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FOR WHAT COMES NEXT

Energy Consumption of Data Centres

Fact and Fiction

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What are data centres and why do we need them?

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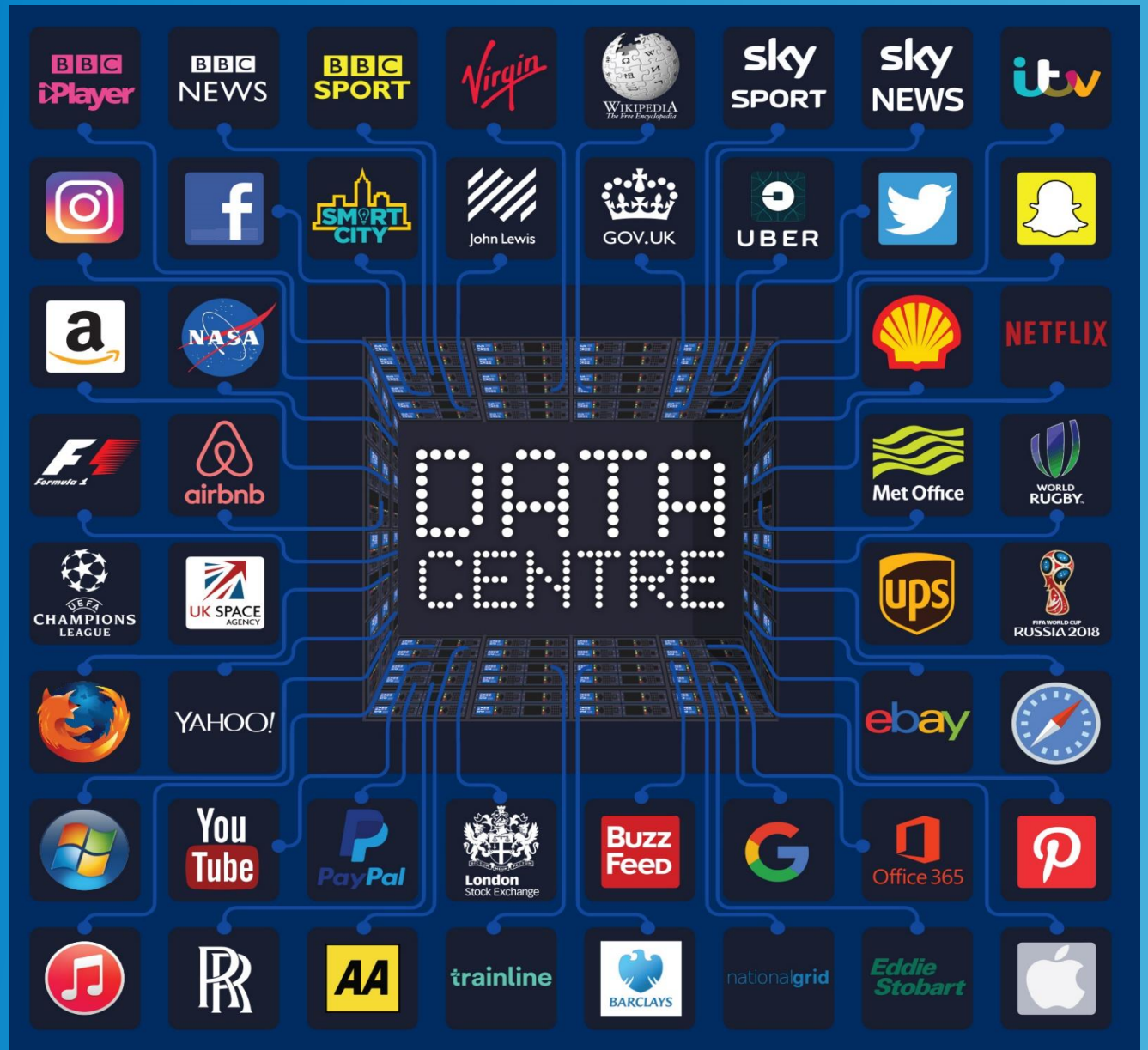

Data centres store, process, receive and transmit digital data. They are purpose built facilities that consolidate IT activity to optimise resilience, security and efficiency.

Data centres, along with communications networks, comprise digital infrastructure.

Data centre underpin every aspect of our daily lives, and all modern economic activity.

Data Centre Carbon Footprint as a proportion of ICT

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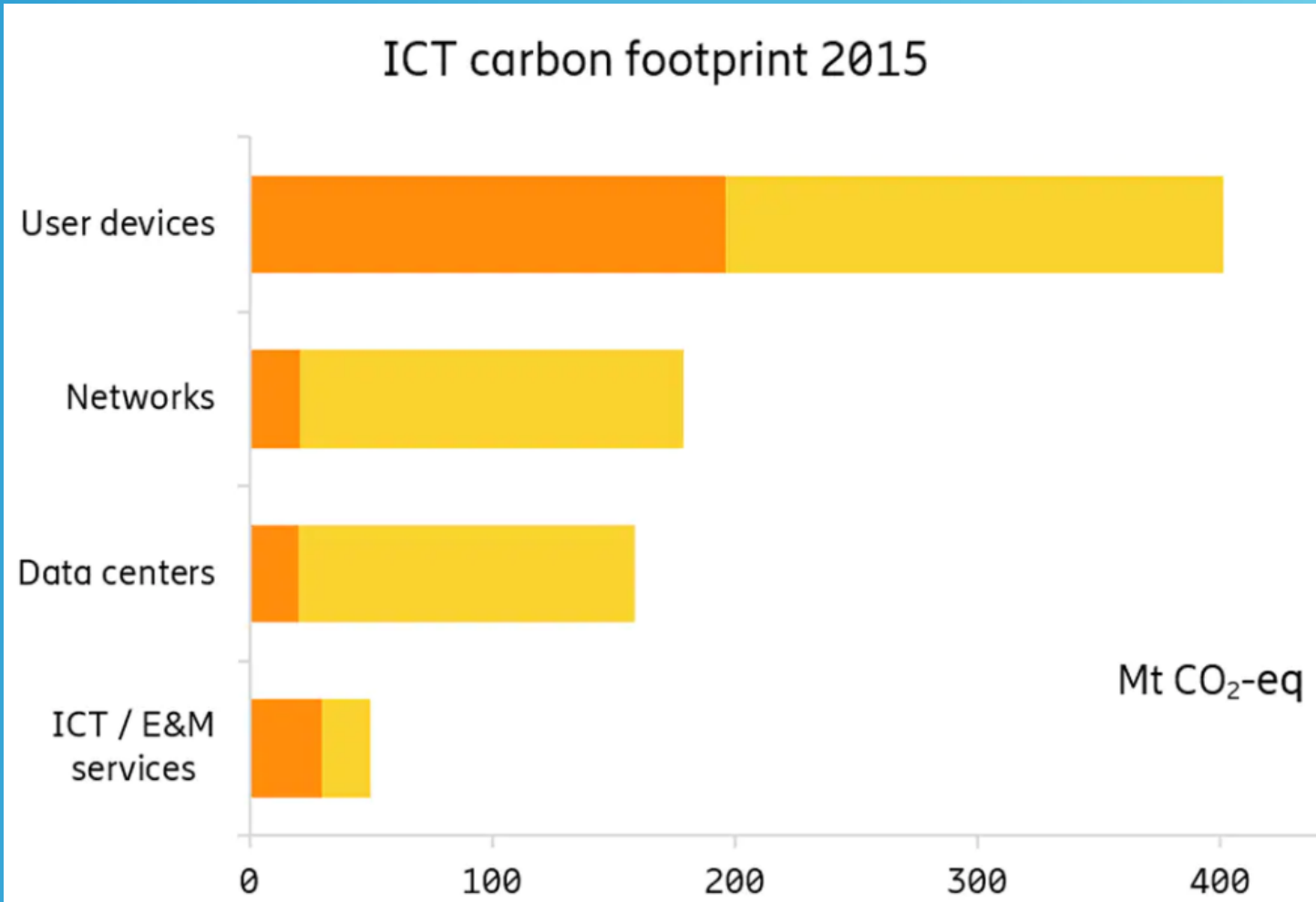
- Data centres are electro intensive
- Data centres consume around 1% of global electricity (IEA 2020) – around 200 TWh a year.
- Studies suggest that data centres consume between 15% and 25% of ICT energy (networks and devices account for the rest)



