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भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
विद्युत प्रणाली योजना एवं मूल्यांकन - I प्रभाग
Power System Planning & Appraisal - I Division

सेवा में / To

The Secretary
Central Electricity Regulatory Commission
4th Floor, Chanderlok Building, 36 .
Janpath, New Delhi - 110001

विषय/Subject: Final Report on Construction of BALCO - Dharamjaygarh 400 kV D/c (2nd) line

Madam/Sir,

This has reference to Central Electricity Regulatory Commission RoP dated 17.01.2019 on petition no. 299/MP/2018 in which honorable Commission has decided to constitute a Committee under the Chairmanship of Member (Power System), CEA with representatives of BALCO, POWERGRID (CTU) and NLDC to deliberate on all aspects of construction modalities for BALCO - Dharamjaygarh 400 kV D/c line and submit a report to the Commission.

In this regards, the Committee constituted under the Chairmanship of Chairperson/Member(PS), CEA met thrice. The report containing the deliberations on the options for providing connectivity to M/s BALCO and recommendations including facilitations required from CERC is enclosed as Annexure I.

Encl: as above

भवदीय / Yours Faithfully,

(गौतम रॉय / Goutam Roy) 7/5/2019
(मुख्य अभियन्ता / Chief Engineer)

Copy to:

1. PPS to Chairperson, CEA
2. Sh. Ravinder Gupta, Chief Engineer, CEA
3. Sh. Ashok Pal, CGM (CTU), POWERGRID
4. Sh. G Chakraborty, Sr. GM, POSOCO
5. Sh. Devendra Patel, AVP, Bharat Aluminium Company Limited

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Report

on

Construction

of

BALCO – Dharamjaygarh 400 kV D/c (2nd) line

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Report on Construction of BALCO – Dharamjaygarh 400 kV D/c (2nd) line

1. Background

1.1 M/s Bharat Aluminium Company Limited (BALCO) has integrated aluminium complex situated at Korba, in the state of Chhattisgarh. The present installed capacity of the aluminium smelter for production of primary aluminium is 575 KTPA having 2 Pot lines. M/s BALCO is a generating company with an installed capacity of 2010 MW (4x67.5 MW+4x135 MW+4x300 MW) and smelter load of 940 MW at BALCO Complex, Korba.

1.2 BALCO has already been granted connectivity of 2010 MW [1200 MW (4x300) as IPP and 810 MW (4x67.5 + 4x135) as CPP] through BALCO–Dharamjaygarh 400 kV D/c line. The total LTA granted to M/s BALCO is 350 MW [200 (TN) + 95 (KSEB) + 55 (CSPTrCL)]. The existing connectivity of BALCO generation complex with ISTS grid is shown below at figure-1:

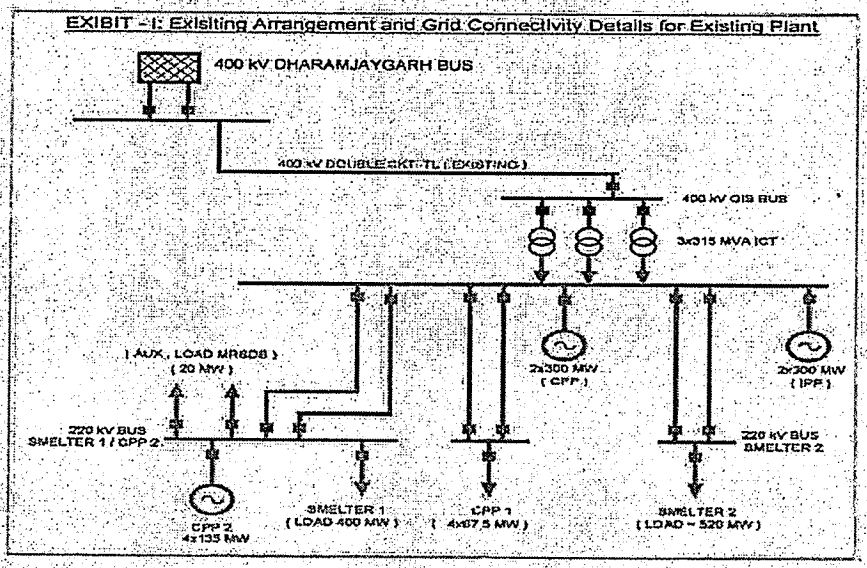
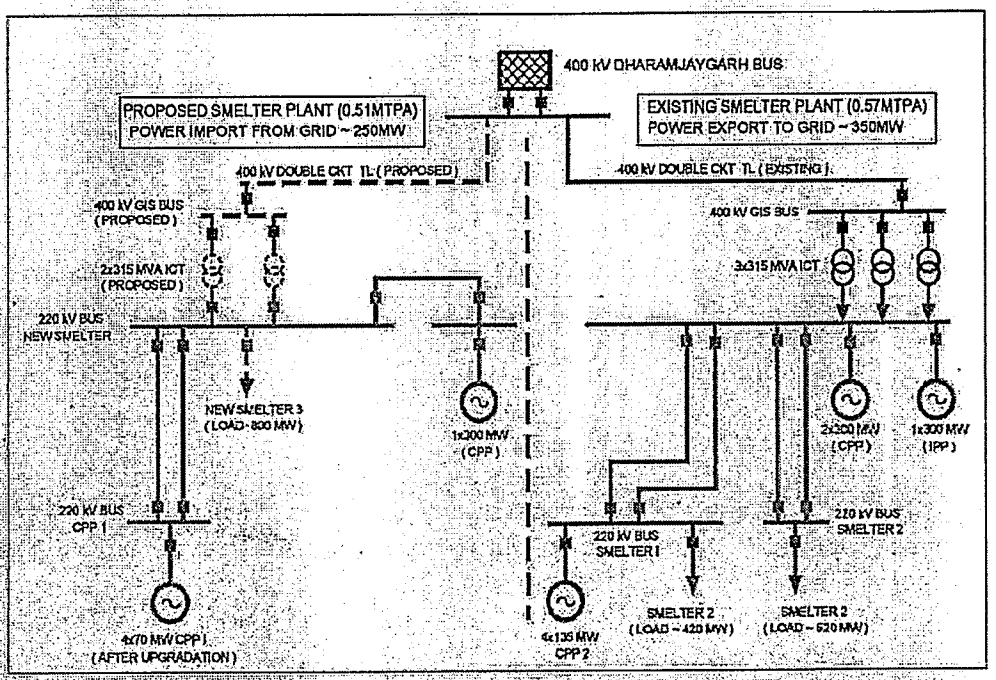


