)

- *LILO of Parbati-II- Koldam at Parbati Pooling Station, 400 kV D/C (QUAD)*
- *LILO of one ckt of Parbati-II – Parbati Pooling at Parbati-III*
- *Parbati Pooling – Amritsar 400 kV D/c*
- *Establishment of 400 kV Parbati Pooling station*

Allain Duhangan HEP(192 MW) of M/s AD Hydro and Malana-II HEP(100 MW)of M/s EPPL

- *Injection of power from Allain Duhangan & Malana-II at Parbati Pooling stn.*

The implementation of Parbati-II to Koldam 400 kV line was planned through Parbati Koldam Transmission Company Ltd. (A JV of Reliance and POWERGRID). Due to certain policy issues, MOU agreement could not be signed. AD hydro requested MOP for implementation of ADHEP- Nalagarh 220kV D/c line in case of delays in identified scheme as their project was scheduled to commission by Apr'2008. During the 21st SCM held on 3/11/2006 it was discussed and agreed that considering that the 400 kV system may not be available at the time of commissioning of the generation project it was decided that M/s AD Hydro may construct Allain Duhangan – Nalagarh 220 kV D/c line. During the meeting the issue of evacuation of power from Malana-II was also discussed.

Subsequently, while discussing the evacuation arrangement for Malana-II HEP, it was suggested to M/s A D Hydro to upgrade the conductor of the line, so as the power from

both the projects i.e. Malana-II and Allain Duhangan can be evacuated through the 220 kV D/c line. In the recommendation letter of CEA to MOP on grant of sec-68 to M/s AD Hydro it was mentioned that out of the total 400MW transmission capacity of the 220kV D/c AD Hydro-Nalagarh line, 192MW would be utilized for evacuation of Allain Duhangan HEP and balance capacity would made available to other projects of Parbati/Beas valley. It was suggested to M/s A D Hydro to upgrade the conductor of the line, so as the power from both the projects i.e. Malana-II and Allain Duhangan can be evacuated through the 220 kV D/c line. However, AD HEP expressed their reservation for the changes in the conductor of this line as 80% of single zebra conductor was already delivered. So there was no option left other than to go ahead with the single Zebra conductor line. Further considering the commissioning schedule of generation of Allain Duhangan as well as for Malana-II HEPs and scenario prevailing at that time, it was decided that Malana-II may be evacuated through LILO of one ckt of Allain Duhangan – Nalagarh 220 kV D/c line. In the meeting taken by Chairperson,CEA wherein M/s ADHydro and M/s EPPL was present it was decided that both parties would mutually decide on sharing of the cost and M/s AD Hydro would take up the issue with CERC regarding sharing of their line cost.

Considering that AD HEP – Nalagarh 220 kV D/c line is not adequate for reliable evacuation of power from both the projects, the issue was again discussed in 30th and 31st Standing Committee Meeting on Power System Planning of Northern Region. During these meetings it has been decided that a 220 kV D/c line shall be constructed from Chhaur substation to Parbati Pooling Station by HPPTCL and evacuation of power of Malana-II HEP shall be delinked from AD Hydro – Nalagarh 220 kV D/c line to provide the reliability of power evacuation of both HEPs.

In view of the urgency of implementation of this line, matter is put up again to the members of Standing Committee Meeting. HPPTCL is requested to expedite the implementation of 220 kV Chhaur-Parbati Pooling Station D/c line and give the firm time frame for the same.

Members may kindly approve.

4. Converting 2x80 MVAR fixed reactors at Gorakhpur end of 400kV Barh-Gorakhpur D/C line into switchable line reactors.

Barh - Gorakhpur 400 kV D/c line (under construction by POWERGRID as part of Barh transmission system) is having 2x80 MVAR fixed line reactors at Gorakhpur end. Subsequently, this line was agreed to be looped-in & looped-out at Motihari sub-station in Bihar (to be constructed through TBCB). However, even after LILO at Motihari S/s, the length of each section of this line would be more than 150 km. For better reactive power management and system operation, it is proposed to convert these fixed line reactors into switchable line reactors. The proposal has been agreed in-principle by CEA and by the previous meeting of Standing Committee Meeting on Power System Planning of ER.

Members may kindly approve.

5. Provision of Bus reactor at Parbati-II HEP and extension of 2nos. circuits of 400kV Parbati-III HEP- Parbati Pooling Station line (being constructed by PKTCL) upto Sainj HEP Switchyard

It is mentioned that provision of 400 kV, 125 MVAR bus reactor at Parbati-II HEP and 400 kV, 80 MVAR bus reactor at Parbati-III HEP, was approved in 15th NRPC meeting held on 24th December,2009. Subsequently, in 24th TCC/27th NRPC meeting held on 29-30th Nov.,2012 at Amritsar, NHPC representative informed about space constraints at Parbati-II & Parbati-III HEP to accommodate above proposed bus reactors. It was decided in the 27th NRPC meeting that a committee comprising of CEA, CTU and NHPC would carry out a site visit at Parbati complex for exploring the feasibility and space for providing the above bus reactors.

The site visit was carried out in May,2013 and it was observed that space for bus reactor is not available at Parbati-III HEP. However,the committee observed that at Parbati-II HEP GIS hall (at 1st Floor), space is available for providing one no. 400 kV GIS bay for bus reactor and 400 kV 125 MVAR bus reactor (or 3 single phase units of 41.66 MVAR) can be accommodated at the space available at Ground Floor where presently a temporary store of M/s L&T is located. In view of this, it is proposed that NHPC may keep provision of 125 MVAR bus reactor at Parbati-II HEP.

Regarding evacuation of Sainj HEP, it is mentioned that PKTCL is constructing 400 kV 2xS/c lines from Parbati-I HEP to Koldam HEP. Portion of these lines between Parbati-III HEP and Parbati Pooling Station has been completed for evacuation of Parbati-III HEP. It is proposed that PKTCL may be requested to extend these 400 kV lines up to Sainj HEP switchyard by December,2014 matching with the scheduled commissioning of Sainj HEP. This will facilitate evacuation of generation of Sainj HEP which is also taken up in Main **Agenda item no.15.**

Members may discuss and concur.

6. Requirement of 2 nos. 220 kV line bays at 400/220 kV Bhinmal S/s of POWERGRID- agenda from RRVPNL

RRVNL has intimated that at present 4 nos. of 220 kV line bays provided at 400/220 kV Bhinmal S/s (PG) have been utilized by RRVPNL for feeding their 220 kV S/s. They have requested for providing additional 2 nos. 220 kV line bays at Bhinmal S/s under ISTS for feeding the load of their new 220 kV Sayla S/s.

In this context it is mentioned that 2x315 MVA, 400/220 kV ICTs have been provided at Bhinmal S/s and as per earlier approved norms, 6 nos. 220 kV line bays can be provided under ISTS for feeding 220 kV S/s of STU. As such the proposal of RRVPNL is in order and **members may agree to the same.**

7. Response to POSOCO report on Operational Feedback on Transmission Constraints

POSOCO in its report on 'Operational Feedback on Transmission Constraints - April 2013' has listed a number of transmission lines and ICTs which are experiencing constraints due to overloading. The report is available on POSOCO website (posoco.in >document>operational-feedback).

