

French Telecoms Economics 2020

Final report
December 2020

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01 A steady growth of the global digital ecosystem driven by American and Asian players

02 Telecom players, driving force in the Digital ecosystem in France and supporting the fourth industrial and technological revolution

03 Investments in telecom infrastructures essentials during COVID outbreak

04 Telecom strongly contributing to environmental challenges:
France must choose its model for a sustainable digital ecosystem

French Telecoms Economics 2020

01 A steady growth of the global digital ecosystem driven by American and Asian players

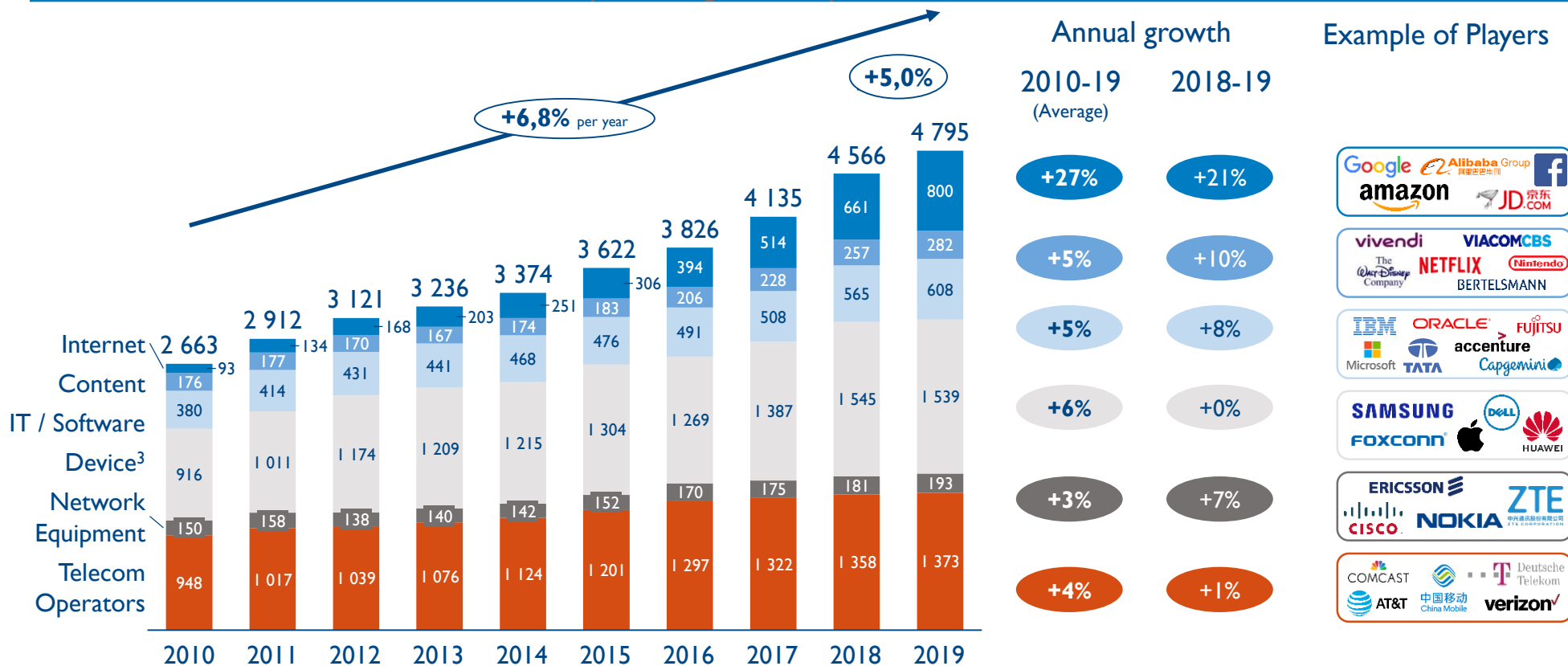
02 Telecom players, driving force of the Digital ecosystem in France and supporting the fourth industrial and technological revolution

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04 Telecom strongly contributing to environmental challenges
France must choose its model for a sustainable digital ecosystem

A digital ecosystem becoming more mature and still fast growing

Revenues from the digital ecosystem
World, based on top 180 digital companies¹ 2010-2019, billion euros²



Source: Thomson Reuters Eikon, Arthur D. Little Analysis

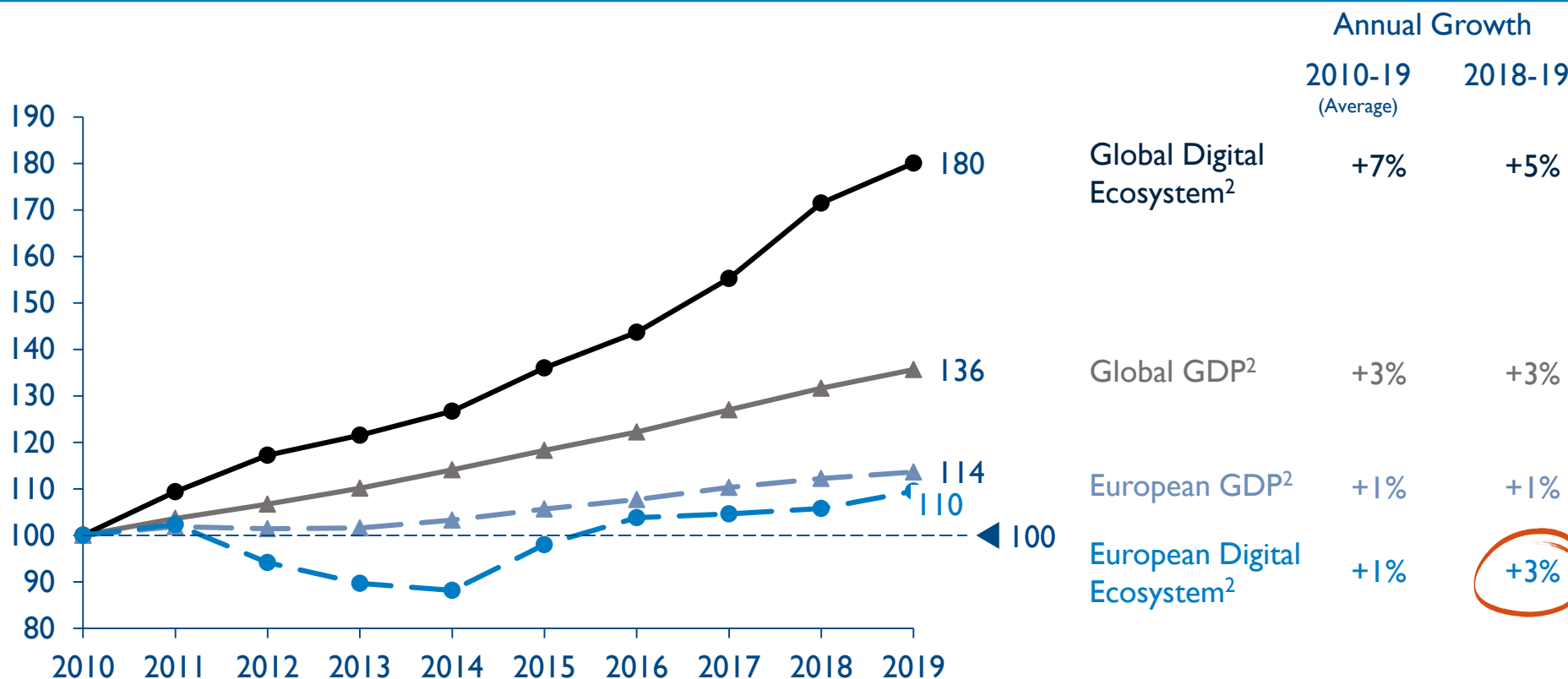
Notes: 1) Panel of 180 companies: By sector, selection of the top 30 companies in 2019 by their turnover, 2) Constant 2019 Euros.

3) As Huawei is not listed, revenues were added to the panel of 180 companies in the sample; Huawei is classified as a "Device" player, this category representing 55% of its revenues in 2019

