5G WILL INCREASE NOT REDUCE CARBON EMISSIONS

April 24, 2021

"5G WILL PROMPT ENERGY CONSUMPTION TO GROW BY STAGGERING 160% IN 10 YEARS"

- InterDigital - Create. Connect. Live. Inspire.
- Industry-friendly US based report concludes ‘Nonetheless, the efforts from CSPs, industry associations, and standardization bodies will not be enough. As more and more 5G network infrastructure are getting deployed, more aggressive energy optimization methods and technologies need to be developed to address the increase in carbon footprint.’ Sept 2020.
- **Network Elements**: Key network elements include baseband unit, remote radio head, small cells, core networks, passive equipment for cooling, monitoring and control function. The model does not include network equipment for backhaul and transport.
- **End Devices**: This includes personal mobile devices such as smartphones and tablets, as well as cellular-powered IoT devices, including those connected to LTE Cat1, LTE Cat M1, and NB-IoT network.

A University think tank: ‘there are few industry studies on the whole-network energy use impacts of 5G

- The project is currently part way through the review of the energy use impacts of 5G networks. Whilst a number of promising technological options have been identified and assessed in the green mobile networks literature (e.g. putting parts of the network to sleep during low traffic hours is a particularly promising approach), **our emerging results suggest that there have so far been relatively few studies that model the whole-network energy use impacts of 5G. We also note that relatively little attention has so far been paid to the embodied energy use associated with the large-scale addition or replacement of network infrastructure, the potential for rebound effects associated with changes in user behaviour encouraged by 5G, and demand-side management.**
- CREDS update: The energy use impacts of 5G mobile networks - Sussex Energy Group at SPRU
- Sussex Energy Group at SPRU - Researching ways to achieve the transition to sustainable, low carbon energy systems

Greenpeace East Asia (April 2021) reports massive carbon emissions increase due to 5G in China:

Superfast but not so clean: China's 5G network is causing its carbon emissions to soar | Euronews

Report is here:

a5886d59-china-5g-and-data-center-carbon-emissions-outlook-2035-english.pdf (greenpeace.org)

5G to power Internet of Things (IoT)

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EXPONENTIAL RISE IN CARBON EMISSIONS

According to the High Council on Climate (2020) report to the French government, “The carbon impact of 5G deployment [in France] could amount to between 2.7 and 6.7 million tons of CO2-equivalent in 2030. That’s a significant increase compared to the tech sector’s environmental impact (about 15 million tons of CO2-equivalent in 2020),” p 6.

IEEE (2019) states ‘a 5G base station is generally expected to consume roughly three times as much power as a 4G base station. And more 5G base stations are needed to cover the same area.’

Billions of internet-connected devices could produce 3.5% of global carbon emissions within 10 years - surpassing aviation and shipping -and 14% by 2040, according to Climate Home News (2017.)

’A report (2015) estimates that electricity usage from communications technology could contribute up to 23% of the globally released greenhouse gas emissions in 2030.’

Anders S and Andrae, G, On Global Electricity Usage of Communication Technology: Trends to 2030, Anders S. G. Andrae * and Tomas Edler, ,’ Challenges 2015, 6, 117-157;

Academics are challenging the notion that we can considerably reduce carbon emissions by increasing efficiency and cutting down on waste.

- In fact, they warn that the internet explosion and increasing connectivity via the IoT and smart devices could increase global emissions by 3.5% by 2020 and **up to 14%** by 2040.
- In an update to a 2016 peer-reviewed study, Swedish researcher Anders Andrae says the internet of connected things (ICT) industry's power demand is likely to increase from 200-300 terawatt hours (TWh) of electricity a year in 2017, to **1,200-3,000TWh** by 2025.
- Data centres alone could emit **1.9 gigatonnes** (Gt) of carbon emissions, or 3.2 percent of the global total.

