Total Energy Model for Connected Devices

28 April 2021

International Energy Agency

Agenda

10h00 – 10h10	**Welcome to the webinar and introduction** Moderator: Emi Bertoli, Policy Analyst, Energy Efficiency Division, International Energy Agency Presentation: • George Kamiya, Digital/Energy Analyst, Strategic Initiatives Office, International Energy Agency
10h10 – 10h40	**Presentation and online interface demonstration:** • Paul Ryan, Director, EnergyConsult Pty Ltd • Anson Wu, Director, Hansheng Ltd
10h40 – 11h00	**Q&A** Moderator: Emi Bertoli, Policy Analyst, Energy Efficiency Division, International Energy Agency

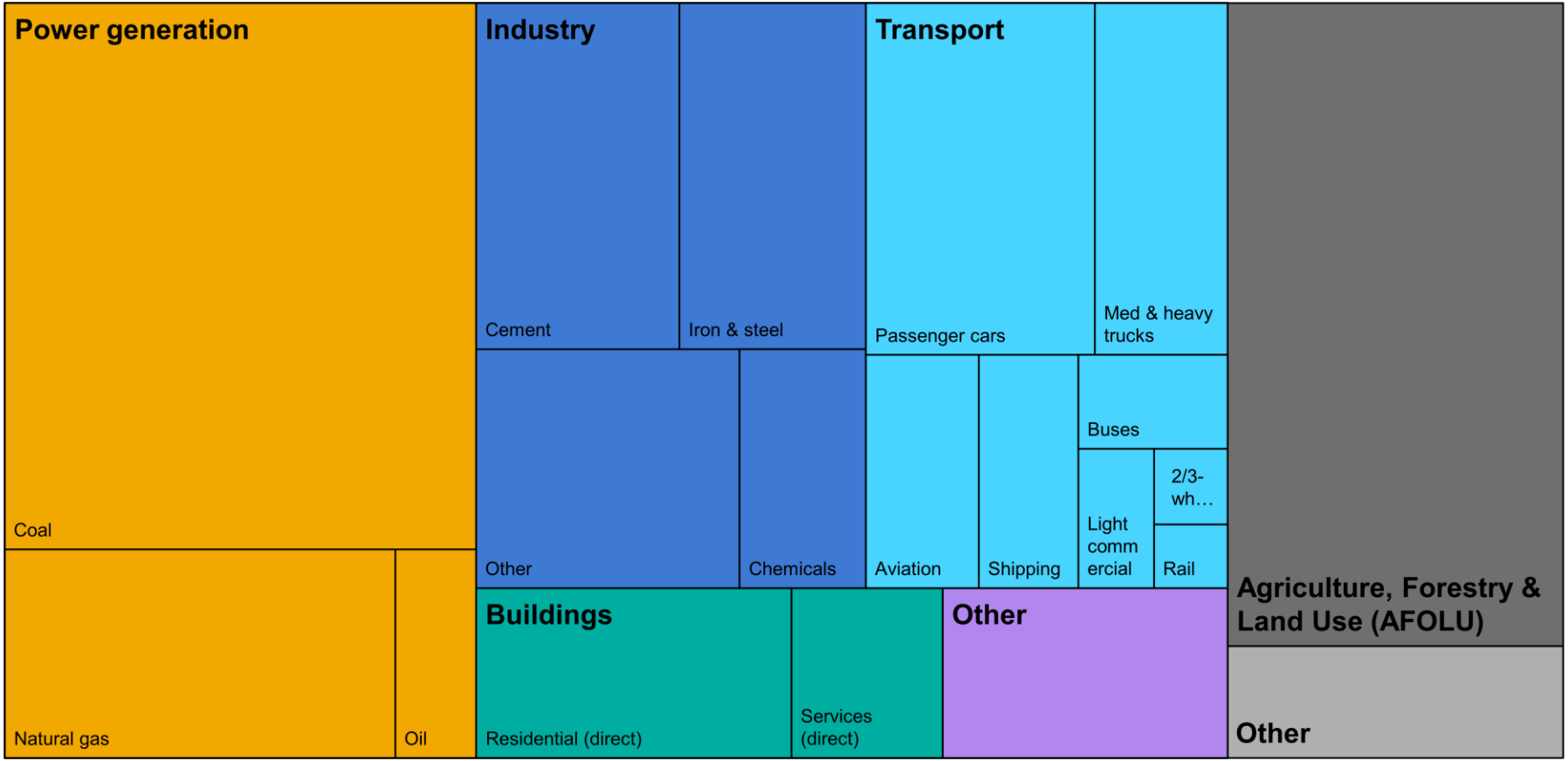
Energy and climate impacts of digital technologies

