

# ENTSO-E ITC Transit Losses Data report 2020

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# 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 35 countries, are responsible for the **secure and coordinated operation** of Europe's electricity 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 completion 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 interconnected 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, integrated 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 technical rigour as well as developing sustainable and **innovative 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 infrastructures 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.

# 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 transparent 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 further 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 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-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  $\tau$  (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  $\Delta P_{\text{loss } k}(T)$  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  $\tau$ , 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 2020.

# 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  $\tau$  (3<sup>rd</sup> Wednesday 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  $\tau$ , each snapshot timestamp is given a weight  $w_\tau$ .
- The monthly WWT compensation is yielded by ITC Party  $k$ 's losses cost  $C_{losses}(k)$  multiplied by the losses energy caused by transit.

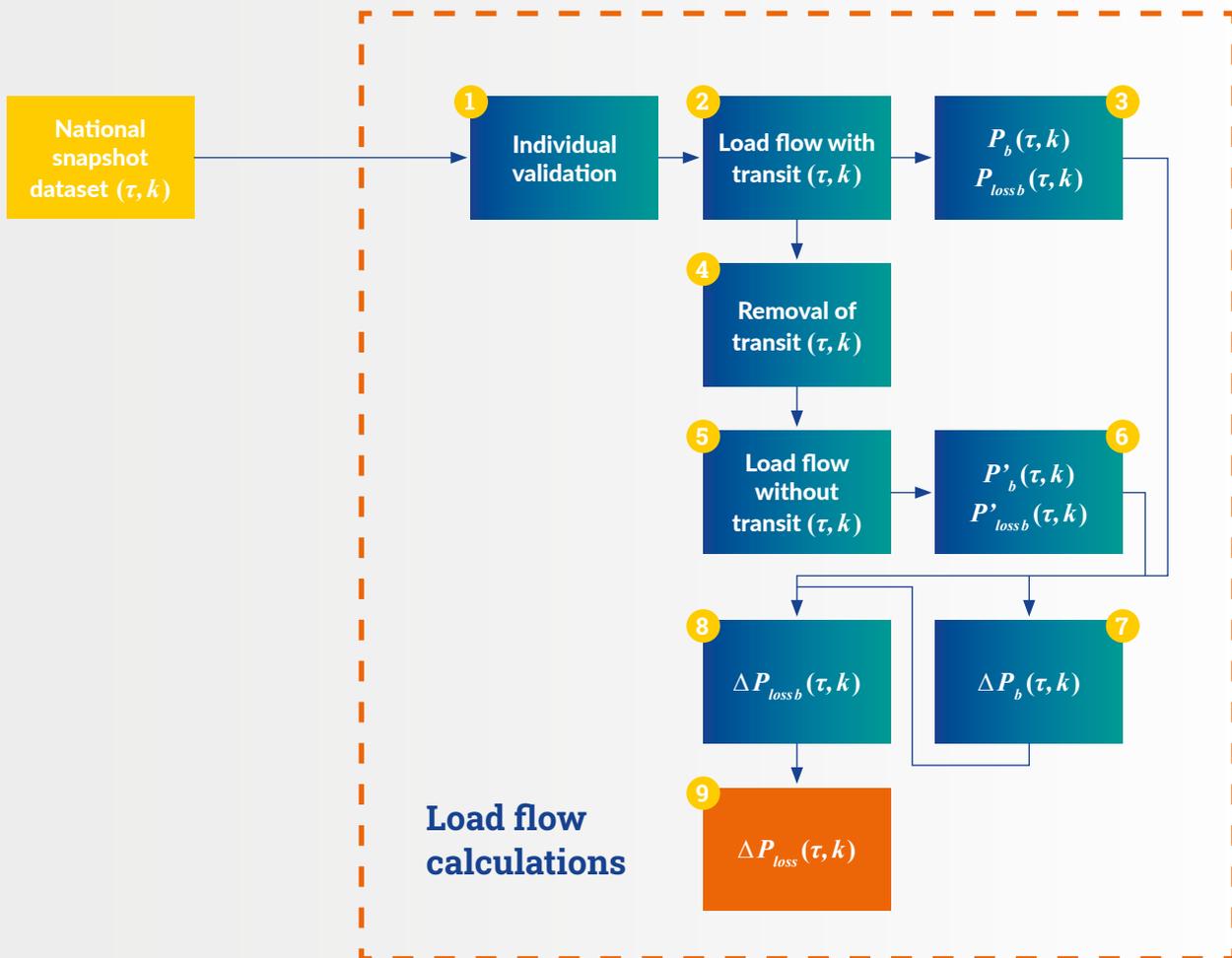
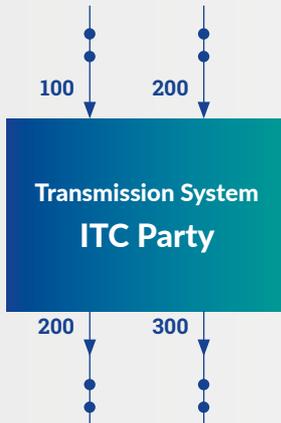