A European digital ecosystem now growing faster than GDP

Digital ecosystem revenue growth¹ vs. the economy

World, 2010-2019, base 100 in 2010

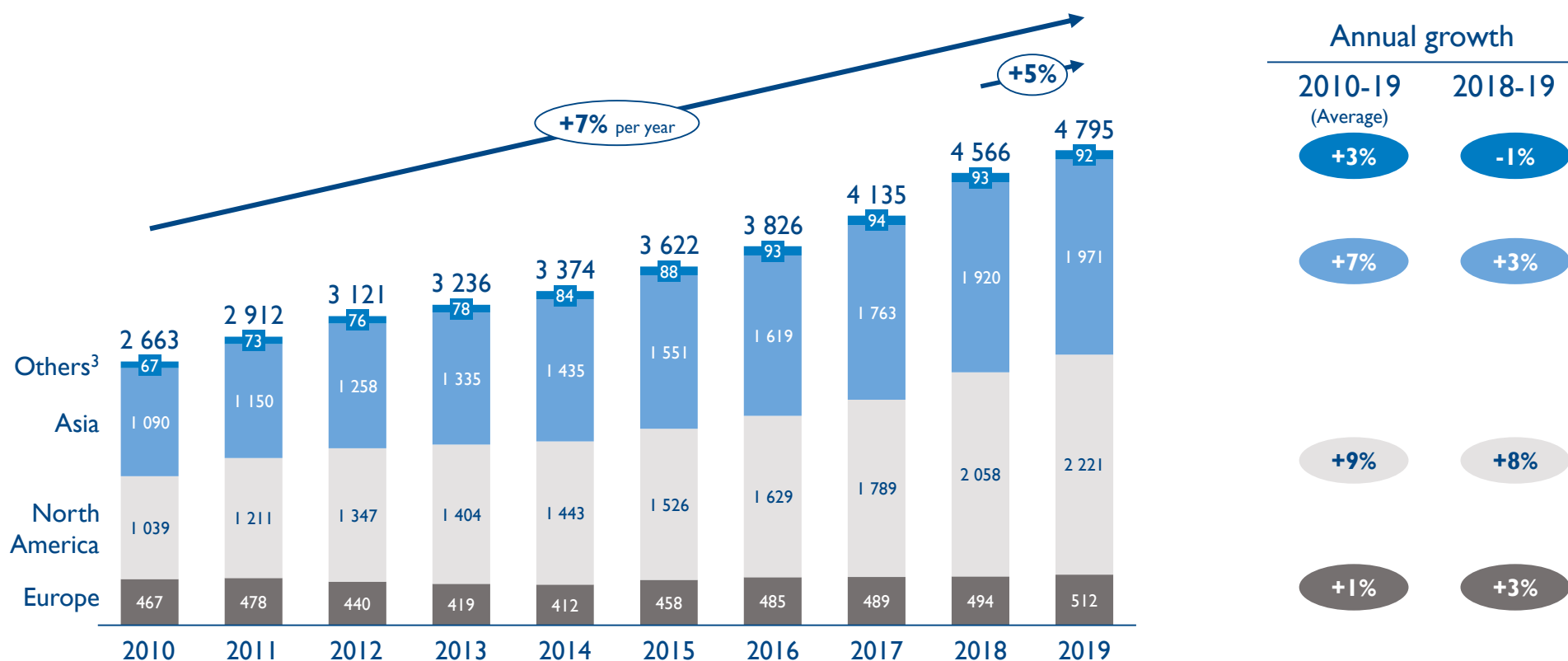


Source: Thomson Reuters Eikon, World Bank, Arthur D. Little Analysis

Notes: 1) Panel of 180 companies: By sector, selection of the top 30 companies in 2019 by their sales in 2019, 2) In constant 2019 euros, within the perimeter of the countries considered in the digital ecosystem (representing 75% of world GDP, or 70% of European GDP for European data).

European digital players still lagging behind American and Asian champions

Digital ecosystem revenues¹
World, 2010-2019, billion euros²



Source: Thomson Reuters Eikon, Arthur D. Little Analysis

Notes: 1) Panel of 180 companies: By sector, selection of the top 30 companies in 2019 by turnover, 2) Constant 2019 Euros, 3) Includes the top 30 companies outside Asia, North America and Europe (only Oceania, Middle East, Africa and South America).

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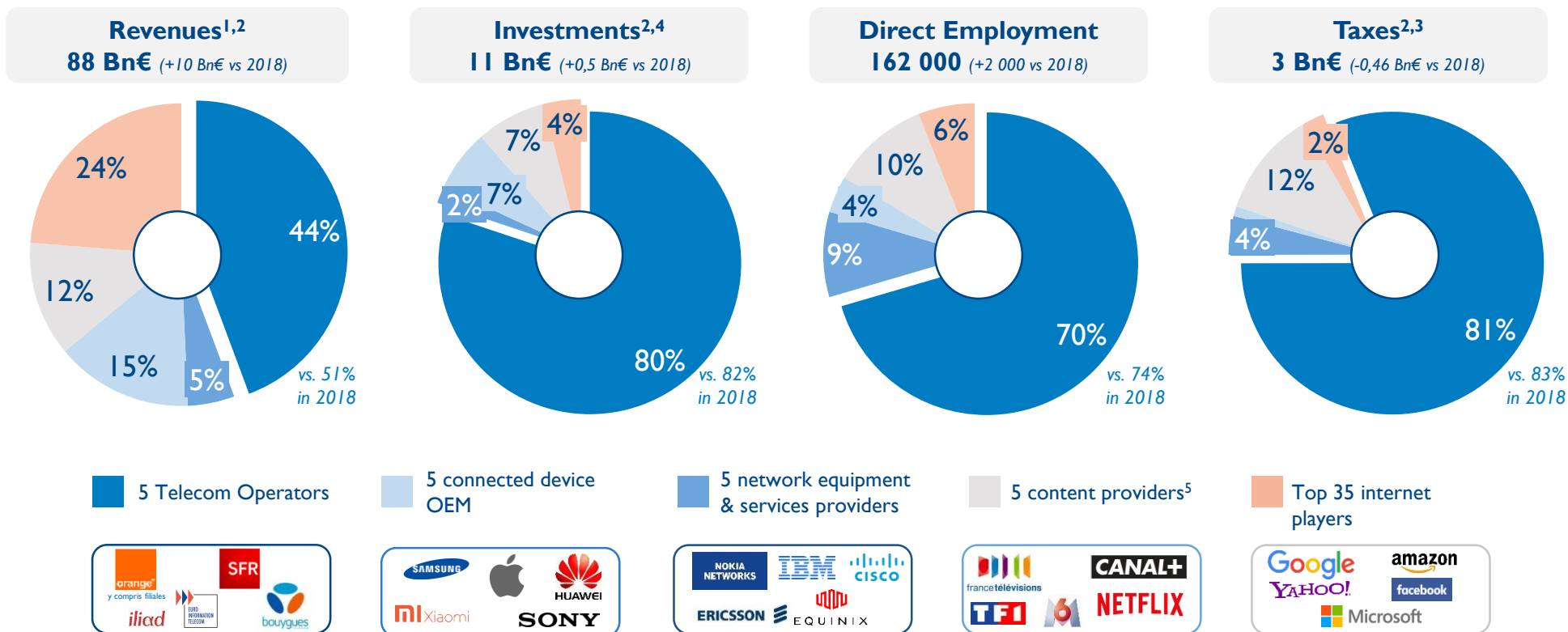
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Telecom players, driving force of the Digital ecosystem in France

Contribution of main players to the French Digital Ecosystem

France, 2019 (vs. 2018) – based on a selection of largest players by category



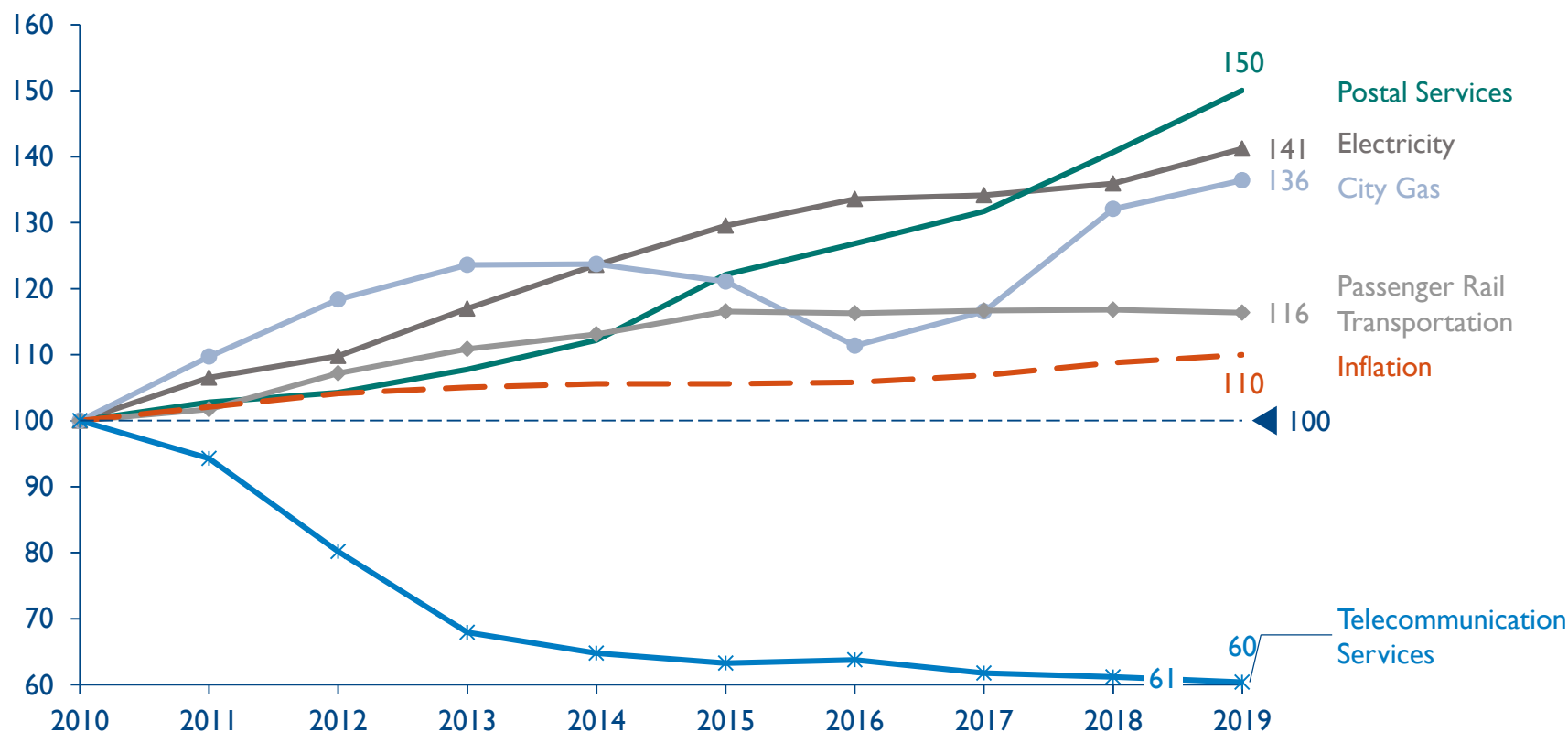
Source: Thomson Reuters Eikon, Diane, Annual Reports, Arthur D. Little Analysis

Notes: 1) Reported or estimated revenues in France or documentary research, 2) Data adjusted to take into account the estimated effective revenues of international players in France, 3) Corporate income tax and similar taxes and payments - excluding fines/agreements/adjustments paid by Internet players; 4) Based on gross investments (excluding asset disposals) 5) Netflix revenues calculated on the basis of the number of subscribers reported.