Figure 1: Existing arrangement in BALCO Complex

1.3 BALCO had informed that a new Aluminium smelter plant with a capacity of 0.51 MTPA has been planned in the existing BALCO complex, which would require power of around 800 MW. The requirement of power for the new smelter would be fulfilled through available internal captive power generation capacity to the extent of 550 MW and the balance requirement of power would be imported from grid.

1.4 M/s BALCO has submitted application to CTU for 250 MW connectivity as a bulk consumer with following arrangement through segregation of units as under:

- 580MW [1x300MW (CPP) + 4x70MW (up gradation of 4x67.5MW) (CPP)] units on one bus with New Smelter Load of 800MW] for which BALCO sought connectivity to the tune of 250MW for meeting the average demand of the smelter load
- 1440MW [1x300 (IPP) + 2x300MW (CPP) + 4x135MW (CPP)] units on the other bus with existing smelter load of 940MW. Accordingly, the exportable capacity on this bus would be about 385MW out of which LTA of 350MW is already granted.
- The proposed connectivity arrangement of BALCO generation complex is shown below at figure-2.



Installed capacity	- 580 MW	Installed capacity	- 1440 MW
Aux. Consumption (Considering max. 8%)	- 45 MW	Aux. Consumption (Considering max. 8%)	- 115MW
Ex- bus capacity	- 535 MW	Ex- bus capacity	- 1325 MW
Load	- 800 MW	Load	- 940 MW
Deficit	- 265 MW	Exportable Capacity	- 385 MW

Figure 2: Proposed connectivity arrangement for 250 MW as Bulk Consumer

1.5 The issue pertaining to grant of connectivity of BALCO as bulk consumer for 250 MW was deliberated in the 42nd, 43rd meeting of Standing Committee on Power System Planning for Western Region and 1st meeting of Western Region Standing

Committee on Transmission, wherein, CEA has opined that existing connectivity of BALCO with Dharamjaygarh through 400 kV D/C line provided for injection of power is sufficient. In the meetings, WRLDC had informed that existing regulations do not allow simultaneous import (drawl) and export (injection) of power at the same point. The grant of connectivity to BALCO for 250 MW as bulk consumer was agreed through BALCO-Dharamjaygarh 400kV D/c (2nd) (new) line along with associated 400 kV bays at both ends to be implemented by M/s BALCO at its own cost. As there is no provision for implementation of transmission line by bulk consumer, M/s BALCO, was advised to approach Central Electricity Regulatory Commission (CERC) regarding construction modalities for the 400kV D/c line.

2. Constitution of Committee

2.1 In pursuance to above, BALCO filed a petition no. 299/MP/2018 before the Hon'ble CERC in Sep. 2018, interalia, praying that the petitioner may be allowed to own, construct and operate BALCO-Dharamjaygarh 400kV D/c (2nd) dedicated transmission line.

2.2 CERC in its Record of Proceeding (RoP) dated 17.01.2019 on the above petition decided to constitute a Committee under the Chairmanship of Member (Power System), CEA with representatives of BALCO, POWERGRID (CTU) and NLDC to go into all aspects for construction modalities for the 400 kV D/C BALCO - Dharamjaygarh transmission line.

3. Proceeding of Committee

3.1 The 1st meeting of the Committee was held under the Chairmanship of Sh. P S Mhaske, Member (Power System) / Chairperson, CEA on 19-04-2019 and all aspects (including requirement of the line) regarding construction modalities for the BALCO - Dharamjaygarh 400 kV D/C (2nd) transmission line were deliberated in detail.

3.2 CEA opined that from optimum transmission planning point of view, to meet M/s BALCO requirement (drawl of 250 MW from grid as bulk consumer and injection of 350 MW into the grid for fulfilling its LTA obligations as an IPP), the existing connectivity of M/s BALCO with ISTS i.e. BALCO – Dharamjaygarh 400 kV D/C line, is adequate. CEA vide its letter no. CEA-PS-11-14(11)/1/2018-PSPA-1 Division I/3638/2019 dated 16-01-2019 (copy enclosed at Annexure-1) has forwarded its comments on the above petition to Hon'ble CERC.

3.3 CTU citing the Regulation 8 of CERC (Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-State Transmission and related matters Open Access in inter-State Transmission) Regulations, 2009 (amended in 2017), stated that the regulation allows a bulk consumer (minimum load of 100 MW) to have connectivity with inter-state transmission system (ISTS) but do not have provision of construction of dedicated line by a bulk consumer. Endorsing the views of CEA, CTU

stated that connectivity to BALCO for import of 250 MW of power may be given through the existing BALCO-Dharamjaygarh 400kV D/c line from the optimum transmission planning point of view as a special case and suitable metering arrangement may be devised for overcoming problems related to energy accounting, scheduling and issues related to control area.