Bright orange = embedded energy. Source: Ericsson 2018

But what about growth?

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Digitisation of existing processes, services and activities.

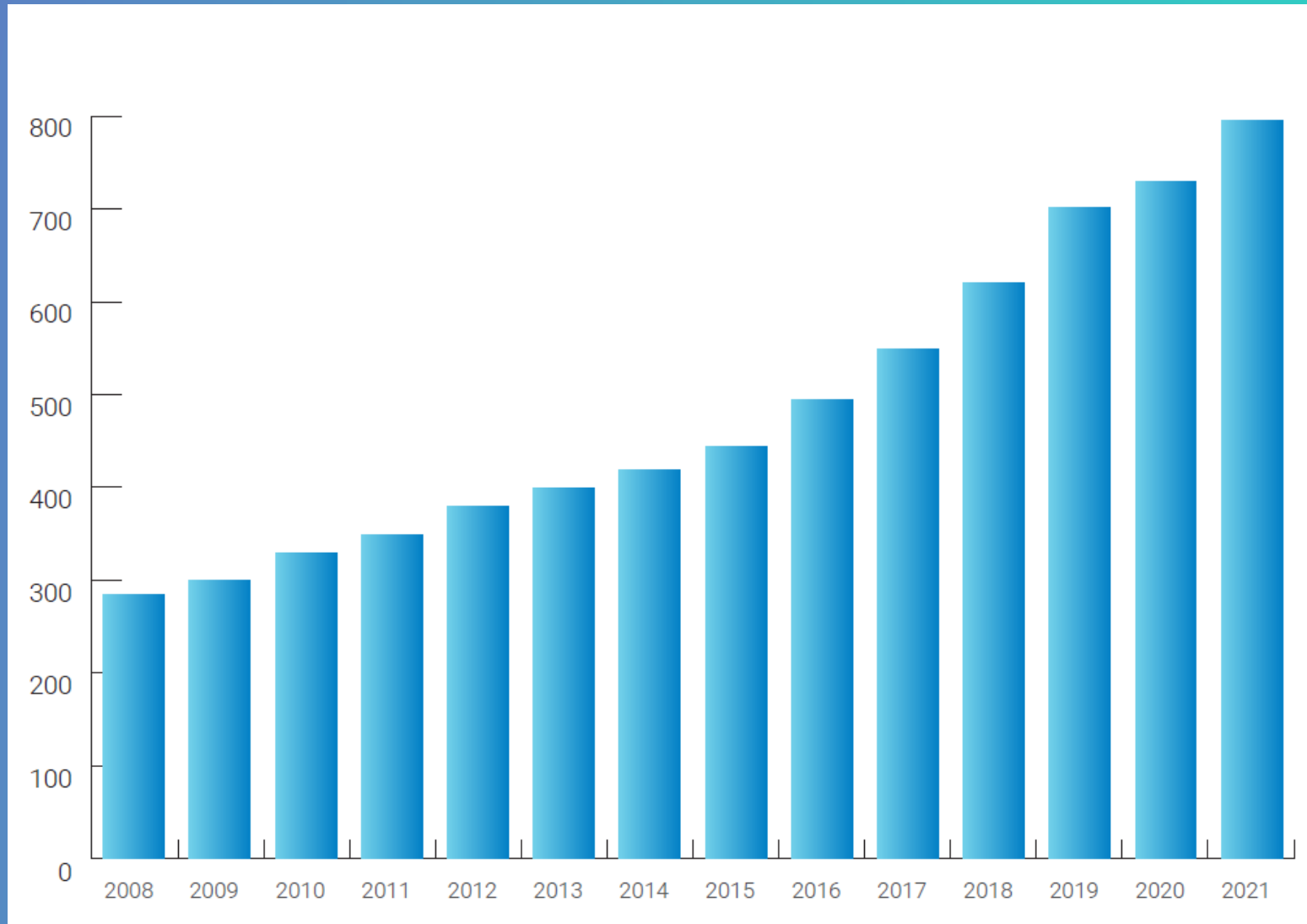
Digitally enabled government policies and agendas

Migration and outsourcing of on premises data centres

Consolidation and outsourcing of distributed IT

Development and adoption of new, data hungry technologies: IoT / M2M, AI, etc.

