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Energie-effiziente Mobilfunknetze der nächsten Generation

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NOKIA

Nokia key targets to reduce use of energy, CO2* emissions, materials and waste

Renewable energy in own operations



2025



Limit global warming to 1,5C degrees. 95% circularity rate



2030



Nokia Scope 1,2,3 CO2 emissions**
From our offices, labs, final assembly, installation and takeback

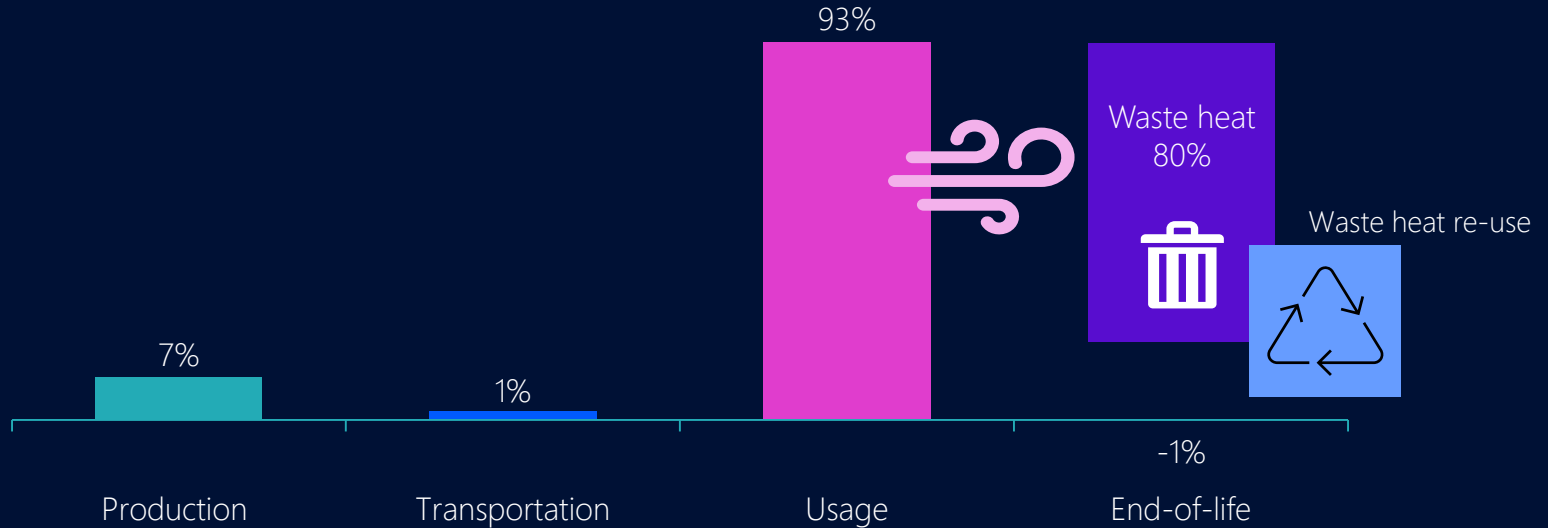
Net zero in our value chain



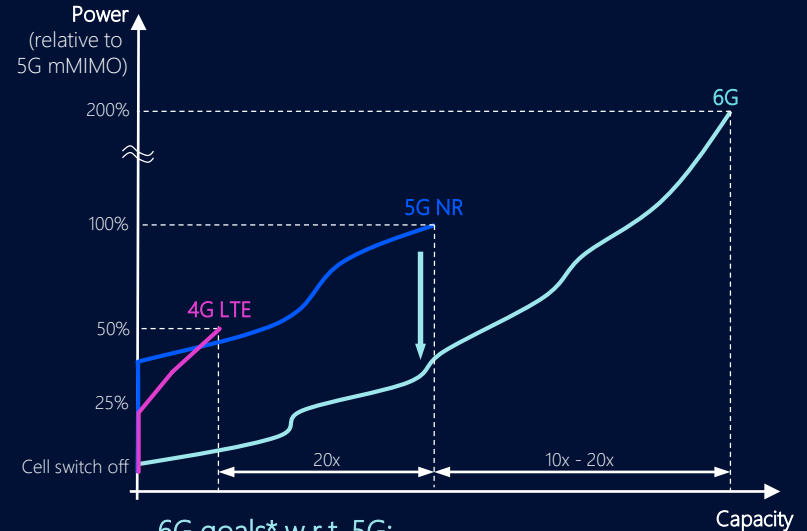
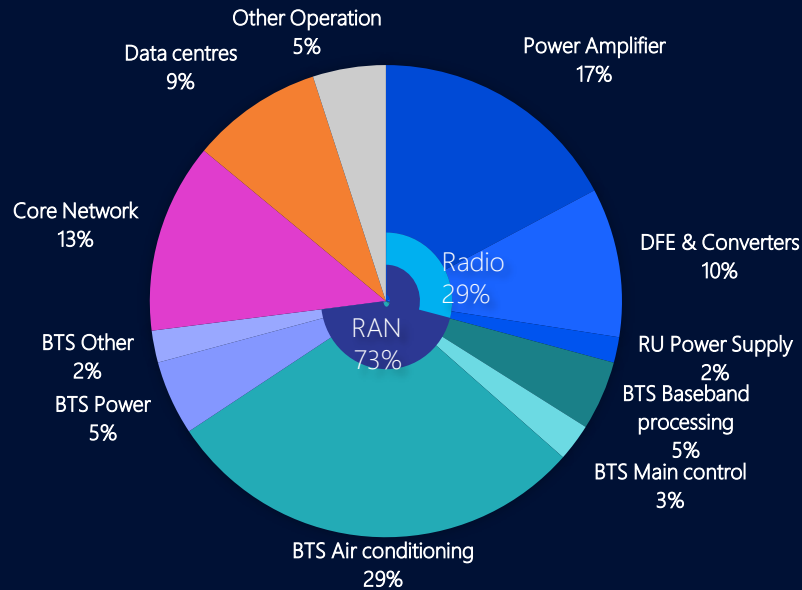
2040