The transmission constraints pertaining to Northern Region have been analysed and observations are given as under:

- The constrainst due to high voltages during light load conditions, is being addressed through reactive compensation addition in the system.
- The observations on the constraints due to high line loadings are listed below:

	Constraint	Reason	Remarks.
1	Transmission System for evacuation of 1140MW(2x110MW+2x210MW+ 2x250MW) at Parichha	Associated transmission system for recently commissioned 2x250 MW units at Parichha is yet to be commissioned.	As an interim Measure UPPTCL was to terminate 400kV D/c at Mainpuri. Status of progress of work and commissioning schedule of Mianpuri(UP) may be given by UPPTCL
2	Transmission System for evacuation of 1200MW Rosa TPS in Uttar Pradesh	LILO of only one circuit of 400 kV Lucknow-Bareilly D/C was done at 400 kV Rosa to facilitate generation evacuation. Consequently the 400 kV Lucknow-Bareilly ckt-2 and 400 kV Lucknow-Rosa-Bareilly are unevenly loaded	The arrangement is temporary arrangement. With the commissioning of Shahjhanpur substation which is expected by 2013 the constraint will be over come.
3	Tie line between Unnao and Panki substation of U.P.	400 kV Unnao-Panki is often loaded in the range of 700- 900 MW.	Lucknow-Kanpur 400kV D/c has been approved under NRSS-XXII and preliminary activities have been initiated.
4	220 kV Sarna-Heeranagar S/C	The 220 kV Sarna- Hiranagar-Jammu section is getting heavily loaded during.Summer and winter	The envisaged 220kV RSD-Hiranagar D/C and the 220 kV network downstream of 400 kV Samba is yet to be commissioned. POWERGRID has commissioned Samba substation with 220kV bays. PDD may indicate the schedule of their 220kV lines
5	High loading in western UP during peak loading condiiton	During low hydro generation and increased drawl by Western UP and Uttaranachal Dadri-Muradnagar, Meerut-Muzzafar Nagar and and Meerut	AT Meerut 1x500MVA is covered un Augmentation of transformer in NR and is under construction.

		transformer gets overloaded.	Under NRSS-XXI, Bareilly-Kashipur-Roorkee-Sharanpur has been taken up by PWOERGRID and is expected to be commissioned by 2013-14. UPPTCL has also planned substation at Hapur to meet its load in Western part. UPPTCL may indicate the status.
6	New element pending since long could be suggested for expedite	• Underlying 220kV network of 400/220kV for Deepalpur, Kabulpur and Manesar in Haryana. • 400kV Daultabad-Gurgaon D/C • 400kV Dadri-Loni Road and underlying 220kV network of loni road • LILO of 400kV Dehar-Bhiwani BBMB • LILO of 400kV Dehar-Panipat	LILO of Dehar lines is taken up by POWERGRID and expected by Aug'2014 This line is commissioned.
7	Upcoming network in Northern region may be expedited	• 400kV Dhanoda-Bhiwani PG D/C • 400kV Ring network in Punjab system • Connectivity of J&K valley system with the rest of the grid • 400kV substation in Western UP (Bagpat, Aligarh, Orai) • 400kV substation in Uttarakhand e.g Dehradun, Srinagar • 400kV interconnection of Uttarakhand i.e 400kV Bareilly-Kashipur, 400kV Kashipur-Roorkee and 400kV Roorkee-Saharanpur • 400 kV Rihand-III-Vindhyachal pooling station D/C	400/220 kV New Wanpoh S/s in J&K with additional conenctiitvty is expected by Apr'2014. PDD may indicate it 220kV lines completion schedule from New Wanpoh S/s. 765 kV switching station at Aligarh and 765/400 kV Orai S/s were approved in in 31st SCM held on 2nd January'13. Preliminary activities initiated. Scheduled for 2016-17

		• Enhancing the connectivity of NR system with WR system.	Dehradun has been delayed due to land acquisition. 400kV interconnection of Uttarakhand is expected by March'14 NR-WR are already connected by 2nos of 765kV lines. To enhance the connectivity of WR-NR Gwalior – Jaipur 765 kV 2*S/c lines are under construction.

CTU and STU may indicate the progress of the above planned transmission works to be implemented by them.

Members may discuss.

8. Integrated transmission system in Uttarakhand to be implemented by PTCUL:

The issue of implementation of integrated transmission system for evacuation of power from various hydro projects (including Central Sector, State Sector & IPPs) in Uttarakhand (UITP) was discussed in various Standing Committee meetings as well as in TCC & NRPC meetings. The issue was discussed in the 2nd TCC and 3rd NRPC meeting held on 10/11/2006 wherein Chairman / Members observed that PTCUL could take up the "intra-state transmission system" upto the pooling point on their own, for which there was no requirement of any commitment of payment of transmission charges by other constituents and arrangement of recovery of transmission charges will be only between PTCUL and the generators. While taking up the implementation of transmission system, the agreement for payment of transmission charges could not be signed with some of the Inter-state generators.

Subsequently, PTCUL took up the matter in NRPC meetings for declaring the system for granting the system as deemed ISTS, however no consensus could be reached.

PTCUL took up the matter with CERC for declaring the integrated scheme as deemed ISTS scheme.

CERC has issued order dated 31/01/2013 regarding declaration of UITP as deemed ISTS. As per the order, CERC had accorded the status of deemed ISTS and directed PTCUL to segregate the transmission lines carrying inter-state power and approach the CTU which is the nodal agency for vetting of the comprehensive scheme in accordance with the connectivity regulations. Further, CTU has been directed by CERC to study the transmission system and in case any modifications are suggested by CTU, the same shall be incorporated and implemented by the PTCUL. CTU has also been directed to monitor the ISTS portion of the UITP scheme.

In regard to above, CTU had a preliminary meeting with PTCUL on 28/05/2013, wherein PTCUL explained the status of the various transmission elements of the UITP scheme. During the meeting it was explained by the CTU that the transmission system needs to be prioritized & phased in such a manner that power does not get bottled up from any generator. It was also informed by the PTCUL that at present their 1st priority is for Alaknanda Basin as the generation projects in other basins may take some time.

The details of the generation projects in Alaknanda basin are enclosed at **Annexure-II** and the details of the integrated transmission scheme in Alaknanda basin are enclosed at **Annexure-III**.

From the generation list it may be observed that Tapovan Vishnugadh (520 MW) project of NTPC, a major project in the basin, may come up first. NTPC need to inform the firm schedule of the generation project. The transmission scheme required for evacuation of power from this project needs to be taken up on urgent basis so as power from the generation project does not get bottled up. The issue of evacuation of power from Tapovan Vishnugadh was discussed during the 28th NRPC meeting of NRPC held on 26/04/2013, it was deliberated that the transmission scheme had already been granted the deemed ISTS status and as per the BPTA already signed beneficiaries had agreed to pay transmission charge for all central sector projects,

existing and future as per applicable CERC regulation. During the meeting beneficiaries agreed for the payment of transmission charges corresponding to MW allocation of Tapovan Vishnugad by Govt of India in line with CERC Regulations.

