EE & Green Impacts of 5G and Beyond

Challenges and opportunities

Green Telecom Workshop

Regius, FREng

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ICT AND GREEN

- REPORTED ICT'S CURRENT SHARE OF GLOBAL GREENHOUSE GAS (GHG) EMISSIONS : 1.8-2.8%
- ICT'S SHARE OF EMISSIONS COULD ACTUALLY BE AS HIGH AS 2.1-3.9%
    - ACCOUNTING FOR ALL OF ICT'S SUPPLY CHAINS AND FULL LIFECYCLE[1]

if ICT's emissions were to **stay stable at the 2020** level over the next decades, the relative share of ICT's emissions in global emissions would increase to more than a **third** as other sectors reduce their emissions in line with 1.5°C warming.

This is due to several factors:

- DATA VOLUME ARE DOUBLING EVERY 18 MONTHS,
- NEW TECHNOLOGIES SUCH AS BLOCKCHAIN AND AI WHICH ARE IMPORTANT COMPONENTS OF 5G AND BEYOND

[1] The climate impact of ICT: A review of estimates, trends and regulations, Lancaster University

Current Green Evaluation

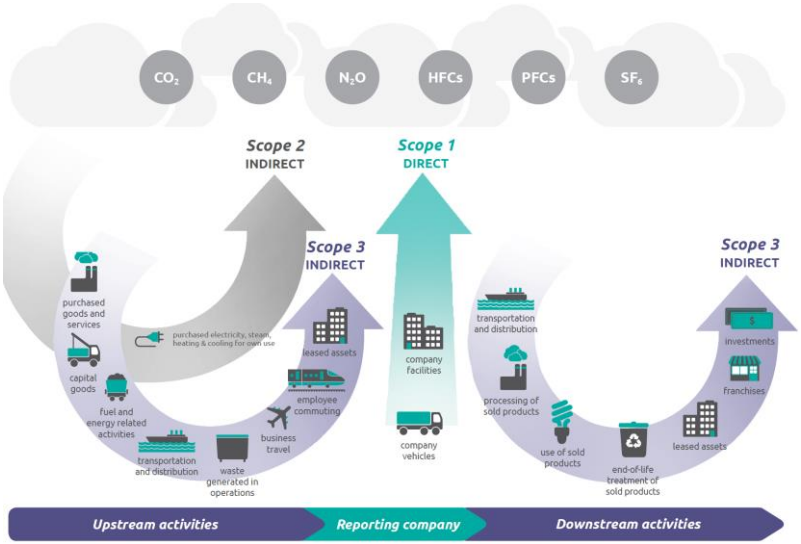
Does not include role of ICT to Vertical industry

Definition

Scope 1: Direct GHG emissions: From sources that are owned or controlled by the company, e.g, , emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.; emissions from chemical production in owned or controlled process equipment.

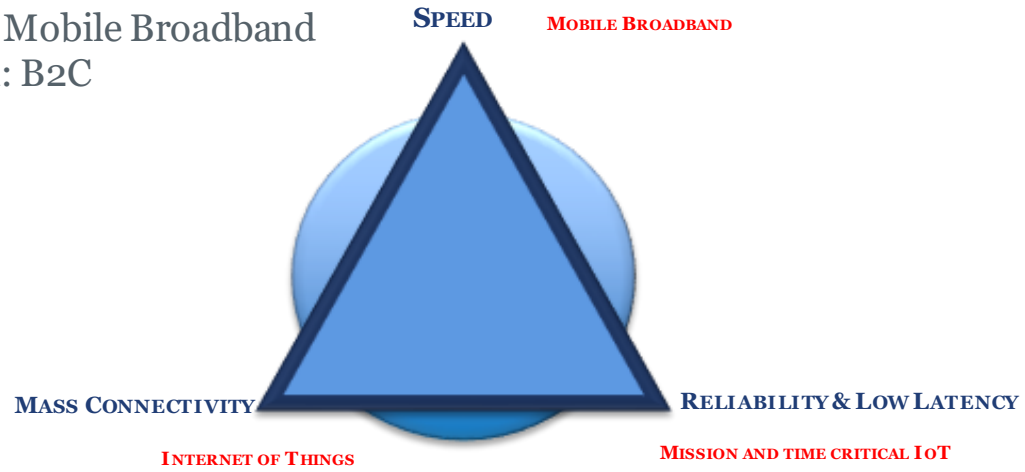
Scope 2: Electricity indirect GHG emissions accounts for GHG emissions from the generation of purchased electricity consumed by the company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organizational boundary of the company. Scope 2 emissions physically occur at the facility where electricity is generated.

