ENTSO-E ITC Transit Losses Data report 2024

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European Network of Transmission System Operators for Electricity

entsoe

ENTSO-E Mission Statement

Who we are

ENTSO-E, the European Network of Transmission System Operators for Electricity, is the **association for the cooperation of the European transmission system operators (TSOs)**. The 42 member TSOs, representing 36 countries[1], are responsible for the **secure and coordinated operation** of Europe's elec- tricity system, the largest interconnected electrical grid in the world. In addition to its core, historical role in technical cooperation, ENTSO-E is also the common voice of TSOs.

ENTSO-E **brings together the unique expertise of TSOs for the benefit of European citizens** by keeping the lights on, enabling the energy transition, and promoting the comple- tion and optimal functioning of the internal electricity market, including via the fulfilment of the mandates given to ENTSO-E based on EU legislation.

Our mission

ENTSO-E and its members, as the European TSO community, fulfil a common mission: Ensuring the security of the inter- connected power system in all time frames at pan-European level and the optimal functioning and development of the European interconnected electricity markets, while enabling the integration of electricity generated from renewable energy sources and of emerging technologies.

Our vision

ENTSO-E plays a central role in enabling Europe to become the first climate-neutral continent by 2050 by creating a system that is secure, sustainable and affordable, and that integrates the expected amount of renewable energy, thereby offering an essential contribution to the European Green Deal. This endeavour requires sector integration and close cooperation among all actors.

Europe is moving towards a sustainable, digitalised, inte- grated and electrified energy system with a combination of centralised and distributed resources.

ENTSO-E acts to ensure that this energy system keeps consumers at its centre and is operated and developed with climate objectives and social welfare in mind.

ENTSO-E is committed to use its unique expertise and system-wide view – supported by a responsibility to maintain the system's security – to deliver a comprehensive roadmap of how a climate-neutral Europe looks.

Our values

ENTSO-E acts in solidarity as a community of TSOs united by a shared responsibility.

As the professional association of independent and neutral regulated entities acting under a clear legal mandate, ENTSO-E serves the interests of society by optimising social welfare in its dimensions of safety, economy, environment, and performance.

ENTSO-E is committed to working with the highest tech- nical rigour as well as developing sustainable and innova- tive responses to prepare for the future and overcoming the challenges of keeping the power system secure in a climate-neutral Europe. In all its activities, ENTSO-E acts with transparency and in a trustworthy dialogue with legislative and regulatory decision makers and stakeholders.

Our contributions

ENTSO-E supports the cooperation among its members at European and regional levels. Over the past decades, TSOs have undertaken initiatives to increase their cooperation in network planning, operation and market integration, thereby successfully contributing to meeting EU climate and energy targets.

To carry out its **legally mandated tasks**, ENTSO-E's key responsibilities include the following:

- Development and implementation of standards, network codes, platforms and tools to ensure secure system and market operation as well as integration of renewable energy;
- Assessment of the adequacy of the system in different timeframes;
- Coordination of the planning and development of infrastruc- tures at the European level (Ten-Year Network Development Plans, TYNDPs);
- Coordination of research, development and innovation activities of TSOs;
- Development of platforms to enable the transparent sharing of data with market participants.

ENTSO-E supports its members in the **implementation and monitoring** of the agreed common rules.

ENTSO-E is the common voice of European TSOs and provides expert contributions and a constructive view to energy debates to support policymakers in making informed decisions.

[1] Ukraine is an ITC Member since 01 July 2024

Background and purpose of this document

The Inter Transmission System Operator Compensation (ITC) Agreement is a multiparty agreement concluded between ENTSO-E and ENTSO-E member countries. It offers a single frame to compensate parties for costs associated with losses resulting with hosting transits flows on networks and for the costs of hosting those flows. All parties removed previously applied transit charges. This report offers a trans- parent overview of the method to compute losses resulting from transits flows and the amount incurred by all parties.