George Kamiya • Strategic Initiatives Office

28 April 2021 • Webinar 8: Total Energy Model for Connected Devices

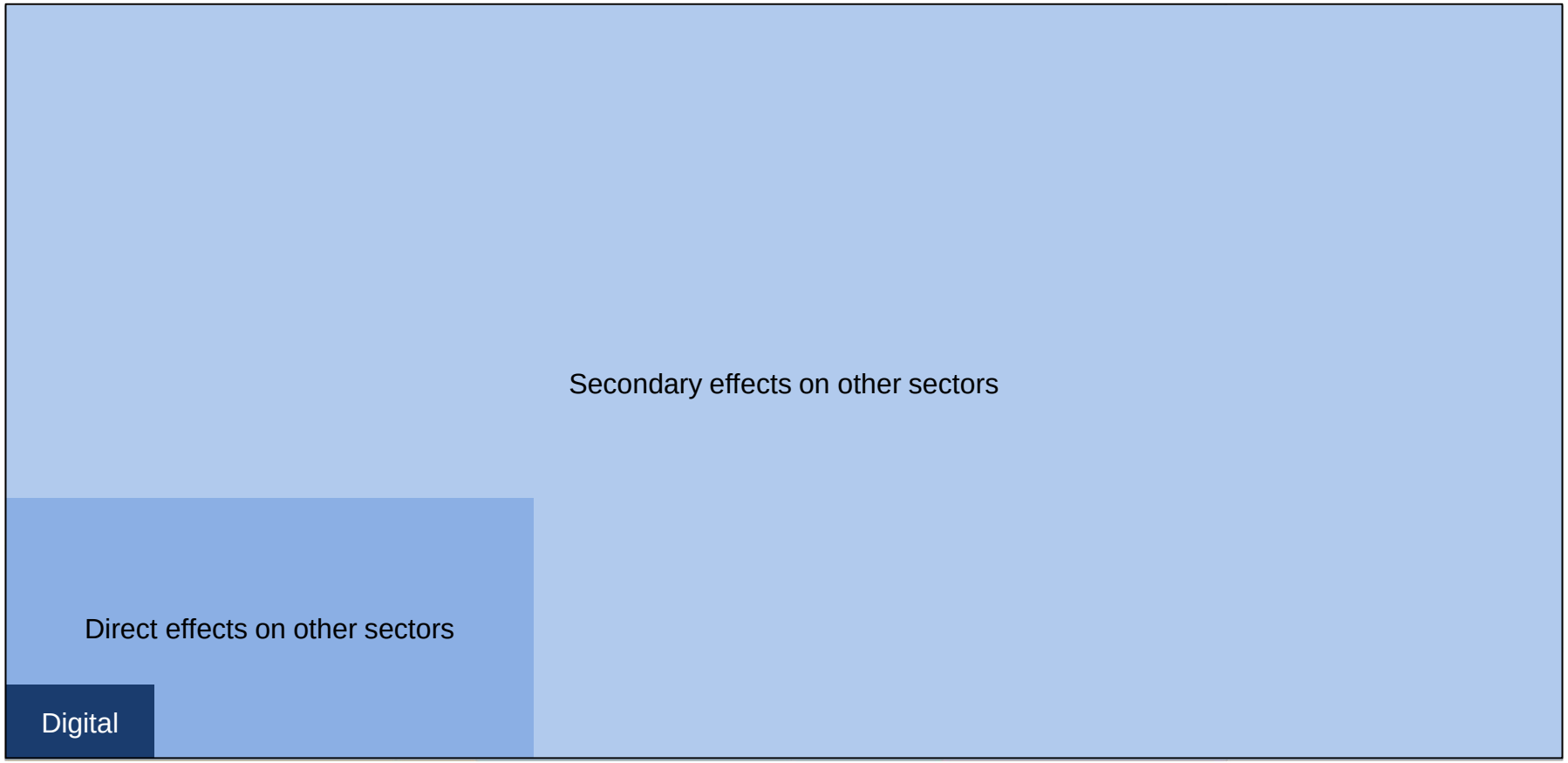
International Energy Agency