3.4 NLDC made the following submissions :

i) As per CERC Regulations BALCO is eligible for connectivity as bulk consumer. CERC Regulations are silent on whether an integrated complex (Load+Generation) can seek connectivity to ISTS, however as per CEA standards the integrated complex may be a "requester".

ii) M/s BALCO as a bulk consumer (integrated complex having generation plus load) seeking connectivity for its 250 MW smelter plant load qualifies as a 'requester' as per CEA Technical Standards. There are examples of distribution licensees who have their own generation viz. the Calcutta Electricity Supply Company (CESC) in Eastern Region or the Tata Power Company Ltd. in Western Region. The requester is required to submit a mathematical model to the CTU or STU to perform inter-connection studies as per the amendment to CEA standards issued in 2013 to clause 6(6)

iii) It is an established practice that whenever there is a gap between CERC regulations and CEA standards, the former needs to be aligned through amendments. The extant regulations of CERC in any case clearly say that CEA technical standards for connectivity should be followed by all users connected to or seeking connectivity to ISTS. Relevant extracts from the CERC (Indian Electricity Grid Code) Regulations are quoted below:-

Regulation 4.1 (IEGC):

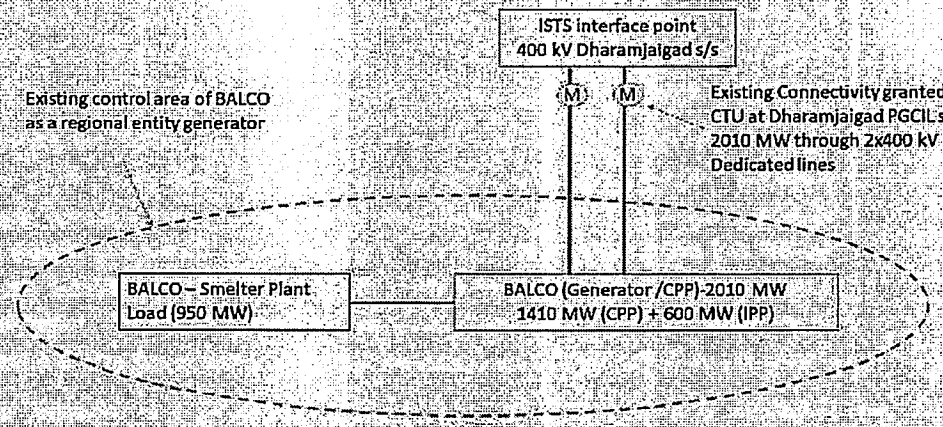
"CTU, STU and Users connected to, or seeking connection to ISTS shall comply with Central Electricity Authority (Technical Standards for connectivity to the Grid) Regulations, 2007 which specifies the minimum technical and design criteria and Central Electricity Regulatory Commission (Grant of Connectivity, Long-term Access and Medium-term Open Access in inter-state Transmission and related matters) Regulations,2009."

iv) Connectivity granted to BALCO as bulk consumer requires construction of a 400 kV D/C line between BALCO and Dharamjaygarh. However, as per definition of dedicated line in the Act, it is not clear from the above, whether such an integrated complex (BALCO) can own and construct a dedicated line for establishing the connectivity with the ISTS.

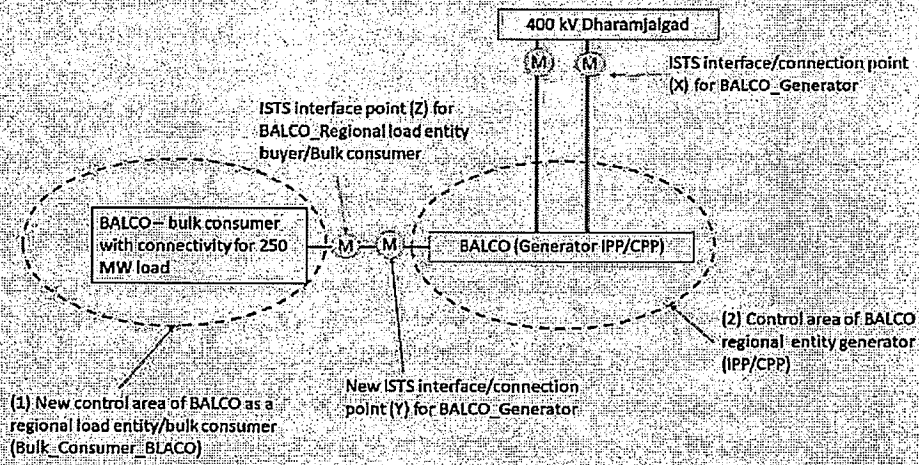
As per section 2(16) of Electricity Act, 2003,

"dedicated transmission lines" means any electric supply-line for point to point transmission which are required for the purpose of connecting electric lines or electric plants of a captive generating plant referred to in section 9 or generating station referred to in section 10 to any transmission lines or sub-stations or generating stations, or the load centre, as the case may be;

v) In present conditions, as illustrated by the schematic diagram below, the 765/400 kV Dharamjaygarh s/s of POWERGRID is the ISTS interface point where, the scheduling, metering, energy accounting and deviation settlement takes place for BALCO as a regional entity generator under scheduling jurisdiction of WRLDC



If the connectivity to 250 MW load of BALCO is granted as a bulk consumer within the existing generator switch-yard of BALCO, the scenario that would emerge is depicted below



vi) The above proposal would involve grant of connectivity behind the dedicated line. Generally, the connectivity has been granted by CTU either at an ISTS point or at

STU point. It is pertinent to mention here that interconnection point of any entity with the ISTS grid has some sanctity, since all metering and interaction with load despatch centres (LDCs) has to be done at this point and LDCs should not be expected to go behind the interconnection point. Deviations, if any, to this general principle, should be very few and far between and wherever done should be only on the basis of a regulatory order or mandate. This has been the situation in case of MEPL/SEPL, AD Hydro/Malana-II projects, where meters behind a dedicated system had to be used for accounting and settlement at the regional level. Similar is the case of ISTS connected RE projects, where the CERC approved procedure dated 3rd March 2017 is being followed.