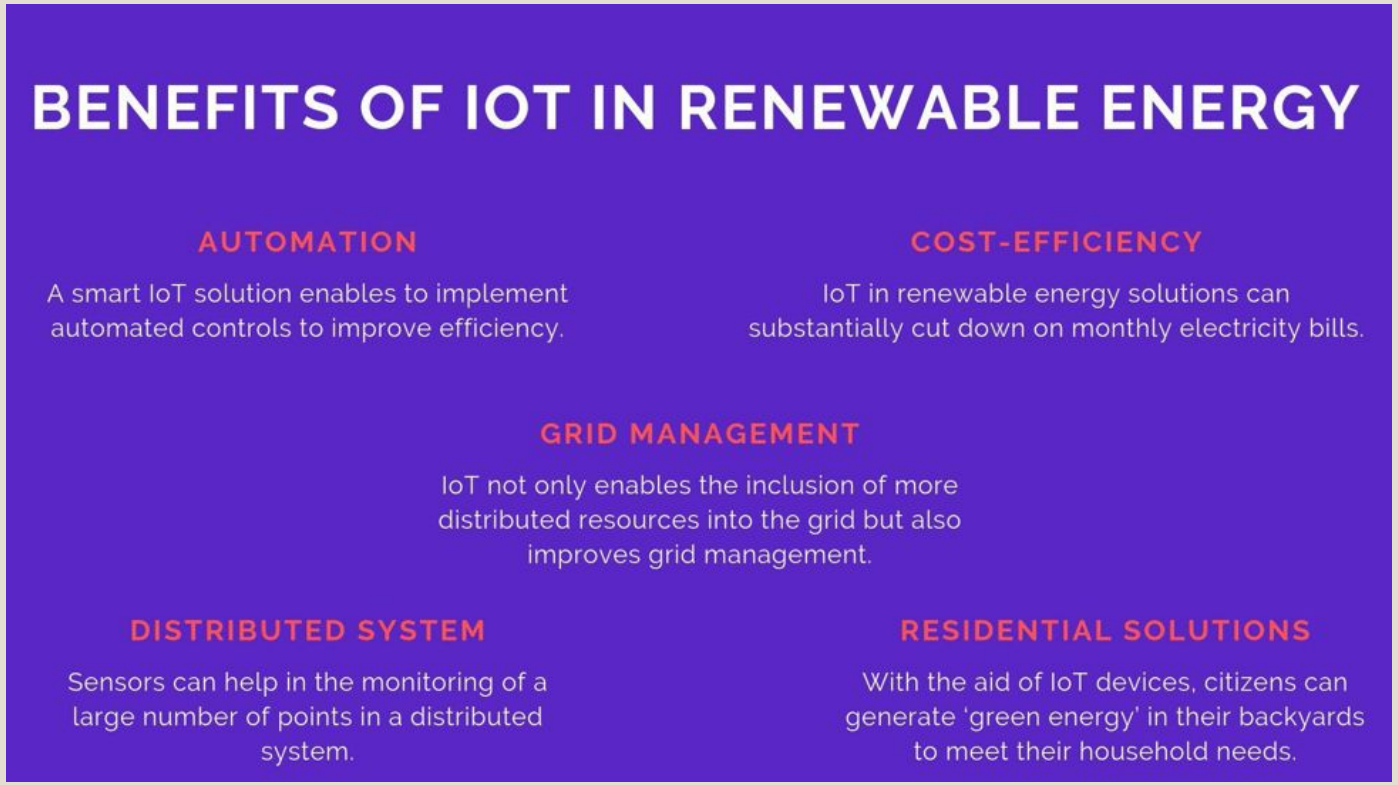
It makes sense. More input equals more output. YET the telecoms claim that 5G will be greener than previous WiFi technologies due to ‘energy efficiency’

The Finnish vendor says its AirScale 5G mMIMO Base Station will achieve an average reduction in power consumption of 50 per cent by 2023 due to improvements in software and hardware efficiencies.

Nokia maintains that 5G is actually greener than previous wireless technology, as it can handle more data bits per kilowatt of energy.

Focus is on ‘energy efficiency’ grid by installing lower-energy power and cooling technology management.

Vodafone say that its energy efficiency initiatives are focused on sourcing and implementing more efficient network equipment, reducing energy demands, and cutting energy use by decommissioning and replacing legacy equipment, and by installing lower-energy power and cooling technologies.