Mobile networks life cycle CO2 emissions



Energy usage in mobile networks



6G goals* w.r.t. 5G:

- 1) $\geq 10x$ peak capacity
- 2) $\leq 2x$ peak power consumption
- 3) -50% in average power consumption

Decoupling traffic growth from energy growth

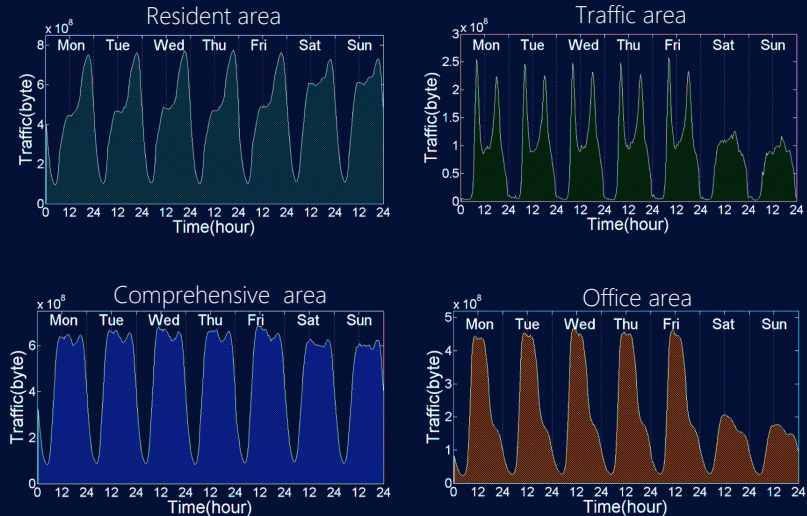
New RAN technologies



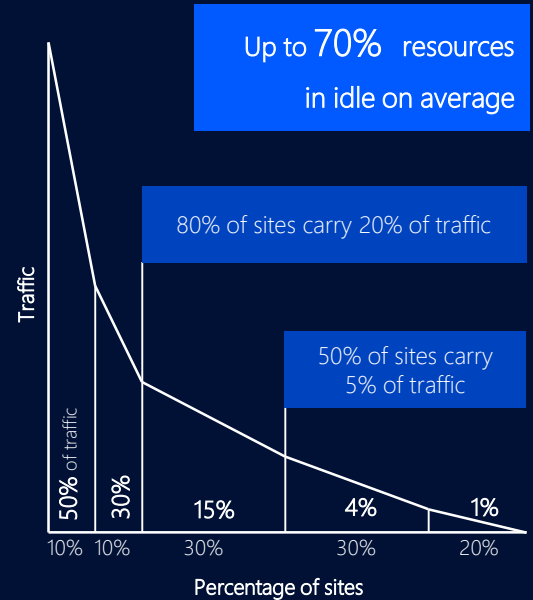
5G enables 100x times traffic with same energy

Network modernization reduced energy consumption in average by 46%

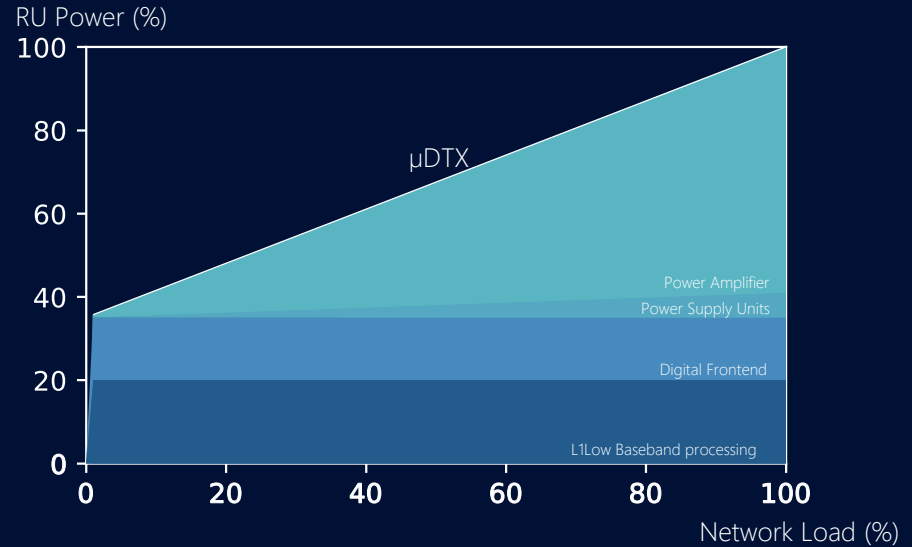
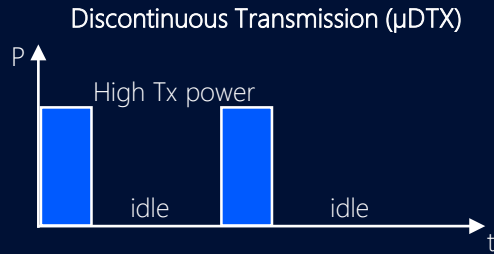
Exploiting mobile traffic patterns



