ERICSSON

Research brief

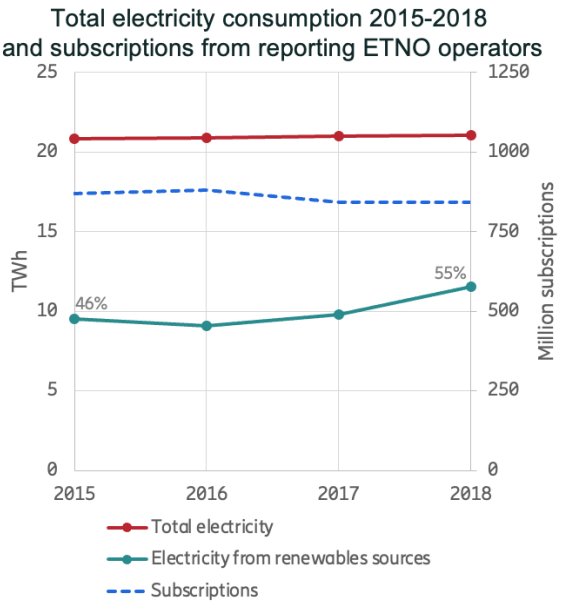
Operational electricity consumption of European telecom network operators nearly constant 2015 to 2020

Operational electricity consumption collected from European telecom network operators remained stable 2015 to 2018 while the data traffic increased by a factor of three. The corresponding greenhouse gas emissions have decreased for the same period, reflecting an increased use of renewable energy. Similar trend detected in 2020 data validation. The annual electricity consumption per subscription remained stable at about 26 kWh combining both mobile and fixed subscriptions in 2018.

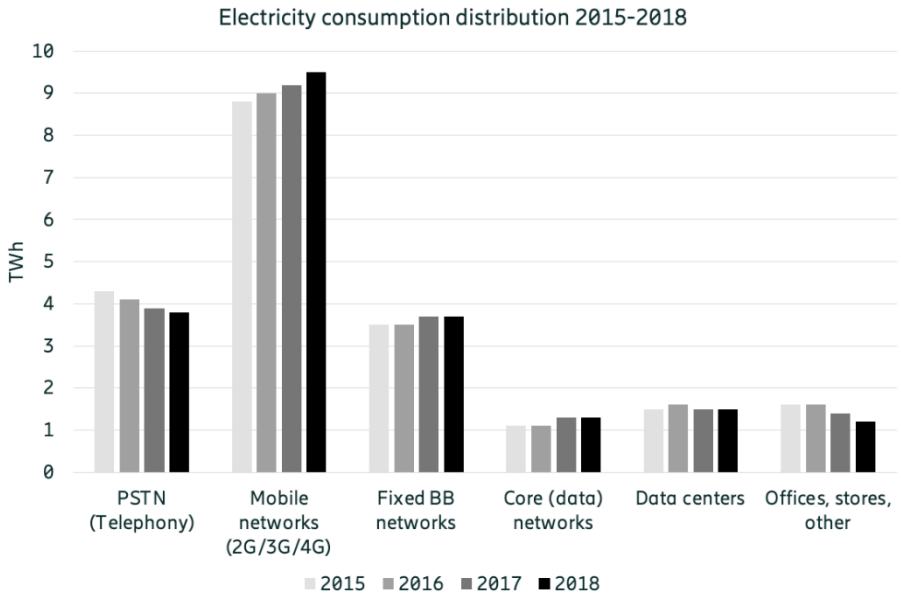
Constant development among European operators 2015-2018

Between 2015 and 2018, the total annual electricity consumption of the European telecom network operators included in the study remained nearly constant, being about 21.0 TWh in 2018 serving over 800 million subscriptions, while data traffic increased by a factor of three. The network operators were all members of European Telecommunication Network Operators (ETNO), hereafter referred to as ETNO Operators[1]. During the same period, the share of electricity from renewable energy sources increased from 46% to 55% leading to reduced greenhouse gas (GHG) emissions from the electricity used to operate the networks. Some of the ETNO operators have operations also outside Europe and there are substantial regional differences in the usage of renewables. The share of renewable electricity supplies is higher in Europe compared to other markets where ETNO operators are presented. The electricity grid emission factors for GHG emissions were 0.13 kg CO_2/kWh in Europe and 0.28 kg CO_2/kWh overseas for the ETNO Operators in 2018.

[1] The reporting operators are referred to as 'ETNO Operators'. Note that this refers to operators active in ETNO´s Sustainability working group, plus additional large ETNO operators. Hence it is a subset of ETNO´s operator membership.