Increasingly delivered through cloud



London colocation market growth since 2008, using MWh as a proxy

The Big Energy Challenge

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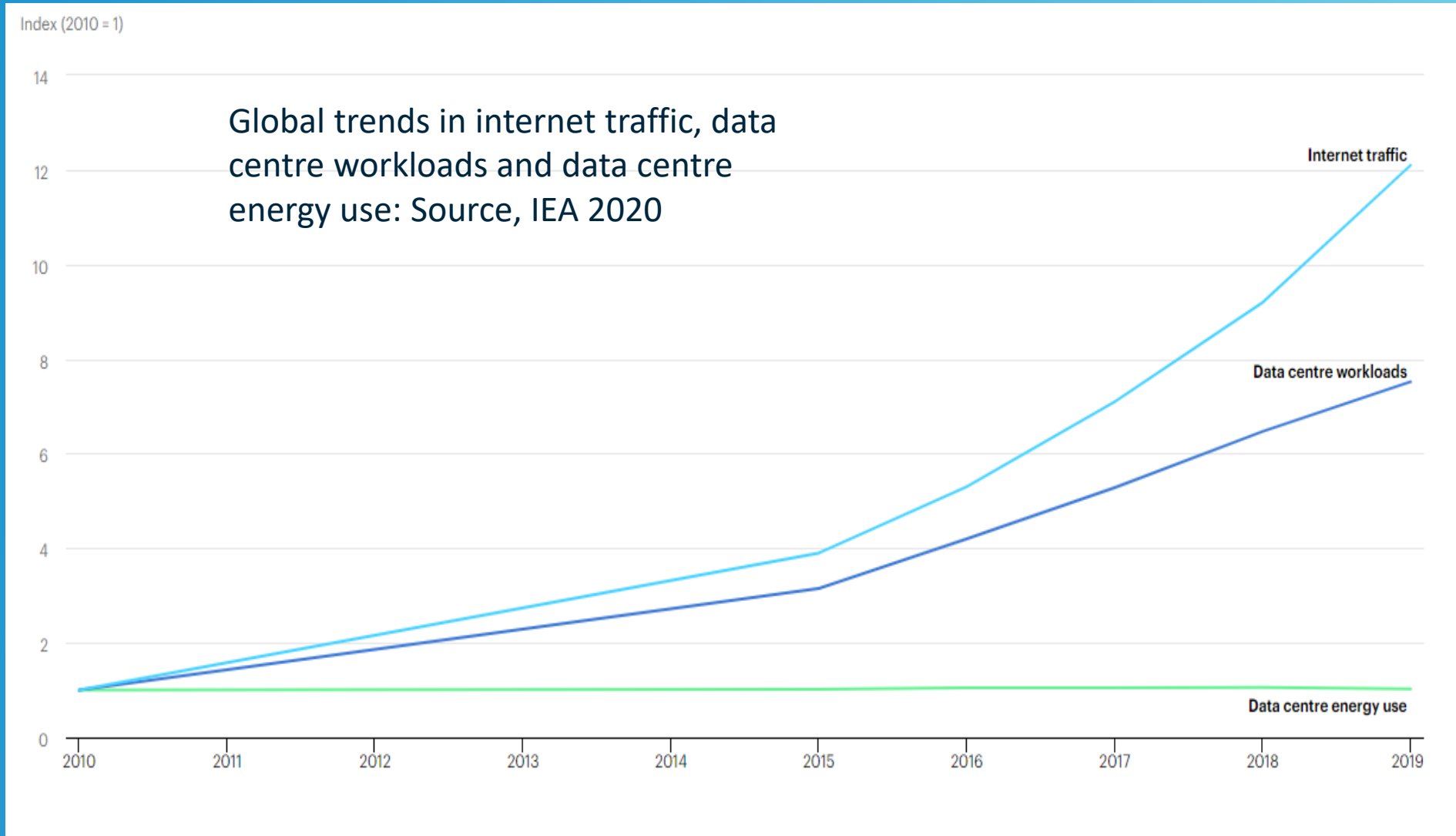
Data centres need to meet the exploding demand for digital data without a parallel increase in energy demand

Currently we are doing well, due to improvements in processor efficiency and advances like virtualisation.



Global trends in internet traffic, data centre workloads and data centre energy use: Source, IEA 2020

Sector electricity demand: trends

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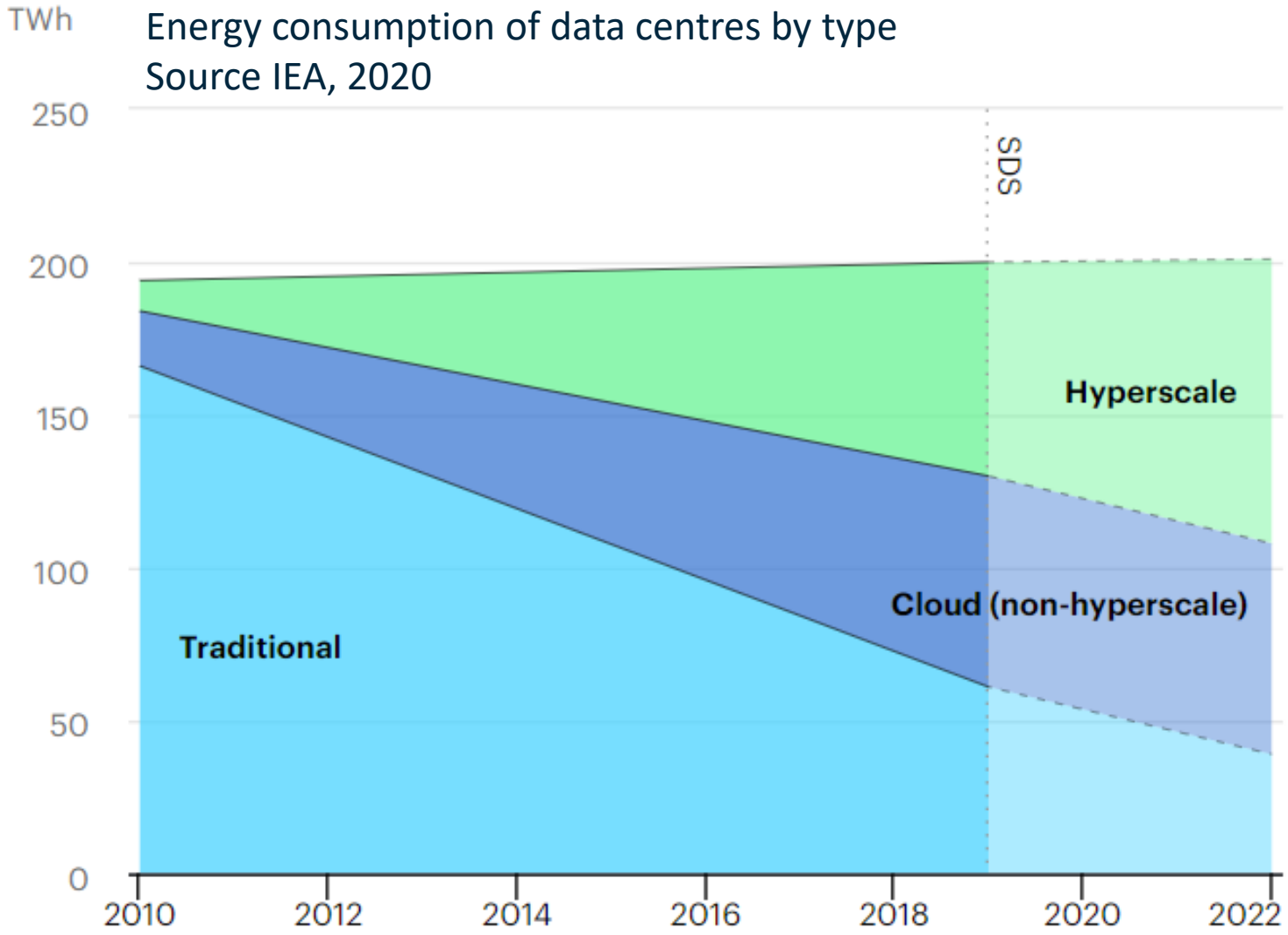

