

Amount of losses incurred on national transmission systems and the methodology used according to art 4.3 of Regulation 838/2010

1. Background and purpose of this document

The Inter transmission system Operator Compensation for Transits (ITC) is governed by Article 13 of Regulation EC 714/2009. Regulation EC 838/2010 contains further specifications of this ITC mechanism. According to Paragraphs 4.2. and 4.3 of the Annex to this legal framework ENTSO-E is mandated to determine:

The amount of losses incurred on national transmission systems by calculating the difference between

- (1) the amount of losses actually incurred on the transmission system during the relevant period; and
- (2) the estimated amount of losses on the transmission system which would have been incurred on the system during the relevant period if no transits of electricity had occurred.

ENTSO for Electricity is also responsible for publishing this calculation and its method in an appropriate format. This document contains these publications.

2. The Method

The losses caused by transits in each transmission system are determined by:

- Recording the load flow Situation for each ITC Party for 6 monthly snapshots T (3rd Wednesdays and preceding Sundays at 03:30h, 11:30h and 19:30h CET/CEST)
 - o with transit represented on interconnected system
 - o with transit represented on disconnected system
- The losses caused by transit for the particular hour $\Delta P_{loss k}(T)$ is then determined as the difference of losses observed in the two situations.
- Based on a mapping that attributes every hour of the month to one of the six snapshots timestamps T, each snapshot timestamp is given a weight w_T
- The overall monthly amount of transit losses for each ITC party is derived by aggregating the weighted transits for the particular hours.

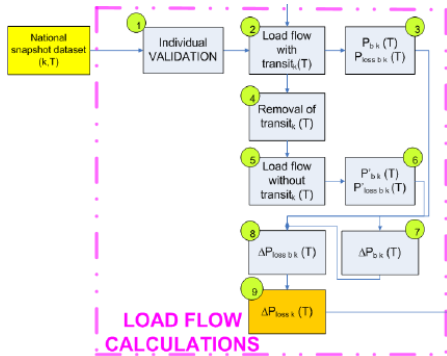
Annex 1 contains further illustrations of this method.

3. The Calculation

Annex 2 contains the calculation results for the year 2011

ANNEX 1: Illustration of the methodology

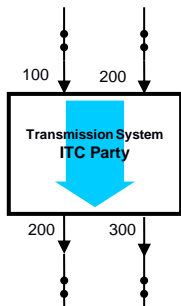
Monthly WWT Calculation: Introduction



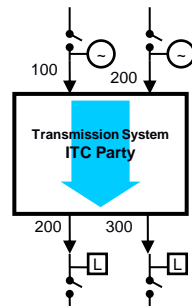
- The losses caused by transit $\Delta P_{loss,k}(T)$ are determined for each ITC Party k for 6 monthly snapshots T (3rd Wednesdays and preceding Sundays at 03:30h, 11:30h and 19:30h CET/CEST)
- Based on a mapping that attributes every hour of the month to one of the six snapshots timestamps T , each snapshot timestamp is given a weight w_T
- The monthly WWT compensation is yielded by ITC Party k 's losses costs $C_{losses}(k)$ multiplied by the losses energy caused by transit.

$\Delta P_{loss,k}(T)$ – load flow calculation (Module 2-3)

Recorded Situation **with transit** represented on **interconnected system** (snapshots)
(measured load flow, result from State Estimation)



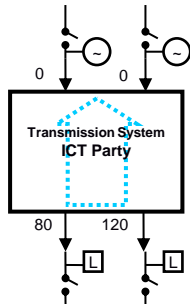
Recorded Situation **with transit** represented on **disconnected system**
(measured load flow, result from State Estimation)



Transit = Minimum { Σ Export, Σ Import }
 Example: Σ Export = 500 MW, Σ Import = 300 MW
 Transit = Minimum { 500 , 300 } = 300 MW

ΔPloss k (T) – load flow without transits (Module 4-5-6-7)

Recorded Situation **without transit** represented on **disconnected system** (measured load flow, result from State Estimation)



Removal of transit by modifying the flows on tie-lines

$$\text{If } \left(\sum_i P_{ex_i} \geq \sum_j P_{im_j} \right) \text{ then } \begin{cases} P_{ex_i} = P_{ex_i} \cdot \left(1 - \frac{\sum_j P_{im_j}}{\sum_j P_{ex_j}} \right) \\ P_{im_m} = 0 \end{cases}$$

$$\text{If } \left(\sum_i P_{ex_i} < \sum_j P_{im_j} \right) \text{ then } \begin{cases} P_{im_k} = P_{im_k} \cdot \left(1 - \frac{\sum_j P_{ex_j}}{\sum_i P_{im_i}} \right) \end{cases}$$

