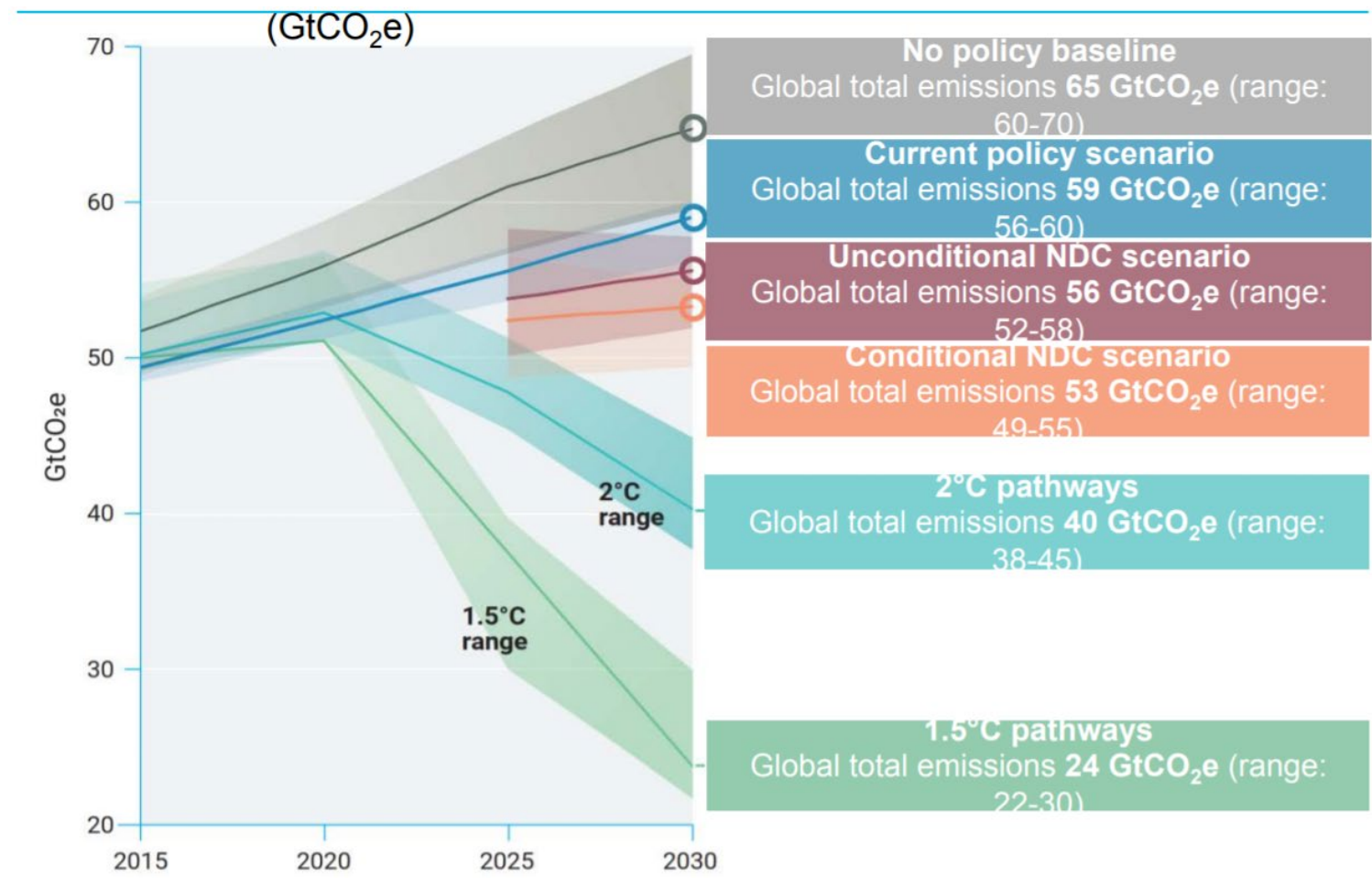


How green is your software?