THE REBOUND EFFECT : ‘energy efficiency’ techniques increases not decreases, energy consumption

- Jevon’s Law or the rebound effect. ‘Identified during the industrial revolution, the "rebound effect" describes how the improvement in the energy efficiency of a particular object (locomotive, computer, etc.) usually leads not to a decline, **but on the contrary to an increase in overall energy consumption** dedicated to the technical function which this object performs (rail transport, IT, etc.). A great many studies have confirmed this state of affairs. See in particular (Santarius, Walnum, & Aall, 2016)’

Catch No.1 ‘ENERGY EFFICIENCY’

- **The concept of energy efficiency as leading to a ‘green’ future has been debunked.**

CASE STUDY:

- **THE LED LIGHTING PARADOX.**
- Reduces cost and
- Energy per item. But
- Encourages more consumption

The Lighting Paradox: Cheaper, Efficient LEDs Save Energy, and People Use More - Inside Climate News

Example of real-life rebound effect in China

- ‘The Chinese government took measures to improve energy performance through accelerating technological progress, such as shutting down enterprises with outdated production technologies and energy inefficiencies and adjusting energy prices to limit the development of enterprises that use outdated technology.
- As a result, the energy consumption per unit of GDP in China declined, but the total energy consumption and carbon emission increased,’ (Li, Sun and Wang, 2018.)
- *In their energy efficiency projects, industry does not take into account the rebound effect.*

Case study: Netflix (Vodafone does not power Netflix)

- **How your Netflix habit could be harming the planet: Daily Mail Online**
- Amazingly, watching an hour of streamed video produces as much CO2 as driving a quarter of a mile.
- 5G promises to download movies faster, with reduced latency. This will translate to even more videos downloaded faster and more Co2 emissions

The Reality:

Although the 5G-new-radio standard is more energy efficient per gigabyte than are the 4G standards, the proposed 5G use cases and new spectrum bands will require many more mobile sites, outstripping potential energy efficiencies

The key to lowering telecom costs: Energy | McKinsey

- efficiency gains are cancelled out by higher consumption of a commodity – such as leaving your energy-efficient heating on more often.
- Wang et al. 2016; Liang et al. 2009; Greening et al, 2000

REBOUND EFFECT

Climate expert Professor Mike Berners-Lee says that with energy efficiency, ‘**total outputs go up not down.**’ Efficiency improvements on their own don’t help us. They only help us if we constrain the inputs.’

Laying out the future of sustainable energy (raconteur.net)

- Berners-Lee suggests that rebound effects have completely undermined all of our efforts to cut down on carbon so far. He demonstrates that each country cannot simply add up all of its carbon ‘savings’. In fact global emissions are still on the rise.
- **A British citizen emits more CO2 in two weeks than some people in Africa do in a year, research (2020) shows.**

VODAFONE'S 'GREEN' POLICIES RELY ON MODIFYING 'CONSUMER BEHAVIOUR'

