

Research Brief

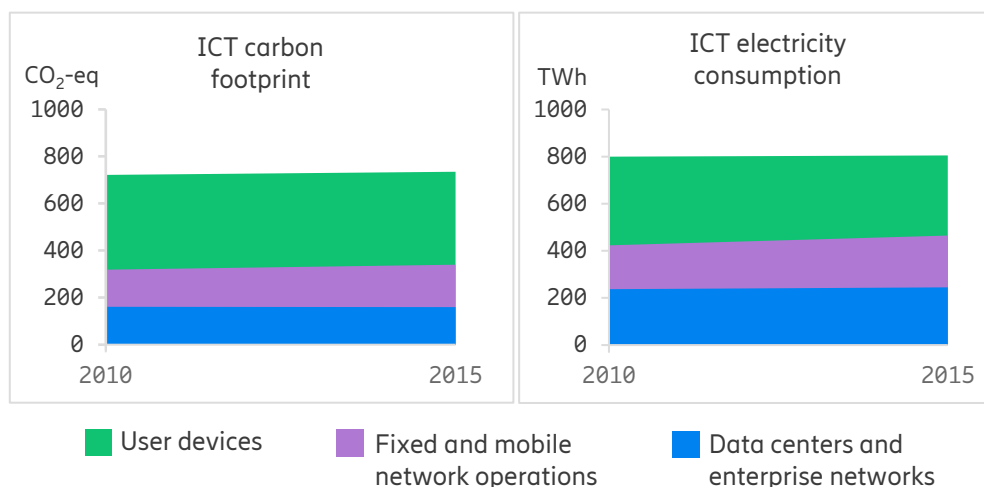
Exponential data growth - constant ICT footprints

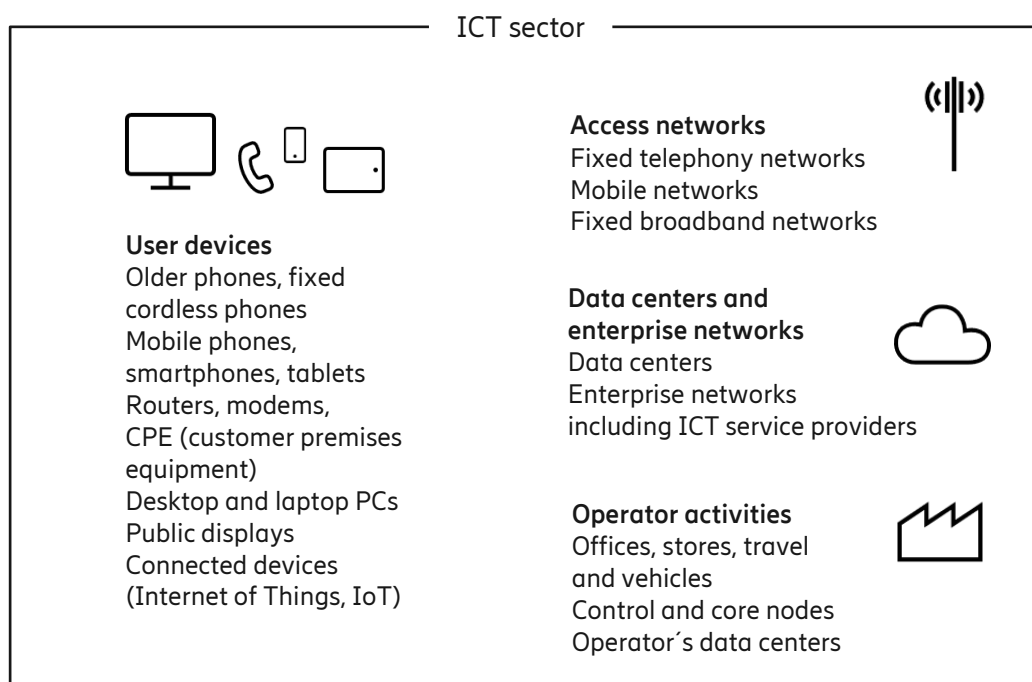
Research from 2018, estimates the ICT sector's carbon footprint to be 730 Mt CO₂-equivalents or 1.4% of overall global emissions, and the sector uses 800 TWh or 3.6% of the global electricity for its operation (based on 2015 data). Despite exponential data growth between 2010 and 2015, the carbon footprint has remained more or less the same.

ICT carbon footprint more or less constant

The carbon footprint from the Information and Communication (ICT) sector, here defined as the total life cycle carbon equivalent emissions from all products and services belonging to the ICT sector globally, was in 2015 at about the same level as 2010 despite exponential growth in data traffic.

Based on a very large and comprehensive data set, including sales volumes, life cycle assessments and measured energy consumption from network operators, the ICT sector's carbon footprint in 2015 was about 730 Mt CO₂-equivalents (CO₂-eq). This corresponds to ~1.4% of the global carbon footprint.





The ICT sector's carbon emissions relate to user devices, such as phones, tablets, computers and modems, followed by ICT networks for both fixed and mobile access, and data centers, including enterprise networks and operator activities. Compared to 2010, the networks' share of the footprint has slightly increased, while the share linked to user devices has decreased.