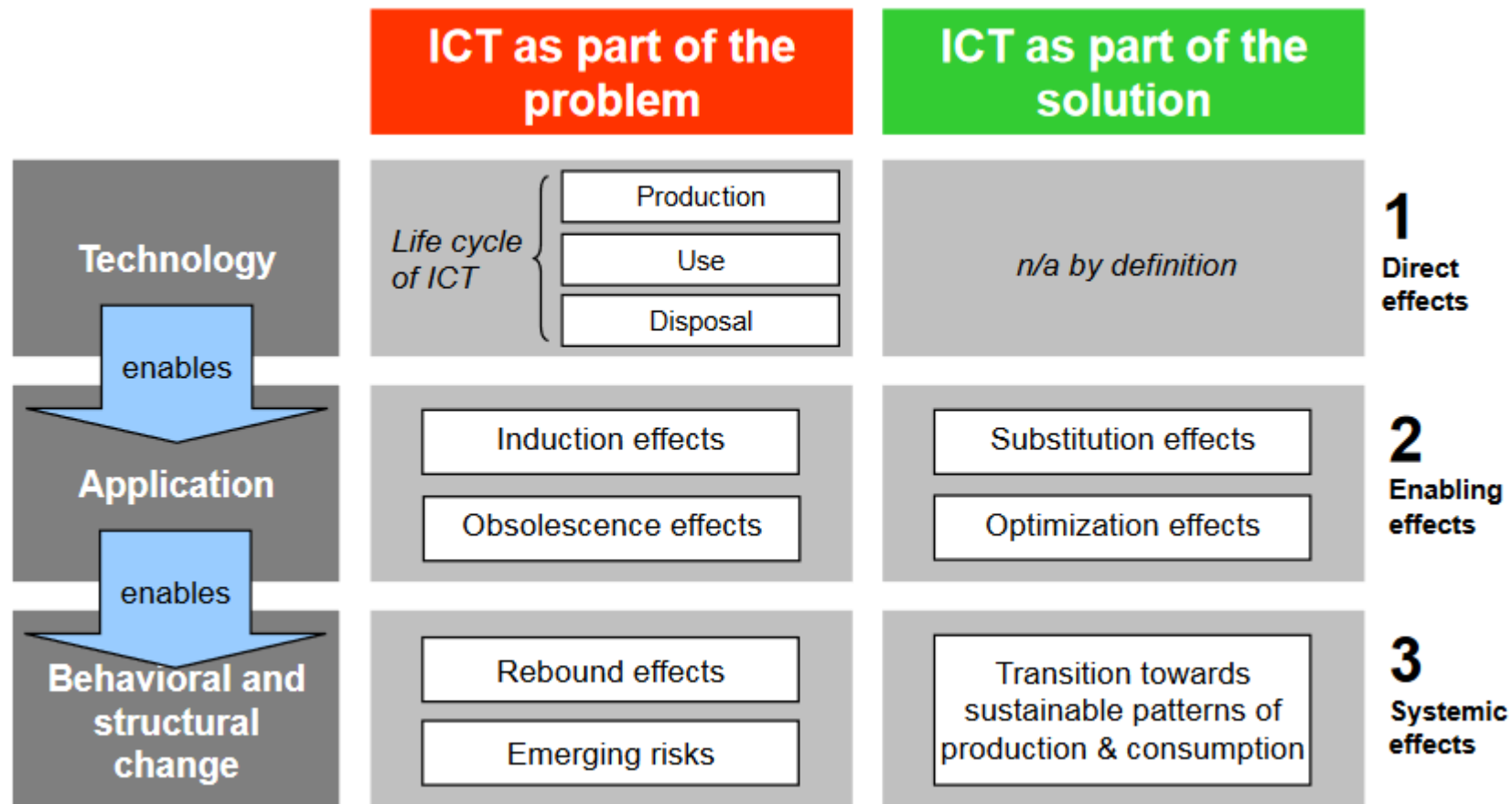
An overview of frameworks and tools

The Paris Agreement and the GHG emissions gap



Source: Emissions Gap Report 2018

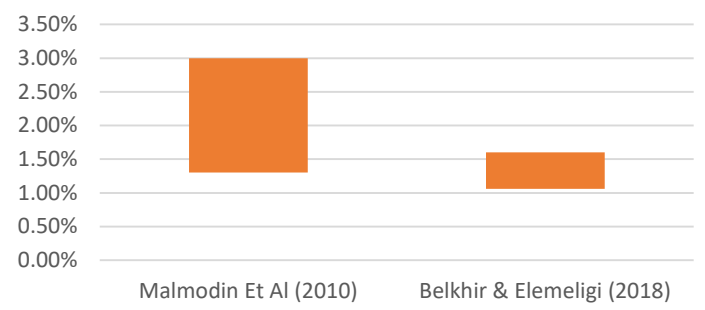
Contribution of the ICT sector



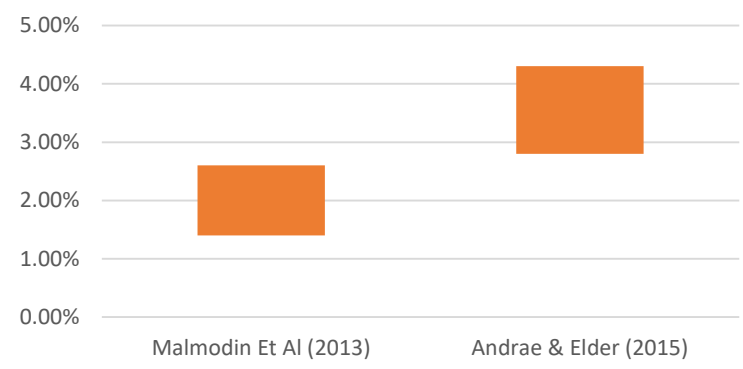
Source: Hilty and Aebischer (2015)