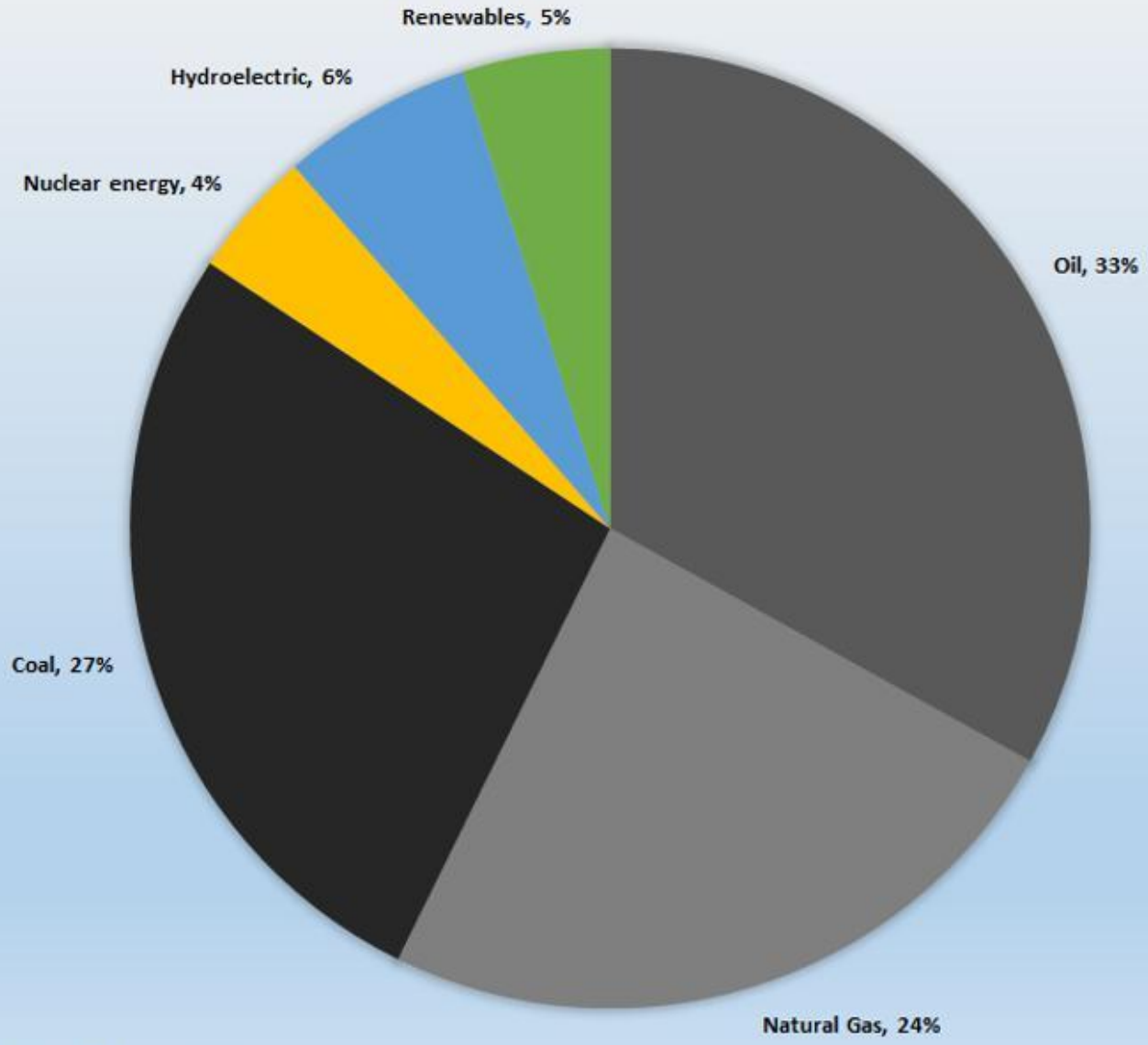
- Vodafone help 'our customers reduce their own carbon footprints with our connectivity and Internet of Things technology.' Vodafone has launched 5G in over 100 cities across 11 of its markets.
- Vodafone UK's energy reductions save 25,000 tonnes of CO_2 - Vodafone UK News Centre Oct 2020.' The amount of energy saved could power a town with a population of 65,000 people for a whole year.
- But Vodafone doesn't say WHAT methods were used to save energy, or how many tons will be emitted due to 5G rollout and IoT. It doesn't address the rebound effect, that energy savings are offset by increased consumption.

TELECOMS BT and Vodafone ACCUSED OF ‘GREENWASHING’

‘Very little detail is provided regarding the scenario analysis that has been carried out and the key assumptions and methodologies that have been used. This **lack of transparency** makes it very difficult to assess the credibility of the companies analysis and therefore their claims regarding long-term viability.’

Client Earth (2021)

PRIMARY GLOBAL ENERGY CONSUMPTION 2019



Data source: BP Statistical Review 2020

VODAFONE’S promises

- RENEWABLES
- Vodafone recently announced that it was going to halve its environmental impact by 2025, as well as power its network using 100% renewable electricity by July 2021. Renewable energy is a collective term used to capture a number of different energy sources. ‘Renewables’ typically includes hydropower, solar, wind, geothermal, biomass and wave and tidal energy.
- **Vodafone will** slash its global carbon emissions to 'net zero' by 2040

BT’s promises

- BT, the joint-largest private purchaser of electricity in the UK will run its global operations on **renewable electricity** where markets allow. BT Group announced that its network, offices and shops worldwide are now powered with 100% renewable electricity.

- BT Group hits 100% renewable electricity milestone worldwide and helps 5.7 million people in the UK with Top Tips on Tech campaign

- What’s the catch?