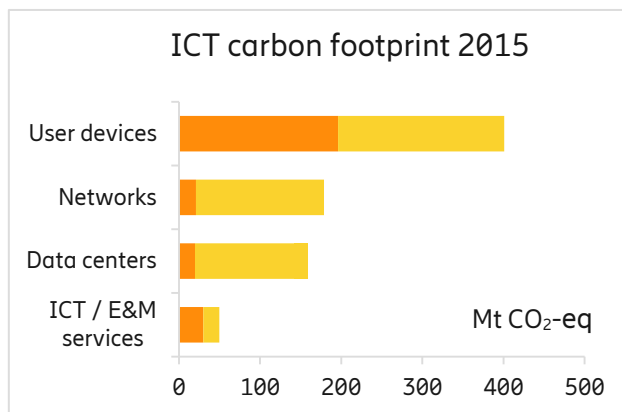
The operational electricity usage of the ICT sector was around 800 TWh in both 2015 and 2010. This represents a trend shift, as electricity usage for the ICT sector had increased about threefold between 1995 and 2010. Compared to 1995 there were in 2015 ten times more users and data traffic has increased by a factor of one million.

The average carbon footprint per ICT subscription was 81 kg CO₂-eq (2015). This should be compared to the global average total carbon footprint of about 7000 kg CO₂-eq per person. Since 2010 the footprint per ICT subscriber has decreased by over 20%. Considered Internet of Things (IoT) devices are included among the user devices and for 2015 these have no significant impact on the overall results.

Most emissions from usage

Overall, user devices account for the largest share of the total carbon footprint of ICT in 2015. For user devices, about half of the emissions are related to usage and the other half to the rest of the life cycle. Desktop PC usage and smartphone manufacturing represent the most substantial impact, followed by customer premises equipment (CPE), laptops and monitors.

For networks and data centers, the greenhouse gas emissions associated with operation account for the largest impact, indicating that continued focus on energy efficiency is important for these products to further reduce the carbon footprint.



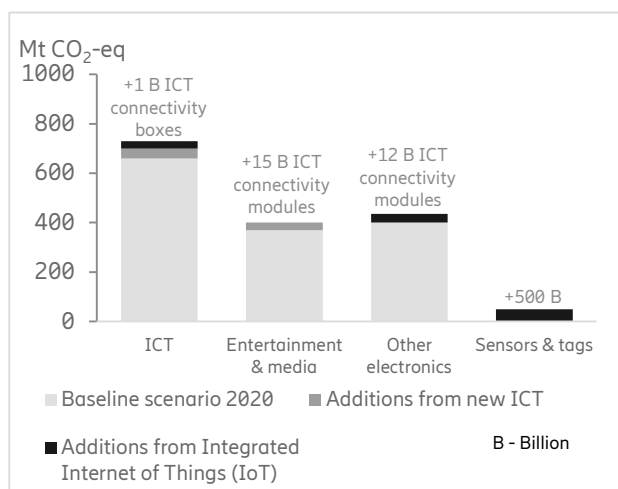
Decrease of the Entertainment and Media sector

Closely connected to the ICT sector is the Entertainment and Media (E&M) sector. The E&M sector, which consists of TVs, TV networks and other consumer electronics, as well as paper and printed media, has started to reduce its carbon footprint. Developments in ICT are a key factor, as increased use of tablets and smartphones has led to a decrease in sales of TVs and other consumer electronics. In 2015 the E&M sector represented about 1.2% of the global carbon footprint, or 640 Mt CO₂-eq, a decrease from about 940 Mt in 2010.

Internet of Things will grow subscriptions

In the future, subscription volumes are expected to continue to grow, partly because a larger share of the global population will be connected, but mostly due to the expansion of Internet of Things (IoT) devices.

However, a future scenario for 2020 with a massive use of new and integrated devices related to IoT indicates only a small increase in the total carbon footprint of ICT and E&M. This scenario includes life cycle emissions associated with one billion ICT connectivity boxes in ICT, 15 billion ICT connectivity modules in E&M and 12 billion in other electronics, as well as 500 billion sensors and tags.



Expectations of the future carbon footprint

Our research shows that the ICT footprint depends on the number of subscriptions. Moving forward, the number of people using the network is expected to continue growing at a linear pace, while IoT will grow exponentially. This indicates that there might be some future growth in the energy and carbon footprints of ICT. However, continued efforts to increase energy efficiency in networks as well as use of smaller, more energy efficient devices will limit the energy usage. Moreover, use of renewable energy can further limit the carbon footprint.

Data traffic growth is driven by video services rather than IoT. It should be noted that the increase in data traffic has changed from exponential to linear growth in some ICT-mature countries. This could be an indication for future global development. However, data growth is not a good indicator of the ICT footprint. Our data shows that the ICT footprint does not scale with data traffic.

Reference to full paper:

[Malmudin, Jens & Lundén, Dag. \(2018\). The Energy and Carbon Footprint of the Global ICT and E&M Sectors 2010–2015. Sustainability. 10.3390/su10093027.](https://doi.org/10.3390/su10093027)