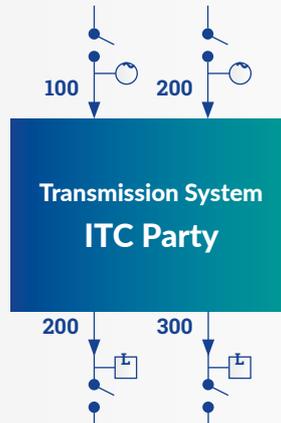
Figure 1: Monthly WWT Calculation

## $\Delta P_{loss}(\tau, k)$ – Load flow calculation (Module 2 – 3)

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



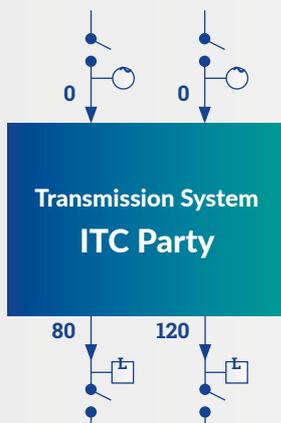
Recorded Situation **with transit** represented on **disconnected** system (measured load flow, result from State Estimation)



Transit = Minimum  $\{ \sum Export_i, \sum Import_j \}$   
 Example:  $\sum Export = 500 \text{ MW}, \sum Import = 300 \text{ MW}$   
 Transit = Minimum  $\{ 500 \text{ MW}, 300 \text{ MW} \} = 300 \text{ MW}$

## $\Delta P_{loss}(\tau, k)$ – 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

$$\text{If } \left( \sum_i P_{ex_i} \geq \sum_j P_{im_j} \right) \text{ then } \begin{aligned} P_{ex'_k} &= P_{ex_k} \times \left( 1 - \frac{\sum_i P_{im_i}}{\sum_j P_{ex_j}} \right) \\ P_{im'_m} &= 0 \end{aligned}$$

$$\text{If } \left( \sum_i P_{ex_i} < \sum_j P_{im_j} \right) \text{ then } \begin{aligned} P_{im'_k} &= P_{im_k} \times \left( 1 - \frac{\sum_j P_{ex_j}}{\sum_i P_{im_i}} \right) \\ P_{ex'_m} &= 0 \end{aligned}$$

Distribution of the overall modification in losses observed on the slack node 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  
 $\tau$  = snapshot timestamp  
 $\Delta P_{loss}$  = relative increase in losses  
 $\Delta P$  = 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  $w_\tau$  vector that attributes each hour of the month to a snapshot