Scope 3: Other indirect GHG emissions is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company. Some examples of scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.



ALL IN ONE NETWORK TECHNOLOGY

Service: Mainly Mobile Broadband
Business Model: B2C



Service: Connecting Machines in Industry
Business Model: B2B or Just B

DIGITAL TRANSFORMATION

5G INNOVATION CENTRE
UNIVERSITY OF SURREY

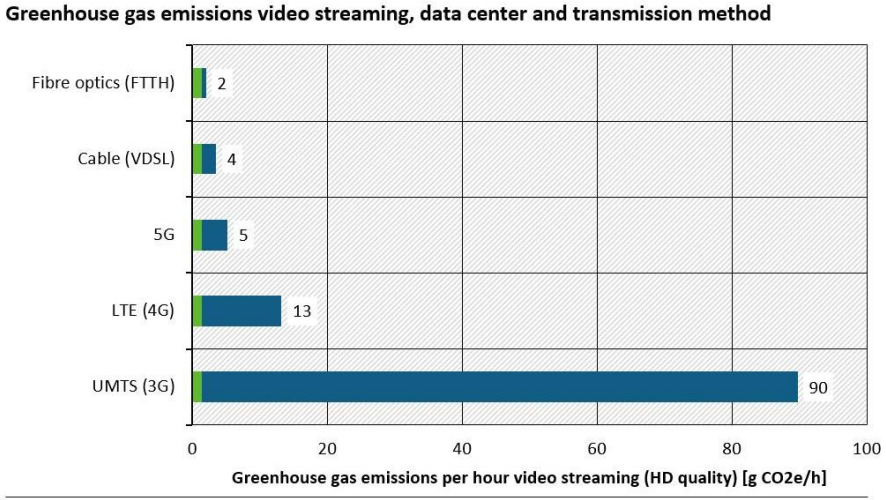
EXAMPLES:

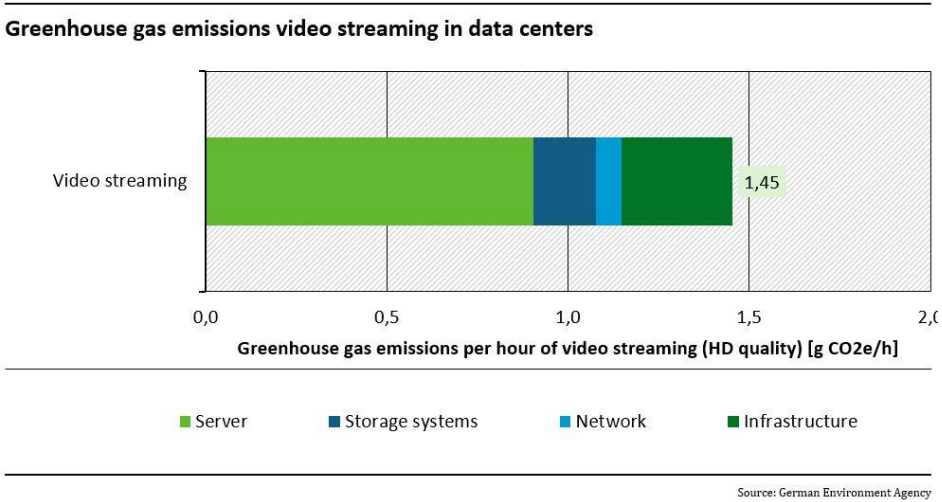
- LOGISTICS/TRANSPORT
- MANUFACTURING
- GAMES/ENTERTAINMENT
- UTILITIES
- HEALTH