Keeping above in view the transmission system proposed by PTCUL needs to be discussed and concurred by the Standing Committee on Power System Planning of Northern Region.

Members may discuss and concur.

Annexure-I

DEVELOPMENT OF ANALYTICAL TOOLS USING PMU BASED PHASOR MEASUREMENTS

S No.	Task	Aim	Deliverables
1.	Line Parameter Estimation	Estimate & Validate transmission line parameter. Inputs required: a) PMU based phasor measurement at both ends of line, bus voltage phasor	• Positive and Zero sequence Line parameter estimation (R,X,B) • Errors in line parameters will be logged for information to operator & correction in linear state estimator parameter.
2.	On line vulnerability analysis of distance relays.	Development of software for validating distance relay characteristic (Zone-1, Zone-2, Zone-3) in real time basis by superimposing on field setting of distance relays. Inputs required: b) PMU based phasor measurement at both ends of line, bus voltage phasor c) Distances relay characteristic and settings.	• Visualization of relay characteristic and apparent impedance trajectory in the R-X plane. • Alarm / messages when thresholds are violated or apparent impedance is some margin (say 20%) from Zone 1, 2 or Zone 3 characteristics of the relay. • Identification of power swing beyond a configurable threshold due to any disturbance in the system • Identification of load encroachment condition in the system • Creation & storage of distance relay characteristics of different lines using templates & available settings • Data available in standard format(CSV, excel, comtrade) • Trigger input for DSA

3.	Linear State Estimator	Development of 3-phase linear state estimator, software based on weighted least square technique.
		
		Inputs required:
		a) PMU based phasor measurement at both ends of line and bus voltage phasor,
		
		b) Substation bus switching scheme/topology
			• Network topology processor to update the bus model
			• Bad data detection
			• Topology error detection to identify the switch device errors
			• Observability analysis to identify maximum observable network with available measurement.
			• Pseudo & historical measurement generation in case of lack of observability.
			• Alarms & warnings for model inconsistencies & limit violation.
			• Network connectivity/graph to provide:
			  •Island details
			  •Issue alarm for loss of connectivity
			  •visualisation by making line dotted/different colour

S No.	Task	Aim	Deliverables
			•Component outage • Visualization of state estimator output in tabular & graphical form. • Power system condition can be played-back along with topology connectivity and flow measurement • Three phase State Estimator
4.	Supervised Zone-3 distance protection scheme to prevent unwanted tripping	The analytics will provide adaptive Zone-3 backup protection to avoid unwanted Zone-3 tripping. Inputs required: a) PMU based phasor measurement at both ends of line and bus voltage b) Distance relay characteristics and settings of candidate line	• Identification of presence of persistent fault in the observable system. • Identification of presence of power swing & load encroachment in the observable system. • The software will generate control signal for disabling of Zone -3 protection based on system condition and adopted protection philosophy
5.	CT/CVT Calibration.	This module will evaluate the accuracy of these instruments. Inputs required: a) PMU based phasor measurement at both ends of line, bus voltage phasor b) Benchmarked PT to act as reference c) Linear State Estimator	• Evaluation of CT/CVT errors in magnitude • Evaluation of CT/CVT errors in phase • Identification of faulty CT/CVT from steady state and transient response • Computation of compensation factors for correcting the steady state response of CT/CVT for state estimation • Verification of measurements against benchmark-CT/CVT • Highlighting the variation using graphs
6	Emergency control for improving system security(Based on angular, voltage & frequency stability)	The module will continuously monitor and analyse the stability (like voltage & angular) based on the trajectories of various parameters like voltage, current phasors, breaker status etc Inputs required: d) PMU based phasor measurement at both ends of line, bus voltage phasor	• Based on the analysis of the evolving trajectories a decision on whether to take an automatic control action and its quantum & location shall be taken by such a scheme. • Five such Wide-Area Emergency Control Schemes shall be developed, which will involve appropriate action in any or all regions, adaptively, depending on the event, such as Controlled system separation (adaptive islanding), Adaptation of relays and control systems using wide area Information etc.

Annexure-II

Details of Generation Projects

S.No.	Name of Generation Project	Location with District	Name of Developer	Whether the project is inter-state or intra-state	Time Frame CoD of Units I & Present Status
1	Tapovan Vishnu gad (520MW)	Chamoli	**NTPC**	inter-state	Unit I - March, 2014
2	LataTapovan (NHL Project) (171 MW)	Chamoli	**NTPC**	inter-state	Unit I - Oct, 2016
3	SingoliBhatwari (99 MW)	Rudraprayg	**L&T**	inter-state	Unit I - Jan 2015 (Now. June 2013)
4	Phatabyung (76 MW)	Rudraprayag	**Lanco Hydro Energies Private Ltd.**	inter-state	Unit I July. 2014
5	Rambara (76 MW)	Rudraprayag	**Lanco Hydro Energies Private Ltd.**	inter-state	-
6	Bhyunder Ganga Hydro Electric Project (24.30 MW)	Chamoli	**Super Hydro Electric Pvt.Ltd.**	intra-state	Unit- I 01st Sept. 2014
7	Alaknanda Hydro Electric Project (300 MW)	Chamoli	**GMR (Badrinath)Hydro Power Generation Pvt. Ltd.**	inter-state	Unit- I Oct-2016
8	Srinagar HEP (330 MW)	Pauri	**GVK(Gori Ganga Hydro Power Pvt Ltd.)**	inter-state	Dec. 2011
9	TamakLata (250 MW)	Chamoli	**UJVNL**	intra-state	45th month from starting date

