



Greenhouse gas emissions in the ICT sector

Trends and methodologies





What is the ICT sector?

ICT = information and communication technology





Computing devices



Data centres



Communication networks



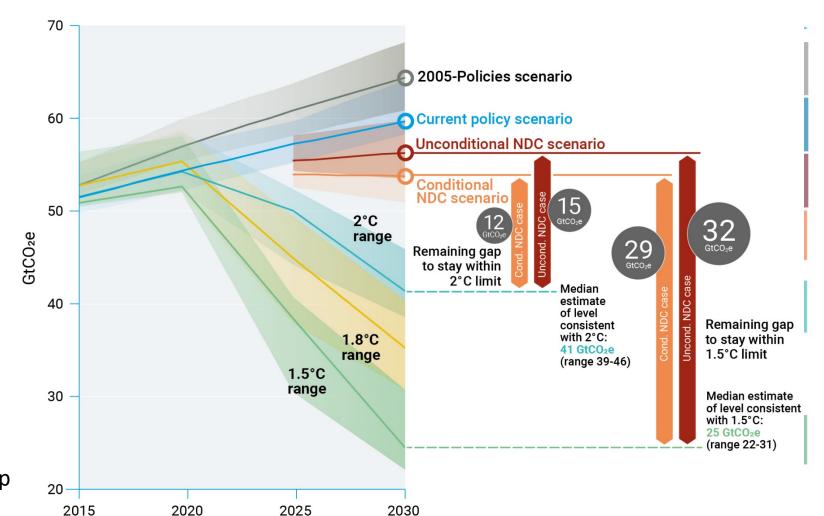


Equipment for entertainment and media





The Paris Agreement and the GHG emissions gap

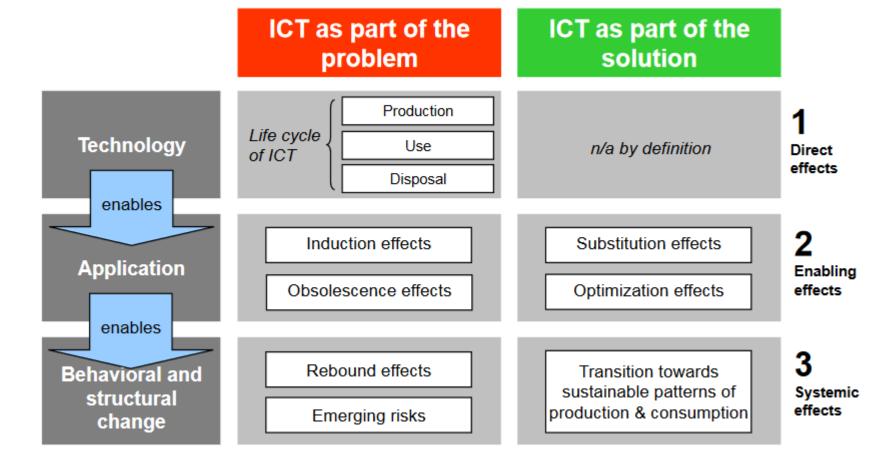


Source: Emissions Gap Report 2019





Contribution of the ICT sector



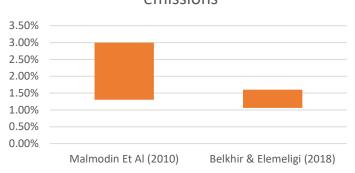
Source: Hilty and Aebischer (2015)



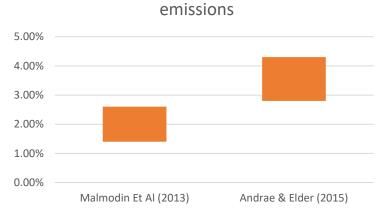


Global GHG emissions in ICT sector

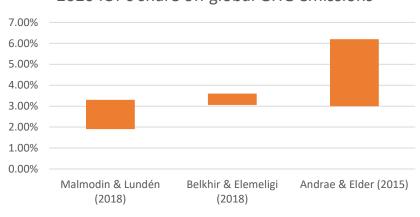
2007 ICT's share off global GHG emissions