Greenhouse gas emissions come from many sectors and sources

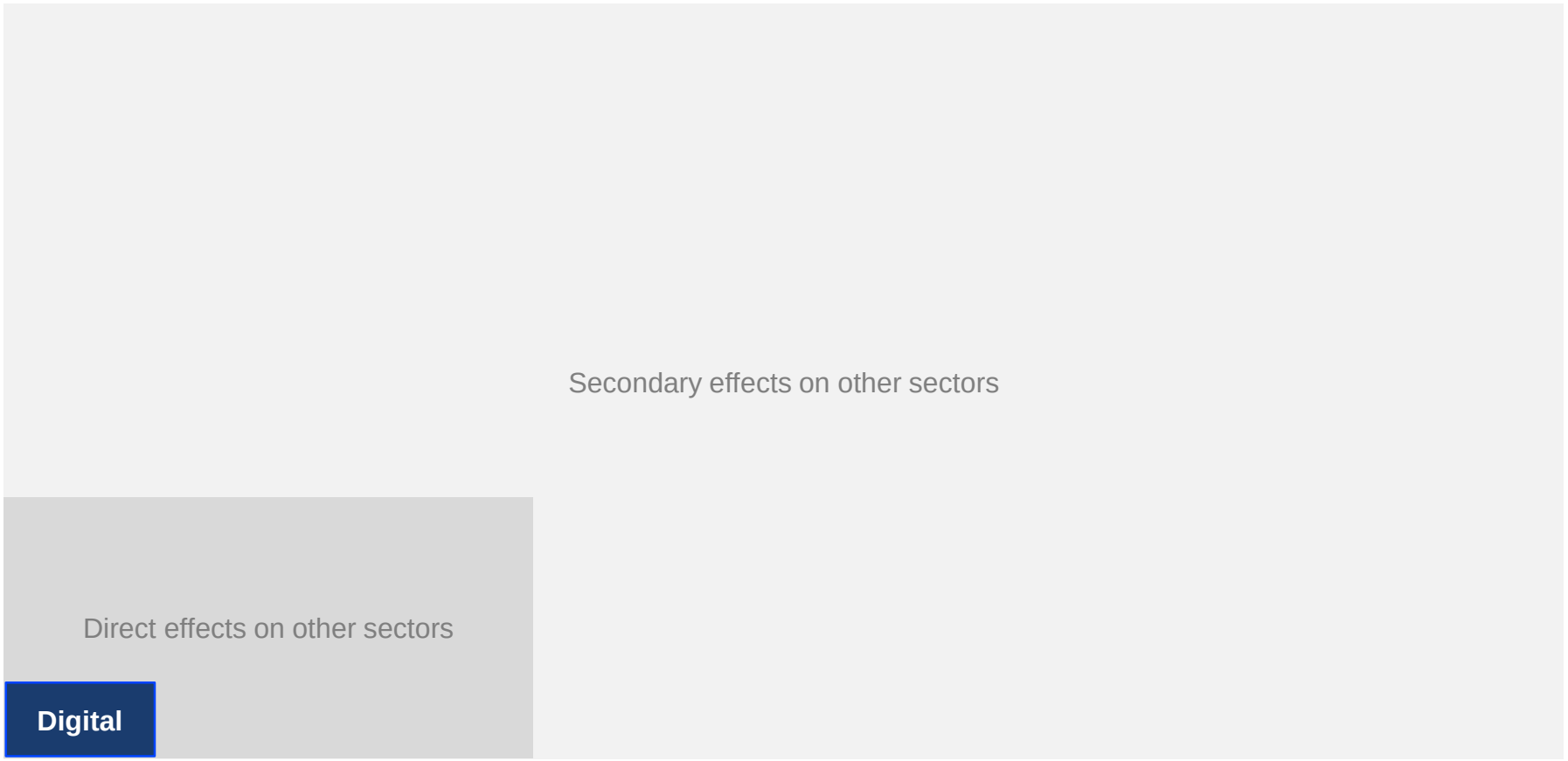


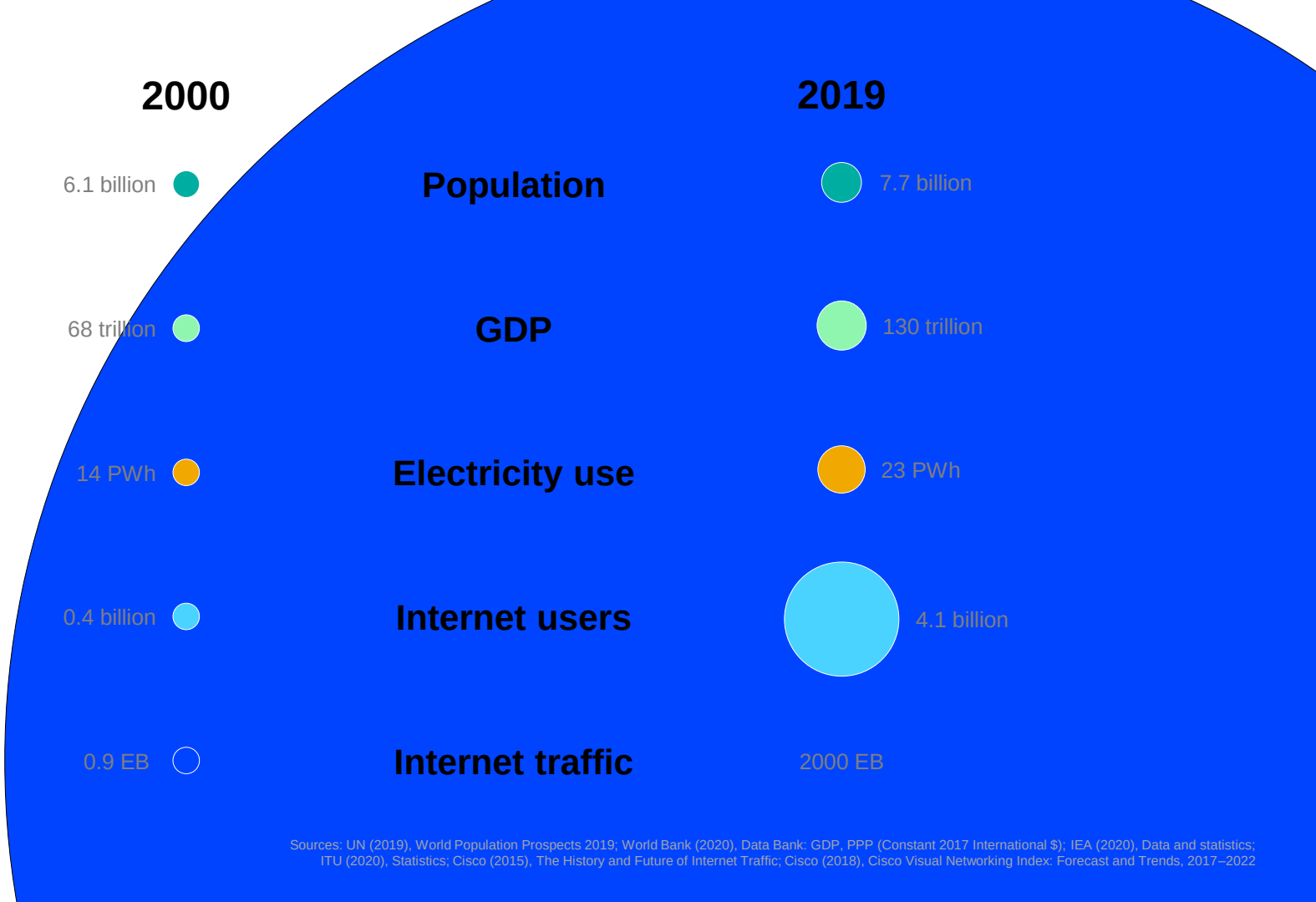
Source: Our World in Data (2020). Emissions by sector. IEA (2020), Energy Technology Perspectives.

