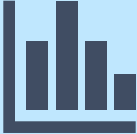
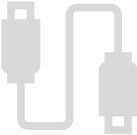

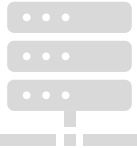



BREKO BroadbandStudy21

Bonn, 27 July 2021
Prof. Dr. Jens Böcker

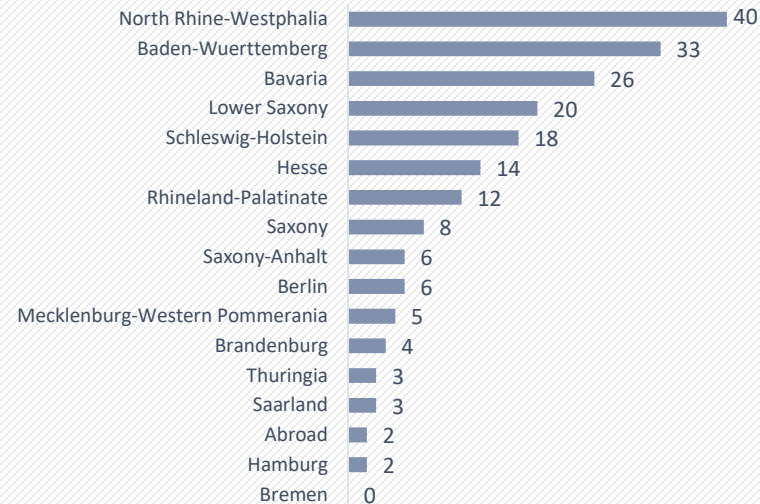


1.	Market Data	
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4.	Regional Data Centres	
5.	Smart City	

201 BREKO network operators have been interviewed throughout Germany in May 2021. The interviewees are executives of telecommunications companies (e.g. Managing Directors, Heads of Strategy, etc.).

BREKO data summary

- 220 of 270 active alternative network operators in Germany are part of BREKO (81%)
- The BREKO market study is representative for the German market and is validated by additional sources
- Regional distribution of the BREKO members:



Source: survey of network operators (n=187-195).