Distribution of the overall modification in losses observed on the slack node to all generators nodes

$$P'_i = P_i \cdot \left(1 + \frac{\Delta P_{Loss}}{\sum_n P_n} \right)$$

ΔPloss b k (T) – for each branch (Module 8)

In case the relative share of losses caused by transits exceeds the relative share of power flow caused by transits, it shall be delimited to this proportion. (Interpretation of ERGEG Guideline)

$$\Delta P_{loss\ b\ k\ (T)} = P_{loss\ b\ k\ (T)} - P'_{loss\ b\ k\ (T)}$$

$$\Delta p_{b\ k\ (T)} = \Delta P_{b\ k\ (T)} / P_{b\ k\ (T)}$$

$$\Delta p_{b\ k\ (T)} = \Delta P_{b\ k\ (T)} / P_{b\ k\ (T)}$$

If {sign (Δ ploss b k (T)) = sign (Δ p b k (T)) and | Δ ploss b k (T)| > | Δ p b k (T)| }

then

$$\Delta P_{loss\ b\ k\ (T)} = \Delta p_{b\ k\ (T)} * P_{loss\ b\ k\ (T)}$$

else

$$\Delta P_{loss\ b\ k\ (T)} = P_{loss\ b\ k\ (T)} - P'_{loss\ b\ k\ (T)}$$

K country
B branch
T snapshot timestamp
Ploss relative increase in losses
Δp relative increase in flows

$\Delta P_{Loss_k}(T)$ – sum for ITC party (Module 9-10)

Sum of all branches within a country

$$\Delta P_{Loss_k}(T) = \sum_b \Delta P_{Loss_{b_k}}(T)$$



The losses energy caused by transit is the scalar product of the $\Delta P_{Loss_k}(T)$ vector times the w_T vector that attributes each hour of the month to a snapshot

$$Compensation_{WWT}(k, m) = Losses_k \sum_{T=1}^{\xi} [\Delta P_{Loss_k}(T) w_T]$$

