

CEA's PROPOSAL FOR SHARING OF TRANSMISSION CHARGES AND ALLOCATION OF LOSSES IN THE ISTS ASSIGNED TO NATION POOL

A-1: For the purpose of determining the sharing of transmission charges and allocation of losses in the Nation pool is proposed to demarcate the total National Grid system in to 12 zones from 'A' to 'L' and and the total all-India system as zone 'M.' as per following:

Zone –A : Part of Northern region covering the states/UTs of J & K, Punjab, Himachal Pradesh, Chandigarh, Haryana and Delhi. In addition, Dadri station would also be included in zone-A.

Zone –B : Part of Northern region covering the state of Rajasthan

Zone –C : Part of Northern region covering the states U.P. and Uttranchal

Zone –D : Part of Western region covering the states of Maharashtra and Goa

Zone –E : Part of Western region covering the states/UTs of Gujarat, DNH and D & D.

Zone –F : Part of Western region covering the states Madhya Pradesh and Chhatisgarh

Zone –G : Part of Southern region covering the states/UTs Tamil Nadu, Pondicheri and Kerala

Zone –H : Part of Southern region covering the state of Karnataka

Zone –I : Part of Southern region covering the state of Andhra Pradesh

Zone –J : Part of Eastern region covering the state of Orissa

Zone –K : Part of Eastern region covering the states/area of Bihar, Jharkhand, West Begal, DVC and Sikkim

Zone –L : The whole of North-eastern region

Zone –M : The total all-India Grid

A-2: Sharing of transmission charges in the Nation pool is proposed to be proportional to product of long-term generation capacity allocation and corresponding stamps for transmission charges. The stamps for transmission charges would be based on estimated transmission burden for the generation capacity allocation and would be determined as elaborated in para 'A-6' of this Annex. In case of generation capacity allocation to National pool as per (4), (c) of para 4.4, that is allocation arising from long-term inter-regional bilateral contracts, the corresponding stamps would be a function of 'from zone' to 'to zone' of the allocation. In case of generation capacity allocation to National pool as per (4), (d) of para 4.4, that is allocation arising from unallocated or merchant generation capacity, the corresponding stamps would be a function of the zone in which the generation is located that is the 'from zone' to 'to grid(zone-M)' of the allocation.

A-3: Sharing of National pool transmission charges would be determined as per following:

MTSC = Monthly Transmission Service Charges for the National pool

G_{ij} = Generation capacity allocated to National pool (gross IC) from zone i to zone j

Ndays = Number of days in the month (30 or 31 or 28 or 29)

Z_{ij peak} = Zonal Matrix transmission stamps for allocation from zone i to zone j for peak hour period of the season of the month

Z_{ij o-t-peak} = Zonal Matrix transmission stamps for allocation from zone i to zone j for other than peak hour period of the season of the month

ZS_{ij} = Z_{ij peak} * 8 * Ndays + Z_{ij o-t-peak} * 16 * Ndays

GZS = Sum of all products of inter-state G_{ij} and ZS_{ij}

= $\sum G_{ij} * ZS_{ij}$

TC = Transmission charges for the month for the allocation G_{ij}

= $\frac{MTSC * G_{ij} * ZS_{ij}}{GZS}$

There would be no transmission charges on unscheduled interchange (UI) transaction. There would also be no transmission charges for short-term open access transaction.

A-4: Allocation of losses in the Nation pool is proposed to be proportional to product of energy dispatch and corresponding stamps for allocation of losses and a weightage factor. Losses in the National pool would be allocated to the following type of energy dispatches:

- (i) Bilateral scheduled energy dispatches from inter-regional generation capacity allocations
- (ii) Bilateral scheduled energy dispatches from allocations made from time to time from the unallocated Central generation capacity
- (iii) Bilateral scheduled energy dispatches from merchant plant capacity
- (iv) Scheduled energy dispatches from merchant plant capacity for sale through Power Exchange (when Power Exchange is operational)
- (v) Bilateral scheduled energy dispatches from short-term open access transactions
- (vi) Unscheduled interchange (UI) injection in to the grid

The weightage factors would be 1 or 2 depending on whether apportionment of losses on the particular energy dispatch is to be as per base value or incremental. For the energy dispatches at (i), (ii), (iii), and (iv) on which apportionment of losses is to be as per base value, the weightage factor would be 1 (one). For the energy dispatches at (v) and (vi) on which apportionment of losses is to be as per incremental, the weightage factor would be 2 (two).