Catch No.2

Consumers will have to buy new 5G phones

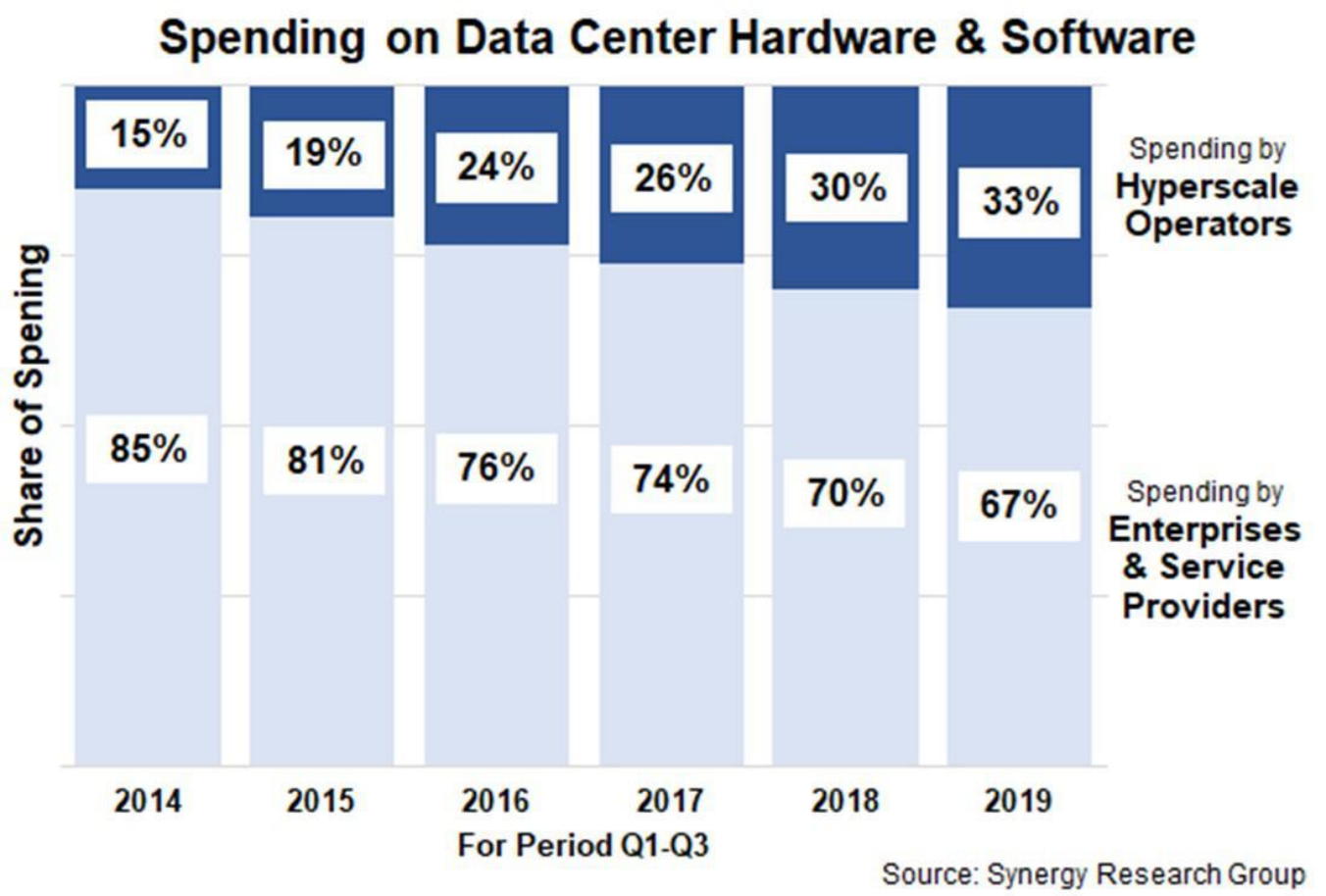
- The increase in greenhouse gas emissions will be due in part to the fact that consumers will need to buy new 5G mobile phones in order to take full advantage of 5G.
- A Swedish study calculated that a smart phone produced 45 kg of CO2 during its entire lifetime, with most of it coming from the production phase—the manufacture of integrated circuits, sourcing the raw material, production of the phone shell, then assembly and distribution.
- If accessories and the mobile network are included, the total life cycle impact is 68 kg CO2.

Catch No.3

Domestic Consumers are connected to much bigger international operators: Amazon, Netflix, Facebook, cryptocurrency like Bitcoin etc.

- These are operated from HYPERSCALE DATA CENTERS that are growing exponentially all over the world, consuming massive energy.
- As we look into the ‘energy efficiency’ and ‘renewables’ claims of these HYPERSCALE DATA CENTERS, we enter a hall of smoke and mirrors, the obscuring and embellishing of the truth with misleading or irrelevant information.