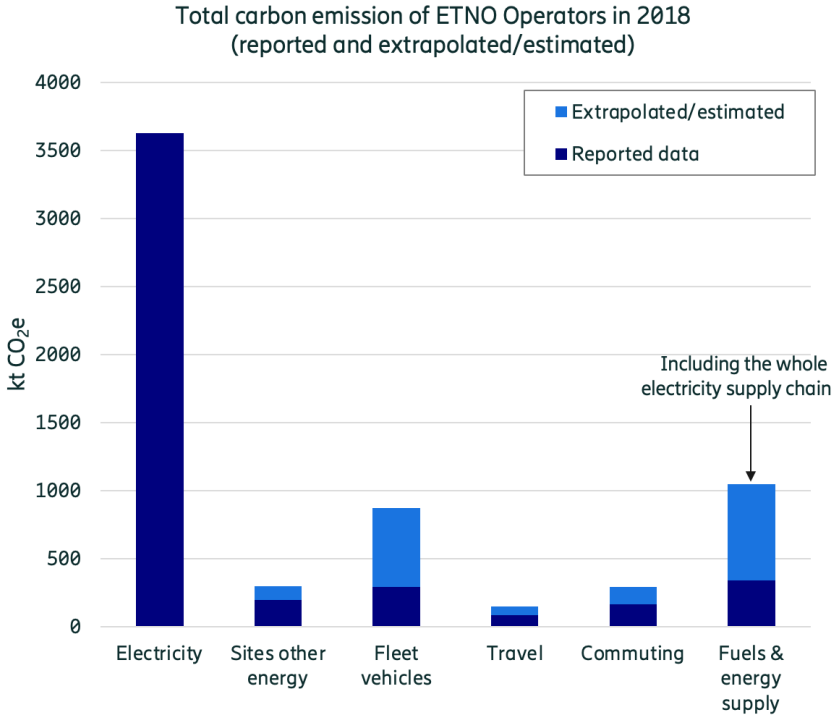


The annual total electricity consumption has increased somewhat for mobile networks and slightly also for fixed broadband between 2015 and 2018, while it has decreased for fixed telephony. This results in a very limited change of the total energy consumption. The operational electricity consumption changes as network technology evolves. Examples of evolution processes are: (i) the shift from fixed to mobile connectivity, (ii) fiber optics replacing copper-based connections, (iii) cloudification of data servers, and iv) the expansion of the Internet of Things and associated Machine-to-Machine connections. Overall, the newer technologies (such as 5G and fiber) are more energy-efficient than older technologies, such as copper-based fixed lines and early generations of mobile networks. All these are fair reasons for the limited increase in electricity consumption as older network equipment is being replaced by new equipment with better data capacity and energy efficiency.



Electricity is not the only source of operational GHG emissions for operators

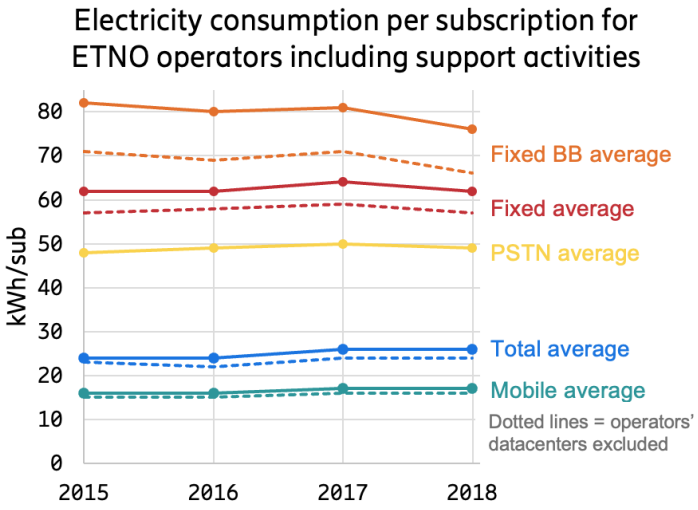
Electricity in the operation of networks are the main source of GHG emissions, measured in carbon dioxide equivalents (CO_2e). However, there are also other sources, like backup fuel, travel for network management, field maintenance activities, which also contribute. The aggregated effects of the other GHG emission sources cannot be neglected, especially not in a scenario with a substantial active purchase of renewable electricity supply as seen in the graph (presenting data in kilo metric ton (kt) CO_2e).



Electricity and operational carbon intensities stable

For 2018, the operational GHG intensity of the ETNO operators equaled 6.6 kg CO_2e per subscription. Hence not including embodied emissions related to materials and production of any equipment. The intensities were quite constant for 2015–2018.

The electricity consumption per subscription for 2018, including support activities (or overhead) was 62 kWh per subscription for fixed networks and 17 kWh per subscription for mobile networks, leading to a total average of 26 kWh per subscription.