A leading role of Telecom operators in improving purchasing power of French end-users

Evolution of end-prices of a selection of essential products and services

France, 2010-2019, Base 100 in 2010

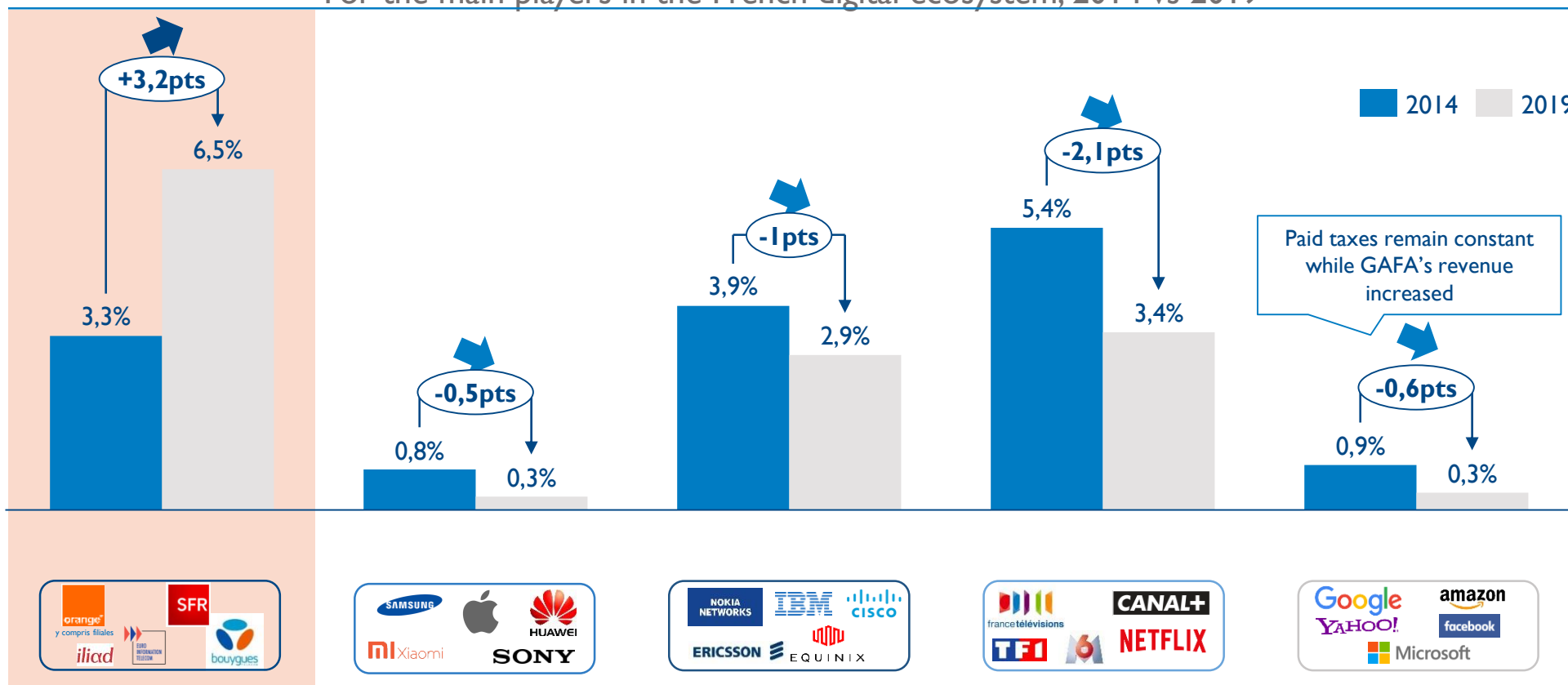


Source: INSEE, Arthur D. Little analysis

A leading role of Telecom players in Digital despite increasing tax pressure

Tax rate¹ as a proportion of revenues^{2,3}

For the main players in the French digital ecosystem, 2014 vs 2019



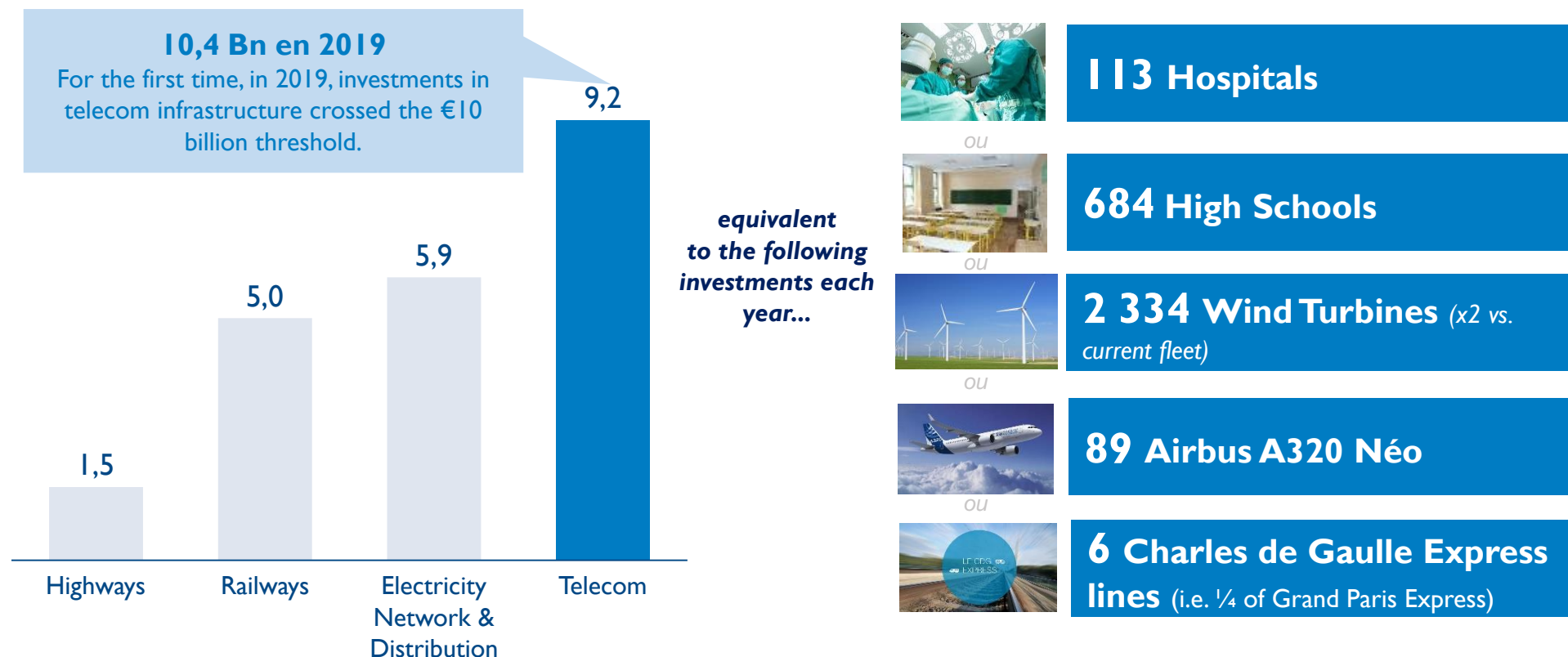
Source: Diane, Annual Reports, Arthur D. Little Analysis

Notes: 1) Corporate income tax and similar taxes and payments - excluding fines/agreement/adjustments paid by Internet players between 2018 and 2020, 2) Revenue declared in France or documentary research, 3) Data adjusted to take into account the estimated effective revenue of international players in France.

A record of +€ 10bn invested in networks in 2019 : Telecom sector, the largest private investor in infrastructures in France

Investment¹ from Telecom versus other Infrastructure sectors

France, 2015-2019, 5 years annual average, billion euros



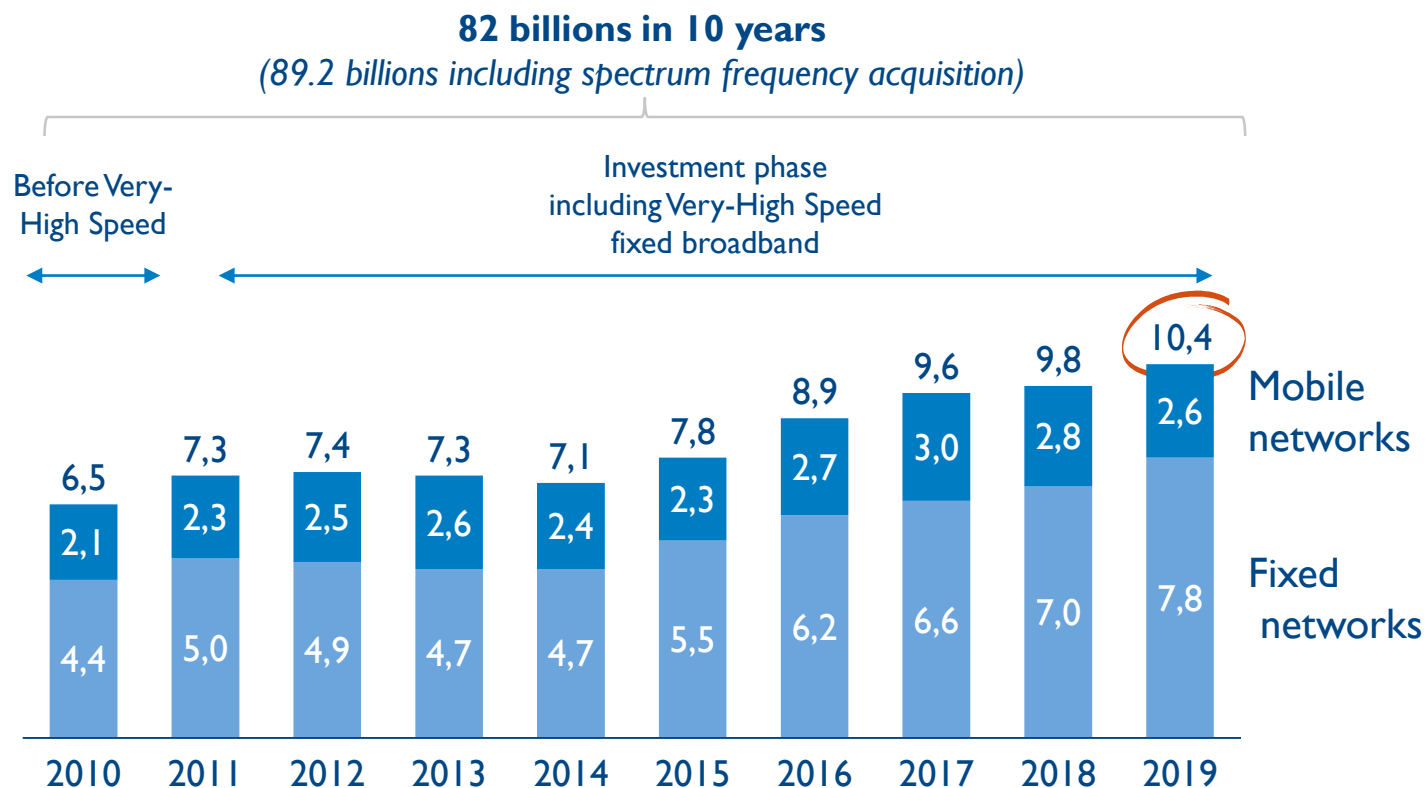
Source: Companies, Documentary Research, Arthur D. Little Analysis

Note: 1) Telecoms: ARCEP figures (excluding purchase of frequencies); Electricity: ERDF; Railway: RFF; Motorways: ASFA (Sanef, SAPN, ASF....)