The ITC Compensation mechanism is governed by Article 49 of Regulation (EU) 2019/943. The ITC mechanism is fur- ther specified by Commission Regulation (EU) No 838/2010 of 23 September 2010 on laying down guidelines relating to the inter-transmission system operator compensation mechanism and a common regulatory approach to trans- mission charging. According to Articles 4.2 and 4.3 of the Annex, Part A, of Commission Regulation (EU) No 838/2010, ENTSO-E is mandated to determine the amount of losses in- curred on national transmission systems by calculating the difference between:

(1) the amount of losses actually incurred on the transmis- sion 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-E is also responsible for publishing this calculation and its method in an appropriate format. This document contains these publications.

Method

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

- recording the load flow situation for each party to the ITC mechanism (ITC Party) for 6 monthly snapshots τ (3rd Wednesdays of a month and preceding Sundays at 03:30h, 11:30h and 19:30 CET/CEST):
  - with transit represented on the interconnected system;
  - with transit represented on the disconnected system;
- the losses caused by transit for the particular hour $\Delta Ploss_k(T)$ is then determined as the difference of the losses observed in the two situations;
- based on a mapping that attributes every hour of the month to one of the six snapshot timestamps τ, each snapshot timestamp is given a weight $w\tau$;
- 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.

Calculation

Annex 2 contains the calculation results for the year 2024.

Annex 1: Illustration of the methodology

WWT = "With and Without Transit". To assess the losses caused by transits, TSOs compute what would have been the losses without transit and compare the outcome with the metered values (with transits).

Monthly WWT Calculation: Introduction

- The losses caused by transit $\Delta P_{loss}(\tau, k)$ are determined for each ITC Party k for 6 monthly snapshots τ (3rd Wed- nesday of a month and preceding Sunday at 03:30 h, 11:30 h and 19:30 h CET/CEST).
- Based on a mapping that attributes every hour of the month to one of the six snapshots timestamps τ, each snapshot timestamp is given a weight w_τ.
- The monthly WWT compensation is yielded by ITC Party k's losses cost $C_{losses}(k)$ multiplied by the losses energy caused by transit.

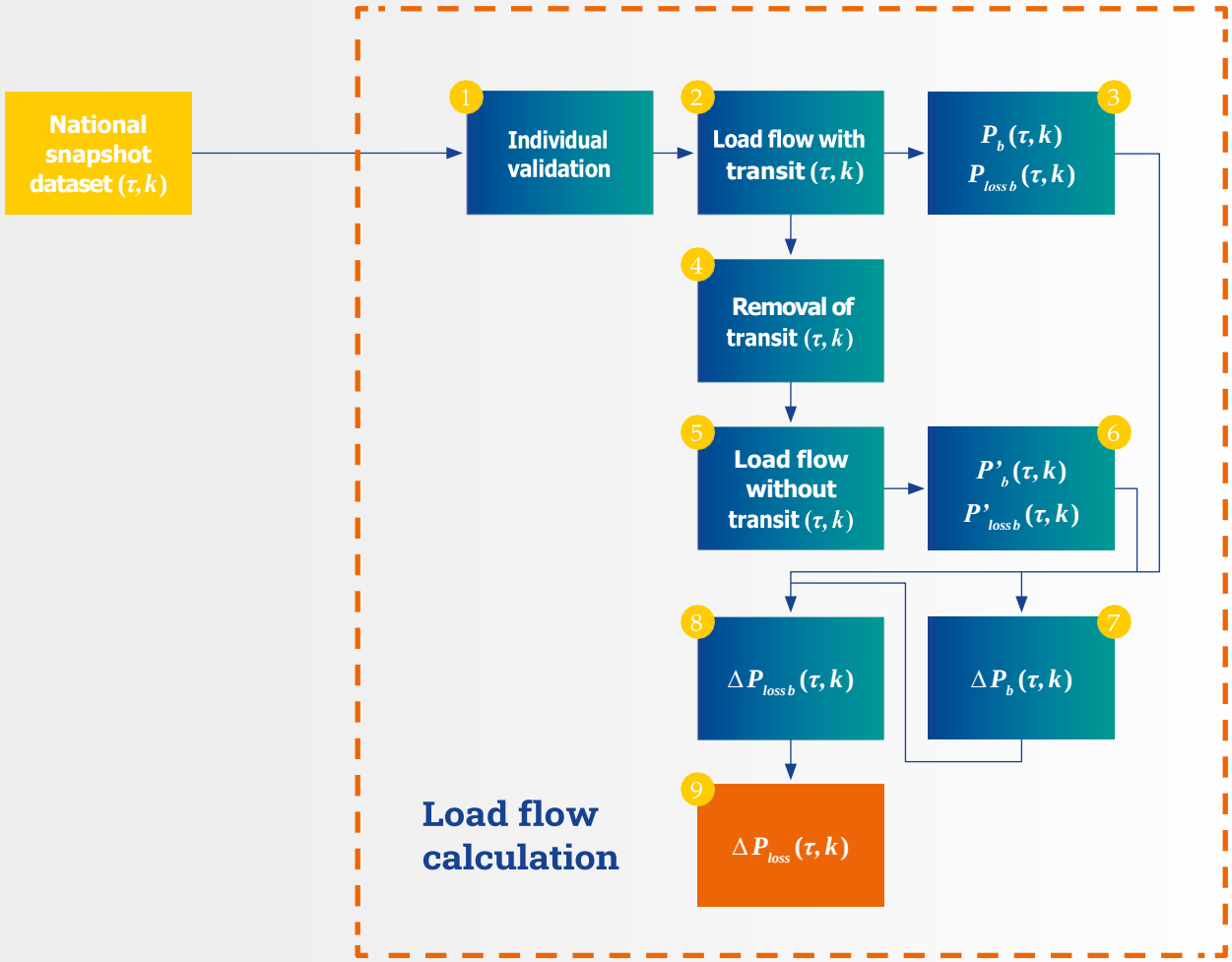
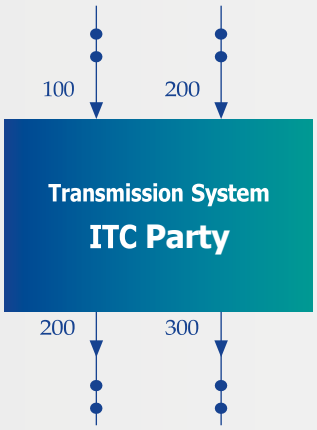