The stamps for allocation of losses would be based on estimated proportion of the losses on account of the energy dispatches and would be determined as elaborated in para 'A-6' of this Annex. In case of energy dispatches at (i), (ii), (iii) and (v), the corresponding stamps would be a function of 'from zone' to 'to zone' of the dispatch. In case of energy dispatches (or interchange) at (iv) and (vi), the corresponding stamps would be a function of 'from zone' to 'to grid(zone-M)' the dispatch (or UI injection).

A-5: Sharing of National pool transmission charges would be determined as per following:

- Loss = Energy Loss for the accounting hour (in the National pool)
- D_{ij} = Energy dispatch from zone i to zone j

$$\begin{aligned}
W_{ij} &= 1 \text{ for energy dispatches of type (i), (ii), (iii) \& (iv)} \\
&= 2 \text{ for energy dispatches of type (v) \& (vi)} \\
ZLoss_{ij} &= \text{Zonal Matrix transmission stamps for loss allocation on National} \\
&\quad \text{pool dispatch from from zone i to zone j applicable for the} \\
&\quad \text{accounting hour depending on season and time of day} \\
EZS &= \text{Sum of all products of National pool } D_{ij} \text{ and corresponding } W_{ij} \\
&\quad \text{and } ZLoss_{ij} \\
&= \sum D_{ij} * W_{ij} * ZLoss_{ij} \\
Loss_{ij} &= \text{Loss allocated to the dispatch } D_{ij} \\
&= \frac{Loss}{EZS} * D_{ij} * W_{ij} * ZLoss_{ij}
\end{aligned}$$

A-6: Determination of Z_{ij} and $ZLoss_{ij}$ would be done in the following manner:

- (1) Zonal Matrix stamps for sharing of transmission charges for the National pool system and apportionment of losses in the National pool system that is Z_{ij} and $ZLoss_{ij}$ respectively would be determined for peak and other-than peak hours of Summer, Monsoon and Winter months.
- (2) Summer months would be taken from March to April to June, Monsoon months from July to October and Winter months from November to February.
- (3) Peak hours would be taken from 07:00 hours to 10:00 hours in the morning and from 17:00 to 22:00 hours in the evening and all the other hours would be taken as other than peak hours.
- (4) The zonal matrix stamps would be derived from load flow studies for base cases for the above specifies six scenarios and corresponding sensitivity cases to determine the incremental load that can be met in Zone X from 100 MW incremental generation in Zone Y.
- (5) For determining the matrices for a financial year starting from 1st April of a year, the power system that is the transmission network and the generation capacities existing on 31st December of the preceding year would be taken.
- (6) Total System at 400KV and above should be represented with network up to 220kV represented as lumped.

(7) Base case generation dispatches would be take as per following:

	Thermal, Gas Nuclear	Hydro
Summer peak hrs	75%	80%
Monsoon peak hrs	70%	90%
Winter peak hrs	80%	50%
Summer other than peak	70%	50%
Monsoon other than peak	65%	70%
Winter other than peak	75%	10%

(8) Demand of the states would be taken as per availability from long-term contracts plus additional demand to account for dispatches from merchant plan capacity and minus to account for base case losses by adjusting the demands of all states by a uniform multiplier.

(9) Distribution of demand within the nodes of a state to be done in proportion to transformer capacity. Power factor of loads incident or lumped at at represented node to be taken as 1.00.

(10) Generator step-up transformer to be represented for all generation which is not represented as lumped and full reactive capability of generating units to be considered for reactive injection or absorption to get voltage regulation within 5%.

(11) Zonal Matrices for the specified seasons/time of day determined and notified before the commencement of the accounting year need not be changed in between the year.

(12) Corresponding to each base case, 144 sensitivity cases would be done to determine the incremental load that can be met in Zone X from 100 MW incremental generation in Zone Y. Generation increment would be taken on a few generation spread across the Zone Y.