1



Revenue of BREKO network operators in 2020:
€ 5.0 billion

2



Investments by BREKO network operators in 2020:
€ 2.9 billion

3



Homes Activated fibre connections by BREKO network operators:
1.9 million

4

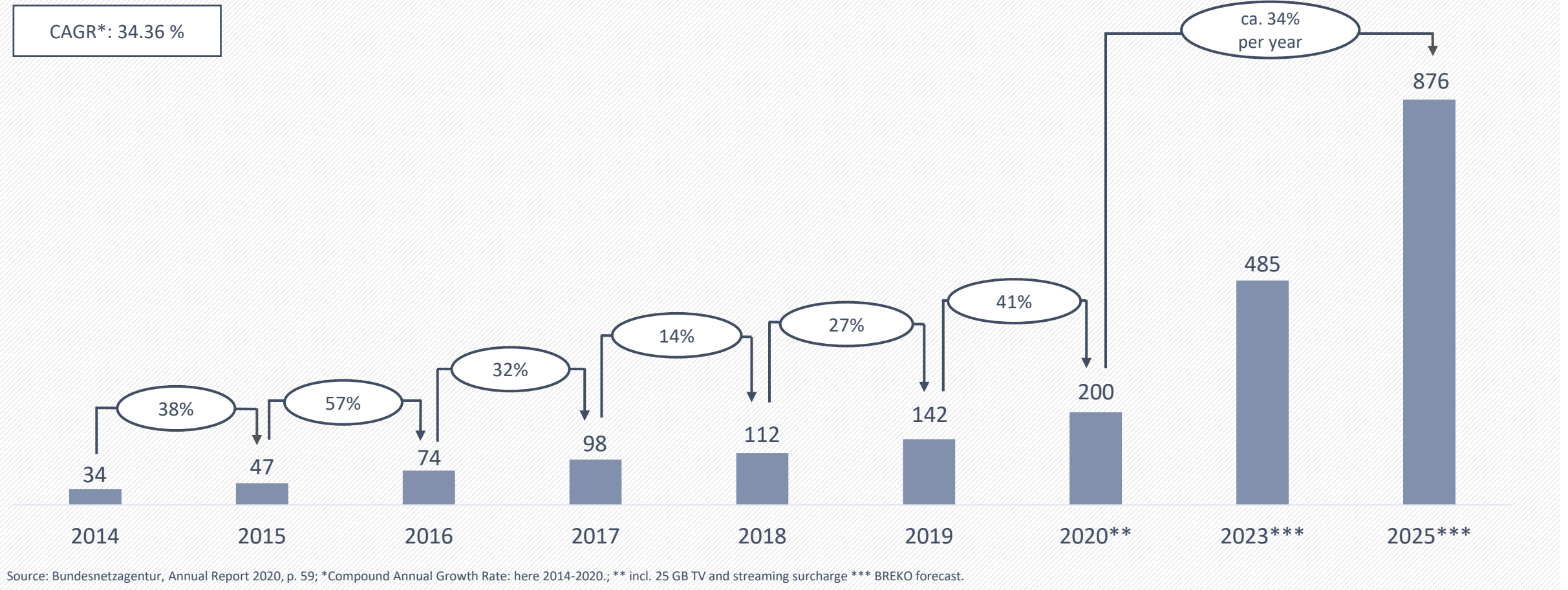


Homes Passed fibre connections by alternative network operators:
6.2 million

Evolution of the data volume

The average growth in data volume in Germany is approximately 34% per year.

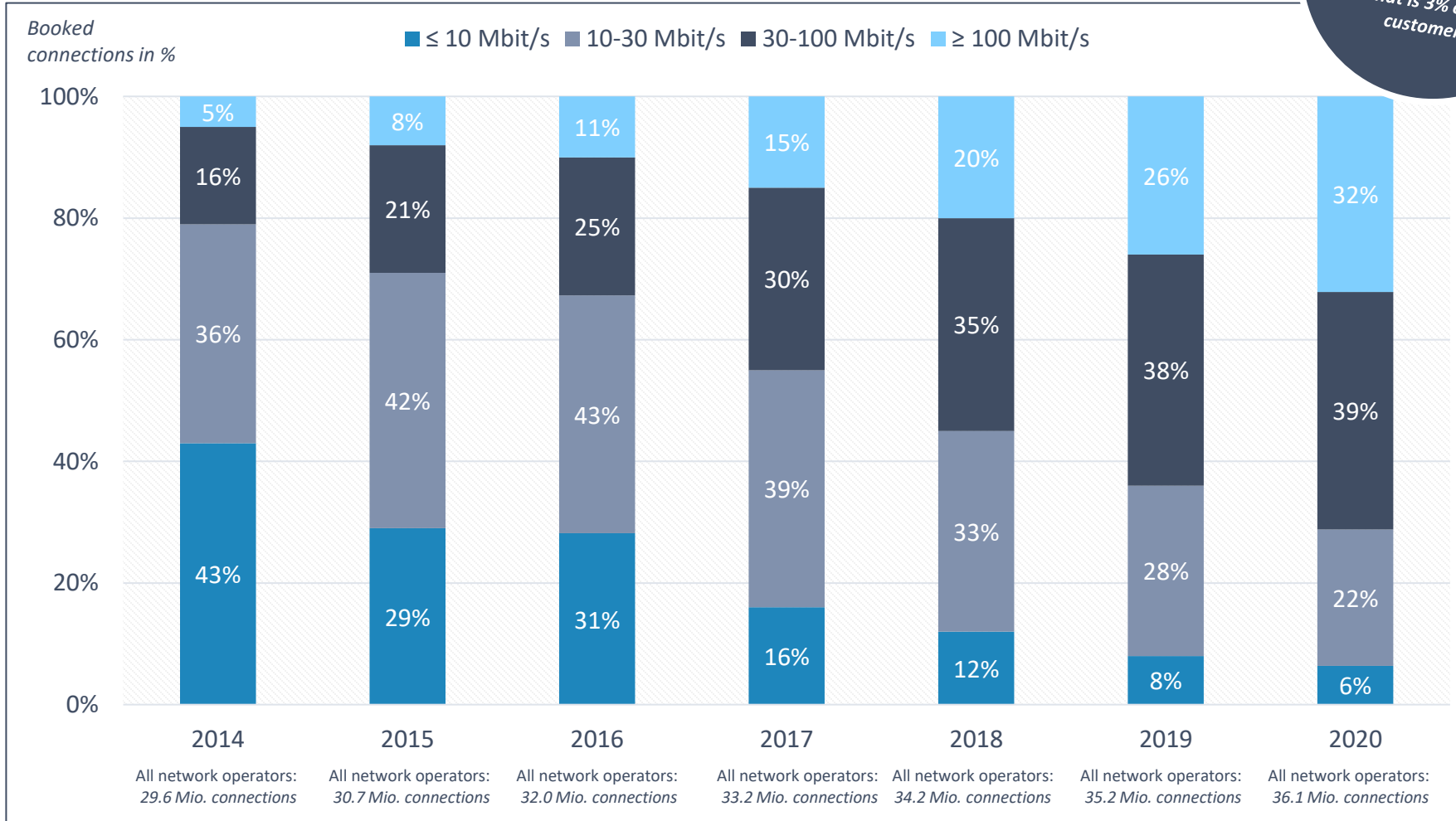
Average data volume of fixed networks per connection and per month in GB over time (incl. TV and streaming services)