Global GHG emissions in ICT sector

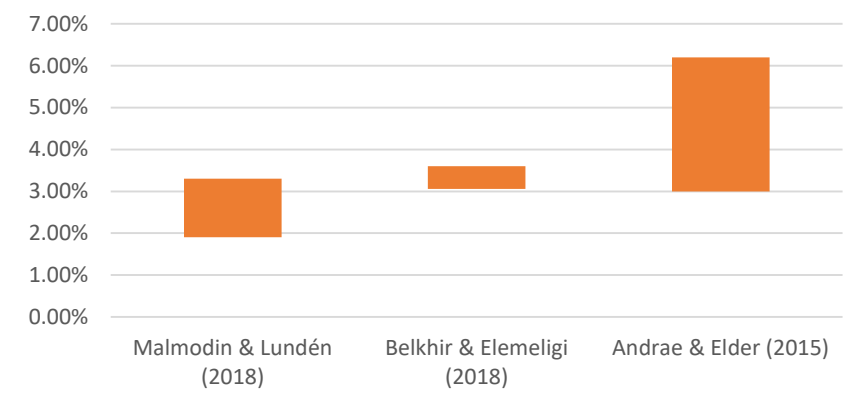
2007 ICT's share off global GHG emissions



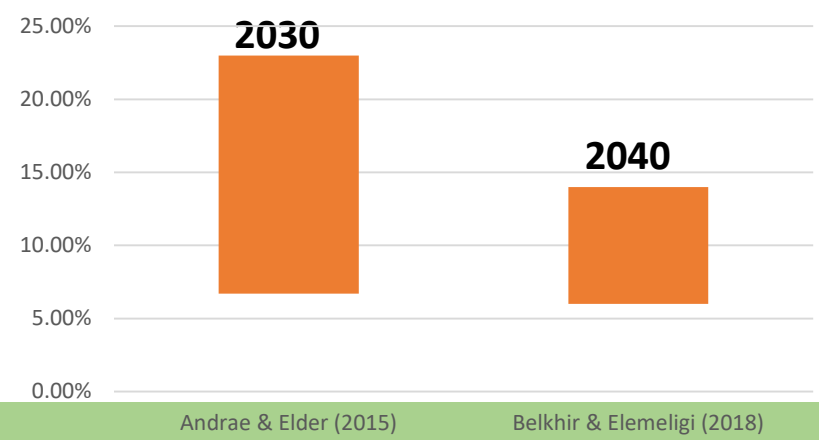
2015 ICT's share off global GHG emissions



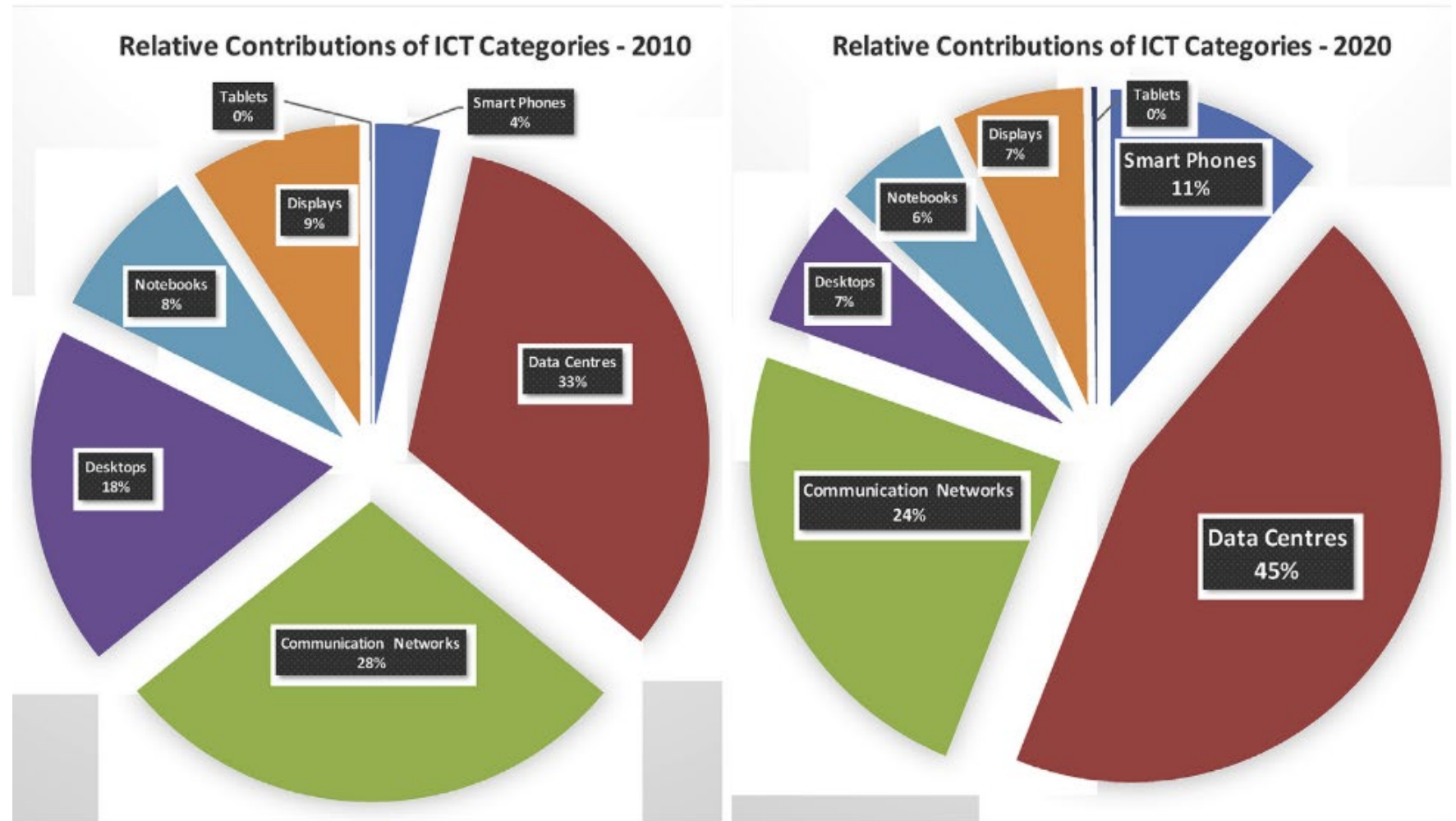
2020 ICT's share off global GHG emissions