GROWTH OF HYPERSCALE OPERATORS



AWS, Google, Microsoft Dominate Data Center Spending (crn.com)

Amazon Web Services is the world's largest hyperscale data center

- Seattle-based Amazon continues to buy land across the globe, including the world's hottest data center markets, at a blistering pace with no plans to slow down data center expansion in 2020. New data center projects overseas for AWS are under way including an $800 million project in Argentina and investing $230 million to expand its presence in Brazil.
- 10 Hot Hyperscale Data Center Companies To Watch In 2020 (crn.com)

Data Centers

- According to the U.S. Department of Energy, data centers are one of the most energy-intensive buildings. They suck up 10 to 50 times the energy per floor space of a typical commercial office building. Taken together, data centers account for around **2%** of total U.S. electricity use.
- “As our country’s use of information technology grows, data center and server energy use is expected to grow too,” the DOE says.
- The more data there is to process, the more energy it will require, is the logic applied to energy use for data centers.

Cloud data centers

- In this off-premises form of data center, data and applications are hosted by a cloud services provider such as Amazon Web Services (AWS), Microsoft (Azure), or IBM Cloud or other public cloud provider.
- Data and applications are distributed among disparate systems, connected and integrated by network services and interoperability standards to function as a single environment. It has meant the term data center is now used to refer to the department that has responsibility for these systems irrespective of where they are located. What Is a Data Center? - Cisco
- **In reality, there is no central control over disparate systems around the world, owned and operated by a multitude of companies.**
- There is no central accounting system of energy expenditures and carbon emissions
- It’s the Wild West

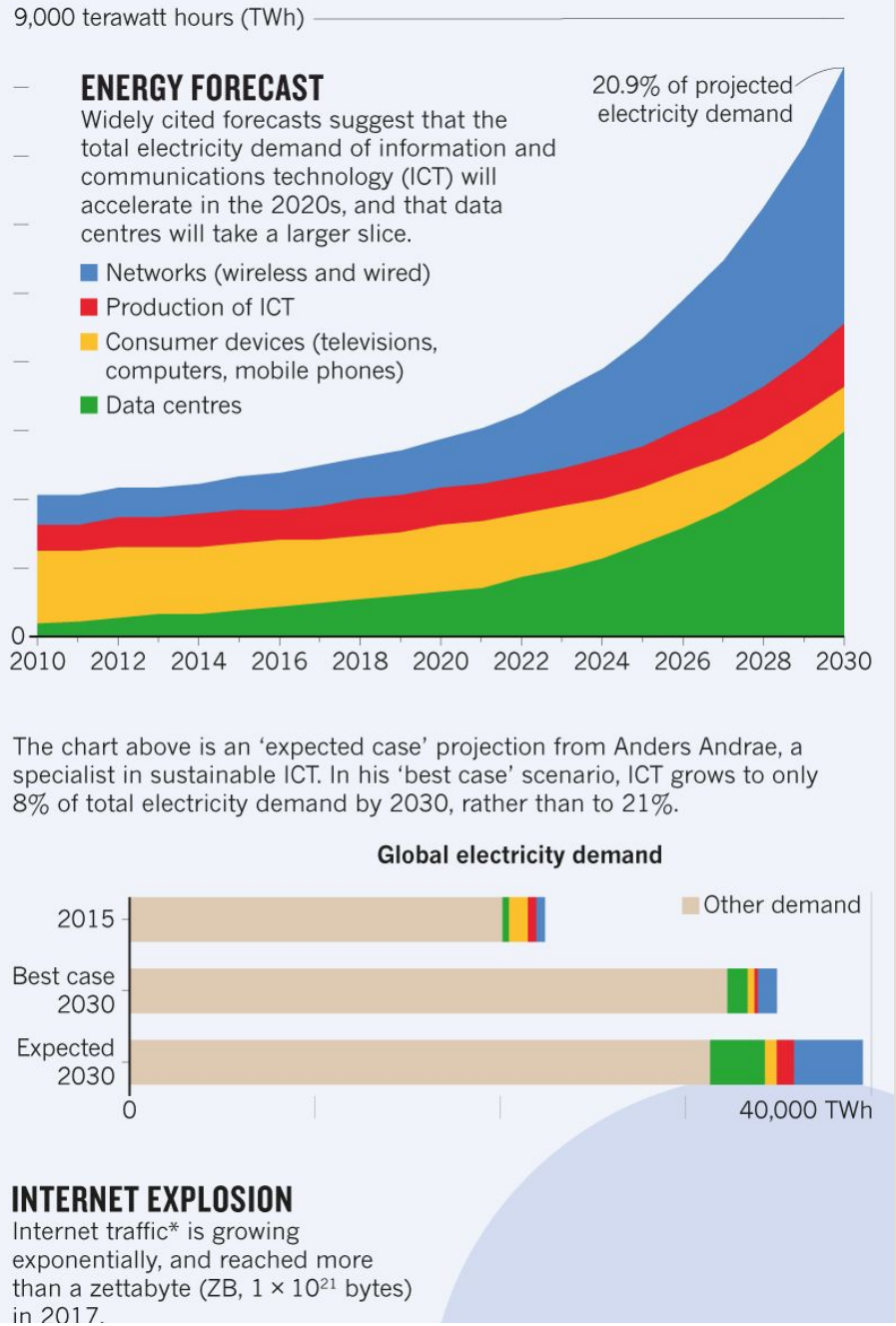
“5G will double mobile industry’s energy use “