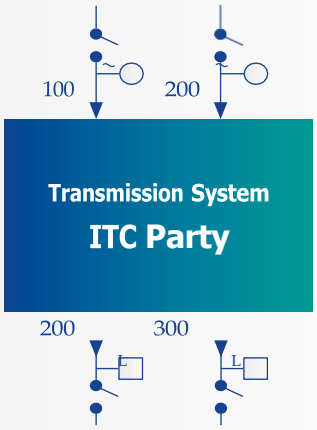
Figure 1: Monthly WWT Calculation

$\Delta P_{loss}\ (\tau, k)$ – 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)



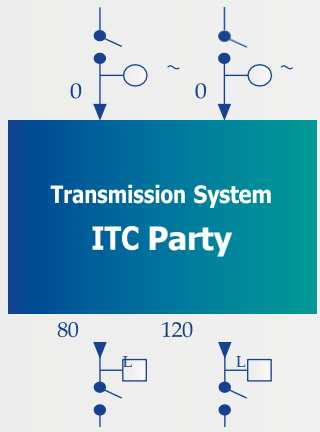
Transit = Minimum $\{\sum Export_i, \sum Import_j\}$

Example: $\sum$ Export = 500 MW, $\sum$ Import = 300 MW

Transit = Minimum $\{500\ MW, 300\ MW\} = 300\ MW$

$\Delta P_{loss}\ (\tau, k)$ – Load flow without transits (Module 4, 5, 6, 7)

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



Removal of transit by modifying the flows on tie-lines

If $(\sum_i Pex \geq \sum_j Pim_j)$ then

$$Pex'_k = Pex_k \times \left(1 - \frac{\sum_i Pim_i}{\sum_j Pex_j}\right)$$

$$Pim'_m = 0$$

If $(\sum_i Pex_i < \sum_j Pim_j)$ then

$$Pim'_k = Pim_k \times \left(1 - \frac{\sum_j Pex_j}{\sum_i Pim_i}\right)$$

$$Pex'_m = 0$$

Distribution of the overall modification in losses observed on the slack note to all generate nodes

$$P_i' = P_i \times \left(1 + \frac{\Delta P_{loss}}{\sum_n P_n}\right)$$

$\Delta P_{loss}(\tau, k)$ – 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)