+€10bn, a historical threshold of investment in Telecom infrastructure

Investment in telecom networks¹

France, 2010-2019, billion euros



+ 7.2 billion in spectrum purchase over the period.

0.9 in 2010
0.9 in 2011
2.6 in 2012
2.8 in 2015

Source: ARCEP, Arthur D. Little Analysis

Note: 1) Investment of the entire telecom sector in networks (telecom service operators and other private players), excluding purchases of mobile frequencies

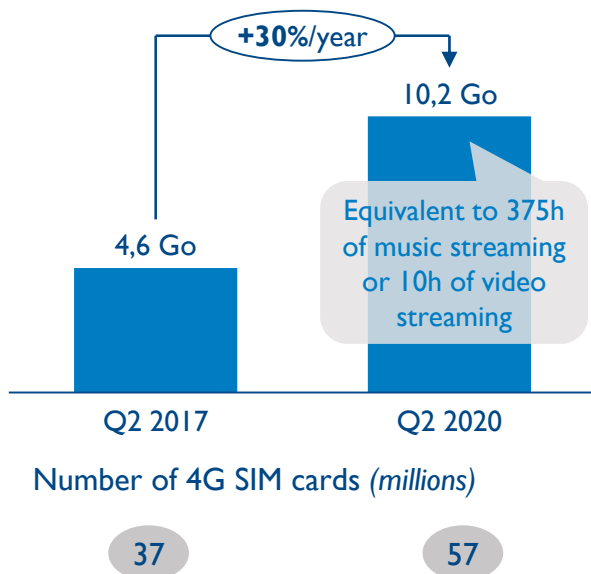
Investment in state-of-the-art infrastructure connecting all French people



Rise of mobile data

A threshold of 10Gb monthly usage per user crossed in early 2020

Average 4G data consumption¹ Monthly average



Number of 4G SIM cards (millions)

37

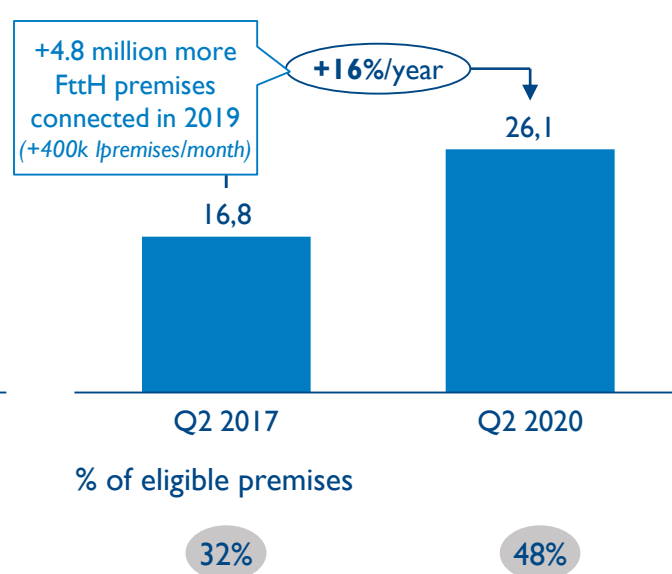
57



Accelerated Fiber deployment

Generalization of very-high speed internet

Premises eligible to very high-speed internet offers¹ - Million premises



% of eligible premises

32%

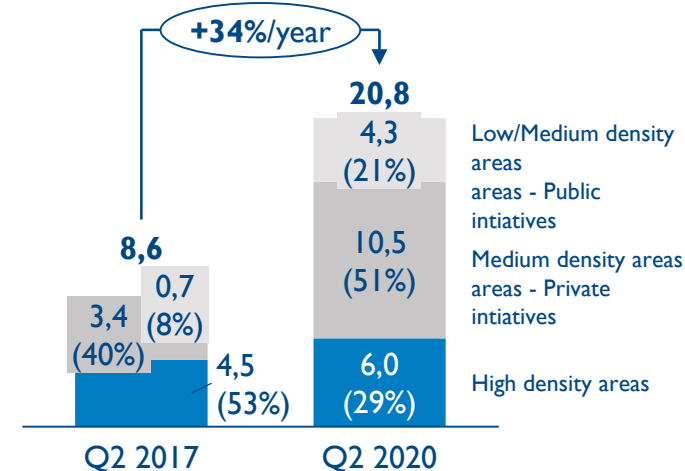
48%



Internet territorial inclusion

Record FttH Homes Passed in low density areas in 2019

XX Number of premises eligible for FttH in millions (xx%) As a percentage of eligible premises



Deployment of FttH fiber x3 in three years in less densely populated areas

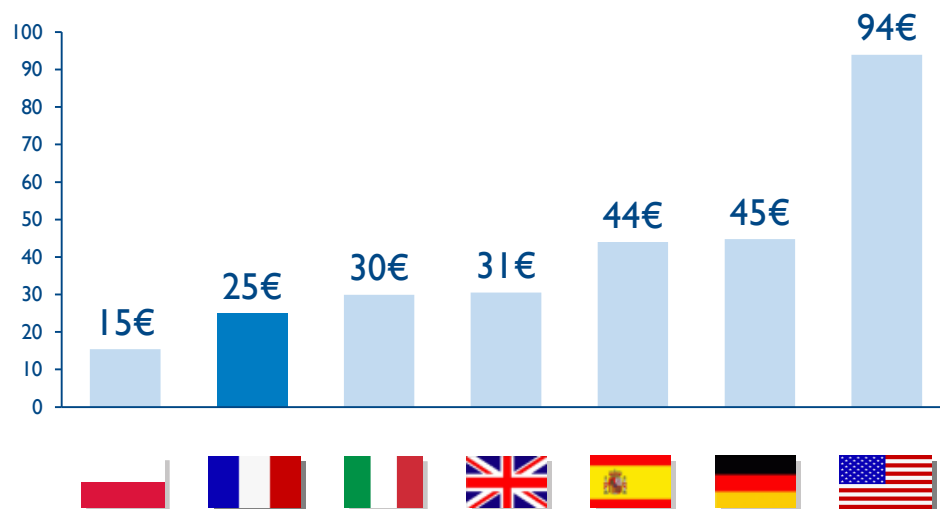
Source: ARCEP, operators, Arthur D. Little Analysis
Notes: 1) Consumption by active 4G card

Prices of telecom services in France among the lowest within major Western markets

Pricing of Fixed Broadband and Mobile offers from leading operators

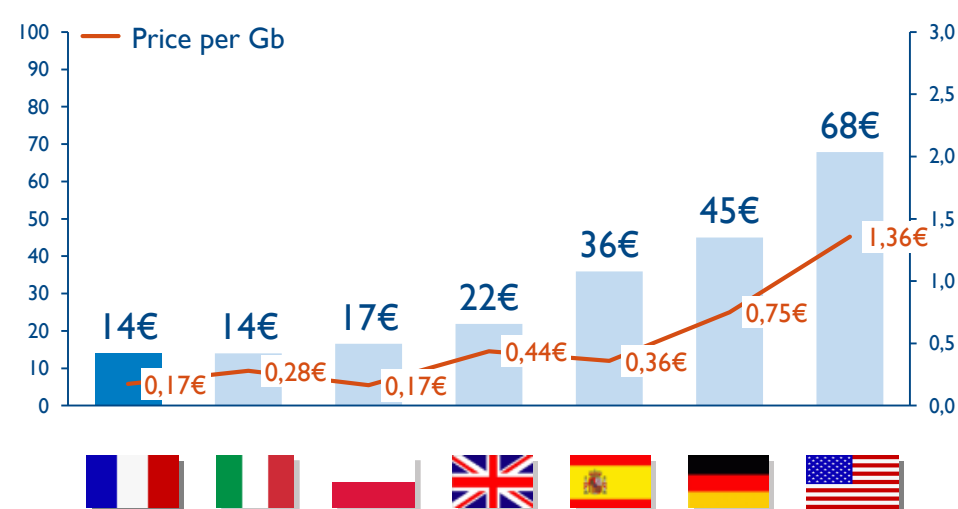
Country Selection, September 2020, € / month (inc. taxes)

Fixed (Triple Play)¹



Mobile²

Benchmark
Mobile 50 Gb



Excluding promotions and connection fees

By country, selection of the most competitive package in terms of price among operators with more than 10% of PDM