ICT's share off global GHG emissions

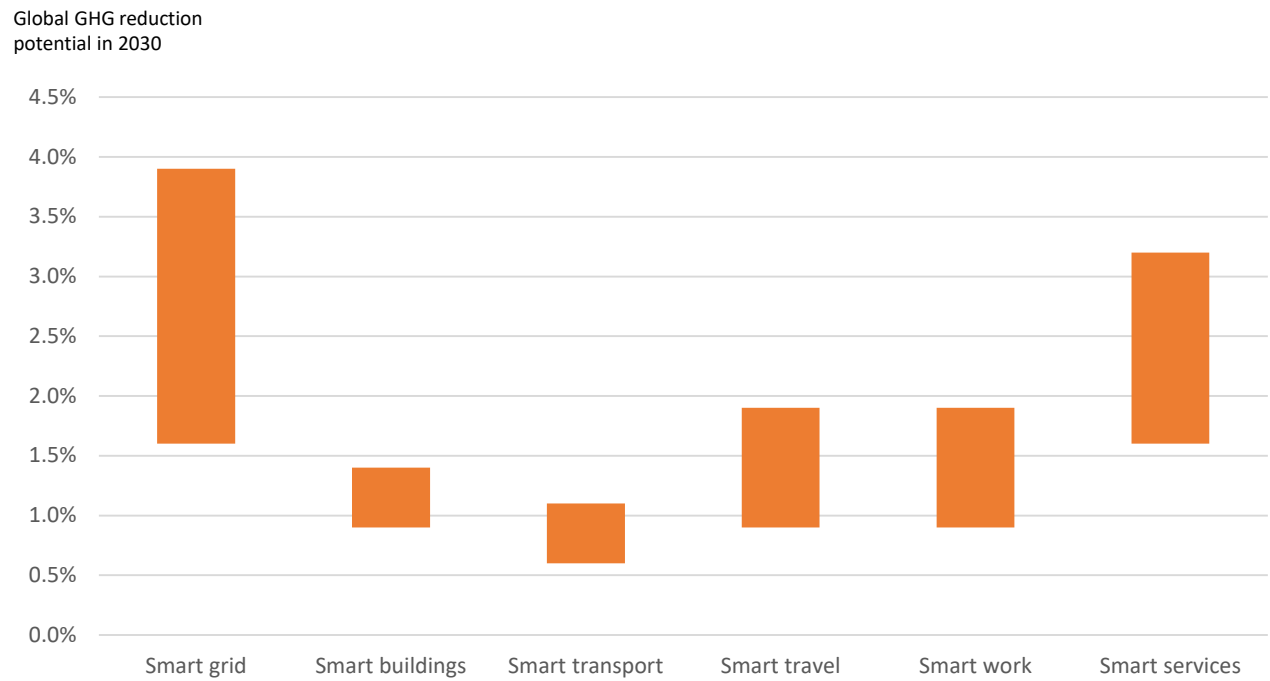


Relative contribution of ICT categories



Source: Belkhir and Elmeligi (2018)