Energy demand of data centres remains surprisingly flat due to efficiency improvements and a shift to cloud and hyperscale data centres.

Fixed network energy intensity (LOG scale)

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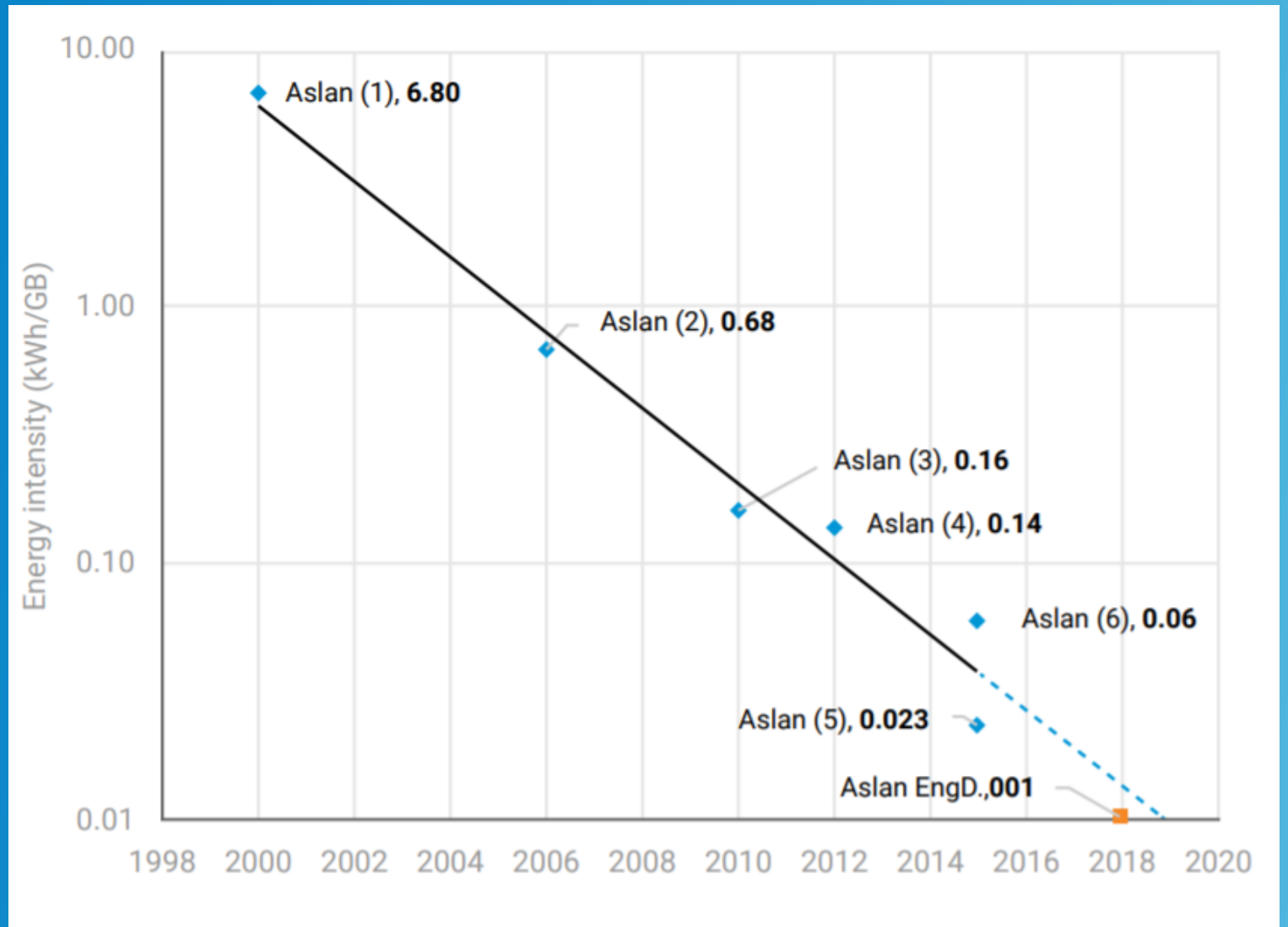
Extracted from Carbon Trust Streaming Report (see below)



Price elasticity

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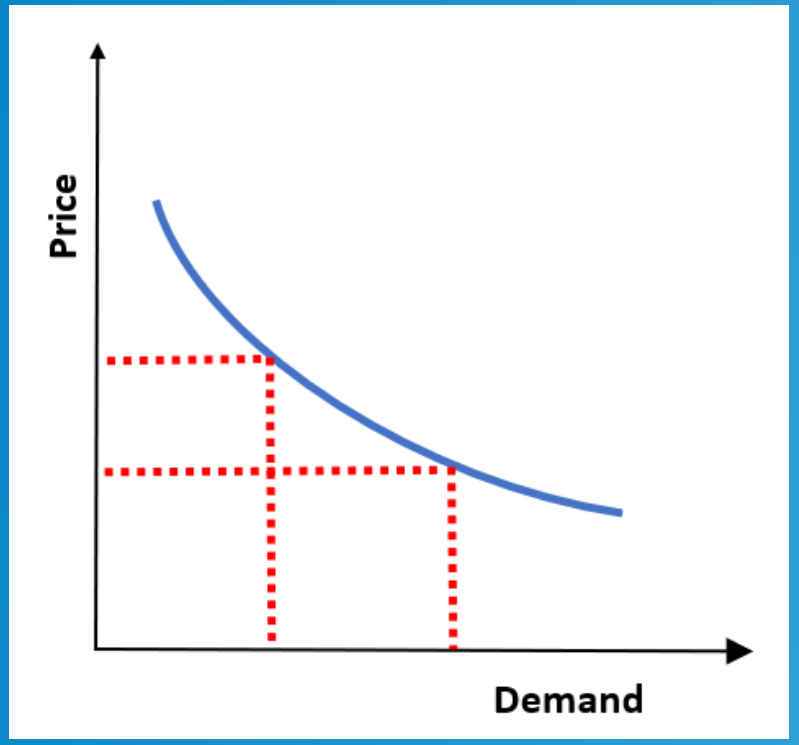