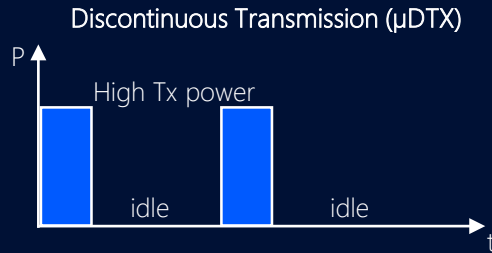
F. Xu, Y. Li, H. Wang, P. Zhang and D. Jin, "Understanding Mobile Traffic Patterns of Large Scale Cellular Towers in Urban Environment," in *IEEE/ACM Transactions on Networking*, vol. 25, no. 2, pp. 1147-1161, April 2017



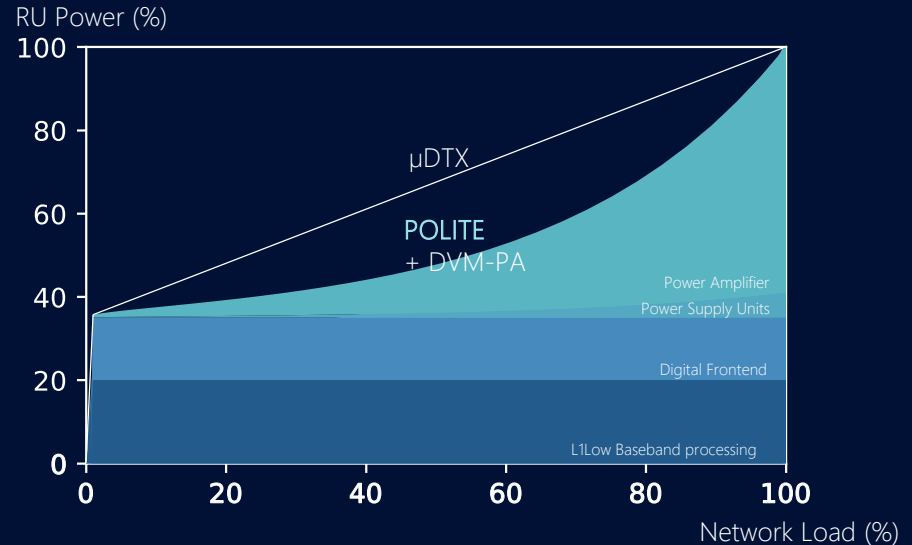
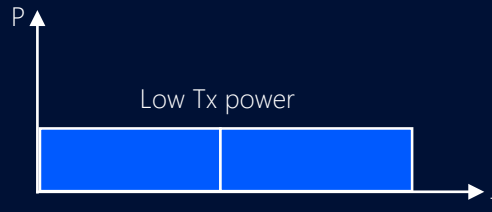
Discontinuous transmission