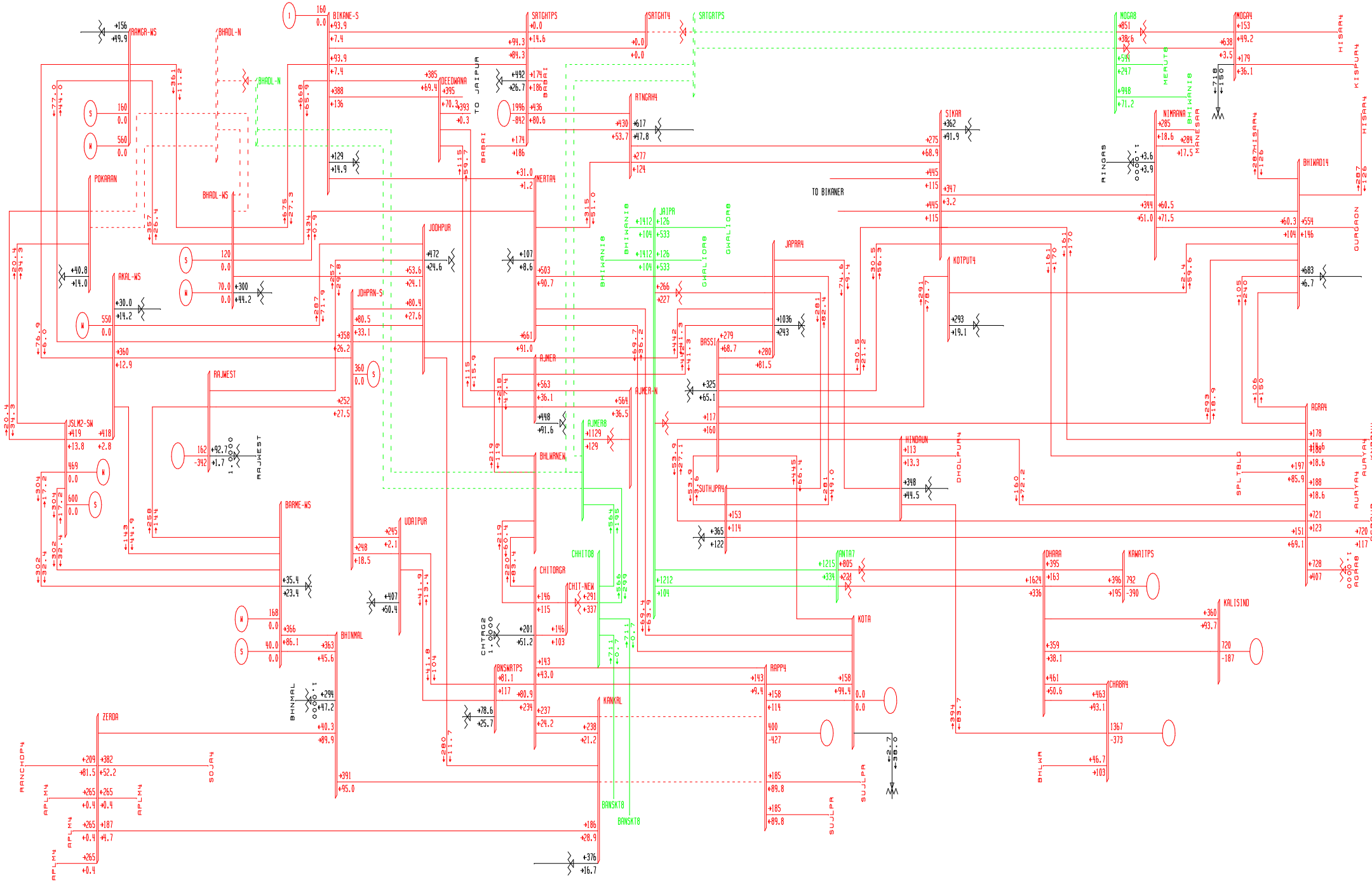
10	NandprayagLangrasu (100MW)	Chamoli	**UJVNL**	intra-state	63rd month from starting date
11	BowalaNandprayag (300MW)	Chamoli	**UJVNL**	intra-state	60th week from starting date (for UNIT-4)
12	Devsari (252 MW)	Chamoli	**SJVN Limited**	inter-state	30.11.2017
13	Pipalkoti (444 MW)	Chamoli	**THDC**	inter-state	-
14	ManeriJhelam (55 MW)	Chamoli	**THDC**	inter-state	-
15	JhelamTamak (60 MW)	Chamoli	**THDC**	inter-state	-

Annexure-III

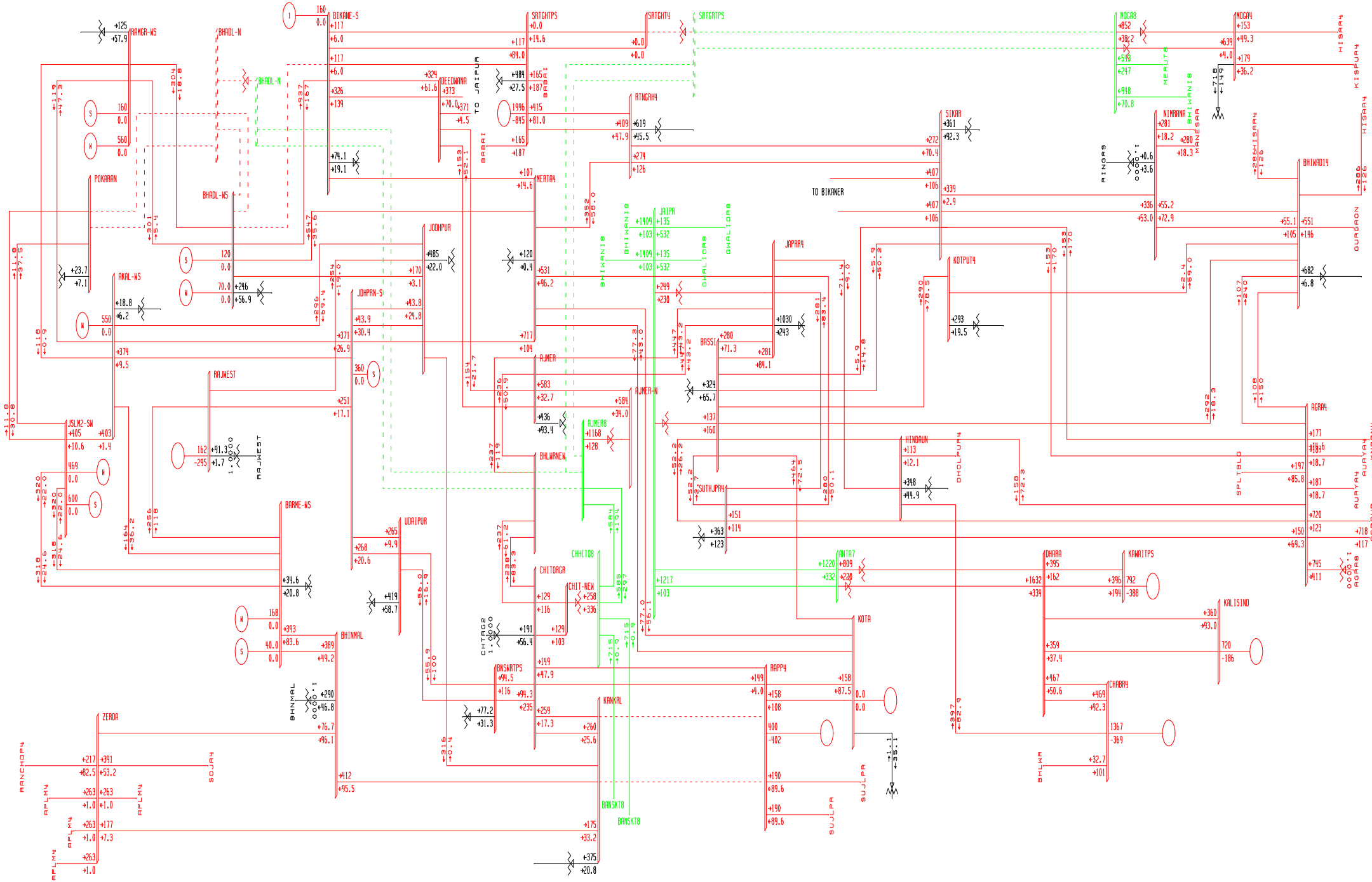
Details of the Common Transmission scheme of Alaknanda Basin		
S.No.	**Name of Transmission line**	**Line length(CKT Kms)/Capacity in MVA**
1	400KV S/s GIS Pipalkoti	630MVA
2	400KV D/C Pipalkoti-Karanprayag-Srinagar line on Quad Moose	184CKM
3	LILO of Vishnuprayag-Muzaffarnagar line at Pipalkoti	1CKM
4	400KV D/C Srinagar-Kashipur line in Quad Bersimis	304CKM
5	400KV S/s Srinagar	630MVA
6	400KV bay at 400KV S/s Kashipur	2.Nos.
7	220KV D/C Twin Zebra LataTapovan-Josimath line	22CKM
8	220KV D/C Twin Zebra Josimath-Pipalkoti line	49CKM
9	220KV S/s Josimath	2x50MVA
10	220KV S/s Baramwari	2x50MVA
11	220KV D/C Baramwari-Srinagar line	220CKM