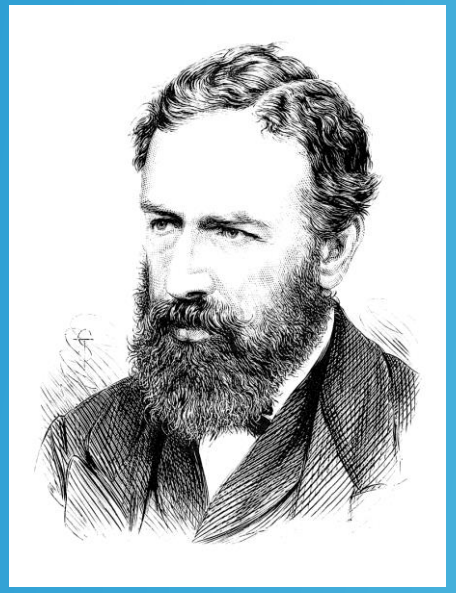

Communications are price elastic. Coffins are not.

Jevons' Paradox:
applies to price elastic commodities.

Impact of Streaming

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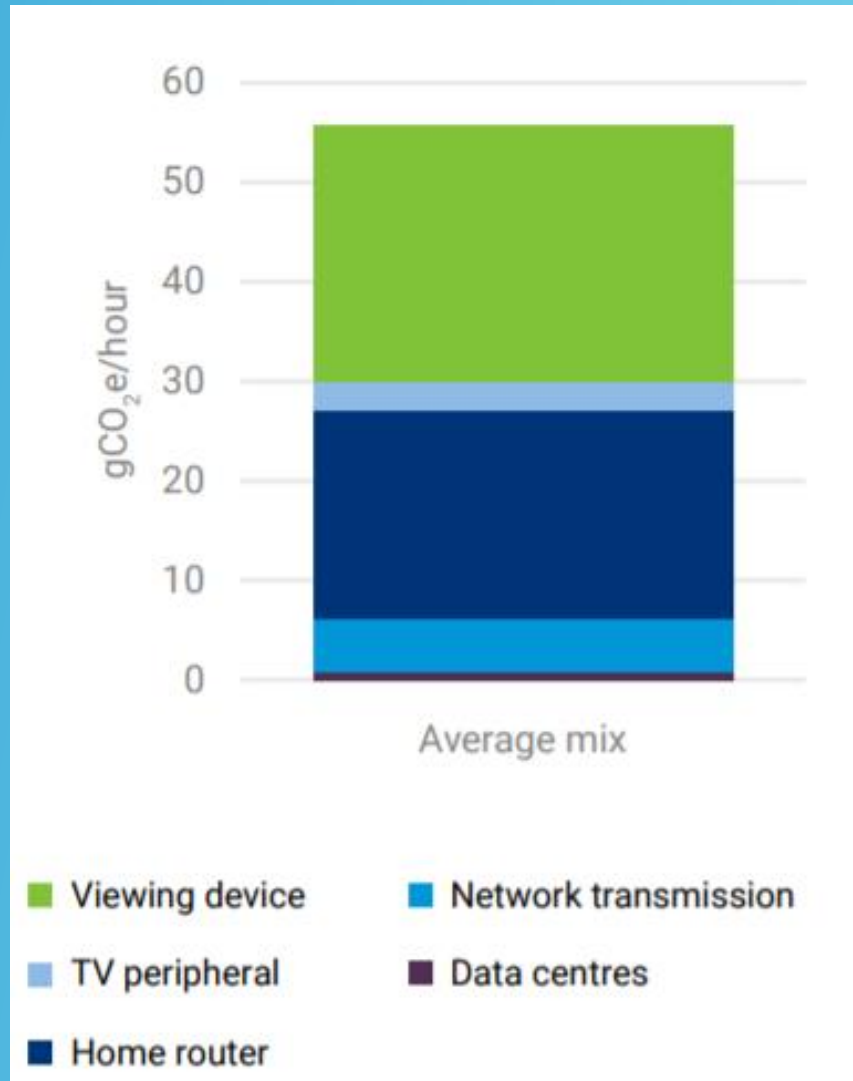
- On average, video streaming emits 55g CO2 per hour
- Largest part of footprint attributable to the viewing device –
- Biggest variability relates to country specific electricity emissions factor
- Changes in video quality have a minimal impact
- Carbon intensity on a downward trajectory
- The impact of streaming is very small compared to other everyday activities

https://www.carbontrust.com/resources/carbon-impact-of-video-streaming



Estimated emissions from one hour of video streaming, European Average, 2020, sourced from Carbon Trust, extract from Carbon impact of video streaming, 2021

Useful Sources

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Analysis of the scope for digital technologies to help reduce emissions Digitalisation and Energy: IEA:
https://www.iea.org/reports/digitalisation-and-energy

Analysis of data centre sector energy use:
Data Centres and Data Transmission Networks: Energy use, IEA 2020:
https://www.iea.org/reports/data-centres-and-data-transmission-networks

Carbon Impact of Video Streaming: Carbon Trust 2021
https://www.carbontrust.com/resources/carbon-impact-of-video-streaming

Detailed explanation of why studies and projections of data centre energy use produce such different results and the pros and cons of different approaches. Eric Masanet at UC Santa Barbara presentation:
https://www.youtube.com/watch?v=-o8j5zIM0iA