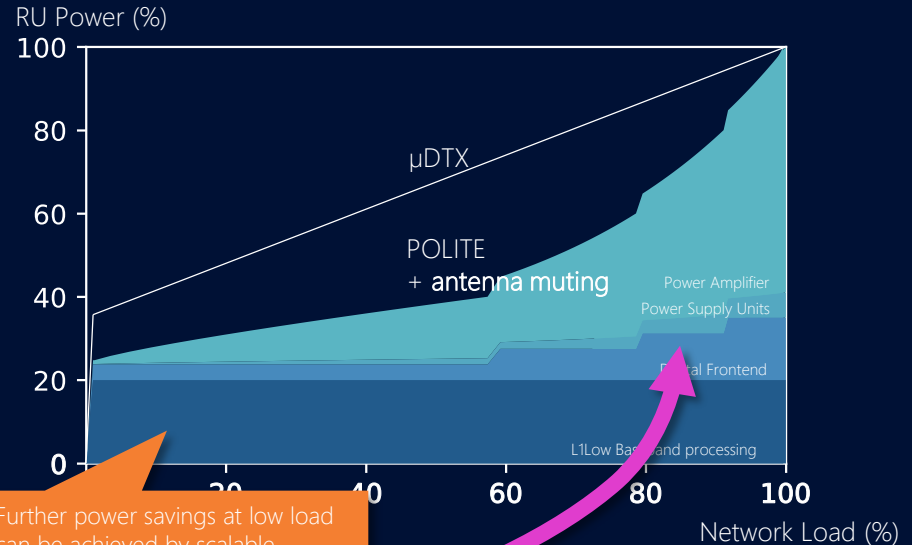
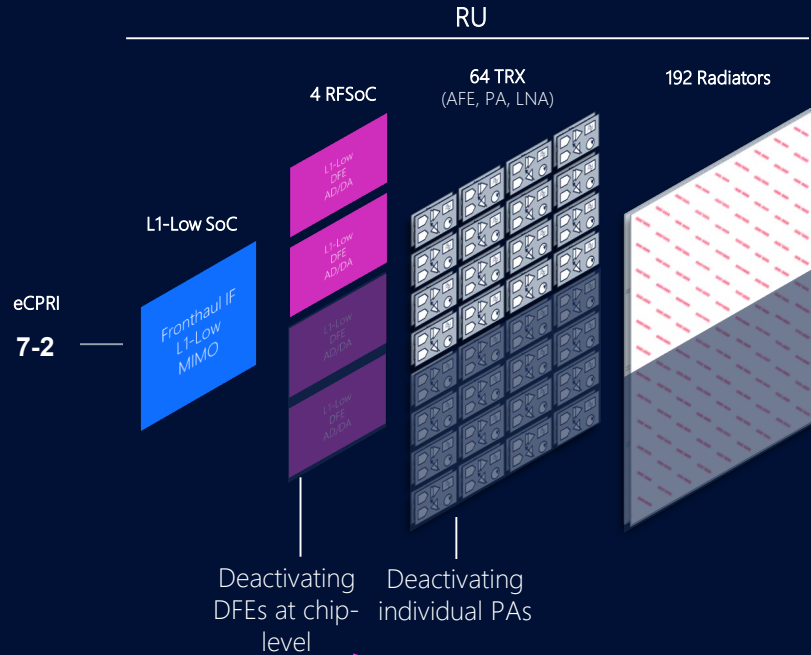
Transmit power reduction



Tx Power Optimization for Low Interference and Throughput Enhancement (POLITE)

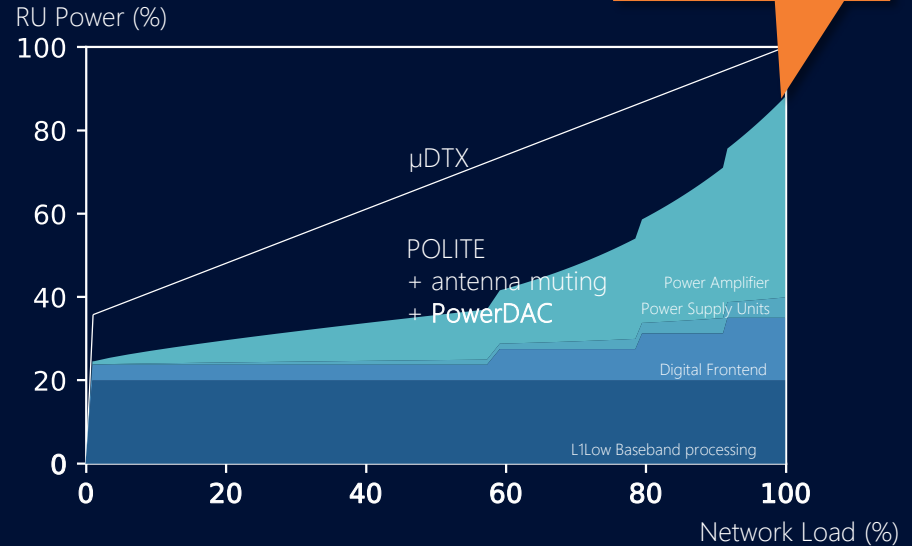
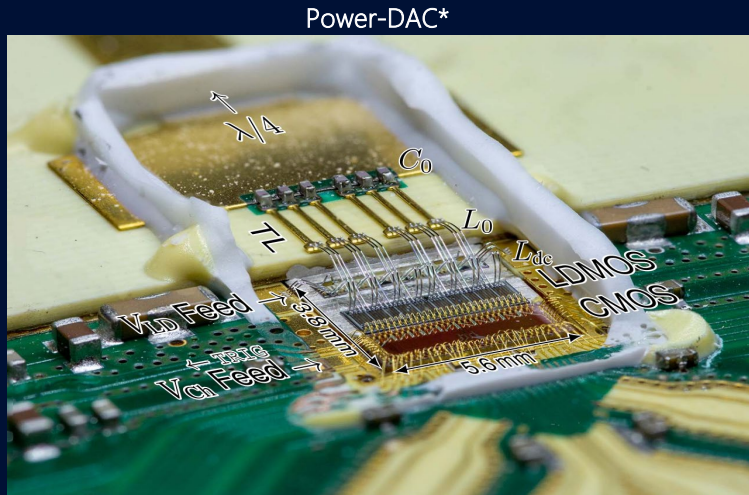