Details of the Alaknanda Basin transmission system to be associated with various generation projects

S.No.	Name of Generators	Capacity (in MW)	Associated Transmission lines
1	**LataTaovan(NTPC)**	171	220KV D/C Twin Zebra LataTapovan-Josimath line
2	**TamakLata(UJVNL)**	250	LILO of one circuit of 220KV D/C Twin Zebra LataTapovan-Josimath line at 250MW TamakLata HEPP
3	**BhunderGnaga (Super Hydro)**	24.3	220KV D/C Twin Zebra Bhunder Ganga-Josimath line
4	**Badrinath(GMR)**	300	220KV D/C Twin Zebra line from 300MW Badrinath HEPP to LILO point on one circuit of 220 KV Bhunder Ganga-Joshimath line
5	**Vishnugad (NTPC)**	520	400KV D/C Twin Moose Vishnugad-Pipalkoti line& LILO of Vishnuprayag- Muzaffarnagar line at Pipalkoti
6	**Pipalkoti(THDC)**	444	LILO of one circuit of 400KV D/C Quad Moose PipalkotiKaranprayag line at 444MW Pipalkoti HEPP
7	**Devsari(SJVNL)**	252	220KV D/C Twin Zebra Devsari-Karanprayag line
8	**BawalaNandprayag (UJVNL)**	300	220KV D/C Twin Zebra BawalaNandprayag-Karanprayag line
9	**Langrasu(UJVNL)**	100	LILO of one circuit of 220KV D/C twin Zebra BawalaNandprayag-Karanprayag line at 100MW Langrasu HEPP
10	**Phatabyung(Lanco)**	76	220KV D/C Single Zebra Phatabyung-Baramwari line
11	**Rambara(Lanco)**	76	LILO of one citcuit of 220KV Phatabyung-Baramwari line at 76MW Rambara HEPP
12	**SingoliBhatwari (L&T)**	99	LILO of one circuit of 220KV Baramwari-Srinagar line at 99MW Singoli-Bhatwari HEPP
13	**Srinagar HEP(GVK)**	330	400KV D/C Twin Moose Srinagar-Srinagar HEPP line



POWER TECHNOLOGIES, INC.®	WITH STRENGTHENING		EXHIBIT-BASE
	FRI, JUL 12 2013 15:50	KV: ≤220 , ≤400 , ≤765	BUS - NONE BRANCH - MW/MVAR EQUIPMENT - MW/MVAR