Common misconceptions about data centres
Ten Myths about Data Centres

UK Energy routemap for data centres
Data Centre Energy Routemap

The Irreversible Myth

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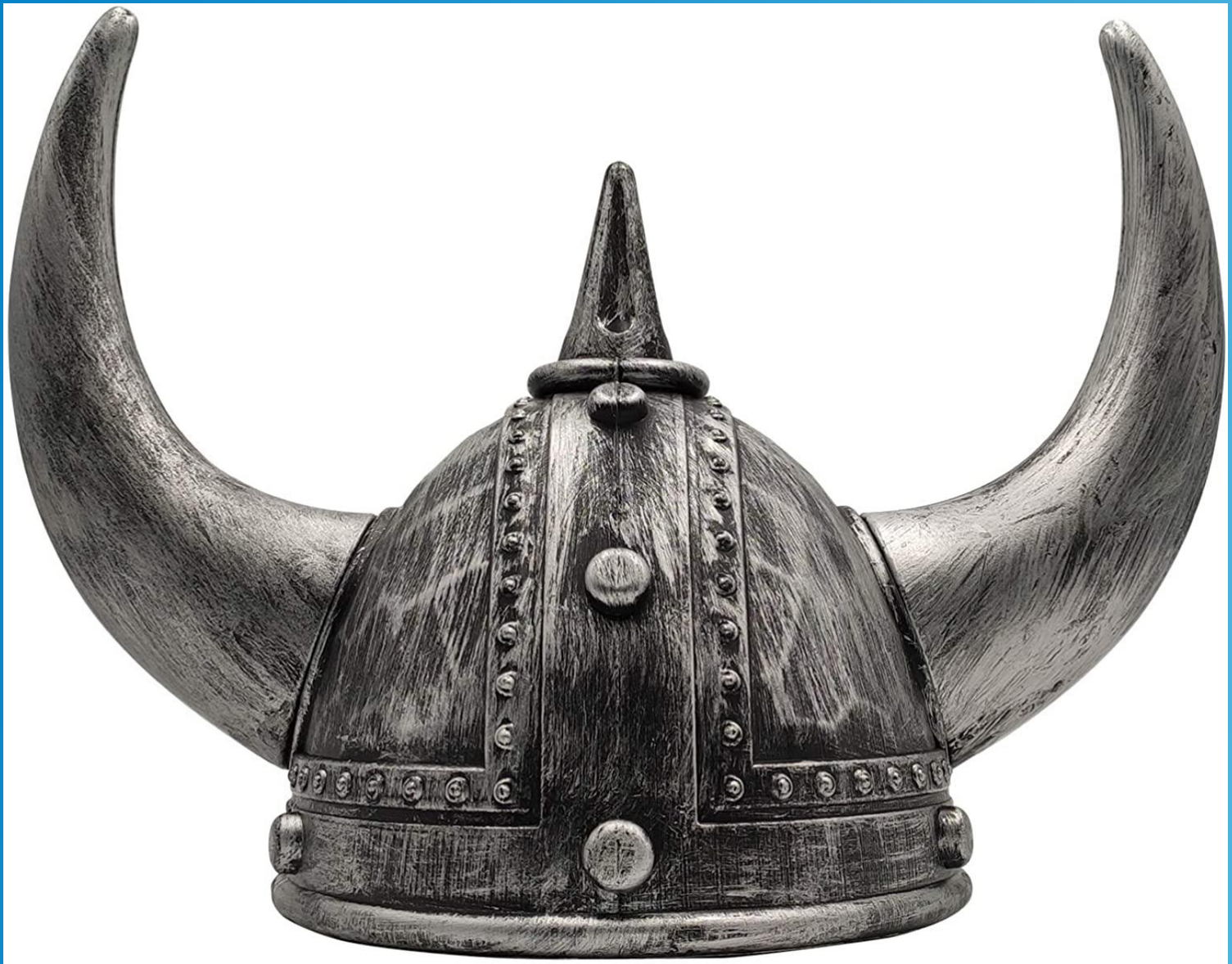

Brandolini's Law:
The energy needed to refute misinformation is ten times larger than the energy required to create misinformation

A few sample myths

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Widespread claim that a google search consumes as much energy as boiling a kettle (150-200g). In fact it is estimated to be 0.2g

Information technology (IT) will use 50% of US electricity in 10 years (Huber and Mills 1999) Currently estimated to use 5%

2002: “The 3G mobile network in Sweden will require a new nuclear reactor” It turned out to be 50 times less (2010)

2007 Simon Mingay, Gartner, claimed that ICT had the same carbon footprint as the airline industry. In fact aviation emits 2-5 times more despite being a fraction of the size of the ICT sector. The comparison also confuses scope 1 and 2, doesn’t allow for radiative forcing or enabling impacts.

2009 paper sponsored by Japanese government predicted exponential growth of internet traffic. Projected that by 2030 the internet routers in Japan would consume all the 2005 electricity grid capacity in Japan. Obviously this didn’t happen.

The SHIFT report claimed that 30 minutes of video streaming equivalent to driving four miles. Exaggerated at least eighty fold, plus the initial estimates confused bits and bytes.

Estimates on the energy intensity of the internet vary by a factor of 20,000!

Streaming estimates!

Sourced from The Carbon Trust, 2021

NB The BITKOM estimates show the difference between streaming on large and small devices.

Estimate	Carbon intensity [g CO2e / streamed hour]
BBC/DIMPACT iPlayer estimate for 2016	93
IEA global estimate for 2019 (Revised estimate, November 2020)	36
IEA global estimate for 2019 (Original estimate, February 2020)	82
Shift Project global estimate for 2018	3,200
Shift Project updated global estimate for 2020	394
Purdue University estimate for 2020 (Nateghi et al., 2020)	440
BITKOM: global estimate for 2018 | 720p | 65" TV	130
BITKOM: global estimate for 2018 | 4K | 65" TV	610
BITKOM: global estimate for 2018 | 720p | Smartphone | Fixed networks	30
LBNL/NU estimate for the U.S. for 2011	360
BBC estimate for the UK for 2011 | STB + TV | SD (480p)	76

Data Centre Energy Quiz…

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Q: How many data centres are there in the UK?

A: 105 to 180,000 (ratio 1:1,714)

Q: How many square metres of white space?

A: 140,000 to 1 million (ratio1:7)

Q: How much energy does the UK sector consume p/a?

A: 2.4 TWh to 320 TWh (ratio1:133)

Q: What is the average airspeed velocity of an unladen swallow?

A: 11m/s. 24mph. African or European? (ratio 1:1)

We set this quiz a few years ago for fun. The variation in answers shows just how many contradictory sources there are – except for the last question, which relates to a cult comedy film, and is obviously nonsense. But everyone got the right answer because there is only one source, the film script!

Why do we overstate data centre energy demand?