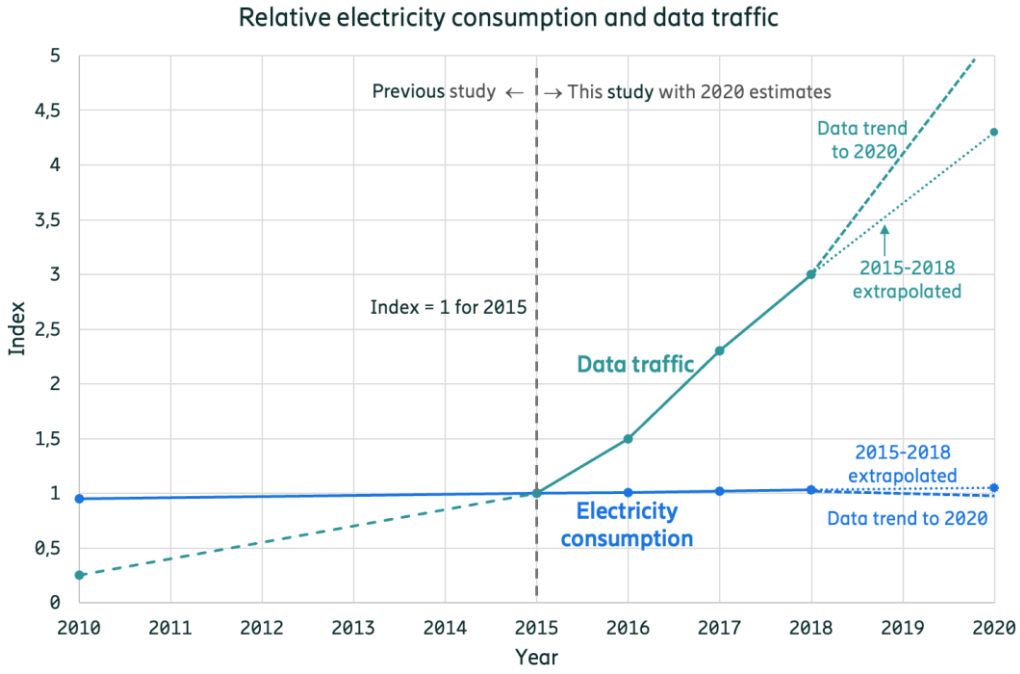
Network electricity consumption does not relate to data traffic

No alignment between electricity consumption and data traffic was seen in the collected data. The table below shows the electricity growth from the data set and the data traffic. Instead, as identified in the authors' previous study[2] on network operators there is a correlation between electricity consumption and number of subscriptions (excluding internet of things subscriptions). Data traffic in a network can be measured in different ways and at different measuring points, and no clear definition exists on how and where to measure. Therefore, electricity consumption per (human) subscription appears to be a more reasonable basis for extrapolation than data traffic, when estimating the electricity consumption of networks.

Period	Electricity growth	Data traffic growth
2010-2015	5%	+300%
2015-2018	3%	+200%
2010-2018	9%	+1100%

During the period of 2018-2020, which also included the initial phase of the COVID-19 pandemic, data traffic grew by an additional +95%, while the electricity consumption decreased slightly which was shown in the publicly available reported data for 2020.

[2] Malmodin J and Lundén D. The electricity and operational carbon emissions of ICT network operators 2010-2015. Report from the KTH Centre for Sustainable Communications, Stockholm, Sweden 2018. ISBN- 978-91-7729-679-9. https://www.diva-portal.org/smash/get/diva2:1177210/FULLTEXT01.pdf



A study with comprehensive data collection and high data granularity

The electricity consumption and operational GHG emissions of European telecom network operators, covering roughly 36 percent of European subscriptions and 8 percent of global subscriptions, were collected in a questionnaire for the period of 2015 to 2018. Data for 2020 was also collected from publicly available company reports for the same ETNO companies. The graph shows the data trend to 2020 based on the collected 2020 data ('data trend to 2020') as well as a direct extrapolation of the 2015-2018 development ('2015-2018 extrapolated'). The results were compared to data for 2010-2015[2]. The electricity consumption and the data traffic for the full period have been indexed in relation to the 2015 level.

From a life cycle perspective, this study focuses only on the use stage. The ETNO data used in this study represents actual conditions, with improved data quality and fewer gaps compared to previous studies. The study is unique due to its comprehensive data collection and high granularity, which extends beyond what is typically found in annual reports.

Reference to full paper:

Lundén D, Malmodin J, Bergmark P & Lövehagen N. (2022). Electricity Consumption and Operational Carbon Emissions of European Telecom Network Operators. *Sustainability*, 2022, 14, 237.