Direct and indirect effects of digital technologies



Energy and carbon emissions from digital technologies



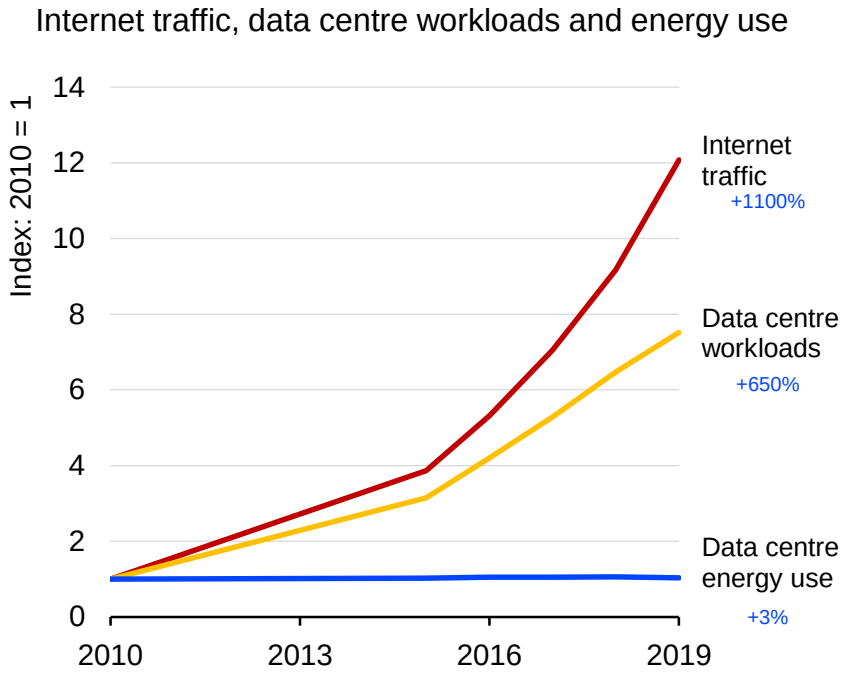


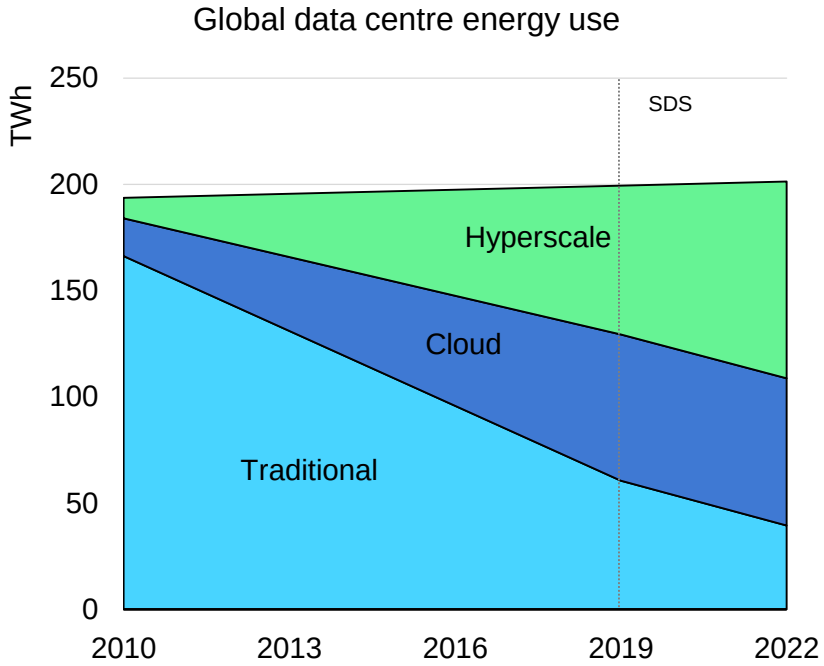
Sources: UN (2019), World Population Prospects 2019; World Bank (2020), Data Bank: GDP, PPP (Constant 2017 International $); IEA (2020), Data and statistics; ITU (2020), Statistics; Cisco (2015), The History and Future of Internet Traffic; Cisco (2018), Cisco Visual Networking Index: Forecast and Trends, 2017–2022

"It's now reasonable to project that half of the electric grid will be powering the digital-Internet economy within the next decade."

Forbes (1999). https://www.forbes.com/forbes/1999/0531/6311070a.html#21a128aa2580.

Data centre energy use



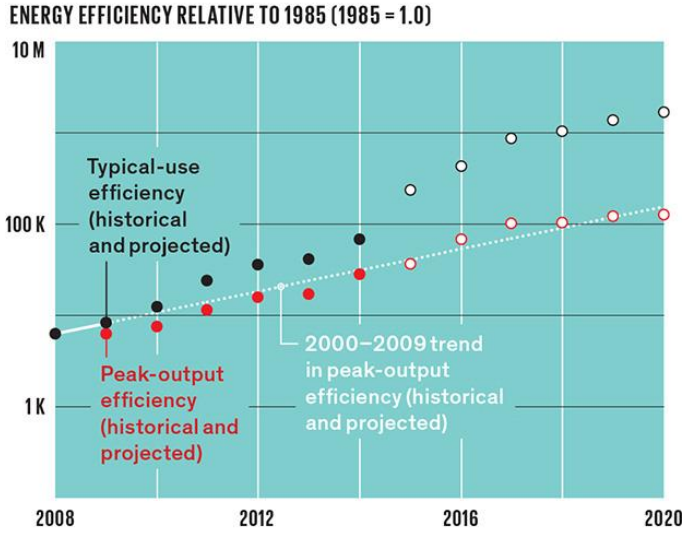


Sources: Masanet et al. (2020). Recalibrating global data center energy-use estimates. IEA (2020). Data centres and data transmission networks; Cisco (2018). Global Cloud Index; Cisco (2019). Visual Networking Index.
SDS = Sustainable Development Scenario