Transmit power reduction through antenna muting



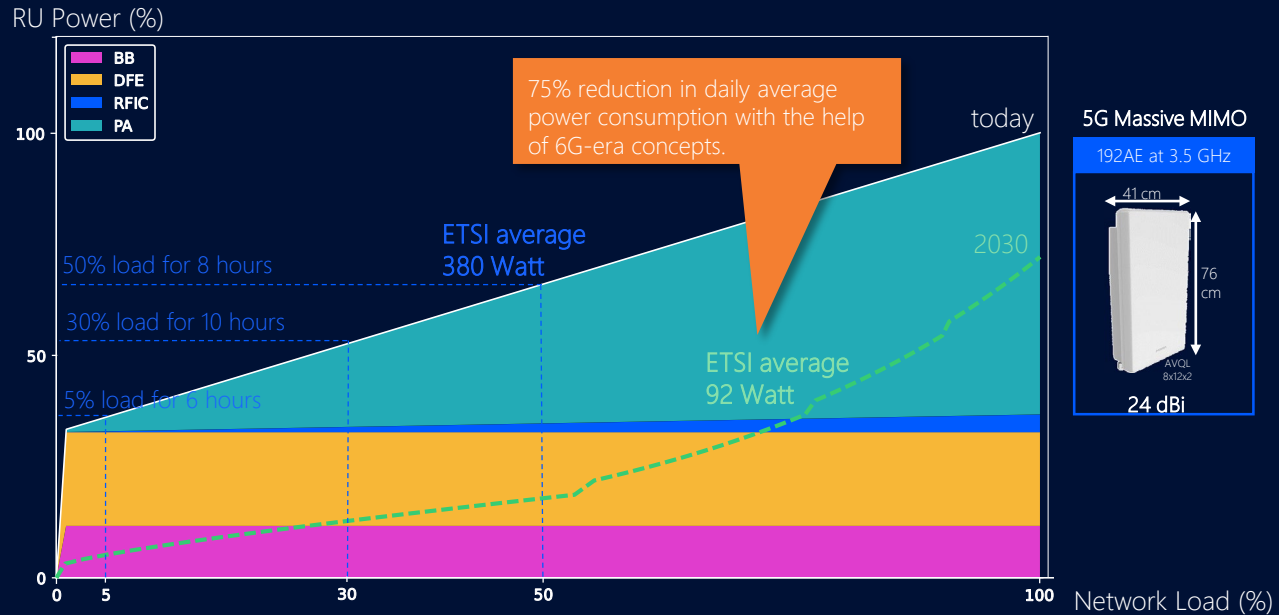
Further power savings at low load can be achieved by scalable baseband processing platforms.

Advanced power amplifiers



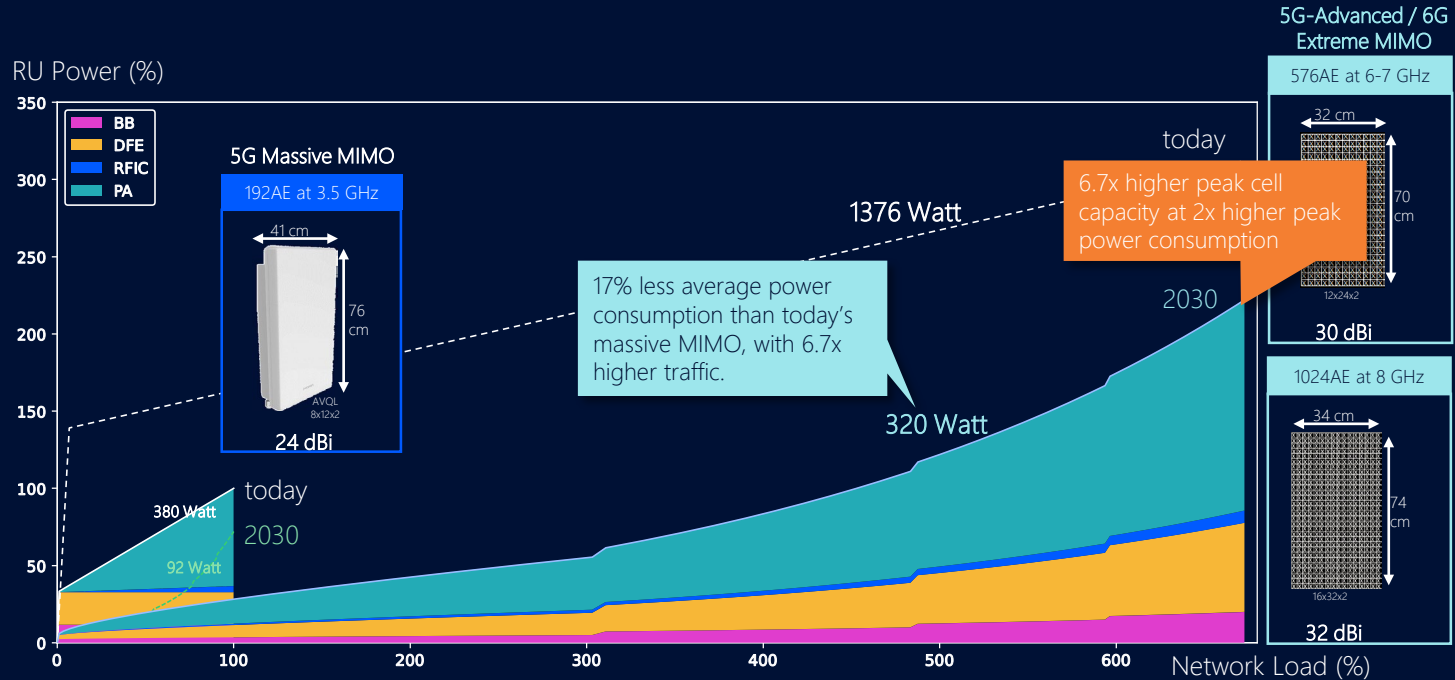
Energy efficiency improvements: A case study