2015 ICT's share off global GHG



2020 ICT's share off global GHG emissions



ICT's share off global GHG emissions

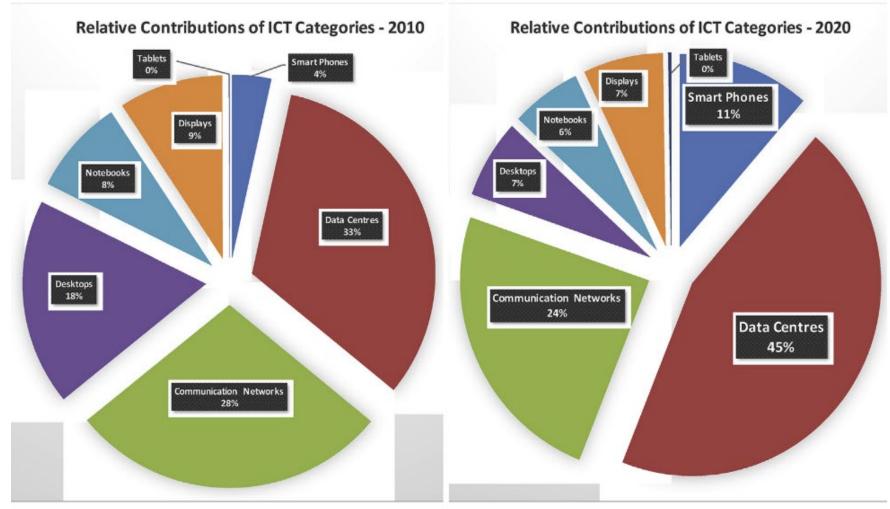


Andrae & Elder (2015) Belkhir & Elemeligi (2018)





Relative contribution of ICT categories

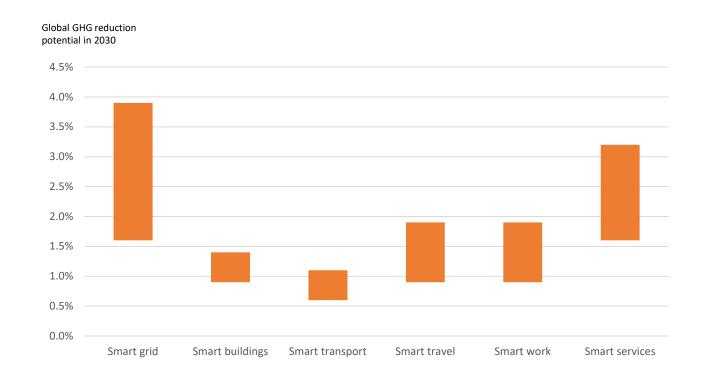


Source: Belkhir and Elmeligi (2018)





Global GHG emission reduction potentials by ICT solutions in 2030



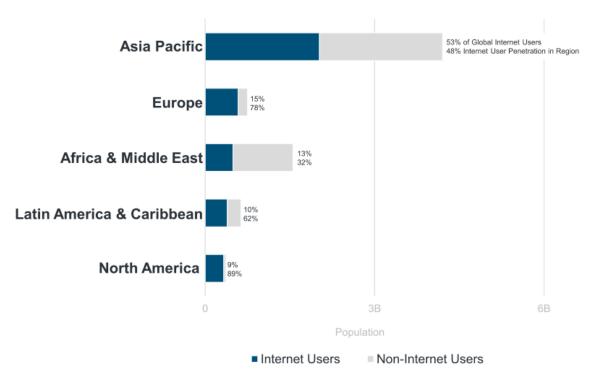
Based on data from Malmodin and Bergmark (2015)





The trends in use of ICT

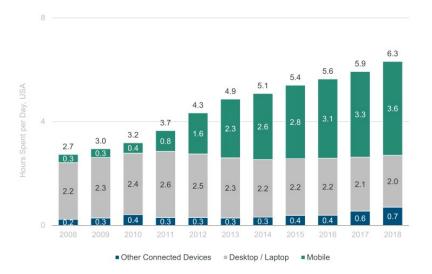
Internet Users by Region, 2018



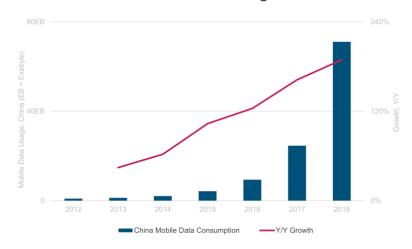
Source: Internet Trends

(2019)

Daily Hours Spent with Digital Media per Adult User, USA



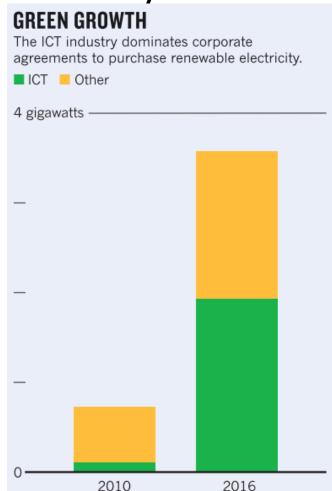
China Cellular Internet Data Usage & Growth Y/Y