ANNEX 2: The calculation results

Country	WWT	WWT	WWT	WWT	WWT	WWT	WWT	WWT	WWT	WWT	WWT	WWT
	weighted	weighted	weighted	weighted	weighted	weighted	weighted	weighted	weighted	weighted	weighted	weighted
	MWh	MWh	MWh	MWh	MWh	MWh	MWh	MWh	MWh	MWh	MWh	MWh
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Albania / AL	-496,74	-189,17	-142,42	0,00	438,21	161,13	0,00	2,50	-2,99	-411,12	0,00	-15,82
Austria / AT	12.208,14	13.003,97	849.447,28	9.676,50	8.780,35	12.248,95	13.953,66	401,22	9.601,64	19.968,57	17.525,01	32.147,94
Belgium / BE	3.022,95	1.942,13	174.014,53	7.949,67	4.496,98	6.998,30	9.527,57	3.970,47	5.477,19	7.948,93	5.144,35	2.239,38
Bosnia / BA	2.610,81	3.026,30	97.064,51	4.429,80	3.717,67	4.209,33	5.557,90	6.805,35	4.478,97	2.999,04	9.484,29	6.327,35
Bulgaria / BG	2.818,97	2.389,12	136.001,54	1.459,37	717,81	9,97	227,01	1.721,31	491,56	1.720,36	2.004,14	1.816,91
Croatia / HR	5.170,38	2.493,66	274.605,48	3.619,25	4.994,76	4.922,00	3.430,97	2.994,04	2.105,18	5.369,78	5.895,68	6.438,13
Czech Rep. / CZ	2.004,74	-1.482,14	-56.653,36	-1.076,41	915,31	-1.567,52	11.012,10	-979,81	-333,57	5.411,88	1.216,83	3.444,81
Denmark / DK	12.179,34	4.569,60	232.709,98	21.052,97	4.131,54	11.164,57	8.469,93	6.137,20	11.182,08	4.799,92	3.985,34	15.352,39
Finland / FI	33.420,78	10.768,86	2.140.617,12	40.036,15	14.253,67	5.704,42	7.282,70	158,35	10.721,66	19.124,83	34.822,57	14.273,43
France / FR	7.623,84	8.230,46	257.145,05	13.948,20	13.179,00	5.870,63	3.365,76	2.584,42	2.423,17	26.197,73	42.352,08	17.078,26
Germany / DE	69.213,16	38.574,12	1.356.078,36	42.157,80	22.531,10	27.472,20	13.037,03	20.667,84	23.565,56	16.952,13	50.668,65	85.652,33
Great Britain / GB	-1.271,12	142,15	35.228,54	-2.582,48	-2.270,56	-2.819,87	-5.862,17	-3.423,33	1,18	0,00	0,00	-8,86
Greece / GR	8.644,11	7.644,29	0,00	4.881,73	3.507,79	5.305,21	3.651,08	5.466,20	1.680,72	1.845,76	6.443,22	4.108,22
Hungary / HU	2.044,14	2.449,30	107.256,76	1.132,06	2.178,41	413,90	2.805,51	2.140,80	781,34	5.419,72	6.194,60	12.109,93
Ireland / IE	-211,00	111,20	2.958,03	141,81	-581,34	296,65	21,12	6,65	-260,47	9,74	-19,72	147,17
Italy / IT	0,00	142,56	73.640,07	124,00	-169,37	-277,59	-518,94	-95,47	100,07	313,15	-973,99	-984,05
Estonia / EE	3.217,59	2.639,87	31.877,30	5.930,22	2.619,40	2.092,87	1.857,58	54,84	2.606,85	3.095,85	425,24	414,35
Latvia / LV	1.806,14	2.188,22	62.776,73	2.598,23	3.569,68	1.696,97	2.852,69	803,14	1.130,75	1.213,63	1.070,81	381,76
Lithuania / LT	96,46	154,24	13.389,77	1.699,36	390,88	1.654,59	1.153,81	346,13	529,80	19,48	349,25	869,36
Luxembourg/LU	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
FYROM / MK	333,74	565,17	18.490,72	728,67	783,28	237,41	833,13	1.135,84	33,45	146,98	224,92	66,26
Montenegro / ME	214,51	532,87	80.793,67	1.341,59	928,17	752,86	1.257,54	771,54	724,24	264,80	2.284,80	1.778,60
Netherlands / NL	1.902,68	138,88	36.463,68	1.811,85	-1.786,79	1.138,76	2.139,26	3.189,20	5.681,02	11.376,92	6.052,55	2.886,54
Northern Ireland / NI	624,22	828,00	51.288,35	1.133,09	926,12	1.022,76	717,46	263,04	0,00	1,96	0,00	0,00
Norway / NO	303,28	548,26	18.776,63	2.354,52	2.950,47	294,49	1.501,65	-92,07	19.532,34	9.609,72	5.456,33	14.924,09
Poland / PL	2.381,13	3.680,50	384.339,52	3.284,18	-3.202,01	-2.368,89	8.726,45	-296,15	1.501,00	27.647,05	13.359,12	11.615,86
Portugal / PT	1.439,66	707,71	51.786,39	-177,93	-566,06	829,08	658,07	1.347,87	737,76	956,72	661,92	2.584,77
Romania / RO	-31,54	-917,90	-36.171,82	-1.846,29	-1.171,58	739,50	-3.179,51	-4.615,99	-2.006,93	-5.745,34	-4.472,26	-4.705,94
Serbia / RS	4.447,71	2.974,83	205.988,01	9.959,13	8.616,79	7.965,34	5.810,53	5.420,13	4.648,09	3.341,31	5.559,42	3.764,43
Slovakia / SK	-304,68	-59,08	127.721,54	1.605,16	329,79	-219,80	10.127,79	5.495,99	4.168,30	8.372,15	7.323,27	9.674,03
Slovenia / SI	1.849,83	1.277,74	97.750,06	1.337,09	290,72	751,83	3.152,32	-375,10	799,58	3.624,94	3.759,17	2.300,14
Spain / ES	3.661,59	3.645,31	233.154,08	4.843,35	3.053,11	11.286,49	10.914,33	13.799,64	3.604,41	2.926,14	735,26	3.671,52
Sweden / SE	26.218,36	-8.361,17	985.576,23	21.041,31	11.458,88	57.657,82	31.395,67	19.780,18	9.331,78	7.344,82	39.776,13	50.741,68
Switzerland / CH	49.400,23	41.484,96	3.334.424,99	40.214,91	13.560,00	18.013,04	22.771,28	18.364,70	21.407,77	32.502,75	50.065,50	56.873,75
TOTAL	256.543,37	145.844,82	11.378.397,33	244.808,87	123.572,18	183.657,39	178.651,25	113.950,64	146.443,48	224.370,27	317.374,49	357.968,72