

Supplementary Material

# Electricity consumption and operational carbon emissions of European telecom network operators

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**Table S1.** Summarized results of aggregated collected data from ETNO Operators. For definitions, please see main article.

Subscriptions		ETNO Total data				ETNO Europe data			
(subs)	Unit	2015	2016	2017	2018	2015	2016	2017	2018
PSTN	millions	95	89	84	82	68	62	57	55
VoIP	millions	16	19	22	25	16	19	22	25
Mobile	millions	694	707	663	664	265	270	256	255
Fixed BB	millions	64	66	68	72	53	55	57	59
<b>Total subs excl. VoIP:</b>	<b>millions</b>	<b>853</b>	<b>862</b>	<b>815</b>	<b>818</b>	<b>386</b>	<b>387</b>	<b>370</b>	<b>369</b>
Total incl. VoIP	millions	869	881	837	843	402	406	392	394

  

Total electricity consumption									
		ETNO Total data				ETNO Europe data			
Network parts	Unit	2015	2016	2017	2018	2015	2016	2017	2018
PSTN	TWh	4,3	4,1	3,9	3,8	2,9	2,8	2,7	2,6
Mobile	TWh	8,8	9,0	9,2	9,5	4,8	5,0	5,1	5,3
Fixed BB	TWh	3, 5	3,5	3,7	3,7	2,8	2,9	3,0	3,0
<b>Overhead</b>									
Data/IP core	TWh	1,1	1,1	1,3	1,3	1,0	1,0	1,2	1,3
Data centers	TWh	1,5	1,6	1,5	1,5	1,3	1,3	1,3	1,3
Offices etc.	TWh	1,6	1,65	1,4	1,2	1,5	1,5	1,3	1,1
<b>Total electricity:</b>	<b>TWh</b>	<b>20,8</b>	<b>20,9</b>	<b>21,0</b>	<b>21,0</b>	<b>14,3</b>	<b>14,5</b>	<b>14,6</b>	<b>14,5</b>

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**Networks' electricity per subscriber – without operators' overhead**


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<b>Subscriber</b>		<b>ETNO Total data</b>				<b>ETNO Europe data</b>			
		<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
PSTN average	kWh/sub	45	46	46	46	43	45	47	46
PSTN+VoIP average	kWh/sub	39	38	37	36	35	35	34	32
Fixed BB average	kWh/sub	54	53	54	51	53	53	53	51
Fixed average	kWh/sub	49	49	50	49	47	49	50	49
Mobile average	kWh/sub	13	13	14	14	18	19	20	21
Total average	kWh/sub	19	19	21	21	27	28	29	29

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**Total electricity allocated to network parts**


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<b>Network parts</b>		<b>ETNO Total data</b>				<b>ETNO Europe data</b>			
		<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
PSTN	TWh	4,6	4,4	4,2	4,1	3,2	3,1	2,9	2,8
Mobile	TWh	11	11	11	12	6,8	7,0	7,0	7,1
Fixed BB	TWh	5,2	5,3	5,5	5,5	4,4	4,5	4,7	4,6

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**Electricity/sub (all electricity incl. overhead and operators' data centers)**


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<b>Subscriber</b>		<b>ETNO Total data</b>				<b>ETNO Europe data</b>			
		<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
PSTN average	kWh/sub	48	49	50	49	46	49	51	51
PSTN+VoIP average	kWh/sub	41	40	39	38	38	38	37	35
Fixed BB average	kWh/sub	82	80	81	76	83	82	82	78
Fixed average	kWh/sub	62	62	64	62	63	65	66	65
Mobile average	kWh/sub	16	16	17	17	26	26	27	28
Total average	kWh/sub	24	24	26	26	37	37	39	39

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**Total electricity incl. overhead (data/IP core and offices), but excluding operators' datacenters**


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<b>Network parts</b>		<b>ETNO Total data</b>				<b>ETNO Europe data</b>			
		<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>	<b>2015</b>	<b>2016</b>	<b>2017</b>	<b>2018</b>
PSTN	TWh	4,6	4,4	4,2	4,1	3,2	3,1	2,9	2,8
Mobile	TWh	10	10	10	11	6,1	6,3	6,3	6,4
Fixed BB	TWh	4,5	4,6	4,8	4,8	3,8	3,9	4,1	4,0

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## Electricity per subscriber (electricity incl. overhead but excl. operators' datacenters)

Subscriber		ETNO Total data				ETNO Europe data			
		2015	2016	2017	2018	2015	2016	2017	2018
PSTN average	kWh/sub	48	49	50	49	46	49	51	51
PSTN+VoIP									
average	kWh/sub	41	40	39	38	38	38	37	35
Fixed BB									
average	kWh/sub	71	69	71	66	72	71	71	68
Fixed average	kWh/sub	57	58	59	57	58	59	61	60
Mobile									
average	kWh/sub	15	15	16	16	23	23	25	25
Total average	kWh/sub	23	22	24	24	34	34	36	36

**Questionnaire (Version 2019-05-14 1.0)**

OperatorDataReport  
- 2019-05-02 1.0.xlsx

**General information****Telecom Operational data questionnaire**

*Please observe!*

*All shared information will be handled with confidentiality and will be shared only in consolidated format where no individual operator data can be identified!*

The more information you are able to provide, the better. It's better that you respond with the data that you have than not respond at all. Leave out what's appropriate for you to not to share!