Presence of such deviations should not lead to the same being considered as a matter of right as the basic philosophy and sanctity of the point of interconnection must be honoured. Otherwise it has the potential to create disputes.

vii) Also, with the above proposal both, bulk consumer (drawing entity) and generator (injecting entity) gets connected at single point with the ISTS (i.e. Dharamjaygarh). The existing regulations does not allow simultaneous import (drawl) and export (injection) of power at a single point. Generating station and bulk consumer are two different entities and are governed by different sets of rules/regulations. There would be issues related to energy accounting / scheduling, if these two different entities are connected through a common transmission line.

viii) Reliability is a prerequisite for any requester or user be it a generator, bulk consumer or integrated complex. BALCO had experienced several outages in the recent past due to problems at Dharamjaygarh substation and their islanding scheme have failed causing load loss. A few cases as given under for reference:

a. On 7-December-2018 (11:31 hours), bus-bar protection operated at Dharamjaygarh substation (s/s) leading to tripping of 2x 1500 MVA, 765/400 kV Dharamjaygarh ICTs & both the 400 kV BALCO-Dharamjaygarh lines reportedly causing loss of generation & load at BALCO complex.

b. On 15.06. 2017 (14:23 hours), delayed fault clearance caused loss of integrity at 765/400 kV Dharamjaygarh s/s & BALCO got disconnected, reportedly causing loss of generation & captive load at BALCO.

c. On 20.04.2017 (10:53 hours) BALCO complex got blacked out due to mal operation of bay control unit (BCU) at Dharamjaygarh substation reportedly causing Generation loss of 960 MW & load loss of 900 MW in BALCO complex.

ix) An alternate feed to BALCO from a source other than Dharamjaygarh s/s would be advisable from reliability considerations alone.

3.5 CEA opined that in future due to renewable generation addition by load serving entity, there would be cases, where it would be economical (from optimal transmission planning point of view) that the entity would be connectivity line for injection as well

as drawl. We have to gear ourselves for facing such situation and suggest necessary changes / modification in relevant Regulation to overcome problems in energy accounting & metering and control area related issues. With respect to reliability of Dharamjaygarh sub-station, it is observed that generation at BALCO complex is sufficient to meet its smelters load consumption, in case of rarest event of tripping of Dharamjaygarh sub-station.

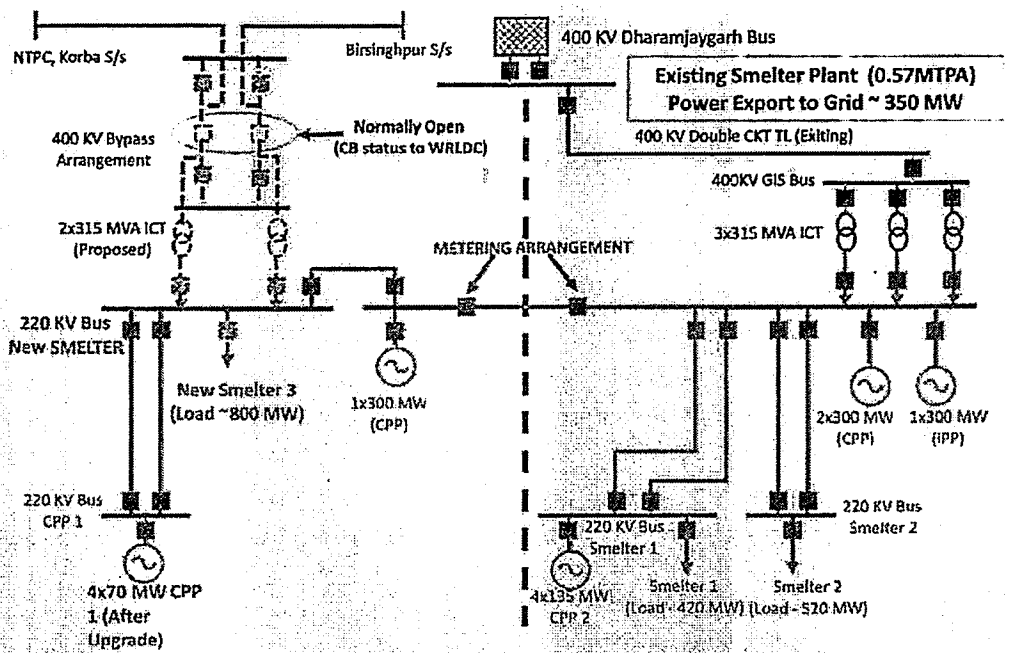
3.6 BALCO made the following submissions:

i) The proposed smelter expansion of additional 5.1 or 6.4 LTPA capacity, would entail additional load of 850 to 1000MW. The new expansion would enhance the risk potential manifold, if new plant / load is connected to the existing BALCO Electrical Network and existing Grid Connectivity. It will significantly increase the complexities and risk of the existing as well as the proposed smelter operations.

ii) As per CEA's Manual on the Transmission Planning Criteria also, Aluminium Smelters are categorised as highly critical load and power supply security and reliability is of paramount importance. Any power supply interruption of 2-3 hours on full load or 8-9 hours on reduced load would lead to major asset impairment, suspension of plant operation and colossal damage to the machineries requiring hundreds of Crores to restore the operations.

iii) Connectivity for the proposed new smelter has already been granted by CTU as per the existing provisions of CERC regulation for the grid connectivity as bulk consumer. Also, BALCO has been granted connectivity through BALCO-Dharamjaygarh 400 kV D/C line as IPP with LTA of 350 MW. Both the connectivities are distinct. Connectivity Regulation has provision for grant of ISTS connectivity to bulk consumer, only a protocol need to be evolved for granting Connectivity / construction of dedicated line to such consumer. The proposed new line can be constructed as a dedicated transmission line by BALCO. BALCO also submitted the reliability studies carried out by M/s ABB and M/s PRDC in support of the dedicated line for new smelter plant.

iv) If proposed new smelter is connected to existing BALCO system and granted connectivity to ISTS through the existing line, the same may result into energy accounting and metering related issues. To avoid this connectivity for the new proposed smelter plant may be considered through a separate new line. However, if connectivity to new smelter plant is provided through the existing BALCO-Dharamjaygarh 400 kV D/c line and in case of tower outage of this line / bus outage at Dharamjaygarh S/S, the grid connectivity to entire BALCO complex would be lost. To take care of this emergency situation, grid connectivity to BALCO may be allowed through LILO of 2nd ckt of Korba-Birsinghpur 400kV D/c line at BALCO switchyard with the bypass arrangement at BALCO 400 kV switchyard. The exhibit showing the arrangement is given below.