Data centres account for around 1% of global electricity use

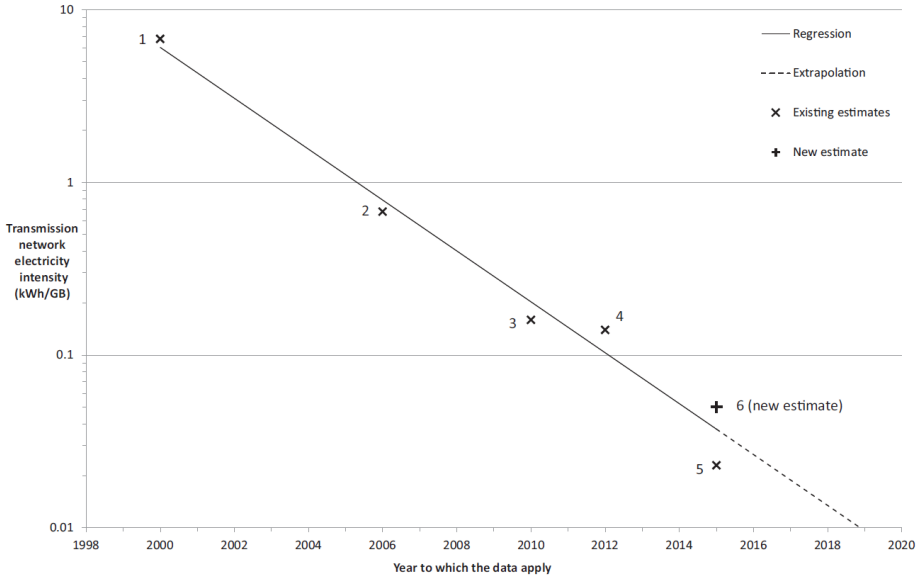
Energy efficiency trends

Computing – “Koomey’s Law”



Koomey & Naffziger (2015), Moore’s Law Might Be Slowing Down, But Not Energy Efficiency.

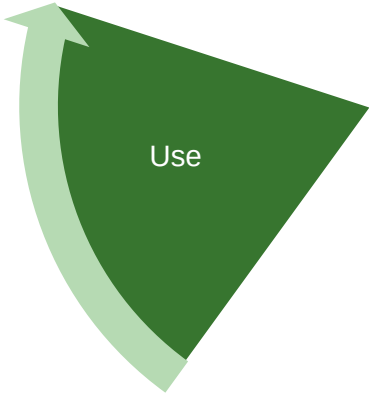
Data transmission

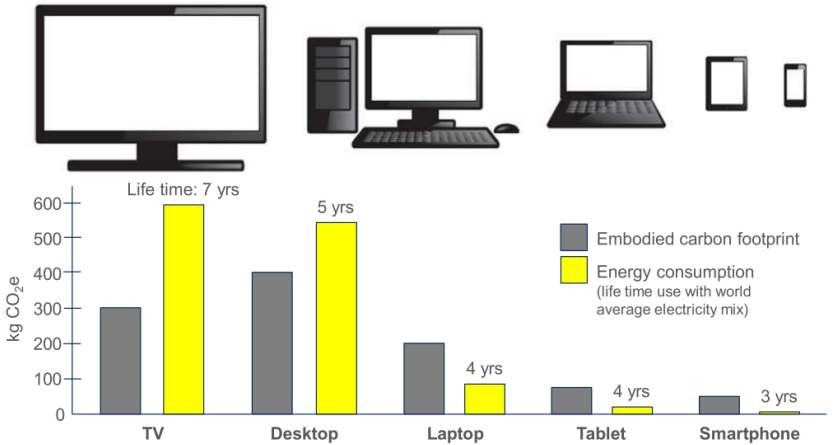


Aslan et al. (2018). Electricity intensity of Internet data transmission: Untangling the estimates.

The energy efficiency of computing and data transmission has doubled every 2-3 years