InterDigital capacitymedia.com

. It is estimated that 53% of all servers will be located in hyperscale cloud data centers by 2021. This basically means AWS, Google Cloud or Microsoft Azure.

Non-renewables continue to make up a large part of the source of that electricity,

We must remain clear-eyed about the staggering energy demands of 5G,” said Henry Tirri, Chief Technology Officer, InterDigital



DATA CENTERS GOBBLE UP ELECTRICITY

- How to stop data centres from gobbling up the world's electricity (nature.com)

- Official statistics are not currently compiled on data center energy use at national or global levels. How Much Energy Do Data Centers Really Use? - Energy Innovation: Policy and Technology

Amazon etc use ‘renewable credits’, said to help to reach climate goals

THE CLAIM: ‘When we factor in the carbon intensity of consumed electricity and ***renewable energy purchases***, which reduce associated carbon emissions, AWS performs the same task with an 88% lower carbon footprint.“

Sustainability in the Cloud (aboutamazon.com)

THE REALITY: By buying renewable credits, electricity from the fossil fuel producer is recorded as sourceless "null" energy, **effectively scrubbing greenhouse gases emitted during its production from the record.**

Vodafone’s customers are mainly consuming electricity from the HYPERSCALE DATA CENTERS owned by the big corporations:

Amazon, Google, Microsoft, Ali Baba, Apple, Facebook, Netflix and other internet businesses are elsewhere, and the majority are not powered by renewables.

- Amazon’s Data Center Offensive Continues In World’s Largest Market (crn.com)
- To clean up their carbon footprints, these companies lean heavily on a tool known as a **renewable energy credit**, which is basically a token representing a utility’s green energy generation. RECs are how companies like Google and Microsoft can claim their data centers are powered 100 percent by renewables while still being connected to grids that use fossil fuels. **In reality, only a fraction of each company’s energy comes directly from solar or wind installations**; the rest comes from RECs. Amazon, Google, Microsoft: Here's Who Has the Greenest Cloud | WIRED

Renewables are powered by fossil fuels

- **Wind** plants must **use** electricity from the grid, which **is** powered by coal, gas or nuclear **power**. ... **Wind turbines** cannot be built and cannot operate on a large scale without **fossil fuels**.
- **Wind farms use fossil fuels for construction and operation**
- A Smaller, Faster, Lighter, Denser, Cheaper author Robert Bryce tells, if all the coal-fired generation capacity in the US were to be replaced by wind, it would need to set aside land the size of Italy. Hydrocarbons are denser energy sources than wind. There is nothing that can overcome that fact.
- James Hansen, the former NASA climate scientist, wrote in 2011: "**Suggesting that renewables will let us phase out fossil fuels is almost the equivalent of believing in the Easter bunny.**"

Cryptocurrency is a massive consumer of electricity

- ‘Today Bitcoin mining consumes 133.65 terawatt-hours a year, more than the annual consumption of countries like Sweden or Ukraine, according to the University of Cambridge’s Centre for Alternative Finance (CCAF). Only 39 per cent of that electricity comes from renewable sources, a 2020 report by the University of Cambridge found.’ Renewables mostly from hydroelectric energy.
- A blockchain tweak could fix crypto’s colossal energy problem | WIRED UK
- But is hydroelectric energy really renewable energy??

A study (2016) from Washington State University finds that methane, which is at least 34 times more potent than another greenhouse gas, carbon dioxide, makes up 80% of the emissions from water storage reservoirs created by dams.