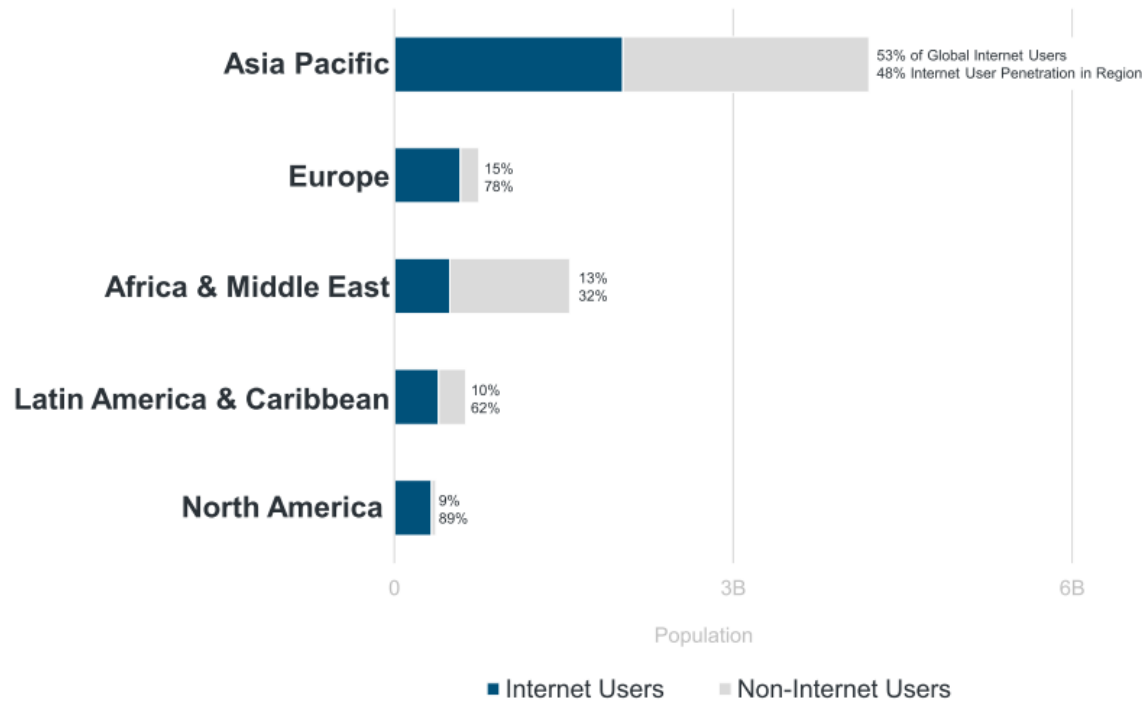
Global GHG emission reduction potentials by ICT solutions in 2030



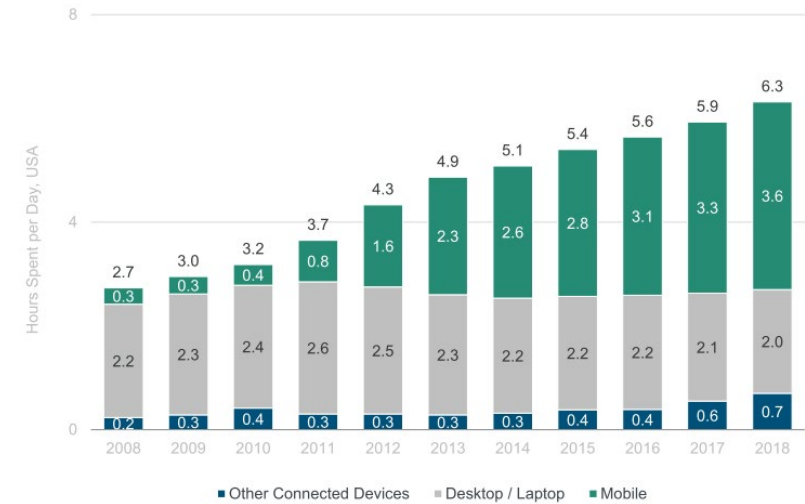
Based on data from Malmodin and Bergmark (2015)