3.7 To take care of grid connectivity, in case of isolation of BALCO complex, the committee members agree to consider the bypass arrangement as above, in case grid connectivity to new smelter plant is provided through existing BALCO-Dharamjaygarh 400kV D/c line.

3.8 After deliberations, the Committee agreed to study in detail merits and demerits of two scenarios i.e. i) providing connectivity with BALCO-Dharamjaygarh 400kV D/c (2nd) line ii) providing connectivity with the existing BALCO-Dharamjaygarh 400kV D/c line before submitting final recommendation to the Commission.

4. Detailed Study Report

4.1 Scenario-1:

Connectivity to BALCO for 250 MW load through BALCO-Dharamjaygarh 400kV D/c (2nd) line along with associated 400kV bays at both ends

In this scenario connectivity to BALCO for its 250 MW load would be granted for through BALCO-Dharamjaygarh 400kV D/c (2nd) line (new) along with associated 400kV bays at both ends. The transmission line would be of dedicated nature, which would serve BALCO load. The cost of construction of line and end bays (about 120 cr.) would be borne by M/s BALCO.

Issue: Electricity Act 2003 / CERC Regulations allows construction of dedicated line by generators but there is no provision for implementation of dedicated transmission line by bulk consumer.

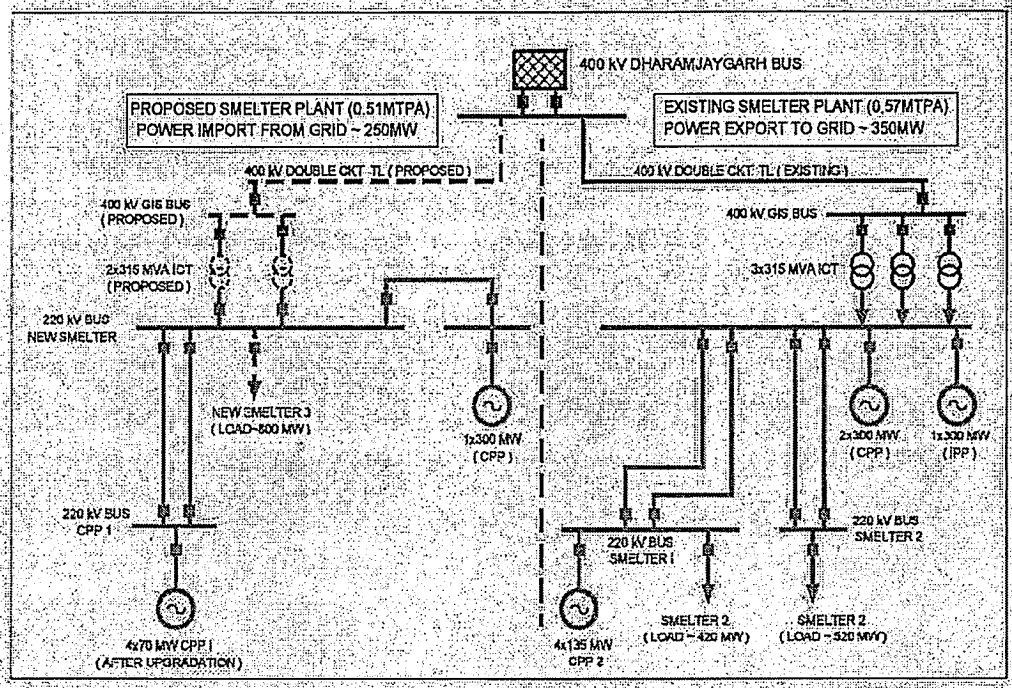
The broad scope of works to be implemented by M/s BALCO for effecting the connectivity is given below:

(i) 400 kV D/c line (about 25 km)

(ii) 4 nos. 400 kV line bays

(iii) 2 x 315 MVA, 400/220 kV ICTs at BALCO Complex along with ICT bays at 220 kV and 400 kV

The schematic arrangement is shown below:



Merits:

a) BALCO as generator and BALCO as a bulk consumer would be connected to ISTS system at Dharamjaygarh through two different 400 kV D/c lines. The Metering and Energy Accounting as Bulk consumer and as IPP would be done at 400 kV at Dharamjaygarh S/s (ISTS).

b) Complete isolation of BALCO as IPP (generator) and BALCO as bulk consumer. Both, BALCO bulk consumer (Generation: 580 MW + Load: 800 MW) and BALCO IPP/CPP (Generation: 1440 MW + Load: 940 MW) are getting connected to the ISTS point through an independent 400 kV D/C TM line.

Demerits:

a) Suboptimal transmission system:

One 400 kV D/C transmission line between BALCO and Dharamjaygarh is injecting 350 MW to the ISTS at Dharamjaygarh and from other transmission line between BALCO and Dharamjaygarh, there is drawl of 250 MW implies round tripping of 250 MW.

b) Unnecessary investment of about Rs. 120 Crores.

c) The construction of 2nd 400 kV D/c line would consume scarce RoW and 2 nos. 400 kV ISTS line bays at Dharamjaygarh S/s.

d) Injection of 350 MW from BALCO to Dharamjaygarh and drawl of 250 MW from Dharamjaygarh to BALCO would incur net annual loss of about 3.95 million units as compared to injection and drawl though same line. In addition there would also be additional losses through new 2x315 MVA ICT and increased losses though exiting 3x315 MVA ICTs. The detailed calculations is enclosed at Annexure-II.

e) In the rare event of tower failure of new 400 kV D/C line between BALCO-Dharamjaygarh / outage of Dharamjaygarh 765/400 kV S/S, the new smelter plant (BALCO-Bulk load) would be operating in islanded mode and the chances of survival are less as it would become generation deficit (to the tune of 250 MW) island.