The hydropower paradox: is this energy as clean as it seems?

Hoover Dam near Las Vegas. Hydroelectric dams are a rich source of greenhouse gas emissions, but the emissions aren't part of global greenhouse gas inventories.

Renewable Energy Depends on Fossil Fuels - BSEEC

- Almost daily, we read headlines that say renewables are on track to replace fossil fuels and move the world toward a low-carbon future. Such platitudes appear to give credibility to the notion that the best days of the oil and gas industry are behind us. But those assertions are unrealistic.
- Wind turbines and solar panels cannot be made solely from other wind turbines and solar panels.
- Fossil fuels are required to manufacture wind and solar equipment, transport and construct them, and provide backup electricity when the wind isn’t blowing and the sun isn’t shining.

Fossil fuel required for wind and solar

- A study of wind and solar development in 26 Organization for Economic Cooperation and Development countries between 1990 and 2013 **found that the fossil fuel-based backup capacity required** for wind and solar is almost equal to the installed renewable capacity.
- The study states “Our paper calls attention to the fact that renewables and fast-reacting fossil technologies appear as highly complementary and that they should be jointly installed to meet the goals of cutting emissions and ensuring a stable supply.”
- Bridging the Gap: Do Fast Reacting Fossil Technologies Facilitate Renewable Energy Diffusion? (nber.org)

Solar Photovoltaic (PV) is now being considered as one of the emerging waste streams in Europe

- E-WASTE
- ‘All over the world, deployment of solar PV as a solar-energy-harvesting technology is increasing at an exponential rate. After the 23-25 years of a typical lifetime, the equipment reaches its end of life (EOL) and it is expected
  that, by the year 2050, 4.5-7.5 million units of sola r PV will be obsoleted.’

- (PDF) Electronic Waste (E-Waste)/Waste Electrical and Electronic Equipment (WEEE): Projecting Future Research Trends using Bibliometric Analysis | Md. Tasbirul Islam - Academia.edu

Natural gas: Providing a helping hand for renewable energy

- Gas-fired power plants solve solar and wind's intermittency issues, says study
- The blue flame may be essential to going green.
- A new study, released by the National Bureau of Economic Research, says that natural gas-fired power generation is pivotal to renewable energy development.

All types of scams. The oil and gas industry: the carbon capture scam.

- Capture the CO2 and store it underground.
- One expert says ‘This is very dangerous thinking. Yet again, we have no idea what impact storing large amounts of CO2 underground will have. We don't understand the security of it, or the extent to which it will leach into our aquifers or the sea (much of the storage may end up beneath the sea, being pumped back into empty oil wells). C02 in water makes the water acidic, and acidic oceans are part of the problem.’

‘5G/IoT/AI will increase carbon emissions in the absence of parallel renewables investment’

- Comparisons such as one movie stream consumes as much as the annual electricity of a small nation, have been made and some refuted.
- ‘Parallel investments in renewable power sourcing will be required to minimize the climate implications of unavoidable data center energy use (Masanet et al. 2020). How Much Energy Do Data Centers Really Use? - Energy Innovation: Policy and Technology

At a time when reliance on fossil fuels needs to shrink, bank finance is helping the industry grow.

An analysis by Rainforest Action Network shows that 33 big banks provided $654bn to 1,800 fossil fuel companies last year — equivalent to 70 per cent of the total capital expenditure of the entire fossil fuel industry last year, as calculated by the International Energy Agency. The total value of loans and bonds and shares underwritten by these banks has increased every year since the 2015 Paris Agreement on climate change.

- Banks must cut the flow of funding for fossil fuels | Financial Times (ft.com)

There are no enforceable mechanisms for reducing carbon emissions

- There are no enforceable mechanisms for reducing carbon emissions anywhere in the world. In fact, the Energy Treaty Charter (1998) ensures that enforcement does NOT happen. The UK is one of 54 countries that allow fossil fuel and nuclear power corporations to sue governments for loss of profit as a consequence of transiting to renewables. This has a chilling effect on the Paris agreements..
- One Treaty to rule them all | Corporate Europe Observatory

ASK:

WILL 5G AND IoT cost the Earth ?

- We all want a safer, sustainable, healthier world.
- What is needed is a united effort to hold corporations accountable, research the facts behind the claims, and ask the hard questions.