$\Delta P_{loss\,b}(\tau, k) = P_{loss\,b}(\tau, k) - P'_{loss\,b}(\tau, k)$

$\Delta p_{loss\,b}(\tau, k) = \Delta P_{loss\,b}(\tau, k) / P_{loss\,b}(\tau, k)$

$\Delta p_b(\tau, k) = \Delta P_b(\tau, k) / P_b(\tau, k)$

If $\{ \text{sign}(\Delta p_{loss\,b}(\tau, k)) = \text{sign}(\Delta p_b(\tau, k)) \text{ and } |\Delta p_{loss\,b}(\tau, k)| > |\Delta p_b(\tau, k)| \}$

then

$$\Delta P_{loss\,b}(\tau, k) = \Delta p_b(\tau, k) \times P_{loss\,b}(\tau, k)$$

else

$$\Delta P_{loss\,b}(\tau, k) = P_{loss\,b}(\tau, k) - P'_{loss\,b}(\tau, k)$$

- k = country
- b = branch
- τ = snapshot timestamp
- ΔP_{loss} = relative increase in losses
- ΔP = relative increase in flows

$\Delta P_{loss}(\tau, k)$ – sum for ITC Party k (Module 9)

Sum of all branches within a country

$$\Delta P_{loss}(\tau, k) = \sum_{b} \Delta P_{loss\,b}(\tau, k)$$

The losses energy caused by transit is the scalar product of the $\Delta P_{loss}(\tau, k)$ vector times the w_τ vector that attributes each hour of the month to a snapshot

$$Compensation\_WWT\,(k,m) = C_{losses}(k) \sum_{t=1-6}^{b} \left[\Delta P_{loss}(\tau, k) \quad w_\tau \right]$$