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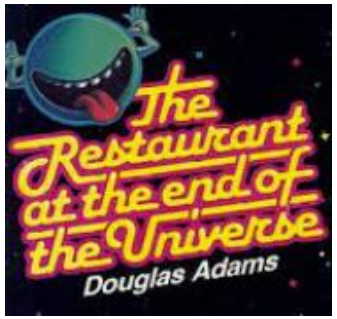
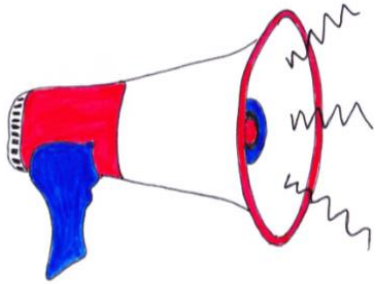
Old sources



Long Horizons

Definitions



MAKING NEWS!

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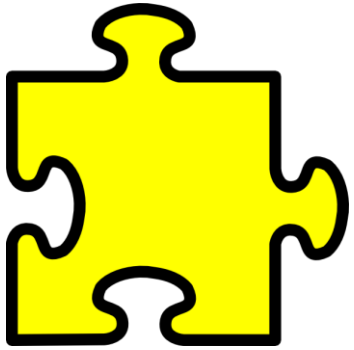
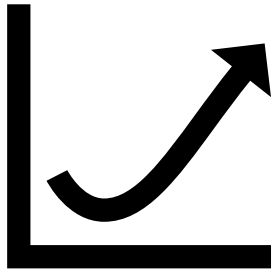
Magic Numbers



Incomplete picture



Misinterpreting Trends

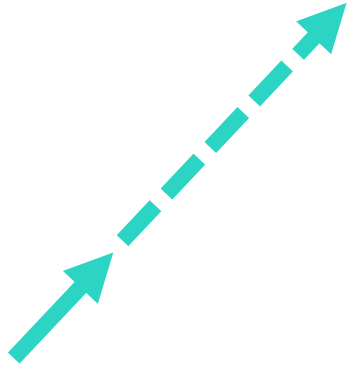
Matrioshkas

Laziness

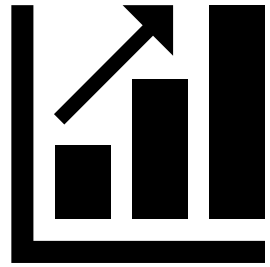
W ≠ Wh

Bits ≠ Bytes

Schoolboy Errors



Extrapolations



Scenarios vs Predictions

How can we do better?

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- Encourage greater transparency in reporting
- Accept that nobody has the whole picture
- Recognise that different sources cover different aspects
- Check whether data is primary or quoted
- Ensure modelling is based on valid assumptions
- ALWAYS check for agendas!
- Always compare multiple sources
- Ask the people who measure energy, and pay the bills
- If it looks ridiculous – it probably is!

The tech sector's own transition to net zero

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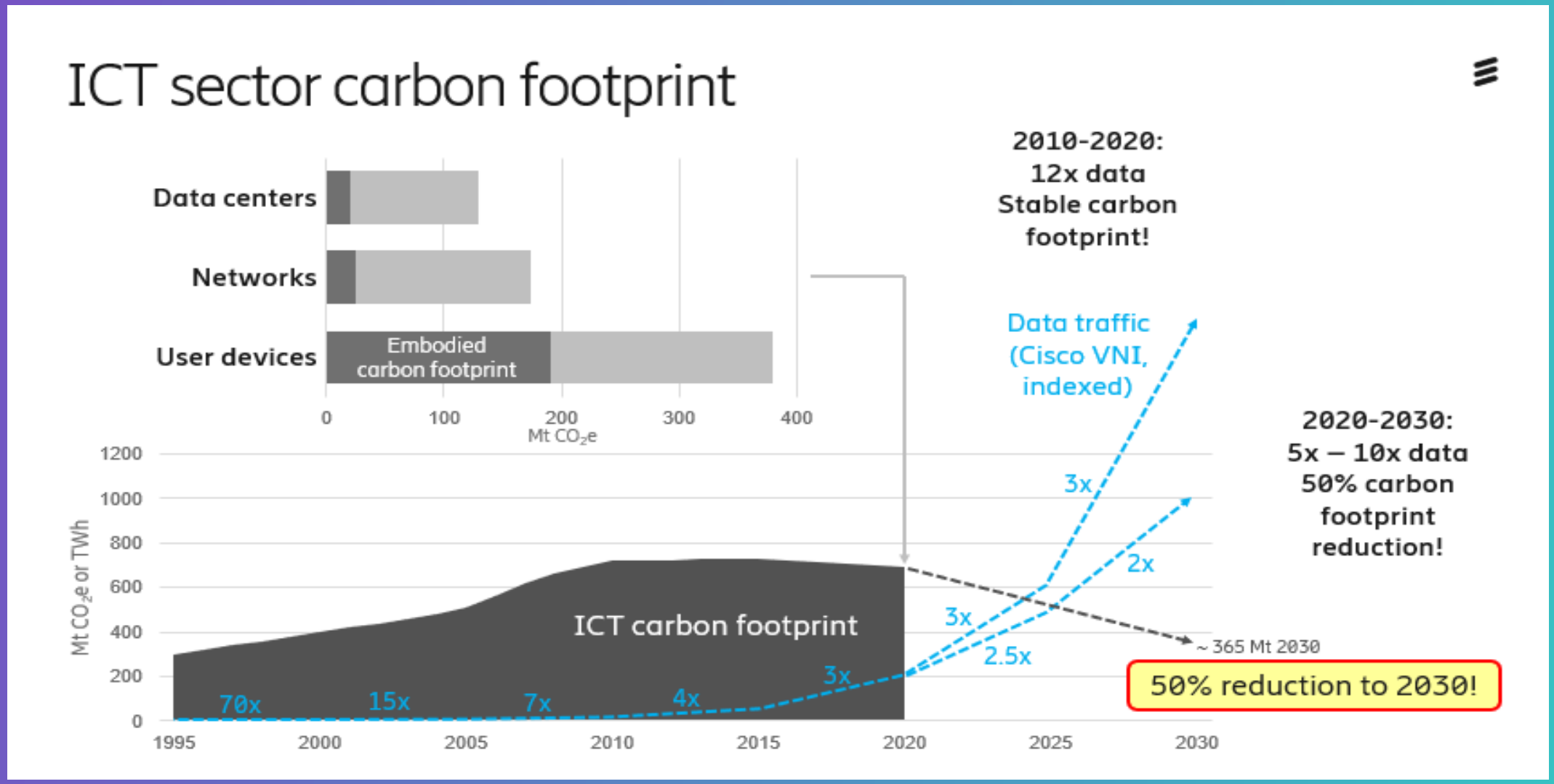