Source: Operator sites, Arthur D. Little Analysis

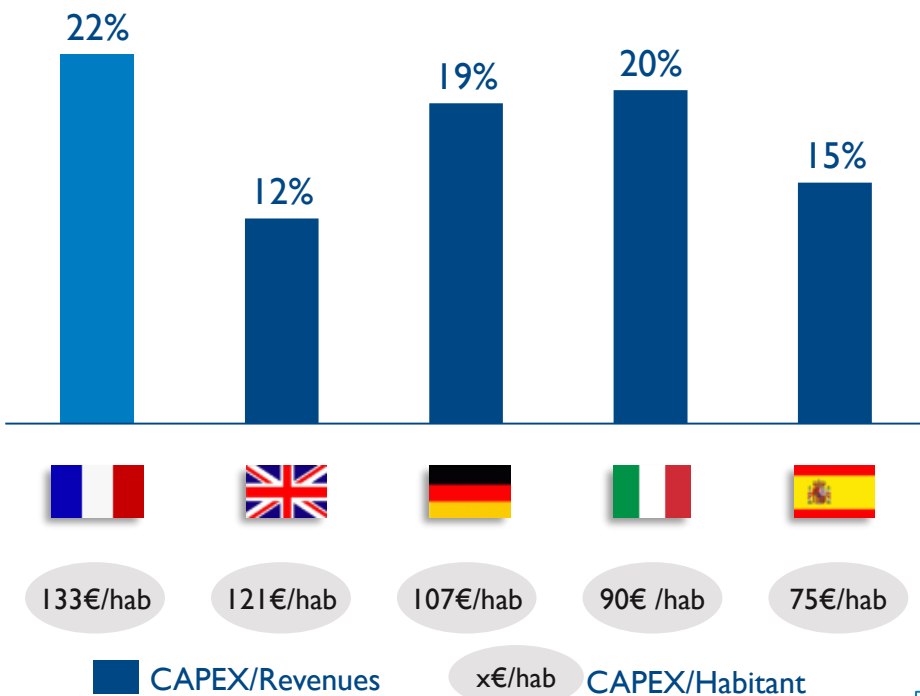
Notes: 1) Triple play offers only; unlimited telephony at least to landlines; unlimited broadband Internet via xDSL or fiber; television included, excluding additional packs; operators with market share > 10% excluding promotions, 2) Unlimited calls (when available otherwise >500 minutes), unlimited SMS/MMS, Internet at least 50 GB; offers without terminal, offers without commitment when available; operators with market share > 10%.

Investment effort of French telecom operators unique in Europe

Largest investment effort in Europe

Investment effort rate per country (CAPEX¹/Revenues¹)

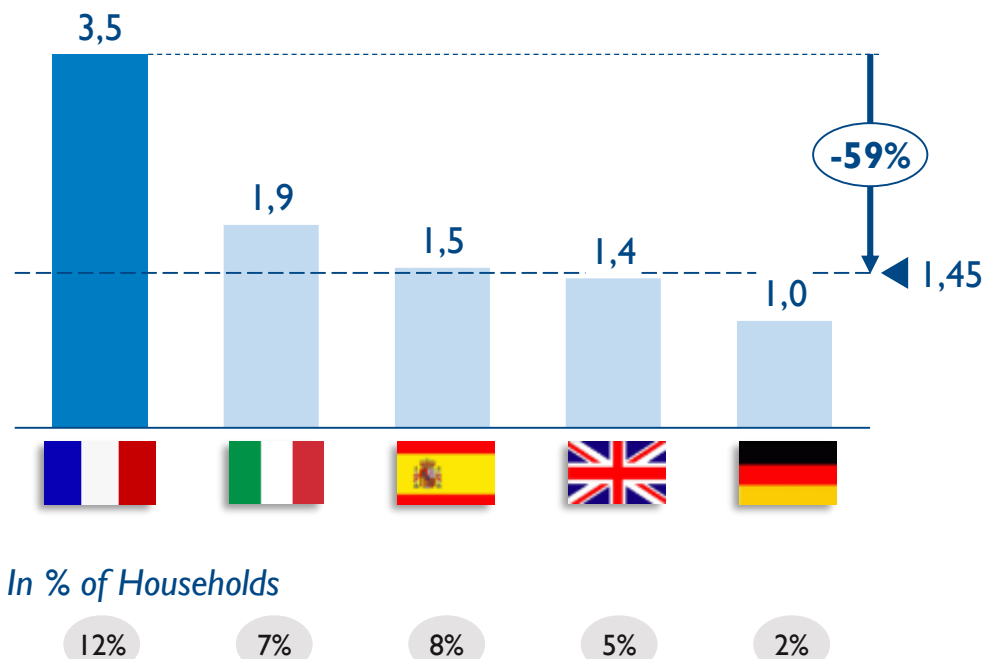
United Kingdom, France, Spain, Germany, Italy 2019



Largest Fiber deployment in Europe

Number of premises connected in FttH/B over 12 months

Selected European countries, Sept 2018 - Sept 2019, millions of premises



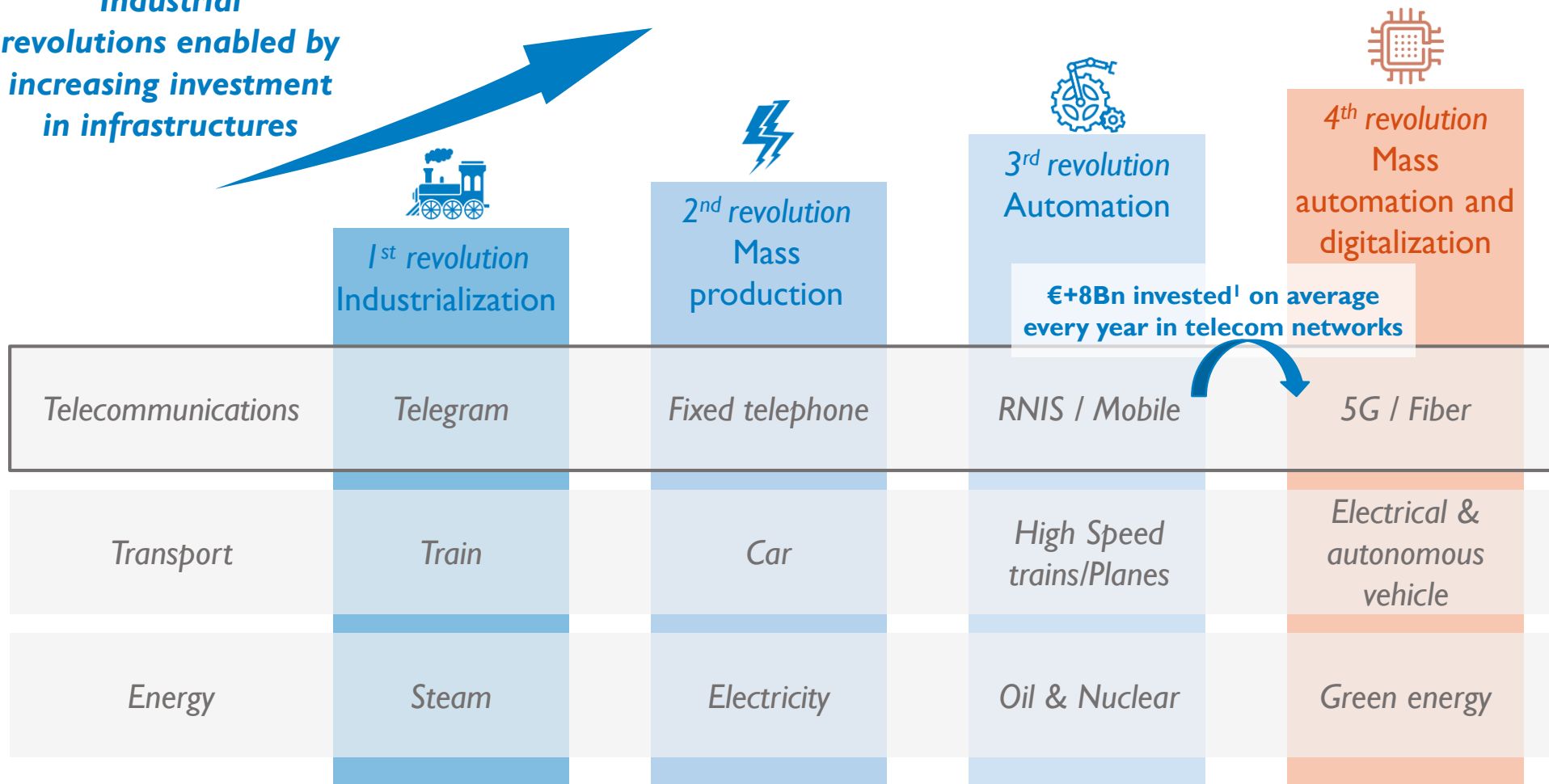
France has accelerated fiber deployment with **5.3m of premises connected between mid-2019 and mid-2020.**

Source: Annual Report, Arthur D. Little Analysis

Notes: 1) Turnover and CAPEX of telecom operators with a fixed or mobile market share >10%.

Investments essentials for the 4th industrial revolution of Digitalization

Industrial revolutions enabled by increasing investment in infrastructures



Source: Arthur D. Little Analysis

Note: 1) Between 2010 and 2019, telecom operators have invested €81.24bn in telecom networks in France.