Annex 2: Calculation Results 2024

2024 WWT weighted MWh												
Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Albania / AL	1654,43	3524,51	4391,90	2522,01	859,36	1401,13	-266,36	363,47	2474,17	4957,02	2170,77	2243,70
Austria / AT	19635,83	32658,27	14501,86	10821,88	16533,46	9926,75	16800,01	20584,73	9649,35	13921,77	16920,06	36315,09
Bosnia / BA	3851,84	3421,81	5098,74	3338,71	2661,59	4725,61	3899,72	5467,63	2801,04	5666,26	1996,58	3953,36
Belgium / BE	13129,85	12796,32	21563,48	12167,93	16983,17	15654,62	14525,49	19324,30	11785,93	15603,36	11997,61	17147,44
Bulgaria / BG	3633,00	4202,13	2349,29	2256,97	1737,35	1942,97	1378,97	185,33	1882,13	6591,27	3736,50	3332,75
Switzerland / CH	22673,78	62208,95	25418,31	21116,36	18805,48	33738,17	11372,85	30341,04	17856,94	15588,63	51055,26	77686,91
Czech Rep. / CZ	32792,35	38857,05	8893,01	4187,21	34242,18	12800,86	26984,84	24363,52	11229,77	24506,81	37323,39	50462,16
Germany / DE	47063,97	89545,13	24582,00	22156,18	20866,50	24622,92	26659,91	45424,44	37106,46	-27803,33	91294,04	223675,67
Denmark / DK	18511,87	38640,48	39004,60	15027,15	35792,29	55167,18	46529,27	28653,83	26458,30	19677,13	29419,04	39989,24
Estonia / EE	2394,83	788,77	926,72	847,57	2219,57	1812,62	3169,65	1758,12	6717,69	5483,88	3105,53	1405,55
Spain / ES	36033,78	49590,79	40670,42	24354,65	10472,90	5928,67	7924,89	15062,67	1358,99	73276,03	7366,96	16343,92
Finland / FI	21253,56	14463,27	24675,17	10210,10	4352,02	2286,86	1611,80	7641,91	16181,34	15447,95	25400,21	16699,42
France / FR	99344,26	76171,93	130360,36	136601,14	35754,69	13481,11	23941,06	31320,51	14466,20	28284,15	43992,96	93657,91
Great Britain / GB	6251,19	-791,91	20914,69	5194,44	12641,76	22363,10	6605,03	6887,42	17984,04	697,89	10686,65	5867,34
Greece / GR	2654,45	4860,32	1939,46	1031,34	1096,39	39,48	2152,78	4287,98	4623,19	6904,78	3702,74	6201,43
Croatia / HR	5181,83	3914,11	14159,02	7341,46	5828,71	7468,93	5538,48	4646,39	2324,71	5805,92	3276,09	6477,25
Hungary / HU	9104,86	9817,60	4609,98	5619,54	15857,78	15023,17	16046,26	11849,94	4594,76	5601,18	2893,89	27790,75
Ireland / IE	0,32	684,65	0,07	-0,41	1,06	0,18	-1,22	-0,29	-5,44	-0,48	-1,77	183,34
Italy / IT	6592,18	8,73	-117,65	2278,88	5274,74	4843,07	10816,62	21320,93	1132,45	4082,94	2496,62	7012,39
Kosovo* / KS*	1645,64	2043,99	2954,81	1811,77	1552,42	1107,94	1250,80	1263,95	564,37	2303,52	2329,13	1300,29
Lithuania / LT	5392,51	4330,03	2000,95	3807,14	1163,07	5954,81	5908,89	2057,49	2411,74	1017,60	1639,45	3216,61
Luxembourg / LU	12,67	6,84	36,83	19,44	0,00	0,00	41,11	349,23	197,40	399,15	14,95	234,65
Latvia / LV	4368,73	2022,81	2802,64	3027,82	824,19	927,90	4084,47	3278,82	4461,74	930,55	4210,68	3965,52
Montenegro / ME	1781,32	3866,27	3319,25	2180,87	1845,66	3205,85	1848,96	2742,28	2680,94	4286,18	2626,42	2964,24
FYROM / MK	1251,72	1702,90	961,19	1234,49	631,68	1096,56	849,85	953,78	1829,86	1858,68	2424,78	1618,00
Northern Ireland / NI	1597,96	773,72	1628,35	1933,00	3295,98	3052,58	3379,87	2954,63	2433,08	1646,02	1244,51	1995,09
Netherlands / NL	23443,05	25938,53	1039,92	7196,65	5765,24	10576,14	12055,93	12705,41	570,97	14410,74	9265,31	47598,90
Norway / NO	-6225,95	137,73	18096,82	6780,48	20251,19	16654,31	23071,23	14283,78	28479,95	7238,98	23318,84	20304,57
Poland / PL	43588,68	42774,52	22313,57	7793,35	43548,57	24202,72	46102,73	41175,92	9584,35	29559,47	73321,84	76538,81
Portugal / PT	-344,60	-171,14	-281,36	-653,85	145,39	3,15	662,64	358,92	-88,46	-210,68	1439,25	2272,42
Romania / RO	2844,16	282,36	5740,41	3259,90	2383,98	4058,10	-288,93	1549,21	-4418,23	350,78	-9477,08	2034,52
Serbia / RS	5124,55	2755,81	14529,00	5175,90	2407,56	3016,45	2136,32	4583,54	1405,50	8009,41	1708,22	6950,56
Sweden / SE	22642,12	46501,88	45427,37	12600,51	24716,84	31308,87	34282,06	80,93	3537,68	11298,87	29420,37	32387,38
Slovenia / SI	10054,07	12992,28	5938,47	10865,13	11096,51	3818,20	5179,46	5373,80	6572,24	6321,84	6200,58	13585,16
Slovakia / SK	13093,63	11102,31	7484,22	4479,20	20432,77	17246,58	19658,46	20304,46	9087,59	8388,08	19799,31	29701,38
Ukraine / UA	-	-	-	-	-	-	-427,13	949,20	-1300,66	1695,09	-329,07	2843,39
TOTAL	482028,45	602423,74	517933,85	358584,93	382042,00	359457,56	385486,77	394449,18	258632,08	323797,43	517990,61	885957,09

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ENTSO-E, the European Network of Transmission System Operators, represents 42 electricity transmission system operators (TSOs) from 35 countries across Europe. ENTSO-E was established and given legal mandates by the EU's Third Legislative Package for the Internal Energy Market in 2009.

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