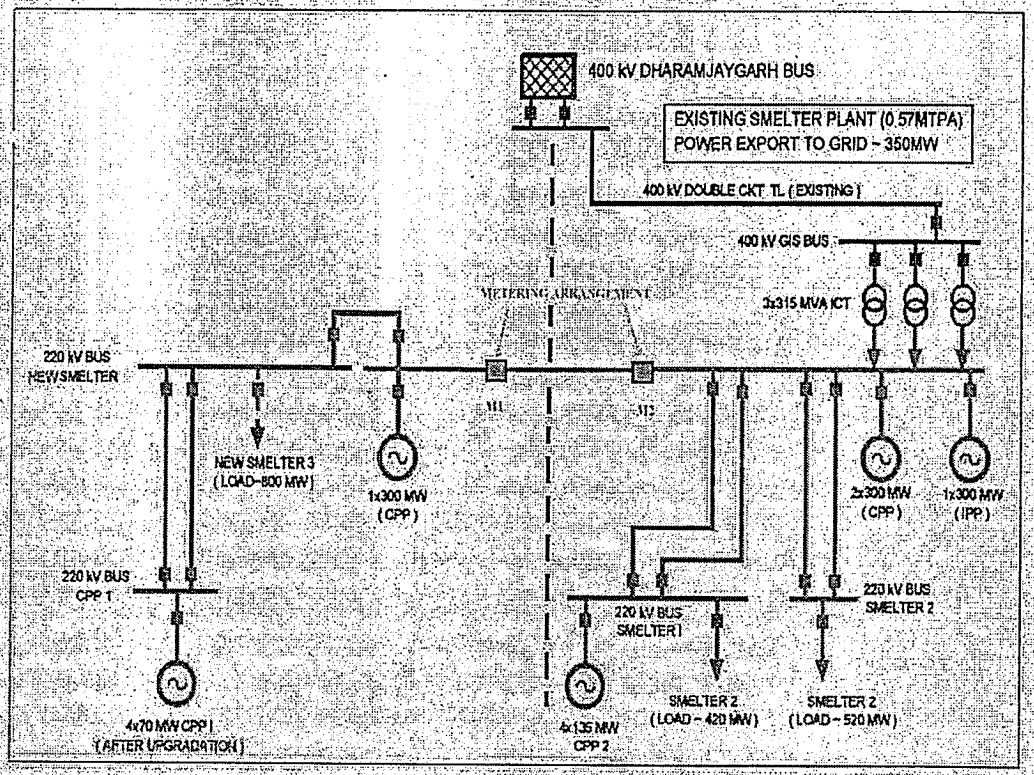
4.2 Scenario-2:

Connectivity to BALCO for 250 MW through existing BALCO-Dharamjaygarh 400kV D/c line

Connectivity to BALCO as bulk consumer for its 250 MW would be granted through existing BALCO-Dharamjaygarh 400 kV D/c line. 220 kB bus of BALCO (IPP) and BALCO (Bulk consumer) would be inter connected.

Issue: Suitable metering and accounting & scheduling arrangement need to be designed for BALCO as IPP (generator) and BALCO as bulk consumer.

Schematic arrangement is given below:



Merits:

a) Optimal Transmission System:

One 400 kV D/C transmission line (existing) between BALCO and Dharamjaygarh would be utilised for injection (350 MW) as well as drawl (250 MW). In fact, there would be net injection of 100 MW, thereby avoiding round tripping of 250 MW of power from BALCO to Dharamjaygarh and back to BALCO. Hence, avoiding transformation and transmission losses for about 250 MW of power.

b) Avoid investment of about Rs.120 cr.

c) Avoid consumption of scarce RoW for 2nd line and 2 no. 400 kV ISTS line bays at Dharamjaygarh.

d) Avoid net annual loss of about 3.82 million units involved in round tripping of 250 MW of power.

e) In the rare event of tower failure of existing 400 kV D/C line between BALCO-Dharamjaygarh / outage of Dharamjaygarh 765/400 kV S/S, the entire BALCO complex (load 1700 MW and generation 2010 MW) would be operating in islanded mode and has better chance of survival.

Demerits:

a) Issues related to energy accounting / scheduling and control area jurisdiction for two different entities (BALCO as IPP and BALCO as bulk consumer) needs resolution.

b) Connectivity to BALCO as bulk consumer involves grant of connectivity at 220 kV bus of BALCO. Generally, the connectivity is granted by the nodal agency CTU / STU at an ISTS point / at STU point.

5. Recommendations:

a) From optimal transmission planning point of view and to conserve scarce RoW, the connectivity to BALCO as bulk consumer for its 250 MW load may be granted through existing 400 kV D/C line between BALCO and Dharamjaygarh. Connectivity to BALCO as bulk consumer involves grant of connectivity at 220 kV bus of BALCO, which is not an ISTS point. Hence, sharing of existing 400kV D/C dedicated line along with 400/220kV, 315MVA ICTs for connectivity to Dharamjaygarh ISTS point for BALCO as a bulk consumer is required.

In case of emergency situation like outage of BALCO-Dharamjaygarh 400 kV D/C line (tower outage) / outage of 400 kV Dharamjaygarh bus, grid connectivity to BALCO can be provided through LILO of 2nd ckt of Korba - Birsinghpur 400kV D/c line at BALCO switchyard (LILO section already existing as a part of earlier interim arrangement and 400 kV switchyard to be implemented by BALCO) with suitable bypass arrangement at BALCO 400 kV switchyard. The LILO would normally remain bypassed at BALCO and in case of exigencies and as per the instructions of the Grid Operator, the LILO could be utilised for extending grid connectivity to BALCO. M/s BALCO needs to submit the bypassing scheme, so that the same could be deliberated with WR constituents and finalised.

Facilitation Required from CERC:

BALCO as bulk consumer may be permitted to use the existing BALCO-Dharamjaygarh 400kV D/C dedicated line along with 3x315MVA ICTs of M/s BALCO (IPP) on sharing basis for Connectivity and Open Access. Further, jurisdiction of POSOCO / WRLDC may be extended to BALCO complex for scheduling and energy accounting for simultaneous injection and drawl by BALCO. For this necessary metering arrangements needs to be placed at BALCO complex for BALCO as bulk consumer and BALCO as IPP (generator).

b) Alternatively, connectivity to BALCO for its 250 MW load may be granted through BALCO-Dharamjaygarh 400 kV D/c (2nd) line (New) along with associated 400 kV bays at both ends as mentioned in scenario-I which would be a transmission line of dedicated nature for BALCO.