Impacts throughout the hardware lifecycle



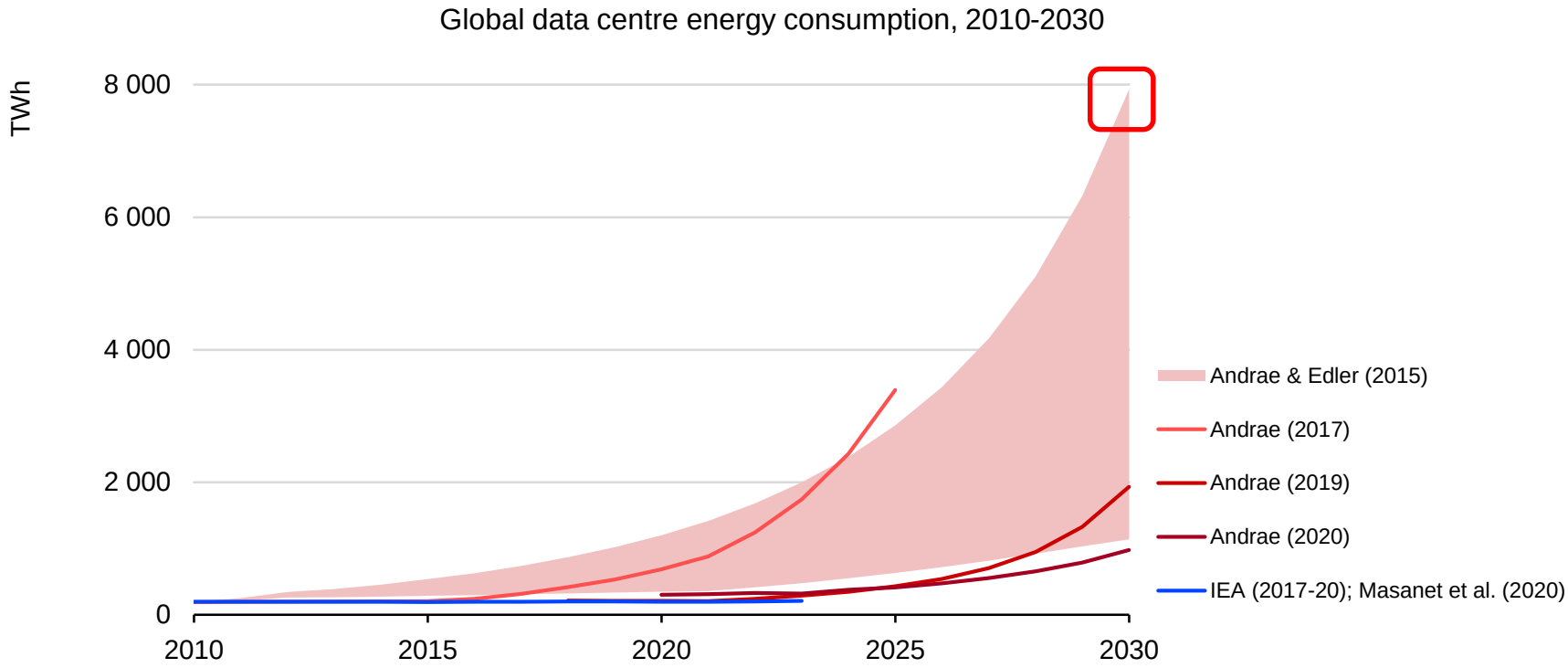


Malmodin & Lunden (2018), The Energy and Carbon Footprint of the Global ICT and E&M Sectors 2010–2015

There are environmental impacts beyond energy use and GHG emissions throughout the product lifecycle, including impacts on soil, air water, biodiversity, and electronic waste.

The Guardian (2017). https://www.theguardian.com/environment/2017/dec/11/tsunami-of-data-could-consume-fifth-global-electricity-by-2025.

Data centres: global energy use estimates



Sources: **Andrae & Edler (2015)**, On Global Electricity Usage of Communication Technology: Trends to 2030 (banded area represents range from "Worst" to "Best"); **Andrae (2017)**, Total Consumer Power Consumption Forecast (Expected scenario shown); **Andrae (2019)**, Projecting the chiaroscuro of the electricity use of communication and computing from 2018 to 2030; **Andrae (2020)**, New perspectives on internet electricity use in 2030; **IEA (2017)**, Digitalization & Energy; **IEA (2020)**, Tracking Clean Energy Progress: Data centres and data transmission networks; **Masanet et al. (2020)**, Recalibrating global data center energy-use estimates.

LIVING

Why climate change activists are coming for your binge watch

By Hannah Sparks

October 28, 2019 | 7:45pm

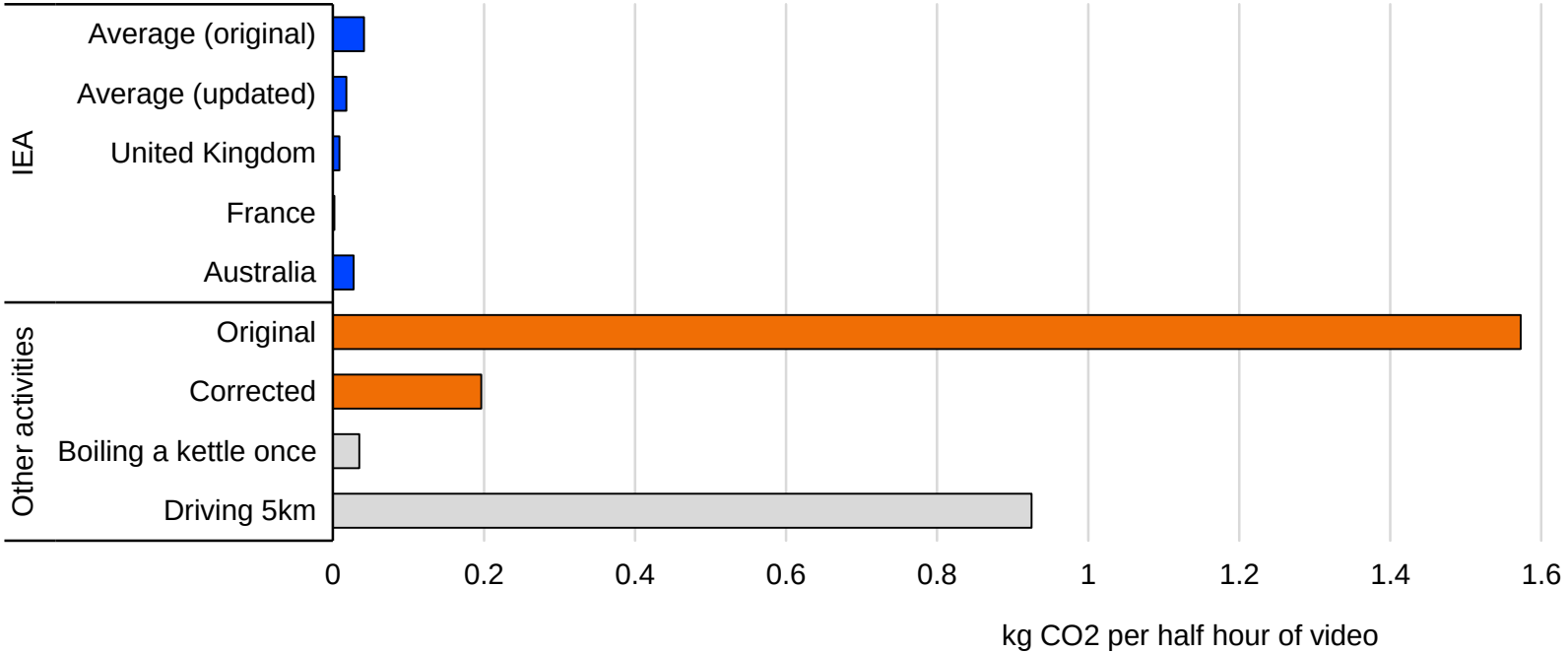
Netflix is having a chilling impact on the environment, a new study finds.

