PRESS RELEASE

Forecasting the energy consumption and carbon footprint of Germany's mobile communications by 2030

How do Germany's mobile communications networks fare in terms of their environmental impact? This question was investigated in a new Fraunhofer IZM study that models the carbon footprint of creating and using current and future mobile communications networks.

The authors of the study „Environmental Technology Impacts Assessment for Mobile Communications in Germany" (UTAMO) have produced a world-first in their field: Calculating an approximate, but detailed and reliable ecological assessment for Germany's mobile communications networks, both for the baseline year 2019 and, as a forecast, up to 2030. The methodology for this feat was developed by the team headed by Dr Lutz Stobbe at the Fraunhofer Institute for Reliability and Microintegration IZM in Berlin. The researchers are specialists for lifecycle assessments and the ecodesign of two areas of modern information and communication technology: the telecommunications and data processing equipment that forms the backbone of today's digital ecosystem and the cloud-based internet. Even though innovation and development is progressing by leaps and bounds in the field and constantly improving energy efficiency of the systems, the technology's hunger for energy and resources continues to grow in absolute terms.

How will this change once the 3G(UMTS) infrastructure is phased out, the 4G (LTE) networks expand, and 5G communications continue to make headway? How much carbon will be emitted to make the necessary hardware in the next few years? What can be done to layout the local topology and balance loads to achieve the best possible energy management? How would the move to renewable energies impact the climate emissions of the mobile communications networks? Answering these questions means collating and processing a mountain of technical, operational, and economic data.

Fraunhofer develops model for calculating the carbon emissions of mobile communications infrastructure

To do so, the researchers around team leader Lutz Stobbe developed a lifecycle-driven accounting model that helps them establish the carbon footprint of producing the infrastructure and the power consumption of the access and aggregation networks. They focused on the hardware infrastructure, that is, the wireless communications devices like base stations, and on optical transmission and connection technology. Their calculation also included the additional power needed to cool the hardware and the conversion losses along the way in a comprehensive Power Usage Effectiveness (PUE) model. To estimate the carbon emissions from producing the infrastructure, the team came up with a simplified hardware model for individual parts of the technology that

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gives particular prominence in the calculation to the energy-hungry and high-emission production of semiconductor circuits (ICs), printed circuit boards (PCBs), ports and other bulk materials for cases, racks, and masts. Left out of the calculation are end user devices like smartphones or sensors.

The calculatory model matches the published power consumption of Germany's mobile communications network for the year 2019 extremely well. The forecast had assumed a yearly growth rate in data traffic based on the annual averages for the previous five years to map how the network would expand and usage increase. Its prediction: Energy consumption would see a two or threefold increase, while the network's theoretical capacity would grow by a factor between 10 and 40. The study also revealed that an increase in network traffic brings higher energy consumption, but that the relationship is not simply linear: The right configuration of individual sites, regular updates to the infrastructure hardware, and similar operational interventions are promising options for reining in the power hunger and carbon footprint of the network.

A must-have tool for quantifying carbon emissions

The UTAMO study is showing the effectiveness of a method for estimating the expected environmental impact of information and communications technology. The inventory model can be applied to different future scenarios to reflect technological progress, trends in usage, or operational changes brought in by the network operators. In doing so, the model combines the theory behind ICT with technology that is actually in use. It includes a detailed equipment inventory with data down to the technical properties of individual transceivers. The underlying so-called 5C method was developed at Fraunhofer IZM and covers conditions, capacities, components, configuration, and control - the aspects that represent the diversity of the data covered and the structure of the model. It can be put to use for a range of purposes, from producing specific lifecycle assessments or forecasts to analyzing or producing eco-designs for individual aspects of a network.

As part of the UTAMO project, the study was produced by Fraunhofer IZM on behalf of the German Federal Environmental Agency in the period from 2019 to 2021 (funding ID 3718 36 324 0). It is available for download from the agency's website:
https://www.umweltbundesamt.de/publikationen/umweltbezogene-technikfolgenabschaetzung-mobilfunk

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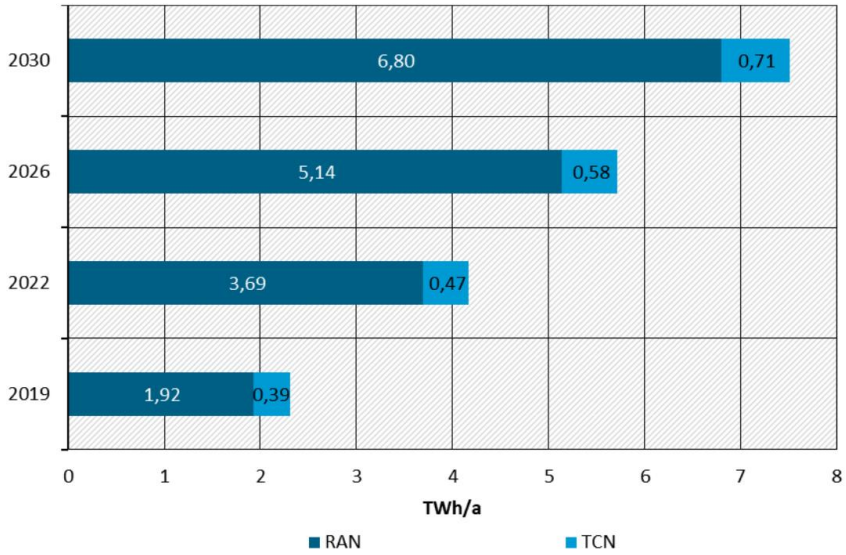

The energy consumption of German mobile communications networks will triple between 2019 and 2030.
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