WITH STRENGTHENING

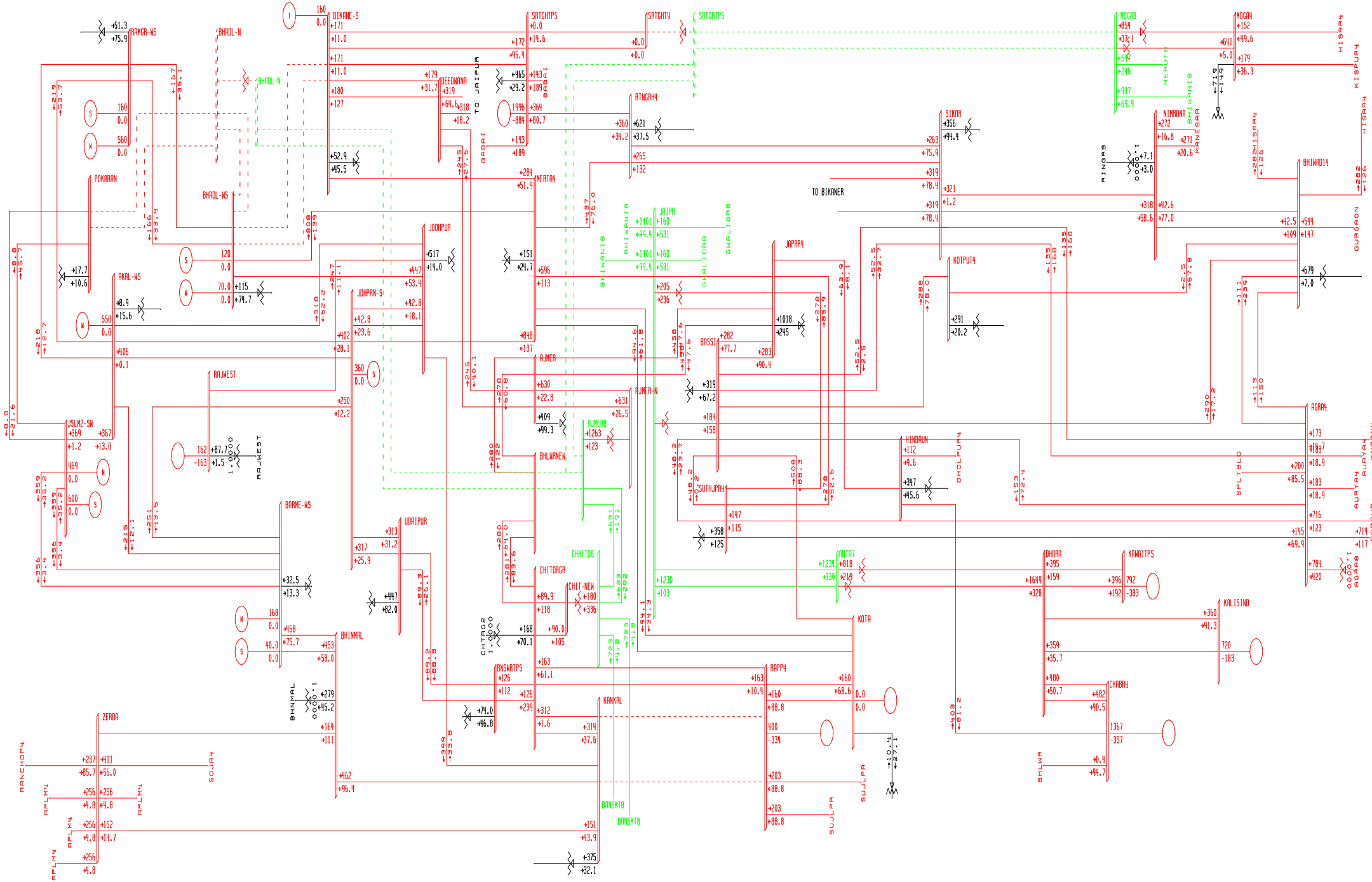
POWER TECHNOLOGIES, INC.®

FRI, JUL 12 2013 15:55

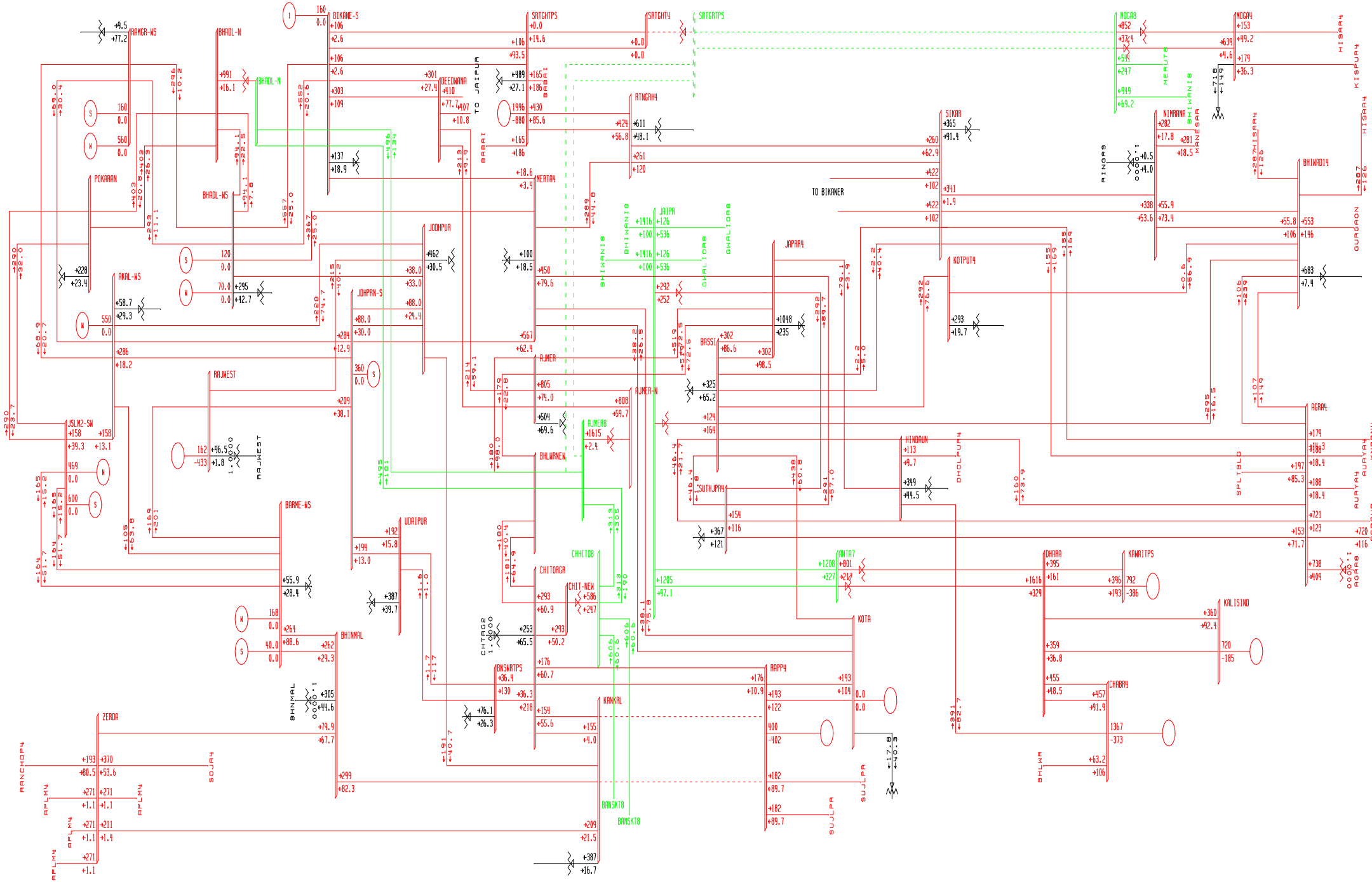
KV: ≤220 , ≤400 , ≤765

BUS - NONE
BRANCH - MW/MVAR
EQUIPMENT - MW/MVAR

EXHIBIT-BASE-01



WITH STRENGTHENING		BUS - NONE	EXHIBIT-BASE-02
POWER TECHNOLOGIES, INC.® FRI, JUL 12 2013 15:55	KV: ≤220 , ≤400 , ≤765	BRANCH - MW/MVAR EQUIPMENT - MW/MVAR	