ICT HAS THE POTENTIAL TO ENABLE A 20% REDUCTION OF GLOBAL CO_2e EMISSIONS BY 2030*

***SMARTer2030**
ICT Solutions for 21st Century Challenges

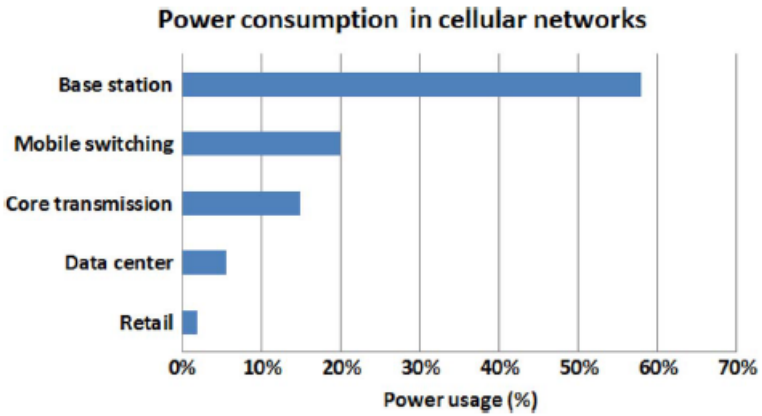
How EE is 5G?

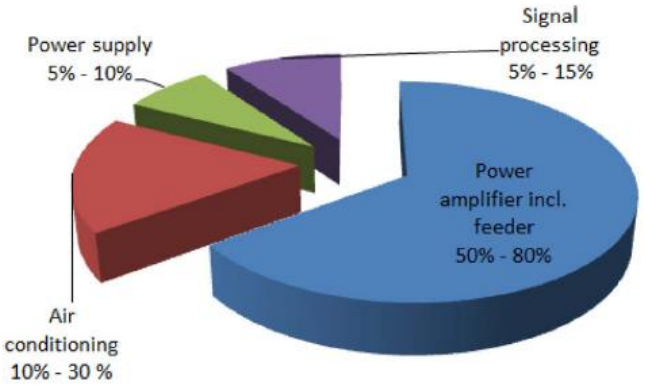




https://www.umweltbundesamt.de/en/press/pressinformation/video-streaming-data-transmission-technology

Power Consumption at BS





EE [bits/Joule/m^2] = Data rate [bits/s] / Energy consumption [Joule/s] /Cell area [m^2]

New Trends against EE

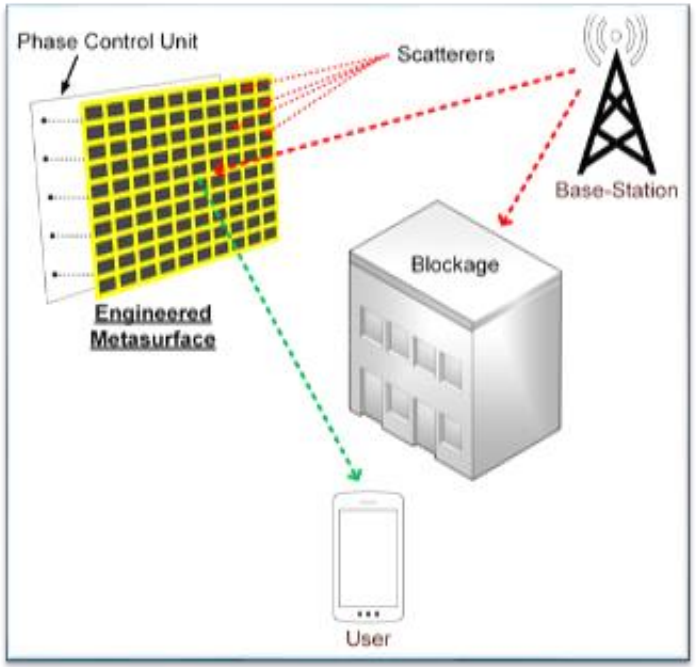
- OpenRAN
- Open Architecture
- Virtualisation
- MIMO
- AI/ML
- BlockChain
- Different Vendors products
- Same technology for different environments

Can we break up this relationship?

$$\text{EE [bits/Joule/m}^2\text{]} = \text{Data rate [bits/s]} / \text{Energy consumption [Joule/s]} / \text{Cell area [m}^2\text{]}$$

COVERAGE & ENERGY EFFICIENCY

Can we increase both simultaneously?