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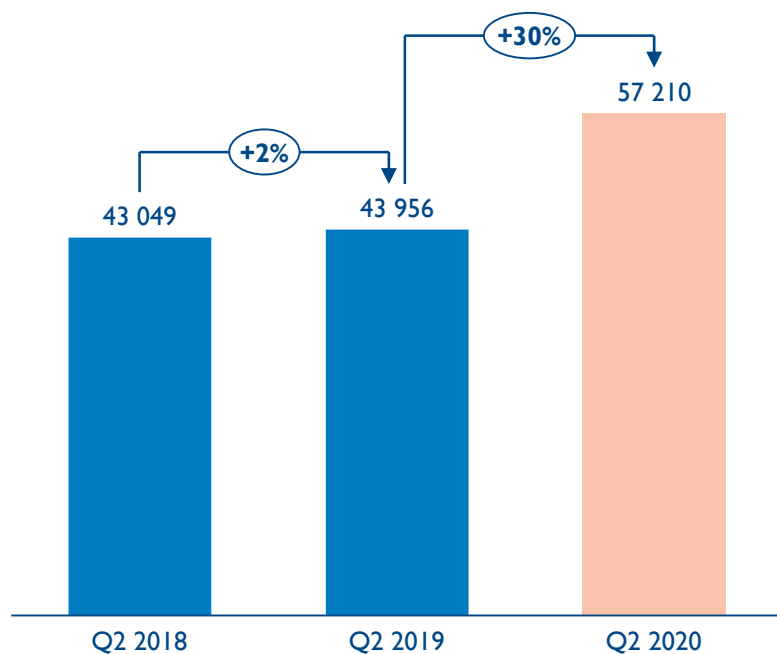
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COVID: robust Telecom networks that coped with surge of traffic

Evolution of mobile voice consumption

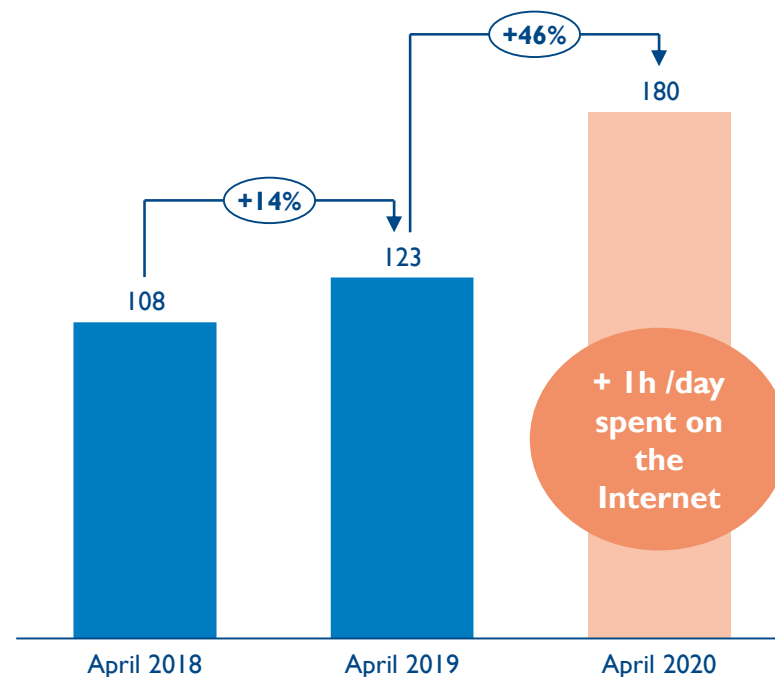
France, Q1 2019 – Q1 2020, millions of minutes



Impact of COVID crisis

Average time spent on the Internet per day

Fixed and mobile, April 2019 – April 2020, in minutes/day



+ 1h /day spent on the Internet

Impact of COVID crisis

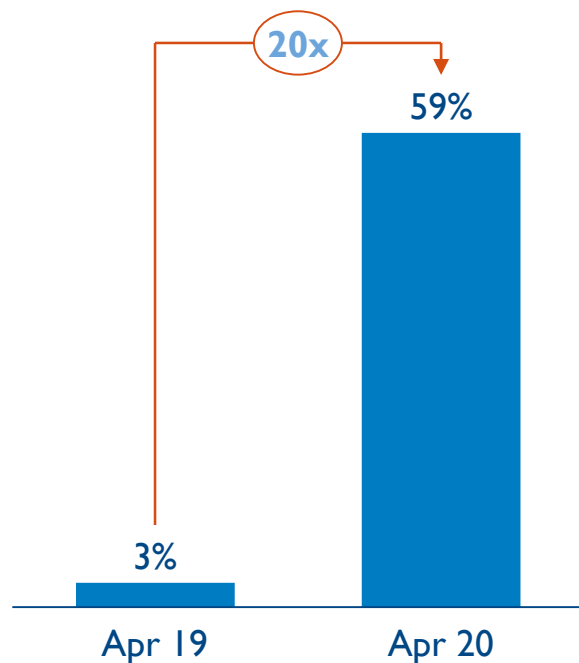
Source: Arcep Q2 2020, Médiamétrie data, Arthur D. Little Analysis

COVID : essential services maintained with Telecom networks in France

Economy

Teleworking employees¹

France, 2019 - 2020, %

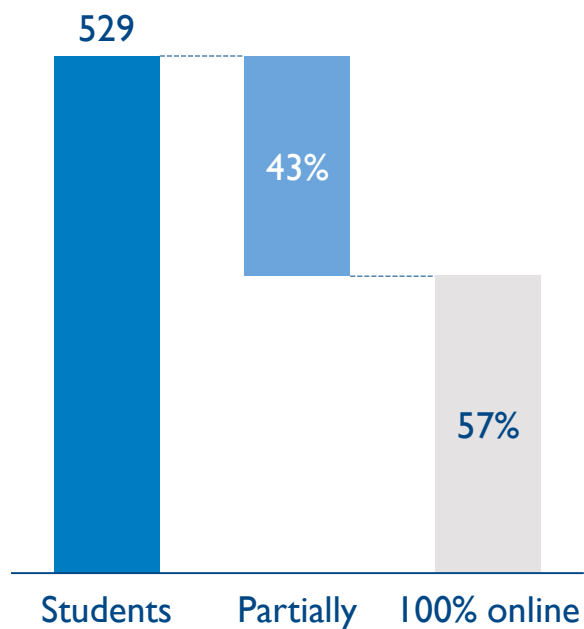


Source: Dares (Ministry of Labour), Arthur D. Little analysis
 Note: 1) At least one day per week

Education

Remote learning

Students of top 10 French universities in 2020, in thousands

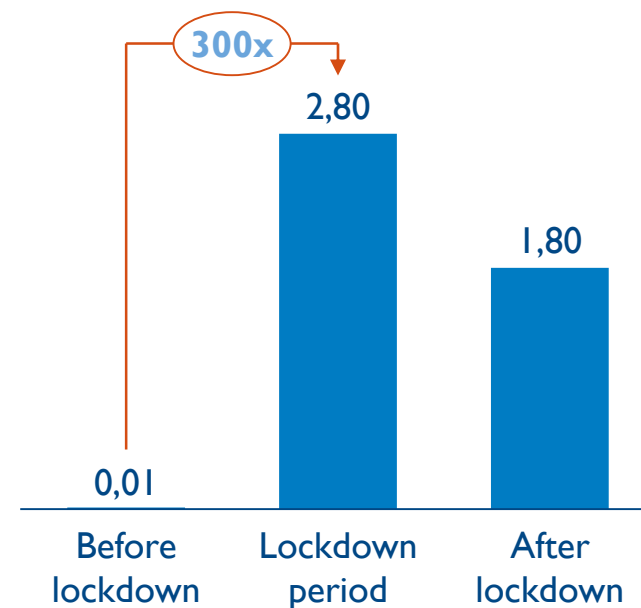


Source: University websites in France, Arthur D. Little Analysis

Health

e-Consultation reimbursed

France, Jan – June 2020, in millions



Source: Ameli (Assurance Maladie), Arthur D. Little Analysis

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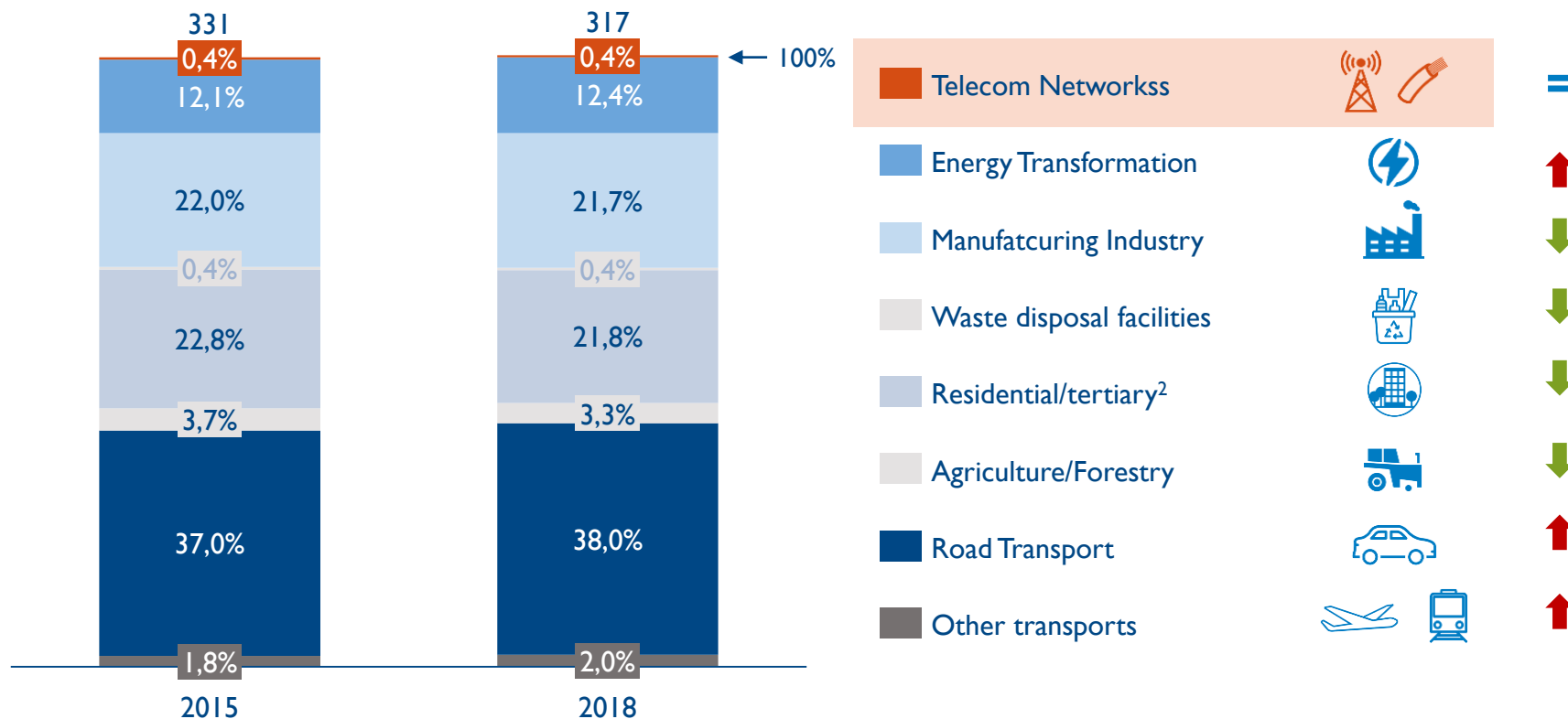
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Sustainability: stable level of Greenhouse Gas emissions from telecoms

Greenhouse Gas emissions in France

2015-2018, Mt EqCO₂, National French emissions– excluding imported emissions¹



Source: INSEE, 2020 Report of the French High Council for Climate Change (telecom data 2015-18), Arthur D. Little Analysis

Notes: GHG: Greenhouse gases; (1) corresponds to the national inventory of emissions by sector measured by SECTEN; not included are international river, sea and air emissions as well as all emissions imported into France; (2) excluding telecom network emissions.