Please send the filled in questionnaire to Dag Lundén.  
Remaining questions can be sent to the same address.

Deadline for response is: 2019-06-15

Lisboa the 14th of May 2019

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## Explanation – Description

	Unit	Description
<b>Operator</b>		
<b>Country/Region (or Globally)</b>		One column per country, region or just one column for total operations
<b>Year</b>		One column per year, to report extra years is optional
<b>Background and subscription data</b>		
Revenue	(USD)	
Employees	#	
PSTN subscriptions (classic voice calls)	millions	
VoIP subscriptions (IP voice calls)	millions	
Mobile subscriptions (Data and voice)	millions	
Mobile subscriptions (Data only - No voice)	millions	
M2M subscriptions	millions	
Fixed broadband subscriptions	millions	All types incl FTTx, xDSL and CATV
IPTV subscriptions	millions	
Total data traffic	million TB	
...or Total data traffic, indexed (e.g. 2015 = 1)	Indexed	
When the consolidated data is published (via ETNO or by other means), do your company want to be named as a source of information or do you want to remain "anonomous"?	Named / Not named	State wheter you want to be officially recognized as a source or not.
<b>ENERGY AND CO2 DATA</b>		
<b>Total electricity</b>		
Electricity consumption purchased/measured	GWh	As measured (including estimates) by the supplier
Own generation, e.g. PV or wind (included above)	GWh	Electricity generation and consumption on the same electricity grid. I.e. Only investments connected to the same electricity grid as the consumption is to be included.
Subtracted co-locations	GWh	Other operators/customers equipment which consumption is included in the sites actual electricity purchases should be subtracted to avoid double accounting.
Added external co-locations	GWh	Own equipment consumption, not included in "Electricity consumption purchased/measured". I.e. electricity included in the site rent (common for mobile rooftop sites). This electricity consumption typically has to be estimated.
Total electricity	GWh	Total electricity = Electricity purchased/measured + own generation - subtracted co-locations + added external co-locations
Green electricity (certified - specified) purchased	GWh	Amount of green electricity purchased. The electricity needs to be certified, produced and delivered within the same electricity grid where you operate. Please note that EU carbon trading is not seen as certified green electricity.
Average emission factor, market based	kton CO2/GWh	The used average emission factor based on specific market conditions i.e. emission factors directly from the suppliers of green electricity.
Average emission factor, location based	kton CO2/GWh	The average emission factor for the country/region, based on IEA. The emission factor can of course also include low-carbon electricity from e.g. nuclear and hydro power.
Total CO2 emissions, market based	kton CO2	Resulting CO2 emissions.
Total CO2 emissions, location based	kton CO2	Resulting CO2 emissions.
<b>Electricity details</b>		
PSTN + VoIP (Fixed voice)	GWh	Also including PSTN and VoIP core nodes
Mobile access + Mobile core	GWh	Also including the mobile core nodes
Fixed broadband	GWh	All Fixed broadband access types nodes incl FTTx, xDSL and CATV
Data transport / IP core network	GWh	All data transport links and systems and all IP core nodes
Data centers	GWh	Not including any of the core nodes above
Offices	GWh	
Stores	GWh	Own stores!
Other	GWh	Wearhouses, storage facilities, service locations etc
<b>Diesel consumption</b>		
Diesel @sites, off-grid/back-up	m3	
Applied Diesel emission factor	ton CO2/m3	Common Diesel emission factor is 2,65 ton CO2/m3
Total Diesel CO2 emissions	kton CO2	
<b>OPTIONAL DATA</b>		
Total other energy	GWh	Please specify the details below
Total other energy CO2 emissions	kton CO2	Please specify the details below
<b>Other energy details</b>		
Facilities (S1 + non-electricity S2)	GWh	
Vehicle fleet (S1)	GWh	
Employee travel (S3)	GWh	
Employee commuting (S3)	GWh	
Transports (S3)	GWh	
Fuel and energy supply (S3)	GWh	
Production (S3)	GWh	
Construction (S3)	GWh	
<b>Other energy details CO2 emissions</b>		
Facilities (S1 + non-electricity S2)	kton CO2	
Vehicle fleet (S1)	kton CO2	
Employee travel (S3)	kton CO2	
Employee commuting (S3)	kton CO2	
Transports (S3)	kton CO2	
Fuel and energy supply (S3)	kton CO2	
Production (S3)	kton CO2	
Construction (S3)	kton CO2	
<b>ADDITIONAL OPTIONAL DATA</b>		
Data traffic, fixed subscriptions	million TB	
Data traffic, mobile subscriptions	million TB	
Data traffic, other	million TB	
Mobile business share of revenue	%	These figures can be used to allocate scope 1+3 emissions e.g. offices and travel
Mobile business share of employees	%	