The trends in use of ICT

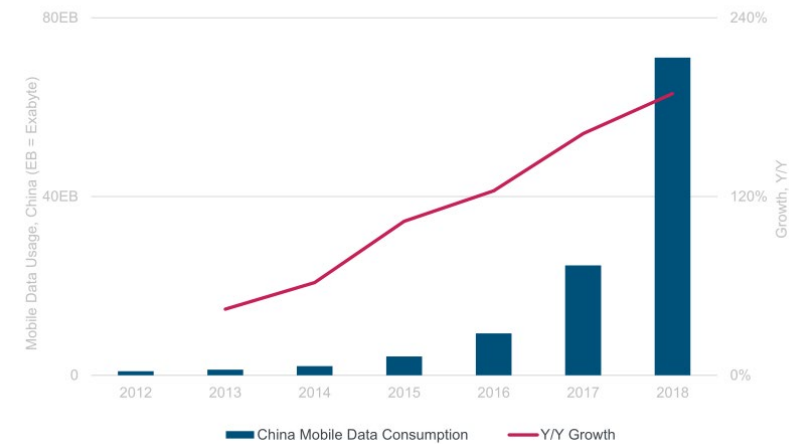
Internet Users by Region, 2018



Daily Hours Spent with Digital Media per Adult User, USA



China Cellular Internet Data Usage & Growth Y/Y



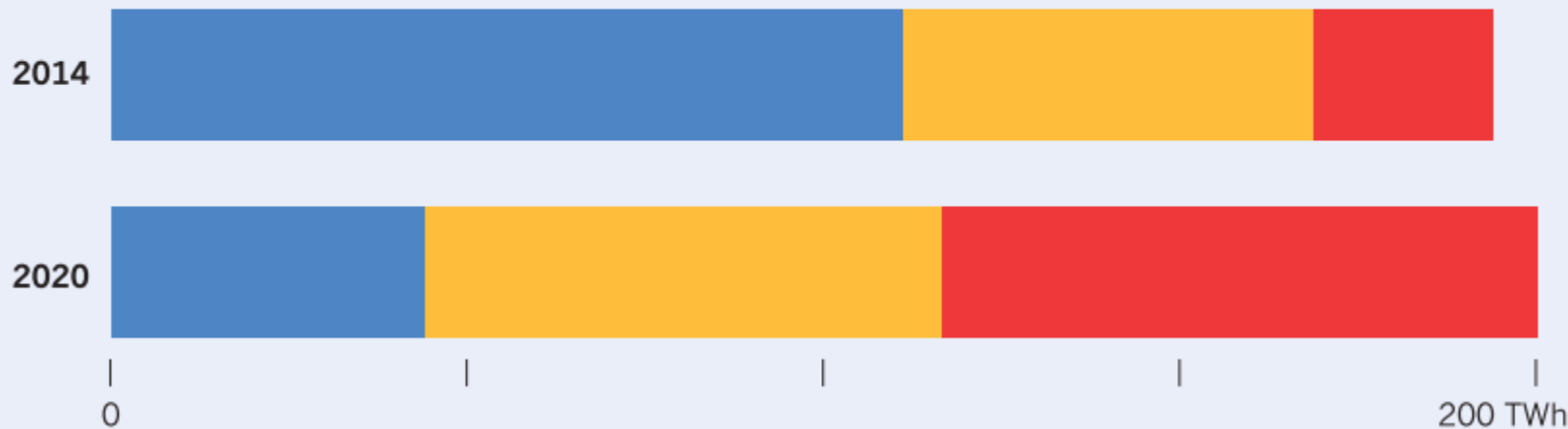
Source: Internet Trends (2019)

Trends: data centres' increased efficiency

HYPERSCALE SHIFT

Efficient 'hyperscale' data centres are predicted to swallow up half of data-centre electricity demand by 2020, as smaller, less-efficient centres shut down.

■ Traditional data centres ■ Cloud data centres (non-hyperscale) ■ Hyperscale data centres

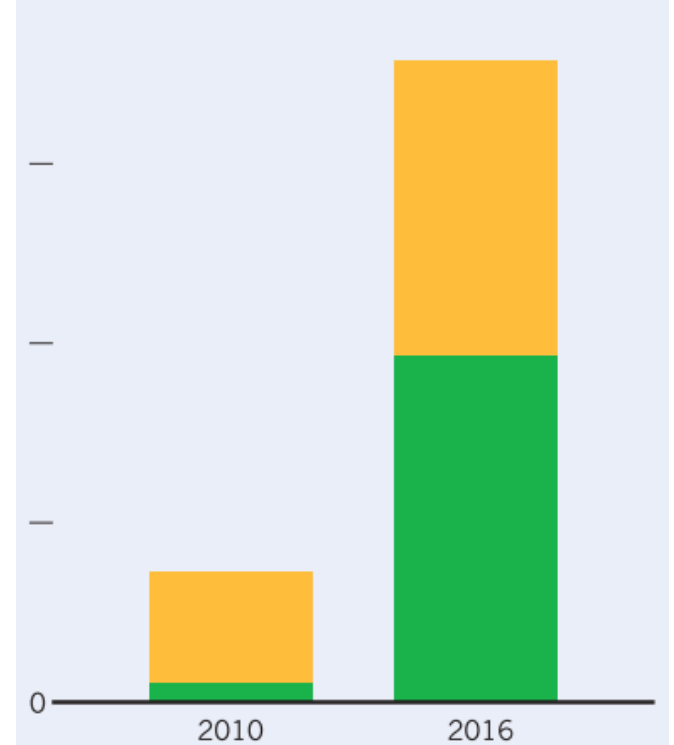


GREEN GROWTH

The ICT industry dominates corporate agreements to purchase renewable electricity.