Available connections by bit rate

Every third connection faster than 100 MBit/s in 2020

More than 1 million customers subscribe to connections ≥ 1 GBit/s. That is 3% of all customers



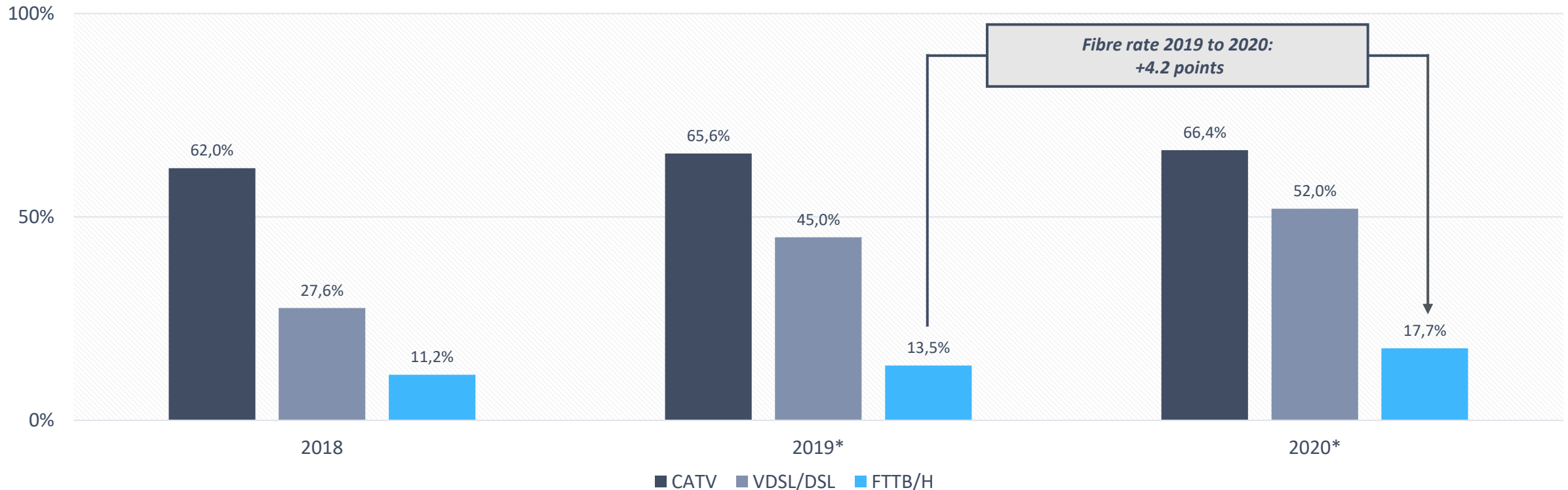
Bitrate	Growth in connections
≥ 100 MBit/s	↑ +2.3 mio.
30-100 MBit/s	↗ +0.7 mio.
10-30 MBit/s	↘ -1.5 mio.
≤ 10 MBit/s	↘ -0.6 mio.