Grid connectivity to BALCO IPP and BALCO Bulk Load, in case of outage of either BALCO (IPP)-Dharamjaygarh 400 kV D/C (existing) line- or BALCO (Bulk consumer)-Dharamjaygarh 400 kV D/C (new proposed) line respectively, can be provided through 220 kV interconnections arrangement. The 220 kV interconnection arrangement would be normally kept open.

Facilitation Required from CERC

Section 9 (1) and 10 (1) of Electricity Act, 2003 have provision for captive generation and Generating Companies to construct, maintain or operate dedicated transmission lines. There is no provision for construction of dedicated line by a bulk consumer in the act.

Enabling provision needs to be made in the act / connectivity regulation to allow bulk consumer to construct transmission line of dedicated nature.

OR

The line of dedicated nature for bulk consumer may be constructed, operated and maintained by transmission licensee (say POWERGRID) and transmission charges for the dedicated line may be borne by the bulk consumer.

Ravinder Gupta
(Sh. Ravinder Gupta)
Chief Engineer (PSPA-I), CEA

Ashok Pal
(Sh. Ashok Pal)
CGM (CTU), POWERGRID

(Sh. G Chakraborty)
Sr. GM, POSOCO

Md. Zeyauddin, AGM
on behalf of (Sh. Devendra Patel)
AVP, BALCO

(Sh. P.S. Mhaske)
Chairperson/Member (PS), CEA

Annexure-I

भारत सरकार
Government of India
विद्युत मंत्रालय
Ministry of Power
केन्द्रीय विद्युत प्राधिकरण
Central Electricity Authority
विद्युत प्रणाली योजना एवं मूल्यांकन-I प्रभाग
Power System Planning & Appraisal-I Division

सेवा में / To,

Secretary
Central Electricity Regulatory Commission
4th Floor, Chanderlok Building, 36
Janpath, New Delhi - 110001

विषय/ Subject: Clarification regarding construction modalities for BALCO Dharamjaygarh 400 kV D/C (2nd line) for the purpose of connectivity to BALCO for 250 MW as a bulk consumer.

संदर्भ/ Reference: CERC Petition No. 299/MP/2018

Sir,

This has reference to above CERC petition for clarification regarding construction modalities for BALCO Dharamjaygarh 400 kV D/C (2nd line) for the purpose of connectivity to BALCO for 250 MW as a bulk consumer. CERC in its RoP dated 15.11.2018 of the above petition has directed the petitioner i.e. M/s BALCO to implead CEA and POSOCO as party and has also directed the respondents to file their reply. In this regards, our comments are as given below:

1.0 M/s BALCO had obtained connectivity for 4x250 (1000) MW as IPP, which was later modified to 1335 MW (4x300 + 2x67.5) on request from BALCO. Its connectivity was finally modified to 2010 MW (4x135 + 4x67.5 = 4x300) MW.

2.0 M/s BALCO has already been granted connectivity in ISTS for 2010 MW through BALCO – Dharamjaygarh 400 kV D/C line as an injecting entity i.e. generator and has sought additional connectivity of 250 MW as a bulk consumer. The additional connectivity of 250 MW has been agreed in the 45th meeting of Western Region Standing Committee on Power System Planning held on 13-05-2018 through 2nd BALCO – Dharamjaygarh 400 kV D/C line. M/s BALCO, as a bulk consumer and entity as generator would be segregated from each other, as given below:

i) 580 MW [1x300 MW (CPP) + 4x70MW (up gradation of 4x67.5MW) (CPP)] units on one bus with New Smelter Load of 500 MW. BALCO has sought new connectivity of 250 MW for meeting the average demand of the smelter load.

ii) 1440 MW [1x300 (IPP)+2x300MW (CPP)+4x135MW (CPP)] units on the other bus with existing smelter load of 940 MW. The exportable capacity on this bus

shall be about 500 MW against which LTA of 350 MW [208 (TN) + 95 (KSEB) + 55 (CSPTCL)] has already been granted.

3.0 From optimum transmission planning point of view, to meet M/s BALCO requirement (drawl of 250 MW from grid as bulk consumer and injection of 350 MW into the grid for fulfilling its LTA obligations as an IPP), the existing connectivity of M/s BALCO with ISTS i.e. BALCO – Dharamjaygarh 400 kV D/C line, is adequate.

4.0 The 2nd BALCO – Dharamjaygarh 400 kV D/C line for providing connectivity to M/s BALCO as bulk consumer has been agreed as WRLDC in the 41st meeting of Standing Committee on Power System Planning in Western Region held on 21.12.2016 had informed that the existing regulations does not allow simultaneous import (drawl) and export (injection) of power at a single point.

5.0 As the 2nd connectivity line would serve only M/s BALCO for drawl of power from the ISTS, therefore, it would be of dedicated nature. In the 41st meeting of Standing Committee Meeting on Power System Planning, M/s BALCO was advised to approach CERC for construction modalities of the line, as there was no provisions regarding implementation of a connectivity line by a bulk consumer.

This issues with the approval of Chairperson, CEA.

भवदीय / Yours faithfully,

(अवधेश कुमार यादव / Awdhesh Kumar Yadav)
Director, PSPA-2

Copy to:

M/s BALCO, Balco Nagar, Korba, Chhattisgarh

Annexure-II

1.0 Assumptions for calculations of Transmission Losses:

i) The length of the Dharamjaygarh- Balco (IPP) 400 kV D/C line and Dharamjaygarh-Balco (BULK Consumer) 400 kV D/C line has been taken as 25 km with Twin Moose conductors.

ii) R,X,B parameter of 400 kV Twin Moose conductor, D/C line in per unit / km / circuit, at 100 MVA base

R: 1.800E-5, X: 1.923E-4 , B: 6.02E-3

R= 0.0288 ohms per circuit per km for 400 kV D/C TM line

R= 0.72 ohms per ckt for 25 km line or 0.36 ohms for 25 km 400 kV D/C line.