- (13) The matrix of incremental load that can be met in Zone X from 100 MW incremental generation in Zone Y may look like following (the figure shown are indicative only to illustrate the process of determining the zonal stamps) :

FROM STATES	V	TO ---->	A	B	C	D	E	F	G	H	I	J	K	L
JK,PB,HP,CH,HR,DE		A	98.9	96.6	111.4	97.0	94.0	109.6	98.4	96.7	100.0	126.8	131.7	171.3
Rajasthan		B	100.8	98.8	114.0	99.1	96.1	112.3	100.5	98.8	102.2	130.2	135.2	177.7
UP, Uttranchal		C	88.9	87.1	99.0	87.5	85.1	97.6	88.6	87.3	89.9	111.1	114.7	143.9
Maha, Goa		D	100.2	98.0	113.2	98.9	95.7	111.6	100.3	98.6	102.0	129.4	134.2	175.9
Guj, D&D,DNH		E	103.3	101.2	117.3	101.8	98.8	115.6	103.3	101.5	105.1	134.7	139.8	185.7
MP, Chattisgarh		F	90.0	88.1	100.2	88.6	86.2	99.0	89.8	88.4	91.2	112.8	116.4	146.7
TN,Kerala,Pondi		G	97.9	95.8	110.3	96.6	93.5	108.8	98.9	97.0	100.3	125.5	130.1	169.0
Karnataka		H	99.7	97.5	112.5	98.4	95.2	111.0	100.6	98.9	102.2	128.6	133.3	174.3
Andhra Oradesh		I	96.5	94.4	108.4	95.2	92.2	107.0	97.2	95.5	98.9	123.1	127.6	164.7
Orissa		J	80.9	79.4	89.2	79.7	77.7	88.1	80.7	79.5	81.7	99.1	101.8	124.1
Bi,Jhar,DVC,WB,Sikm		K	79.2	77.8	87.1	78.0	76.1	86.0	78.9	77.8	79.9	96.3	99.1	120.2
NER		L	69.0	67.9	74.9	68.1	66.6	74.0	68.7	67.9	69.5	81.5	83.5	99.3

- (14) From the matrix in (13) above the following matrix is determined in which each element is equal to 100 minus element of matrix in (13) with negative values made zero:

FROM STATES	V	TO ---->	A	B	C	D	E	F	G	H	I	J	K	L
JK,PB,HP,CH,HR,DE		A	1.1	3.4	0.0	3.0	6.0	0.0	1.6	3.3	0.0	0.0	0.0	0.0
Rajasthan		B	0.0	1.2	0.0	0.9	3.9	0.0	0.0	1.2	0.0	0.0	0.0	0.0
UP, Uttranchal		C	11.1	12.9	1.0	12.5	14.9	2.4	11.4	12.7	10.1	0.0	0.0	0.0
Maha, Goa		D	0.0	2.0	0.0	1.1	4.3	0.0	0.0	1.4	0.0	0.0	0.0	0.0
Guj, D&D,DNH		E	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MP, Chattisgarh		F	10.0	11.9	0.0	11.4	13.8	1.0	10.2	11.6	8.8	0.0	0.0	0.0
TN,Kerala,Pondi		G	2.1	4.2	0.0	3.4	6.5	0.0	1.1	3.0	0.0	0.0	0.0	0.0
Karnataka		H	0.3	2.5	0.0	1.6	4.8	0.0	0.0	1.1	0.0	0.0	0.0	0.0
Andhra Oradesh		I	3.5	5.6	0.0	4.8	7.8	0.0	2.8	4.5	1.1	0.0	0.0	0.0
Orissa		J	19.1	20.6	10.8	20.3	22.3	11.9	19.3	20.5	18.3	0.9	0.0	0.0
Bi,Jhar,DVC,WB,Sikm		K	20.8	22.2	12.9	22.0	23.9	14.0	21.1	22.2	20.1	3.7	0.9	0.0
NER		L	31.0	32.1	25.1	31.9	33.4	26.0	31.3	32.1	30.5	18.5	16.5	0.7

- (15) In the next the, the following matrix is obtained by scaling the elements of matrix in (14) above on a 0 to 18 scale and each element rounded to an integer value:

FROM STATES To --->		A	B	C	D	E	F	G	H	I	J	K	L
JK,PB,HP,CH,HR,DE	A	1	2	0	2	3	0	1	2	0	0	0	0
Rajasthan	B	0	1	0	0	2	0	0	1	0	0	0	0
UP, Uttranchal	C	6	7	1	7	8	1	6	7	5	0	0	0
Maha, Goa	D	0	1	0	1	2	0	0	1	0	0	0	0
Guj, D&D,DNH	E	0	0	0	0	1	0	0	0	0	0	0	0
MP, Chattisgarh	F	5	6	0	6	7	1	5	6	5	0	0	0
TN,Kerala,Pondi	G	1	2	0	2	4	0	1	2	0	0	0	0
Karnataka	H	0	1	0	1	3	0	0	1	0	0	0	0
Andhra Oradesh	I	2	3	0	3	4	0	2	2	1	0	0	0
Orissa	J	10	11	6	11	12	6	10	11	10	0	0	0
Bi,Jhar,DVC,WB,Sikm	K	11	12	7	12	13	8	11	12	11	2	0	0
NER	L	17	17	14	17	18	14	17	17	16	10	9	0

- (16) The matrix for transmission charge stamp Z_{ij} is obtained form matrix in (15) above by limiting the minimum value of each element at the value of 4 and adding the column for Zone M (for 'to grid') arrived at by taking the average of the elements of the respective rows rounded to integer value.

The matrix Z_{ij} in the illustration would be:

FROM STATES To --->		A	B	C	D	E	F	G	H	I	J	K	L	M
JK,PB,HP,CH,HR,DE	A	4	4	4	4	4	4	4	4	4	4	4	4	4
Rajasthan	B	4	4	4	4	4	4	4	4	4	4	4	4	4
UP, Uttranchal	C	6	7	4	7	8	4	6	7	5	4	4	4	6
Maha, Goa	D	4	4	4	4	4	4	4	4	4	4	4	4	4
Guj, D&D,DNH	E	4	4	4	4	4	4	4	4	4	4	4	4	4
MP, Chattisgarh	F	5	6	4	6	7	4	5	6	5	4	4	4	5
TN,Kerala,Pondi	G	4	4	4	4	4	4	4	4	4	4	4	4	4
Karnataka	H	4	4	4	4	4	4	4	4	4	4	4	4	4
Andhra Oradesh	I	4	4	4	4	4	4	4	4	4	4	4	4	4
Orissa	J	10	11	6	11	12	6	10	11	10	4	4	4	8
Bi,Jhar,DVC,WB,Sikm	K	11	12	7	12	13	8	11	12	11	4	4	4	9
NER	L	17	17	14	17	18	14	17	17	16	10	9	4	14

(17) The matrix for transmission charge stamp ZLoss_{ij} is obtained from matrix in (15) above by adding the column for Zone M (for 'to grid') arrived at by taking the average of the elements of the respective rows rounded to integer value. The matrix ZLoss_{ij} in the illustration would be:

FROM STATES	To ---> V	A	B	C	D	E	F	G	H	I	J	K	L	M
JK,PB,HP,CH,HR,DE	A	1	2	0	2	3	0	1	2	0	0	0	0	1
Rajasthan	B	0	1	0	0	2	0	0	1	0	0	0	0	0
UP, Uttranchal	C	6	7	1	7	8	1	6	7	5	0	0	0	4
Maha, Goa	D	0	1	0	1	2	0	0	1	0	0	0	0	0
Guj, D&D,DNH	E	0	0	0	0	1	0	0	0	0	0	0	0	0
MP, Chattisgarh	F	5	6	0	6	7	1	5	6	5	0	0	0	3
TN,Kerala,Pondi	G	1	2	0	2	4	0	1	2	0	0	0	0	1
Karnataka	H	0	1	0	1	3	0	0	1	0	0	0	0	1
Andhra Oradesh	I	2	3	0	3	4	0	2	2	1	0	0	0	1
Orissa	J	10	11	6	11	12	6	10	11	10	0	0	0	7
Bi,Jhar,DVC,WB,Sikm	K	11	12	7	12	13	8	11	12	11	2	0	0	8
NER	L	17	17	14	17	18	14	17	17	16	10	9	0	14