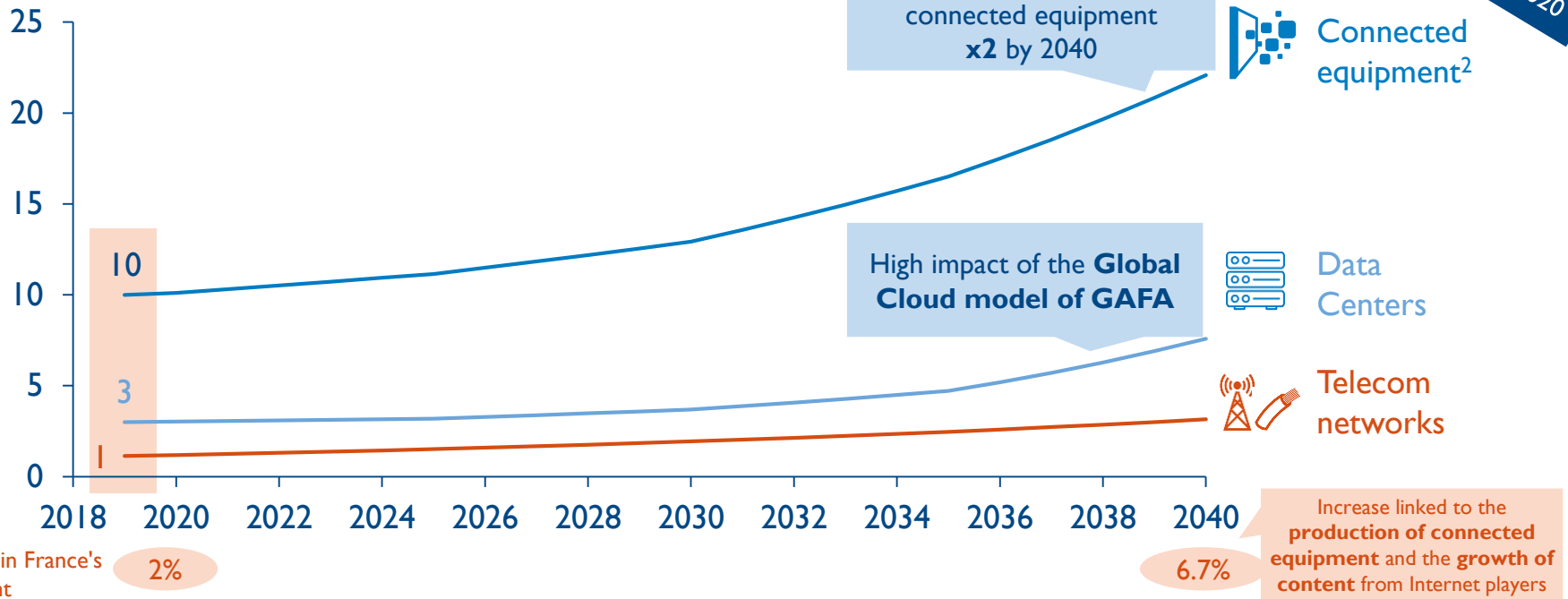
Expected growth of digital carbon footprint by 2040, directly linked to Internet and Connected Equipment players

Digital carbon footprint in France

Based on the estimates of the central scenario of the Senate report - June 2020

Senate Report 2020

In Mt CO2eq national inventory and imported emissions



▶ The Increase of 60% of digital sector emissions in 2040 vs. 2019 is mostly due data centers and connected equipment (86% of emissions from connected equipment are due to their production¹)

Source: 2019/2020 Report of the Senate Digital Footprint Fact-finding Mission, Arthur D. Little Analysis

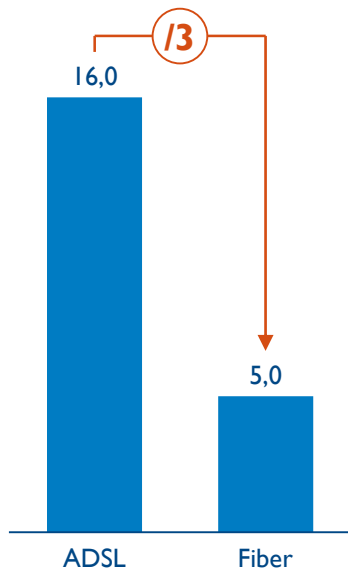
Notes: 1) Production of connected equipment mainly in Southeast Asia, with high carbon intensity of electricity (213.8gCO2eq/kWh on average vs. 57.1gCO2eq/kWh in France); 2) smartphones, computers, printers, computer screens, tablets, TVs, boxes, game consoles, virtual reality headsets, connected speakers, advertising screens and IoT connection modules

Investments from telecoms essential for a sustainable digital ecosystem

Fixed network: Fiber

FTTH vs ADSL kWh/line/year divided by 3

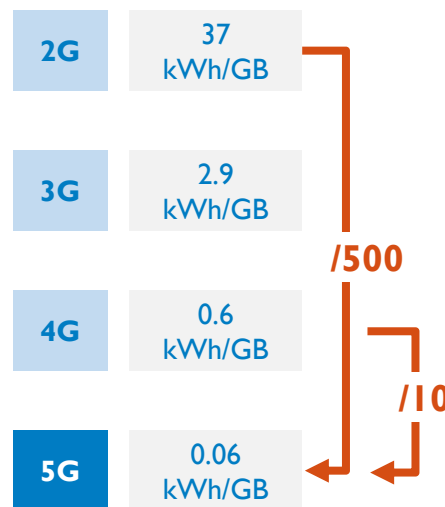
Average annual consumption per line in kWh



Mobile network: 5G

5G vs 4G kWh/GB divided by 10

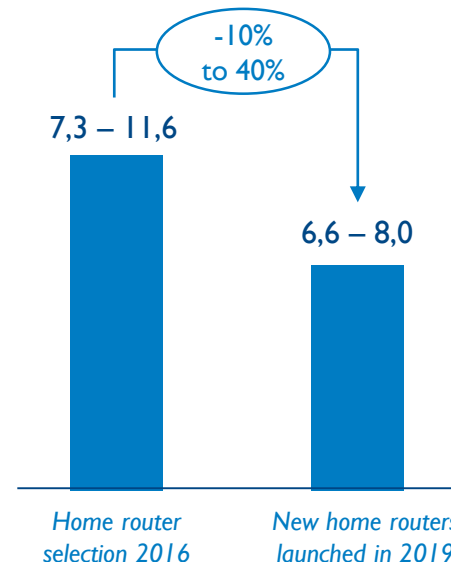
Power consumption in kWh/GB from mobile networks



Home Internet routers

20%² decrease of annual energy consumption of Internet routers

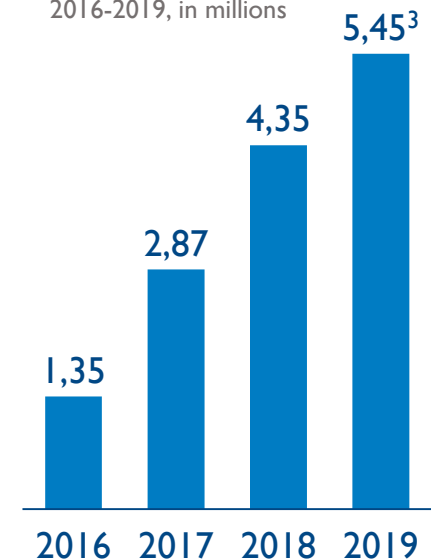
Power consumption in Watt/h¹ per box France - 2016 - 2019



Mobile devices

Growing recycling effort of mobile devices

Mobiles recycled by FFT³ operators France - Cumulative over 2016-2019, in millions



Source: Arcep Note n°5 "The digital carbon footprint", Technical notes from the box operators, Orange press release, FFT aggregated data, Arthur D analysis. Little

Notes: (1) In standby mode, with Internet connection maintained; (2) 3.9TWh in 2019 versus 4.9TWh in 2015, while the number of Internet boxes increased by 11% over the period.

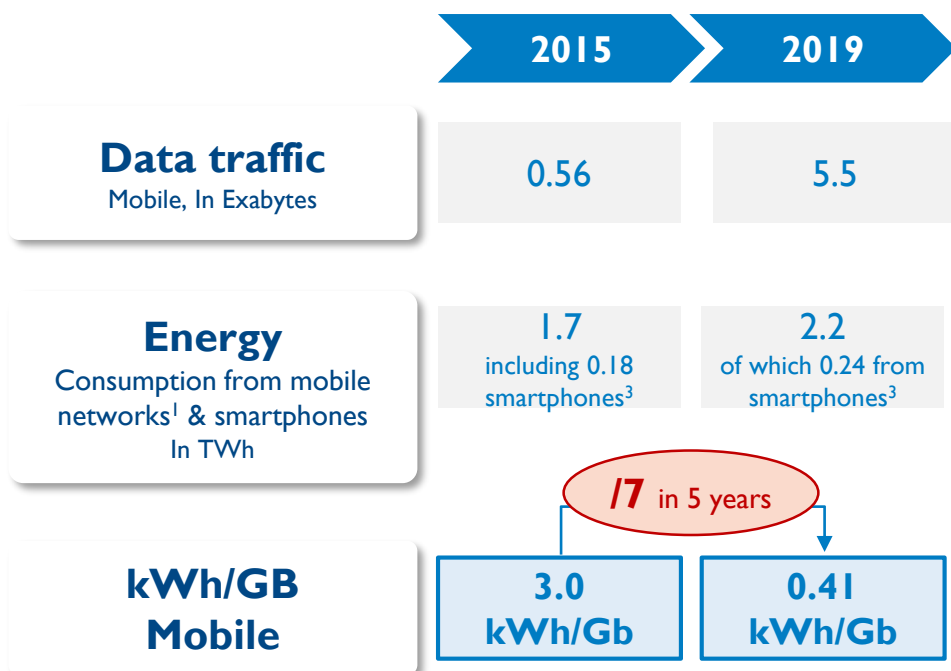
(3) The number of mobiles taken back/recycled represents 18.2% of new mobiles marketed since 2016.