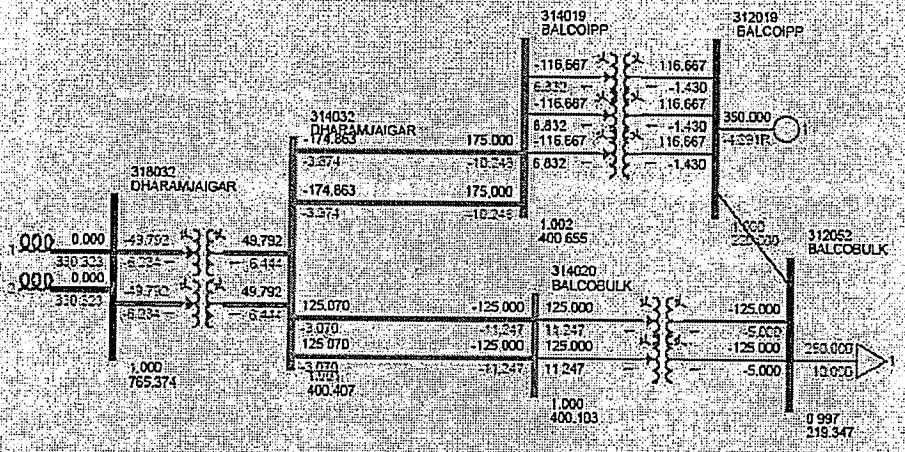
Z_{base} for 400 kV = 1600

iii) Power Factor of 0.95 and unity.

iv) Average power injection by BALCO IPP is 350 MW for 8760 hours in a year. Average power drawl by BALCO as Bulk consumer is 250 MW for 8760 hours in a year.

2.0 Transmission losses assessment based on system studies

BALCO AS INJECTING AND DRAWING ENTITY CONNECTED SEPERATELY TO DHARAMJAYGARH



The power flow on the 400 kV lines shows the power factor as unity.

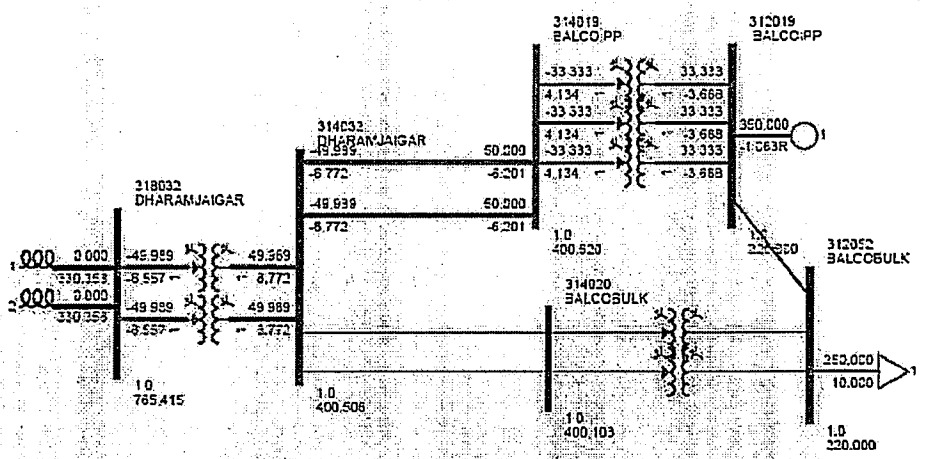
Transmission losses (Current*current*resistance) calculation based on power flow:

Loss in Dharamjaygarh- BALCO (IPP) 400 kV D/C line= 2*(175.0 -174.863) MW = 2*0.137= 0.274 MW

Loss in Dharamjaygarh- BALCO (BULK consumer) 400 kV D/C line= 2*(125.070 -125.0) MW = 2*0.07= 0.14 MW

Total Loss = 0.274+0.14 = 0.414 MW

BALCO AS INJECTING AND DRAWING ENTITY CONNECTED JOINTLY TO DHARAMJAYGARH



The power flow on the 400 kV lines shows the power factor as unity.

Transmission losses (Current*current*resistance) calculation based on power flow:

Loss in Dharamjaygarh- BALCO (IPP) 400 kV D/C line= 2*(50.0 – 49.989) MW = 2*0.011= 0.022 MW

Total Loss = 0.022 MW

Additional transmission loss in case BALCO is connected separately as Bulk consumer and an IPP as compared to single connectivity = 0.414-0.022 MW = 0.392 MW or 392 kW

3.0 Transmission losses assessment based on calculations

Calculations with 0.95 pf

R of the D/C line=	0.36	Ohms
Power Factor=	0.95	
For 350 MW power flow on the line current (in amps)=	531.79	Amps
Loss (kW)=	305.42	kW
Annual Loss (in Million Units)=	2.68	MU
For 250 MW power flow on the line current (in amps)=	379.85	Amps
Loss (kW)=	155.83	kW
Annual Loss (in Million Units)=	1.37	MU
For 100 MW power flow on the line current (in amps)=	151.94	Amps
Loss (kW)=	24.93	kW
Annual Loss (in Million Units)=	0.22	MU
Net transmission loss in (kW)=	436.31	kW

Net Annual Loss (in Million units)=	3.82	MU

Calculations with unity pf

R of the D/C line=	0.36	Ohms
Power Factor=	1	
For 350 MW power flow on the line current (in amps)=	505.20	Amps
Loss (kW)=	275.64	kW
Annual Loss (in Million Units)=	2.41	MU
For 250 MW power flow on the line current (in amps)=	360.85	Amps
Loss (kW)=	140.63	kW
Annual Loss (in Million Units)=	1.23	MU
For 100 MW power flow on the line current (in amps)=	144.34	Amps
Loss (kW)=	22.50	kW
Annual Loss (in Million Units)=	0.20	MU
Net transmission loss in (kW)=	393.77	kW
Net Annual Loss (in Million units)=	3.45	MU

The values of the losses is almost same with unity power factor.