RECONFIGURABLE REFLECTING/TRANSMITTING SURFACES

ENERGY EFFICIENT COVERAGE:

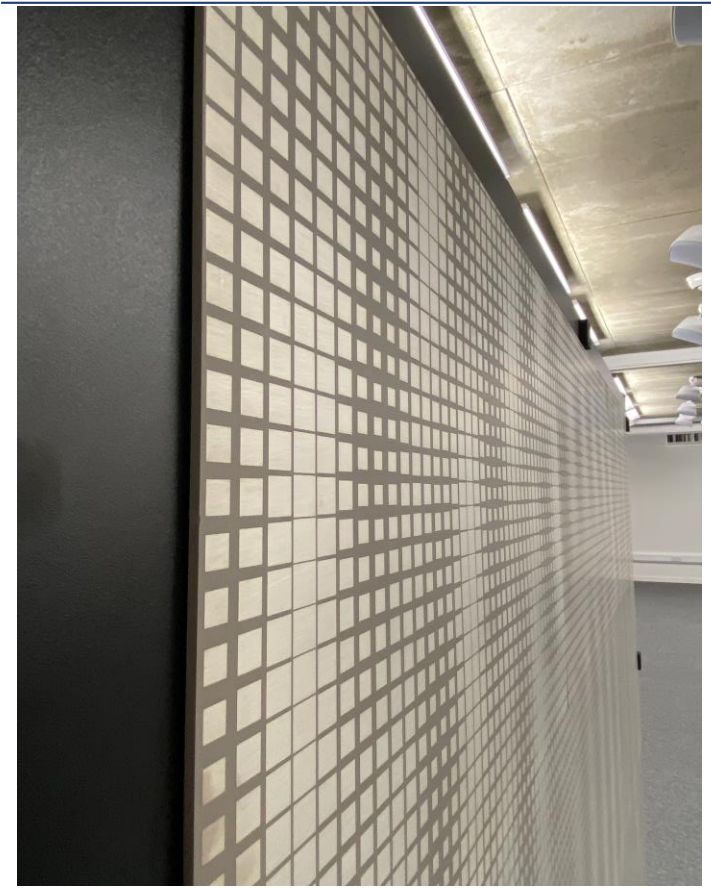
OUTDOOR 2 OUTDOOR

OUTDOOR 2 INDOOR

INDOOR 2 INDOOR

World's first working RIS based on Holography Principle

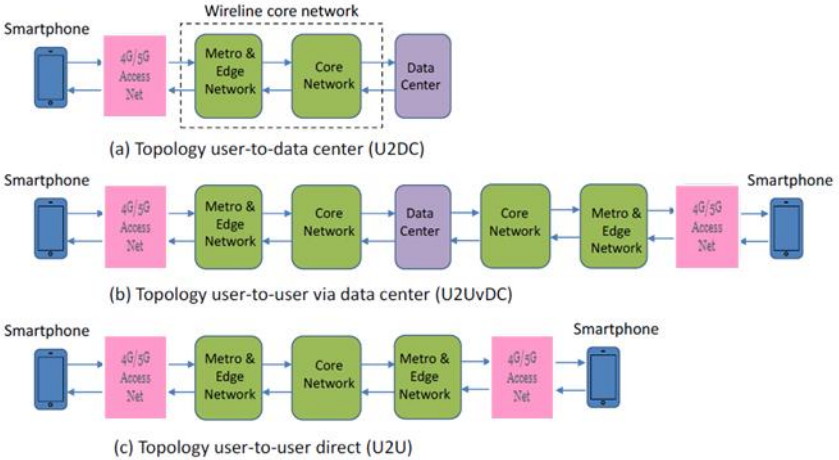
Reflective Intelligent Surfaces



- Thickness: 3mm
- Unit cells: 11000
- Beams: 2 reflected beams towards $\pm 45^{0}$
- Measured Gain: 20 dB
- Bandwidth: 400MHz (3.3 GHz- 3.7 GHz)
- Input power: zero

Energy Modelling Challenges

- Need an E2E model
- A complex problem for cellular
- Even more complex problem in Industry 4.0
- Different Network elements involved depending on session
- Different Services
- Different equipment from different vendors (probably each equipment should provide an interface to measure energy consumption as a new KPI)



- **Communication between user and data center (U2DC): Web browsing, navigation, cloud upload/download, video play, AR/VR.**
- **U2UvDC: text/voice/video messages, etc.**
- **Direct U2U: audio/video chat, etc.**

THANK YOU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6G WIRELESS:
A NEW STRATEGIC VISION
5GIC Strategy Advisory Board
6GIC