Source: Ericsson presentation delivered at techUK 2020 conference *Decarbonising Data, data taken from* https://www.mdpi.com/2071-1050/10/9/3027

ICT Sector GHG Emissions Trajectory

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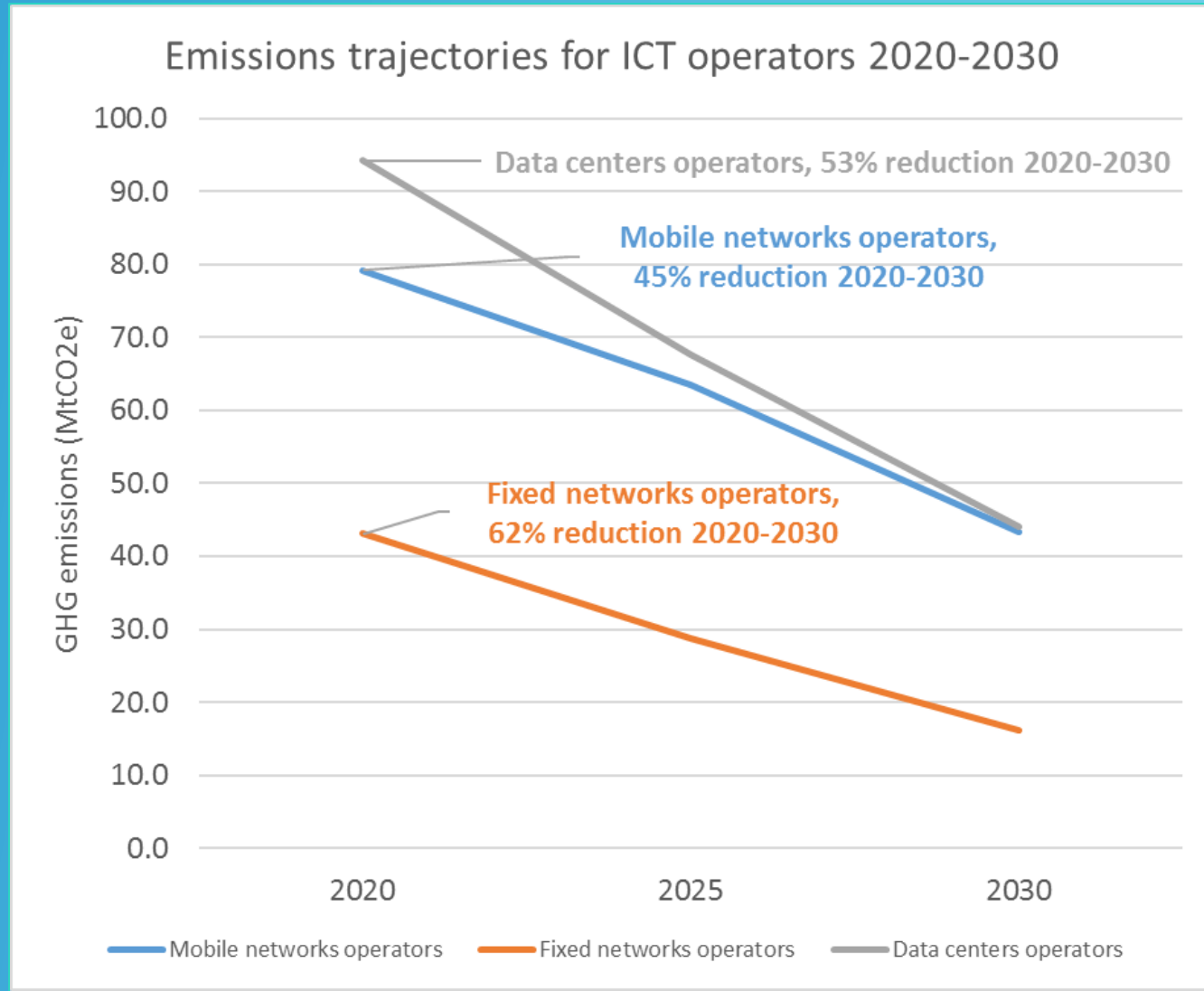
- ICT sector released a science based pathway for ICT emissions in line with the Paris Agreement

- Trajectory compatible with 1.5°C scenario
- Data Centre SBT Trajectory requires a 53% reduction in emissions



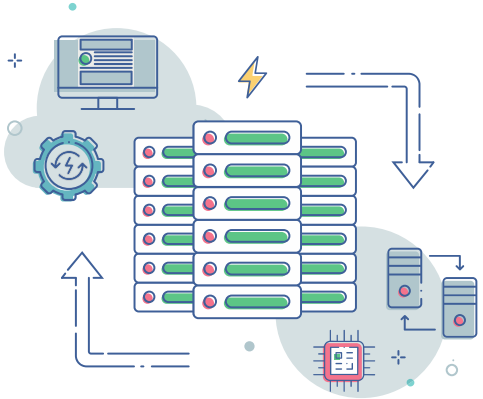
Climate Neutral Data Centre Pact

- **Launched Jan. 21st 2021**
- **Developed by the industry with the support of the European Commission (EVP Timmermans, DG Connect…)**
- Engages Pact Operators (data centres and cloud infrastructure providers) towards **Climate Neutrality by 2030** with clear metrics to achieve in 2025 and 2030 on:
  - Energy efficiency,
  - Clean energy,
  - Water conservation,
  - Circular economy
  - Circular energy systems
- Engagements will be **monitored by independent third-party audits** (for SMEs a self-assessment procedure will enable less costly onboarding)
- Supported by **biggest players of the industry** operating in Europe (European and non-European companies) **as well as SMEs**

https://www.climateneutraldatacentre.net/

Climate Neutral Data Centre Pact

THE GREEN DEAL NEEDS GREEN INFRASTRUCTURE



WE REUSE AND REPAIR SERVERS

WE PROVE ENERGY EFFICIENCY WITH MEASURABLE TARGETS

2020
Signing of the **Climate Neutral Datacenter Pact.**

2025
First milestones of the pact.

2030
Climate Neutral datacenters.

WE PURCHASE 100% CARBON-FREE ENERGY

Cloud computing is the **technological force for change** behind the European Green Deal & Digital Strategy. **Cloud infrastructure providers** & **data center operators** created a self-regulatory initiative for data centers to be **climate neutral by 2030.**

WE PRIORITISE WATER CONSERVATION

Contact

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For more information about data centres please visit:

https://www.techuk.org/data-centres-programme/data-centres-resource-index.html

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