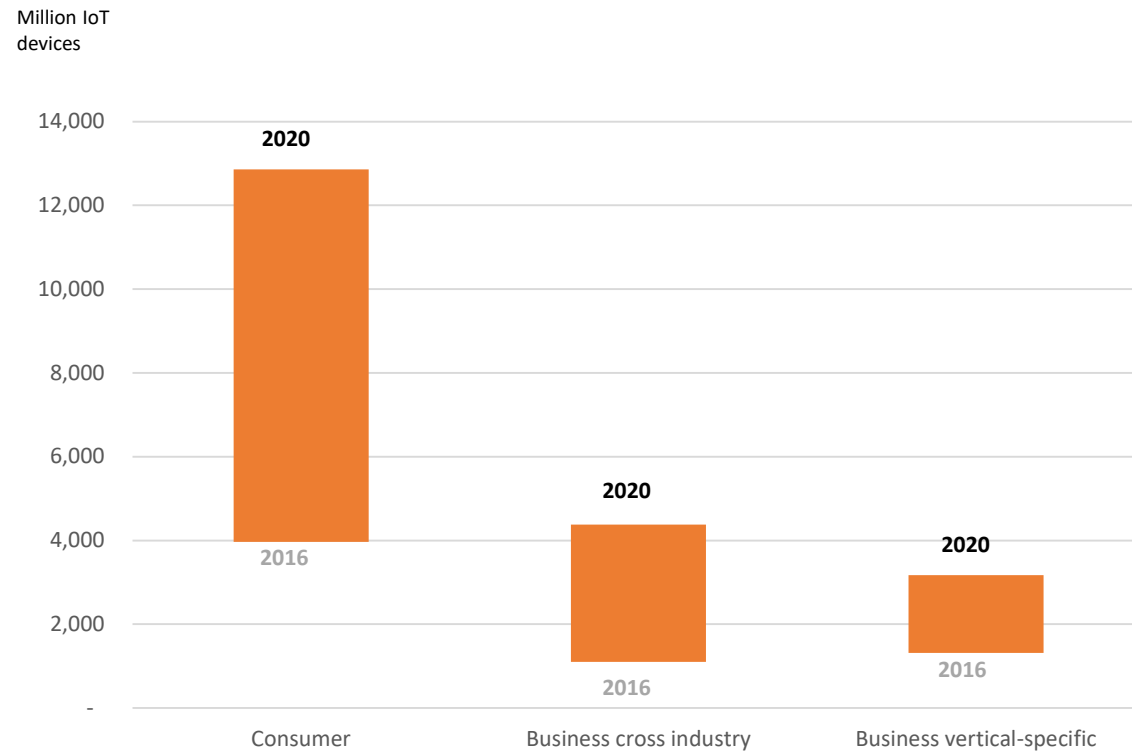
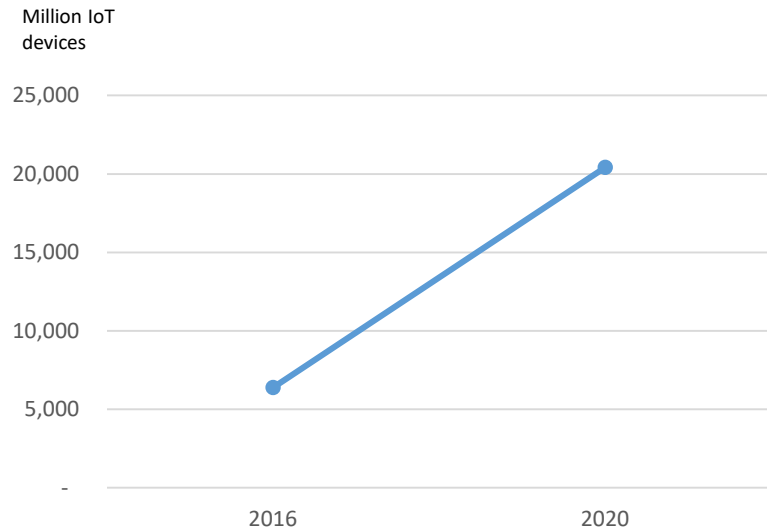
■ ICT ■ Other

4 gigawatts



Source: Jones (2018)

Trends in connected IoT devices



Source: Gartner (2017)

The trends in applications of ICT sector: IoT

Priority Matrix for the Internet of Things, 2019

benefit	years to mainstream adoption			
	less than 2 years	2 to 5 years	5 to 10 years	more than 10 years
transformational		Digital Business Technology Platform Edge AI Event Stream Processing	Blockchain and IoT Digital Twin Infonomics Internet of Things IoT Business Solutions IoT-Enabled Applications IoT-Enabled Product as a Service	Autonomous Vehicles
high	Indoor Location for Assets	Edge Analytics Event Broker PaaS (ebPaaS) IoT Edge Architecture IoT Integration IT/OT Alignment MDM of "Thing" Data	Asset Performance Management Building Information Modeling Indoor Location for People Internet of Meat IoT Platform IoT Security IoT Services	
moderate		Managed IoT Connectivity Services		
low				

As of July 2019

Source: Gartner
ID: 369467

Source: Gartner (2019)

The trends in applications of ICT sector: smart cities

Priority Matrix for Smart City Technologies and Solutions, 2019

benefit	years to mainstream adoption			
	less than 2 years	2 to 5 years	5 to 10 years	more than 10 years
transformational		Blockchain Chatbots Smart City Framework	Blockchain Business Models City Operations Center Data Marketplace Distributed Generation Greenfield Smart City Framework Smart Building Sustainability and COP 21 Vehicle-to-Vehicle Communications	Artificial General Intelligence Autonomous Driving Level 5 Circular Economy
high	Smart Lighting	5G Civic and Community Development Smart City Transportation Strategy Water Management	Building Information Modeling Connected Home Digital Ethics IoT Platform Microgrids	
moderate		Data for Good Micromobility	Energy Water Nexus	
low				