Climate scientists are railing against streaming TV and movie services, which they're calling "a waste of resources at all levels."

Researchers estimate that watching a half-hour show via an on-demand video app emits 1.6 kilograms of carbon dioxide into the environment — the equivalent of driving almost 4 miles, according to Maxime Efoui-Hess of Paris-based nonprofit the Shift Project.

New York Post (2019). https://nypost.com/2019/10/28/why-climate-change-activists-are-coming-for-your-binge-watch/,

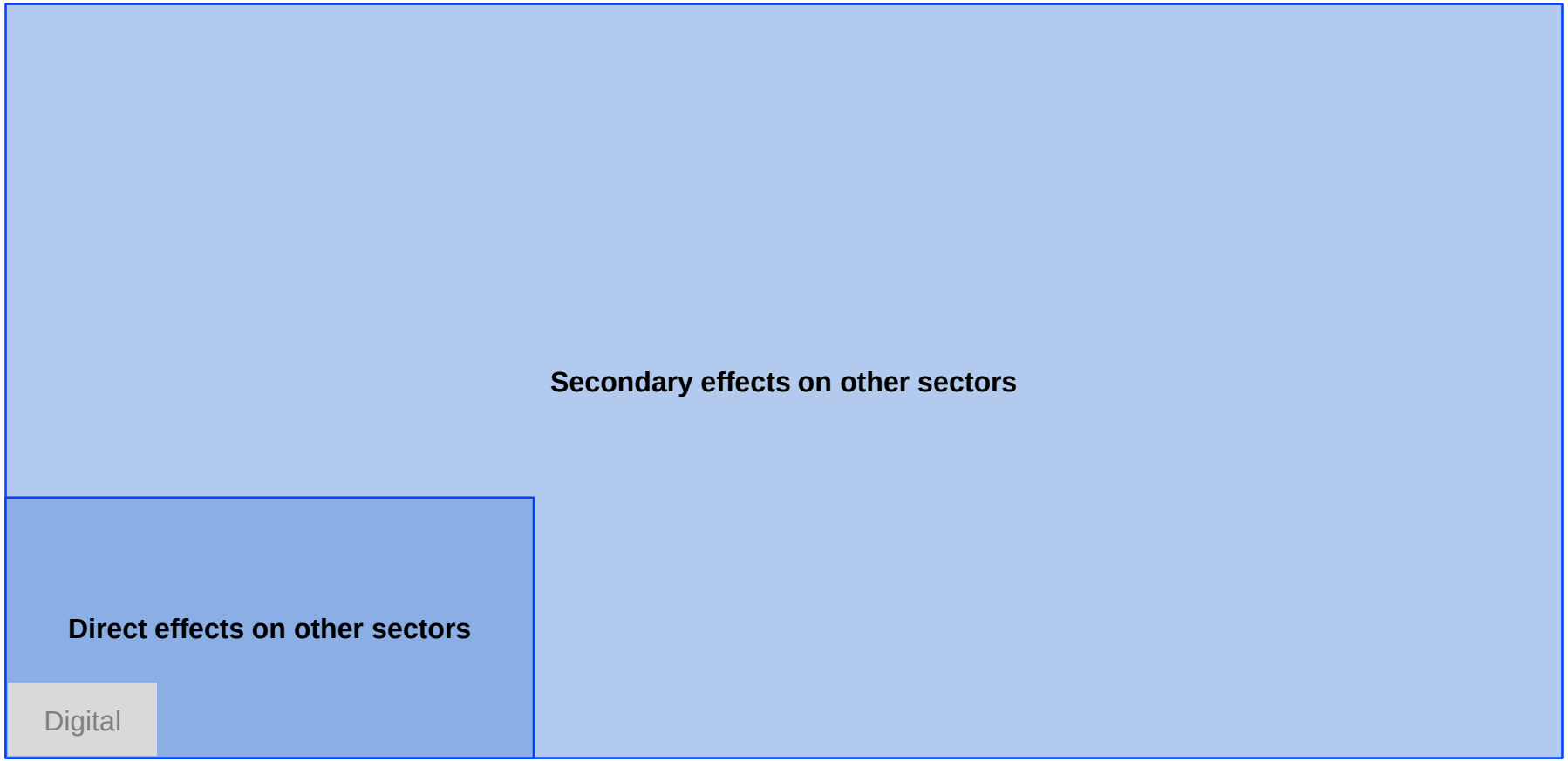
Carbon emissions from streaming video



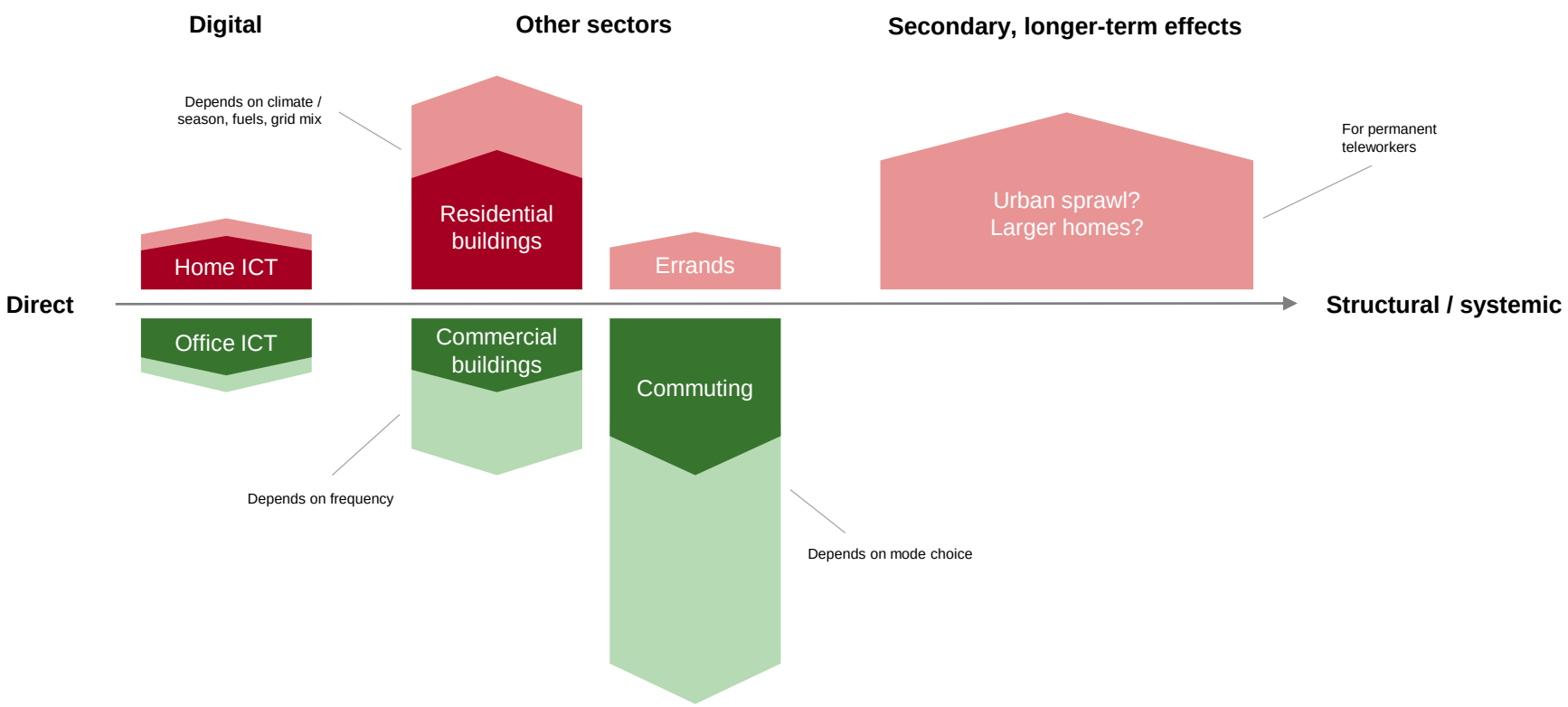
Sources: IEA (2020), The carbon footprint of streaming video: fact-checking the headlines; The Shift Project (2020), Did The Shift Project really overestimate the carbon footprint of online video? Our analysis of the CarbonBrief and IEA articles.

The carbon footprint of streaming video is relatively small, especially in countries with low-carbon electricity

Effects on other sectors



Changes in energy use and emissions from teleworking



Applying digital technologies in the energy sector

- **Buildings:** smart building controls & thermostats; connected appliances & lighting
- **Transport:** shared mobility services; automated & connected vehicles; freight optimisation
- **Industry:** robotics; digital twins; 3D printing; machine learning
- **Electricity:** IoT and automation to improve efficiency and reduce maintenance costs; machine learning to improve solar and wind forecasts, and better match supply and demand from increasingly decentralised sources
- **Oil & gas:** machine learning to reduce costs of detecting methane leaks
- **Policy:** data collection; modelling; assessing policy options and effectiveness

Net impacts on energy use and emissions will be shaped by climate policy

Key takeaways

- Digital technologies have direct and indirect effects on climate change.
- Direct energy use and emissions from digital technologies have been flat over the past decade, thanks to rapid energy efficiency improvements.
- Over the next decade, demand for digital technologies and services is expected to grow rapidly. Limiting emissions growth hinges on energy efficiency (incl. RD&D into next-generation tech), zero-carbon electricity, and decarbonising supply chains.
- The effects of digitalisation on other sectors and activities are potentially much larger than its direct footprint, but these effects are complex and difficult to quantify.
- Strong climate policies are needed to ensure digital technologies are applied to reduce emissions (and not increase them).