More details: [S. Wesemann, J. Du and H. Viswanathan, "Energy Efficient Extreme MIMO: Design Goals and Directions," in IEEE Communications Magazine, 2023](#)

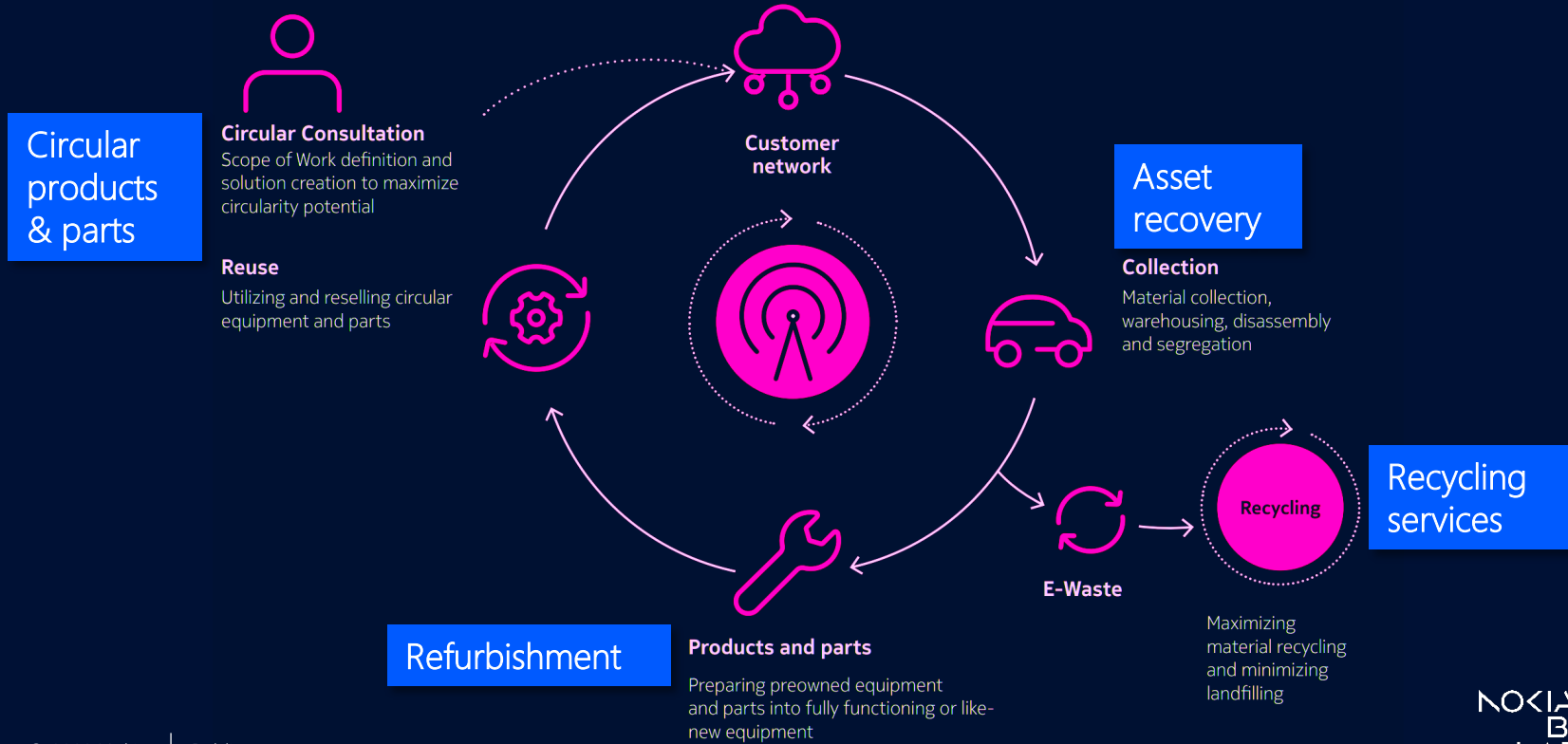


Energy efficiency improvements: A case study

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Circularity

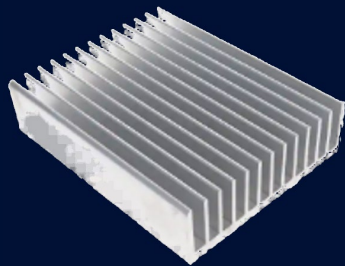


Circular metals

Nokia's aluminum cast component suppliers

Goal: >90% by 2030

Top Suppliers	2020 % Recycled Aluminum (pre-consumer waste)	2021 % Recycled Aluminum (pre-consumer waste)	2022 % Recycled Aluminum (pre-consumer waste)
Weighted Average	54%	72%	*45%