WITH STRENGTHENING

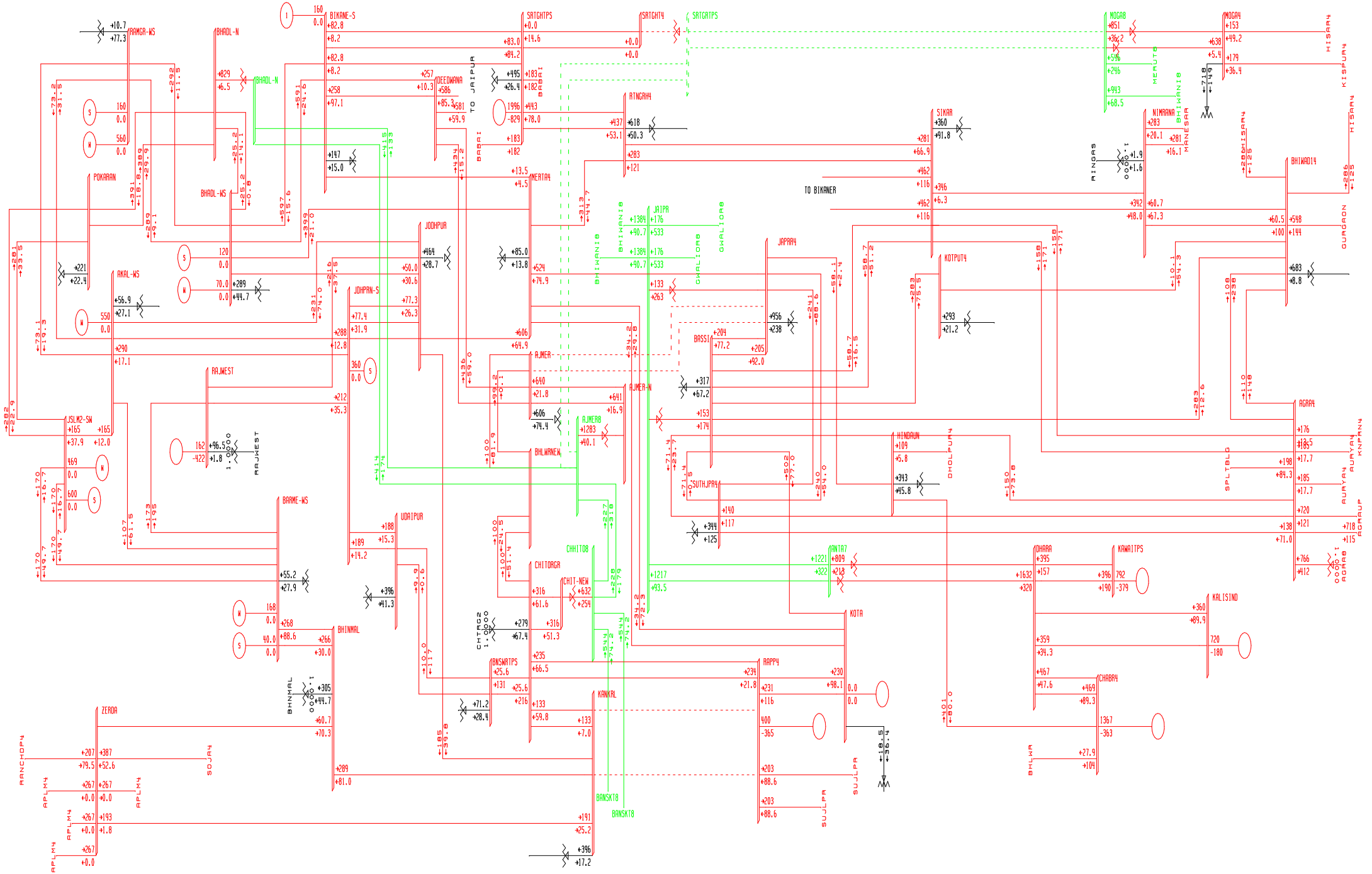
POWER TECHNOLOGIES, INC.®

FRI, JUL 12 2013 16:05

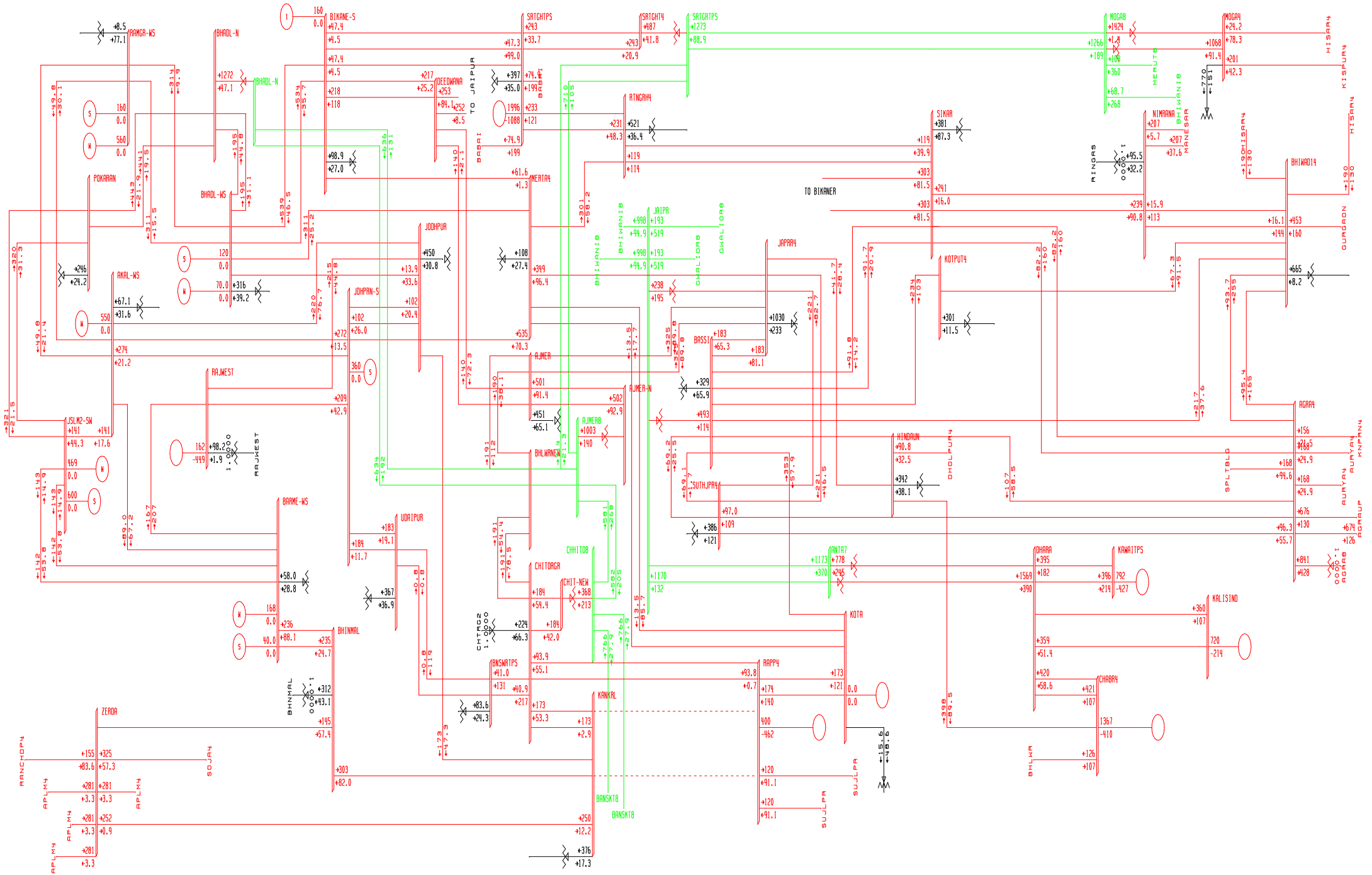
KV: ≤220 , ≤400 , ≤765

BUS - NONE
BRANCH - MW/MVAR
EQUIPMENT - MW/MVAR

EXHIBIT-CASE 1



WITH STRENGTHENING		BUS - NONE	EXHIBIT-CASE 1-01
POWER TECHNOLOGIES, INC.® FRI, JUL 12 2013 16:10	KV: ≤220 , ≤400 , ≤765	BRANCH - MW/MVAR EQUIPMENT - MW/MVAR	