Investments in networks improving the energy efficiency of Data



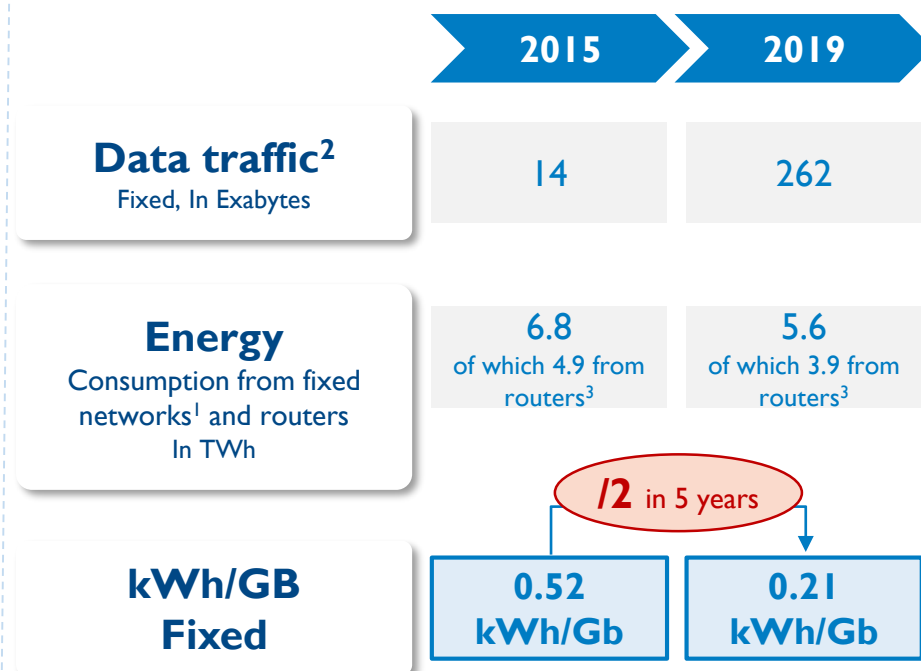
MOBILE

France, Networks and Smartphones - excluding Datacenters



FIXED

France, Networks and Internet device - excluding Datacenters



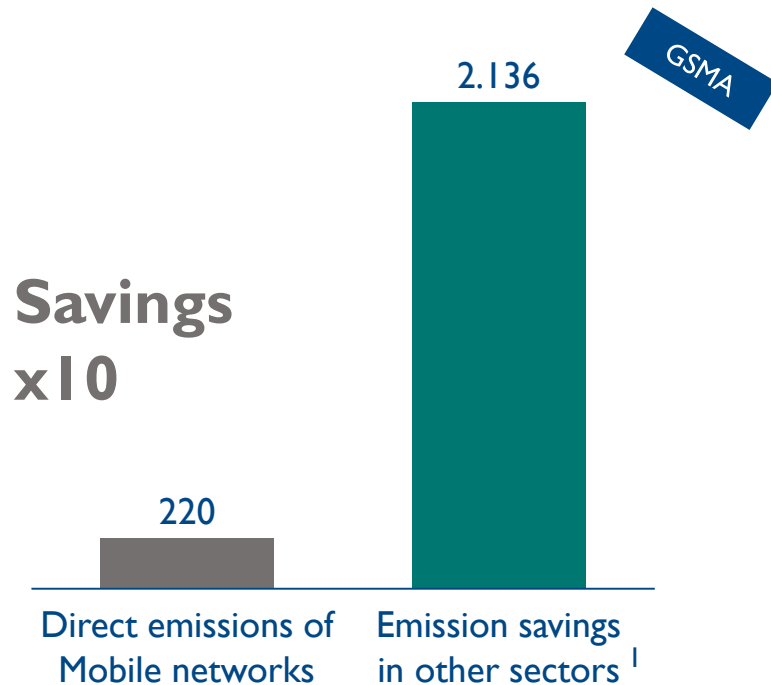
Telecom networks and terminals accounted for 1.6% of electricity consumption in France in 2019

Source: Cisco Virtual Network Index, 2019 Report of the Conseil Général de l'Economie "Reducing the energy consumption of digital technology", Report 2019/2020 of the information mission on the environmental footprint of digital technology in the French Senate, Arthur D. Little Analysis

Notes: (1) Data from the study of the General Council of the Economy and the Report of the fact-finding mission on the environmental footprint of digital technology in the Senate; (2) Fixed traffic estimate based on CISCO VNI data and extrapolation of the 2015-2017 trend to 2018 and 2019; (3) 2018 data, CGE High Estimates, Dec 2019.

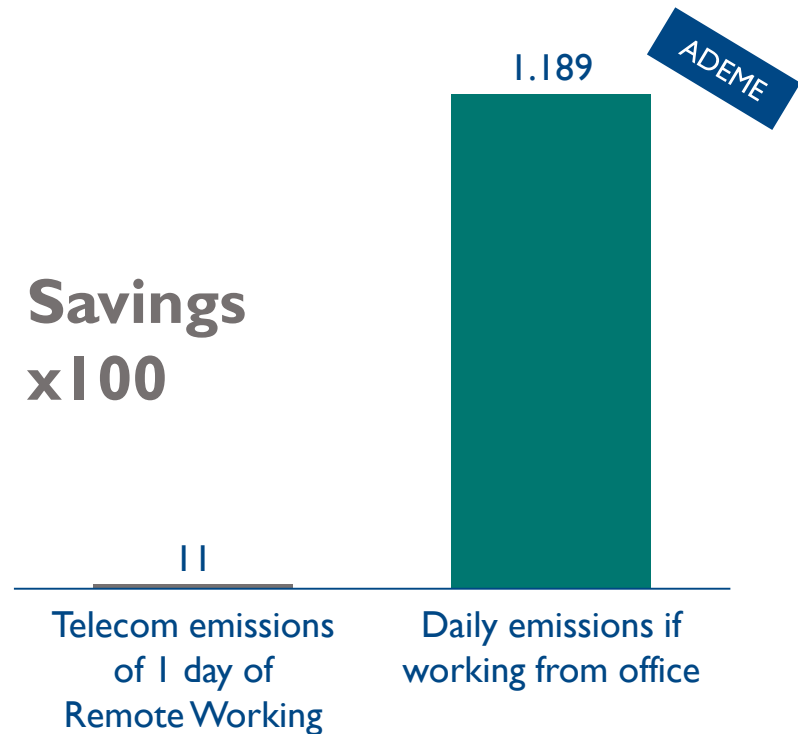
Digital is part of the solution, facilitating reductions of Greenhouse Gas emissions in economy

Telecoms, a catalyst for Greenhouse Gas emissions reduction in economy
In MteqCo2 – Mobile Networks, globally



Source: GSMA, " The Enablement Effect ", GSMA Telefónica Energy and Climate change strategy, Arthur D. Litt analysis
(1) Savings in MteqCO2: Agriculture (55), Real estate (210), Energy (159), Manufacturing (240), Mobility/Transport (644) and Work/Life/Health (828)

Remote working telecom enabling x100 eqCO2 savings
Daily emissions in grams of eqCo2



Source: ADEME 2020. Study on the characterization of rebound effects induced by telework, Arthur D. Little Analysis; Notes: (1) Average emissions per person in employment per year, related to commuting; (2) Savings estimate based on ADEME estimate

French Telecom Operators call to the Government for a sustainable digital environment

Recommendations from the French Federation of Telecom Operators

1 Enable a favorable environment

for digital players to successfully address their challenges

- Encourage a **common methodology to measure GHG emissions** between all digital players and to define reduction objectives
- Support our demand for International OEMs & Vendors for **greater use of sustainable materials and solutions** lowering environmental impact
- Ensure a fair competitive framework and a balanced set of environmental obligations among all digital players¹
- Introduce a **financial contribution** from content providers to the cost of deployment of Telecom infrastructure, based on volume of data carried on networks

2 Support the efforts of French Telecom Operators

- Support the development of **second-hand market** for end-user devices
- Support the sector's investments in new **low energy-intensive technologies**
- Highlight the **positive contribution of ICT technologies** to reduce emissions in other sectors
- Ensure that the **obligation framework** imposed to the telecoms sector² is consistent with the environmental challenges

3 Raise public awareness

- Leverage and amplify the **Telecom sector's environmental efforts**
- **Avoid multiplying obligations** based on purely national environmental indicators ; anticipate that a proliferation a environmental indicators could lead to confusion among end users

Arthur D. Little has been at the forefront of innovation since 1886. We are an acknowledged thought leader in linking strategy, innovation and transformation in technology-intensive and converging industries. We navigate our clients through changing business ecosystems to uncover new growth opportunities. We enable our clients to build innovation capabilities and transform their organizations.

Our consultants have strong practical industry experience combined with excellent knowledge of key trends and dynamics. ADL is present in the most important business centers around the world. We are proud to serve most of the Fortune 1000 companies, in addition to other leading firms and public sector organizations.

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Contacts:

Ignacio GARCIA ALVES
Global Chief Executive Officer
garciaalves.ignacio@adlittle.com

Paul DESJONQUERES
Principal TIME France
desjonquieres.paul@adlittle.com