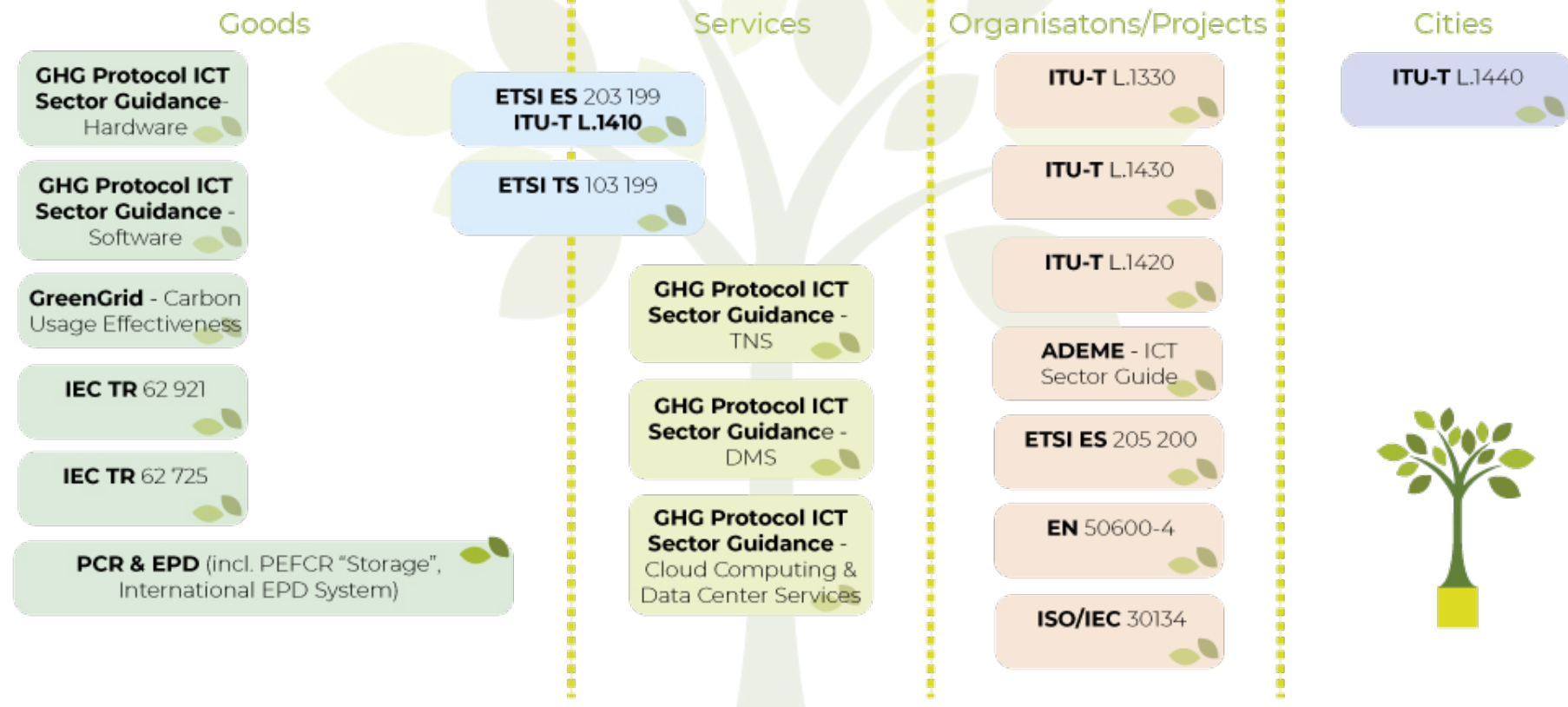
As of August 2019

Source: Gartner
ID: 370301

Source: Gartner (2019)

Methodologies for carbon footprinting in ICT sector

Map of ICT Methodologies



Source: ICTfootprint.eu (2019)

Tools for measuring carbon impacts

Commercial or Free	Name of the tool	Objective	More about the tool
Free	Ecoindex	Measure the carbon footprint of websites	www.ecoindex.fr
Free	Self-assessment tool	To obtain the approx. climate change and primary energy footprint of an ICT-based organization	www.ictfootprint.eu
Commercial	CO2 neutral website	Calculate CO2 emissions from website and reduce a similar amount of CO2 through climate projects	www.co2neutralwebsite.com
Commercial	CAST Green IT index	Measure software's environmental effect based on how efficiently it carry out intended actions, and how robust it is	www.castsoftware.com
Commercial	Greenspector	Performance measuring tool for mobile apps	www.greenspector.com
Commercial	Ecochain	Activity-based footprinting at the product, company, and value chain level	www.ecochain.com

Key takeaways

- Trends in ICT sector potentially turn the sector into a significant contributor to global GHG emissions
- A call for optimizing the ICT sector for energy efficiency - UN Environment's United for Efficiency
- A call for more estimates of the GHG impacts of ICT devices and solutions, with open, transparent data
- A call for prioritizing sustainable human-computer interaction: "sustainability through design", and "sustainability in design"

Thank you!

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