Trends: data centres' increased efficiency

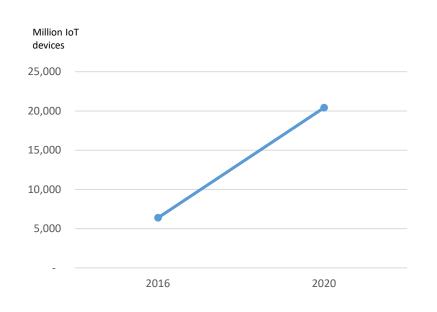


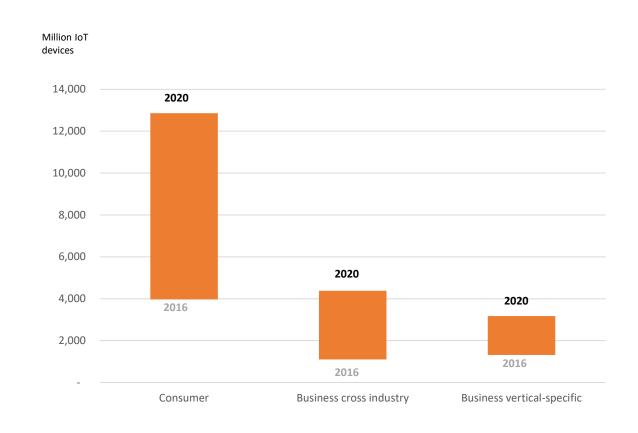
Source: Jones (2018)





Trends in connected IoT devices





Source: Gartner (2017)





The trends in applications of ICT sector: IoT

| ss than 2 years | 2 to 5 years Digital Business Technology Platform Edge Al Event Stream Processing | 5 to 10 years Blockchain and IoT Digital Twin Infonomics Internet of Things | more than 10 years Autonomous Vehicles |
|-------------------------------|---|---|---|
| | Technology Platform Edge Al Event Stream | Digital Twin Infonomics | Autonomous Vehicles |
| | | loT Business Solutions loT-Enabled Applications loT-Enabled Product as a Service | |
| 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 | |
| | Managed IoT Connectivity Services | | |
| | | | |
| | | Event Broker PaaS (ebPaaS) IoT Edge Architecture IoT Integration IT/OT Alignment MDM of "Thing" Data | Event Broker PaaS (ebPaaS) IoT Edge Architecture IoT Integration IT/OT Alignment IMDM of "Thing" Data Event Broker PaaS (ebPaaS) Building Information Modeling Indoor Location for People Internet of Meat IoT Platform IoT Security IoT Services Managed IoT |

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 | | | | | | |

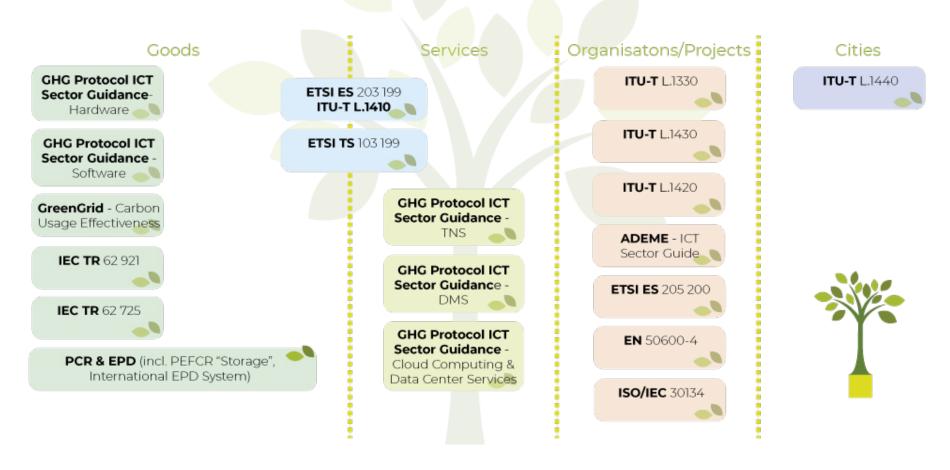
Source: Gartner (2019)





Methodologies for carbon foot-printing 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 ICT solutions, with open, transparent data
- A call for prioritizing sustainable human-computer interaction: "sustainability through design", and "sustainability in design"





Thank you!