~73,000
tonnes of GHG
Avoided

Mechanical parts only

Additionally:
Increase to 50% the
recyclate metals used in:

- aluminum sheet goods
- stainless steel alloys
- copper alloys

* Reduction in 2022 attributed to acute shortages of scrap aluminum

Digitalization is the key to reducing CO2 emissions of societies

Minimizing CO2 footprint



Emissions caused by mobile networks throughout their lifecycle



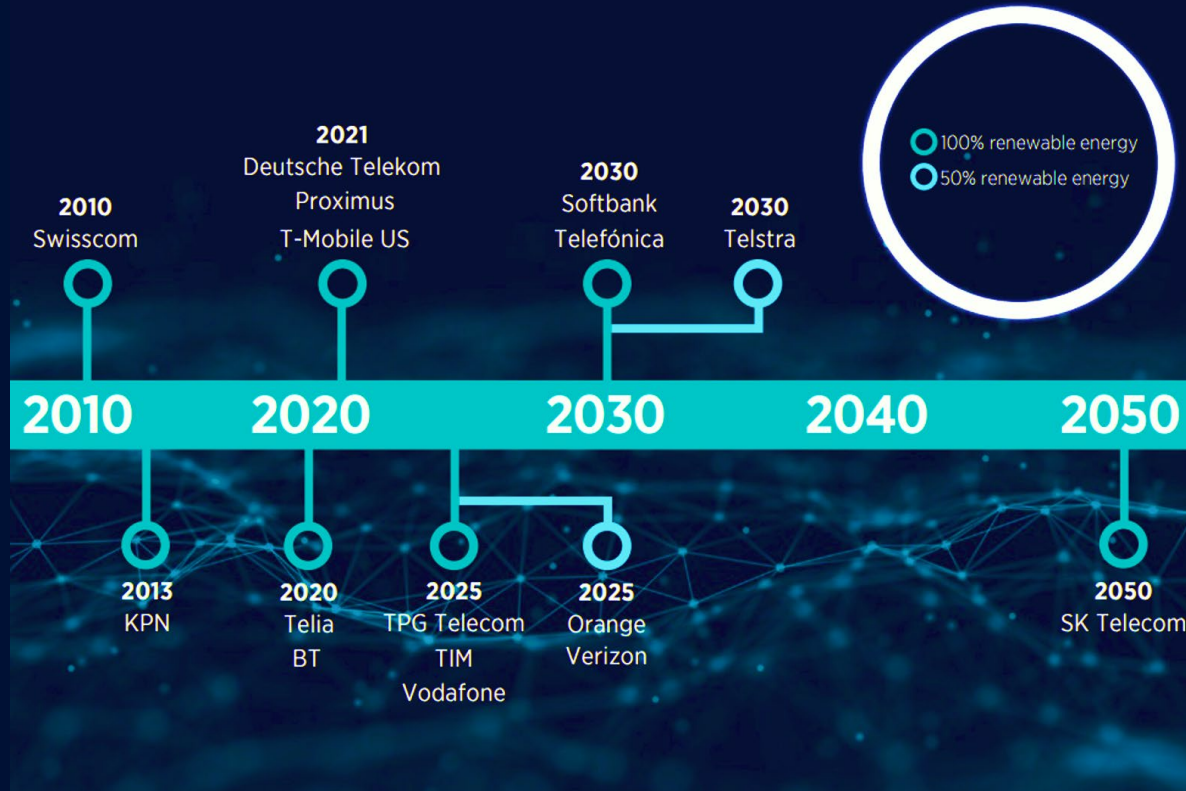
Maximizing CO2 handprint – 10 times the footprint *

Smart...buildings, energy, living, working, and health, transport and cities, agriculture, manufacturing