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

## Annex 2: Calculation Results 2020

2020												
WWT												
weighted												
MWh												
Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Albania / AL	721.241	1,351.161	1,405.190	487.068	681.700	419.268	-6.348	1,011.818	4.926	619.154	-16.480	304.798
Austria / AT	35,665.199	32,695.076	25,744.207	15,473.020	17,771.883	9,997.632	3,259.733	11,953.095	9,799.984	12,216.848	32,350.116	19,810.064
Bosnia / BA	1,830.439	3,005.845	1,235.961	754.318	3,548.300	2,763.040	3,826.158	1,608.429	2,623.310	1,053.469	4,715.164	1,534.652
Belgium / BE	11,691.128	3,723.901	7,183.066	17,339.866	18,002.738	3,492.200	4,059.387	5,209.968	16,148.414	11,630.490	6,602.265	6,450.592
Bulgaria / BG	2,671.046	3,684.433	3,178.212	2,247.362	2,827.461	471.526	341.913	907.212	574.066	1,794.724	17.484	492.345
Switzerland / CH	63,996.601	64,092.598	47,872.907	16,863.262	21,370.666	15,810.624	17,780.696	4,193.604	6,995.692	27,554.878	50,301.824	39,608.021
Czech Republic/ CZ	92,579.218	62,158.254	47,560.776	18,725.296	16,779.614	10,561.018	4,349.446	5,614.356	28,796.612	22,723.422	64,758.671	62,505.166
Germany / DE	38,767.060	19,573.146	44,502.996	29,197.306	43,073.112	51,757.652	39,970.873	32,174.935	92,396.114	53,715.938	44,354.684	167,265.488
Denmark / DK	36,926.876	33,338.766	37,861.491	30,968.374	22,203.673	22,545.928	31,989.094	8,656.704	46,365.688	15,571.331	15,312.044	22,578.598
Estonia / EE	9,940.699	9,347.070	5,009.648	1,849.124	6,720.838	10,682.364	23,967.230	14,463.577	12,547.106	7,616.329	7,427.168	6,954.902
Spain / ES	19,797.217	4,737.628	14,067.753	39,856.024	17,349.418	17,667.810	14,192.220	3,715.194	34,739.990	70,008.677	5,156.757	27,202.323
Finland / FI	37,122.512	37,265.452	29,156.706	12,175.176	27,433.385	43,165.786	46,615.974	28,392.415	29,146.240	35,648.514	41,789.558	29,243.873
France / FR	65,705.145	11,773.613	31,654.699	2,749.160	3,910.996	23,287.414	81,896.284	4,581.174	60,610.702	69,794.379	55,277.604	69,862.318
Great Britain / GB	7,346.052	1,283.569	10,357.698	15,625.268	-16.207	3,683.874	38,473.814	3,156.596	12,571.110	10,142.653	6,439.940	802.735
Greece / GR	493.702	176.805	79.945	282.234	223.380	325.552	458.654	153.018	3,546.044	996.021	2,190.208	1,967.660
Croatia / HR	1,536.436	3,848.317	2,079.380	2,868.070	6,215.949	3,143.842	2,523.987	1,147.007	1,516.046	3,215.912	4,818.969	916.969
Hungary / HU	9,303.093	15,064.902	5,878.774	3,941.988	11,071.621	6,441.392	3,777.419	1,023.248	2,832.810	2,724.789	7,505.831	1,266.678
Ireland / IE	1,442.287	876.636	450.174	87.808	59.703	-24.410	333.735	366.520	762.576	348.334	2,653.248	2,933.191
Italy / IT	1,892.071	10,911.744	4,890.954	738.990	11,018.699	2,429.132	7,703.226	5,620.518	1,225.066	464.307	2,969.801	7,892.711
Kosovo* / KS*	1,467.669	1,833.724	1,152.945	784.184	804.397	854.400	461.013	449.452	844.032	342.604	1,243.662	718.585
Lithuania / LT	12,864.261	8,407.535	8,825.527	2,125.654	4,242.202	7,335.054	6,222.700	6,886.892	10,053.744	4,458.412	9,387.007	7,754.614
Luxembourg / LU	0.000	0.000	0.000	0.000	0.000	0.000	0.000	96.852	108.088	101.990	7.434	40.831
Latvia / LV	2,197.960	2,905.807	2,378.603	1,722.194	983.131	1,940.342	5,238.132	2,518.955	3,132.390	1,037.860	103.583	805.055
Montenegro / ME	5,721.742	6,218.806	3,868.883	2,065.418	-2,841.130	4,721.082	4,475.878	3,137.701	1,230.920	1,315.325	4,011.600	5,035.845
FYROM / MK	522.789	1,057.020	1,053.945	446.838	1,279.088	1,273.354	1,394.416	2,092.447	660.974	435.500	538.740	15.663
Northern Ireland / NI	573.611	434.299	3,530.388	-40.040	205.840	501.722	212.735	390.674	1,970.232	768.464	57.720	800.338
Netherlands / NL	47,363.215	28,380.808	62,186.854	15,502.324	12,516.147	-3,234.558	14,797.477	6,768.781	41,202.668	30,977.866	37,664.143	22,346.288
Norway / NO	-6,507.172	-1,876.104	8,061.179	13,196.950	556.594	412.236	1,796.783	55.311	759.860	-57.503	-2,037.129	-3.568
Poland / PL	70,957.735	42,083.785	28,544.477	40,459.270	8,335.218	2,674.772	10,298.731	2,959.022	9,944.454	22,105.761	27,586.339	14,267.204
Portugal / PT	330.425	-1,233.776	-2,623.802	-125.750	159.348	1,254.766	-244.351	868.441	510.216	964.066	2,287.225	1,478.267
Romania / RO	1,958.538	1,301.148	-996.687	-1,285.922	-3,138.510	3,354.444	2,292.863	3,128.376	-1,822.498	-961.600	-1,811.721	-1,247.502
Serbia / RS	4,266.241	6,374.008	2,321.553	3,618.844	5,876.147	3,552.334	3,657.366	472.043	176.774	1,477.924	2,795.702	-224.102
Sweden / SE	17,407.689	2,853.360	6,411.728	1,155.728	27,170.442	12,240.712	32,989.457	-1,288.156	15,338.184	58,551.974	-4,405.364	75,199.944
Slovenia / SI	3,217.057	5,172.375	5,656.649	2,747.246	3,067.451	3,207.390	2,586.849	843.049	4,506.850	3,110.362	6,237.455	2,414.293
Slovakia / SK	24,274.134	18,201.772	11,315.035	8,666.244	8,942.499	6,918.428	4,859.028	8,836.683	6,947.056	12,577.162	13,787.433	16,309.955
<b>TOTAL</b>	<b>626,043.916</b>	<b>441,023.483</b>	<b>461,857.814</b>	<b>303,268.896</b>	<b>298,405.793</b>	<b>275,628.122</b>	<b>416,552.572</b>	<b>172,165.911</b>	<b>458,766.440</b>	<b>485,046.336</b>	<b>452,078.685</b>	<b>615,304.794</b>

**Any question? Contact us:**

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European Network of  
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