Appendix-1

Procedure for calculation of Transmission System Availability

i) Availability shall be calculated and declared separately for each voltage level.

The transmission system availability shall be declared as per the formula mentioned below. The transmission elements shall be grouped into following categories for the purpose of calculation of availability of Transmission Systems:

(a) AC transmission lines: Each circuit of AC transmission line shall be considered as one element.

(b) Inter-Connecting Transformers (ICTs): Each ICT bank (three single phase transformer together) shall form one element.

(c) Static VAR Compensator (SVC): SVC along with SVC transformer shall form one element. However, 50% credit to inductive and 50% to capacitive rating shall be given.

(d) Switched Bus Reactor: Each switched Bus Reactor shall be considered as one element.

ii) The Availability of Transmission system shall be calculated as under:

% System Availability for the system

$$= \frac{o \times AVo + p \times AVp + q \times AVq + r \times AVr}{o + p + q + r} \times 100$$

Where
o is Total number of AC lines.

AVo is Availability of o number of AC lines.

p is Total number of switched bus reactors .

AVp is Availability of p number of switched bus reactors.

q is Total number of ICTs.

AVq is Availability of q number of ICTs.

r is Total number of SVCs.

AVr is Availability of r number of SVCs.

(iii) The weightage factor for each category of transmission elements shall be as

under:

(a) For each circuit of AC line – Surge Impedance Loading for Uncompensated line (SIL) multiplied by Circuit Km.

(SIL rating for various voltage level and conductor configuration shall be as per the procedure adopted for power system analysis)

(b) For each ICT bank – The rated MVA capacity.

(c) For SVC – The rated MVAR capacity (inductive & capacitive).

(d) For switched Bus reactor – The rated MVAR capacity.

(iv) The availability for each category of transmission elements shall be calculated based on the weightage factor, total hours under consideration and non-available hours for each element of that category. The formulae for calculation of Availability of each category of the Transmission elements are as per Enclosure-**I.**

(v) The transmission elements under outage due to following reasons not attributable to the Transmission Licensee shall be deemed to be available:

(a) Shut down of transmission elements availed by other agency/agencies for maintenance or construction of their transmission system.

(b) Manual tripping of line due to over voltage and manual tripping of switched bus reactor as per the directions of RLDC / SLDC.

(vi) Outage time of transmission elements for the following contingencies shall be excluded from the total time of the element under period of consideration.

(a) Outage of elements due to acts of God and force majeure events beyond the control of the Transmission Licensee.

(b) Outage caused by grid incident/disturbance not attributable to the Transmission Licensee, e.g. faults in substation or bays owned by other agency causing outage of the Transmission Licensee's elements, tripping of lines, ICTs, etc. due to grid disturbance. However, if the element is not restored on receipt of direction from SLDC while normalising the system following grid incident/disturbance within reasonable time, the element will be considered not available for whole period of outage and outage time shall be attributable to the Transmission Licensee.

Enclosure-1

AV*o* (Availability of *o* no. of AC lines) =

$$\sum_{i=1}^{o}\left(Wi(Ti - TNAi) / Ti \right) / \sum_{i=1}^{o} Wi$$

AV*q*(Availability of *q* no. of ICTs) =

$$\sum_{k=1}^{q}\left(Wk(Tk - TNAk) / Tk \right) / \sum_{k=1}^{q} Wk$$

AV*r*(Availability of r no. of SVCs) =

$$\left[\sum_{m=1}^{r} 0.5 \left(WI\ m(TIm - TNAIm) / TIm \right) \right] + \left[\sum_{m=1}^{r} 0.5 \left(WC\ m(TCm - TNACm) / TCm \right) \right] \Big/ \left[\sum_{m=1}^{r} 0.5WIm + \sum_{m=1}^{r} 0.5WCm \right]$$

AV*s* (Availability of *s* no. of Switched reactor=

$$\sum_{n=1}^{s}\left(Wn(Tn - TNAn) / Tn \right) / \sum_{n=1}^{s} Wn$$

Where W*i* = Weightage factor for i^{th} transmission line

Wk= weighted factor k^{th} ICT

WIm & WCm = Weightage factors for inductive & capacitive operation of m^{th} SVC

Wn= Weighted average factor for nth bus reactor

T*i*, T*k*, TIm, TCm, Tn - The total hours of i^{th} AC line, k^{th} ICT, m^{th} SVC

(Inductive Operation), SVC (Capacitive Operation) & n^{th} Switched Bus Reactor during the period under consideration (excluding time period for outages not attributable to Transmission Licensee)

TNA*i* , TNA*k, TNAIm, TNACm, TNAn* - The non-availability hours (excluding the time period for outages not attributable to Transmission Licensee) for i^{th} AC line, k^{th} ICT , m^{th} SVC (Inductive Operation), m^{th} SVC (Capacitive Operation) & n^{th} reactor.