Mobile networks can help societies avoid 10 times more emissions than caused

NOKIA

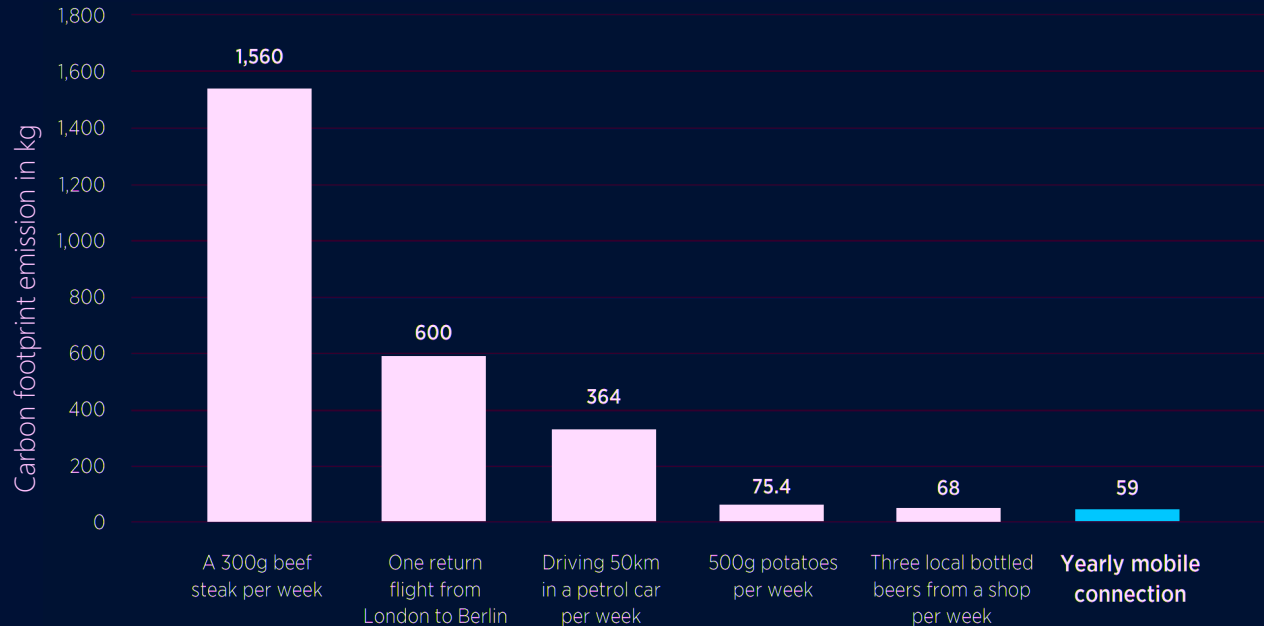
Timeline for mobile operators with renewable energy targets



Source: [Mobile-Net-Zero-State-of-the-Industry-on-Climate-Action-2022.pdf](#) (gsma.com)

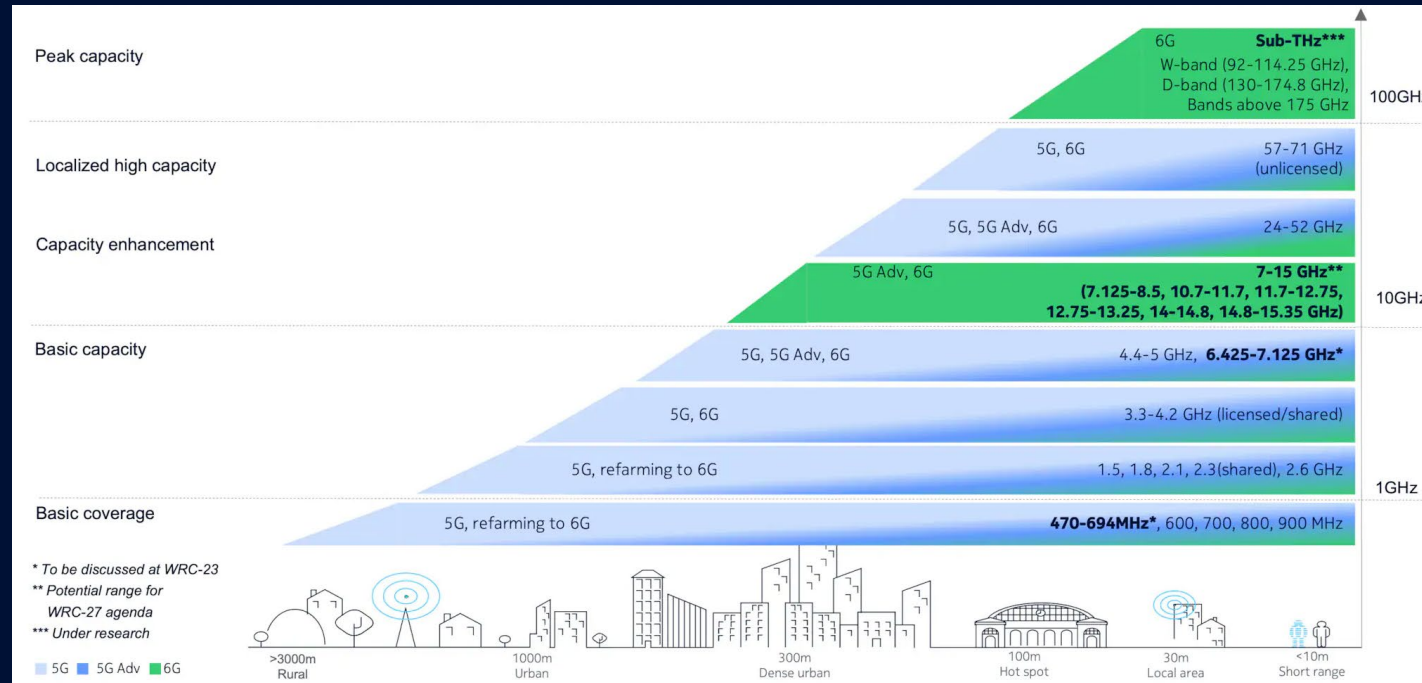
Annual emissions of different activities

By GSM Association representing mobile network operators worldwide



Source: [Mobile-Net-Zero-State-of-the-Industry-on-Climate-Action-2022.pdf \(gsma.com\)](#)

Nokia spectrum vision in the 6G era





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