WITH STRENGTHENING

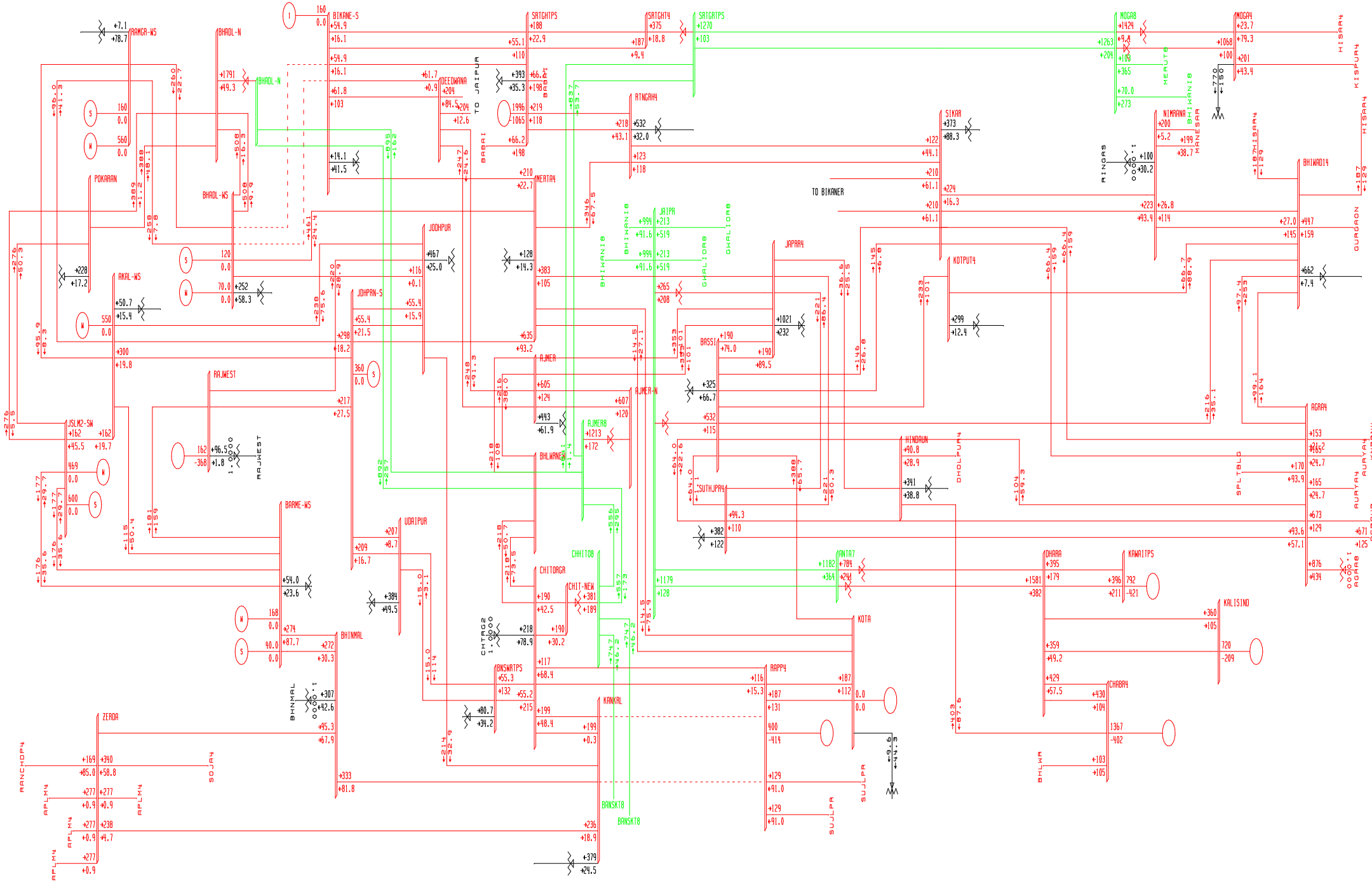
POWER TECHNOLOGIES, INC.®

FRI, JUL 12 2013 16:10

KV: ≤220 , ≤400 , ≤765

BUS - NONE
BRANCH - MW/MVAR
EQUIPMENT - MW/MVAR

EXHIBIT-CASE 2



WITH STRENGTHENING

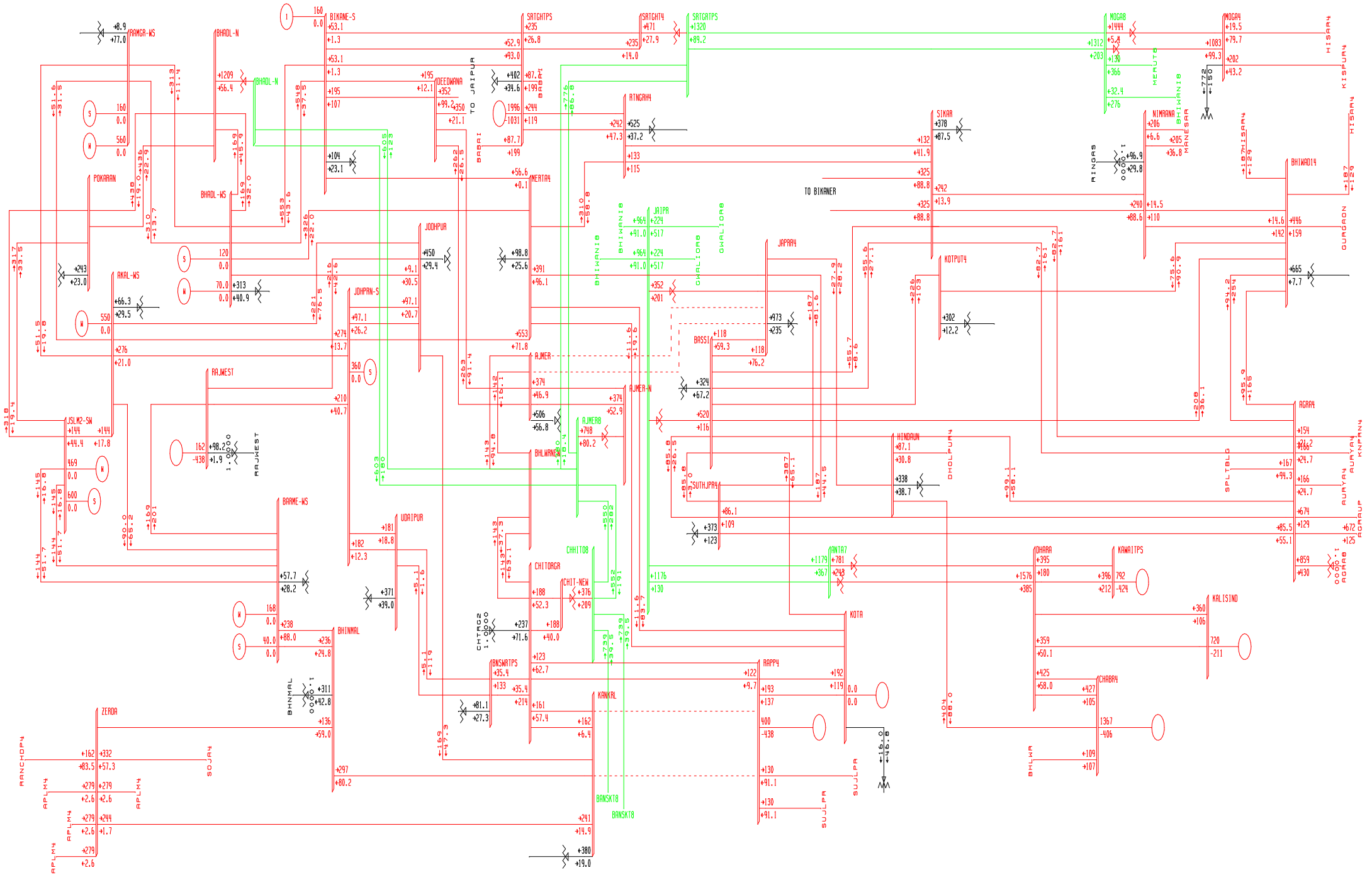
POWER TECHNOLOGIES, INC.®

FRI, JUL 12 2013 16:18

KV: ≤220 , ≤400 , ≤765

BUS - NONE
BRANCH - MW/MVAR
EQUIPMENT - MW/MVAR

EXHIBIT-CASE 2-01



WITH STRENGTHENING

POWER TECHNOLOGIES, INC.®

FRI, JUL 12 2013 16:10

KV: ≤220 , ≤400 , ≤765

BUS - NONE
BRANCH - MW/MVAR
EQUIPMENT - MW/MVAR

EXHIBIT-CASE 2-02