Source: Bundesnetzagentur, Annual Report 2020, p. 55, p. 56.

Fibre rollout is gaining momentum: The fibre rate increases by 4.2 points to 17.7%.

Percentage of available technologies ≥ 200 MBit/s based on all households, companies and public institutions

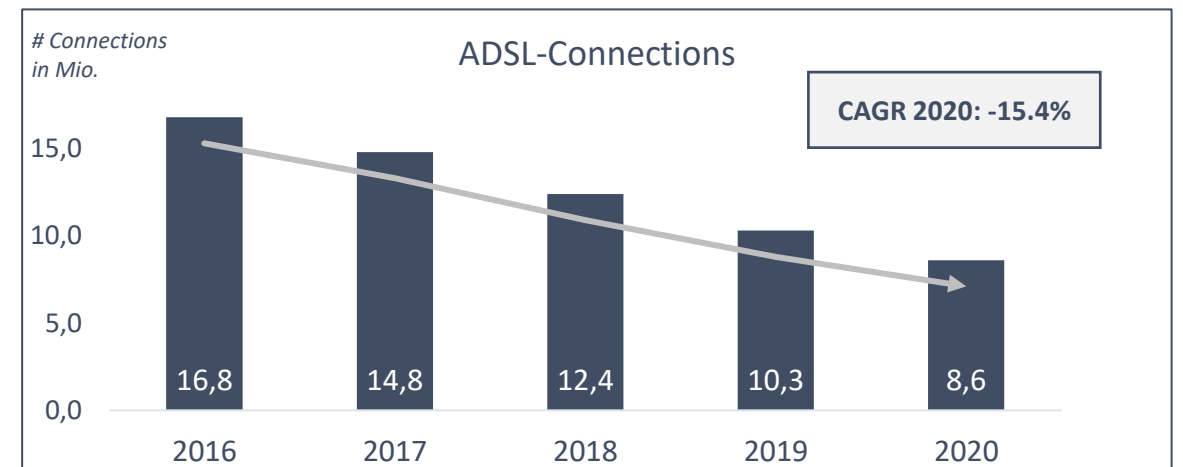
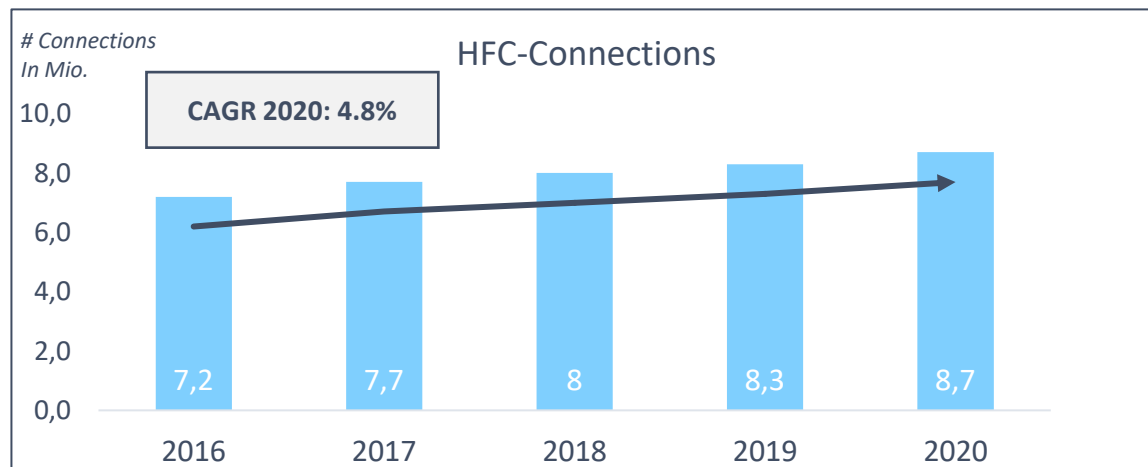
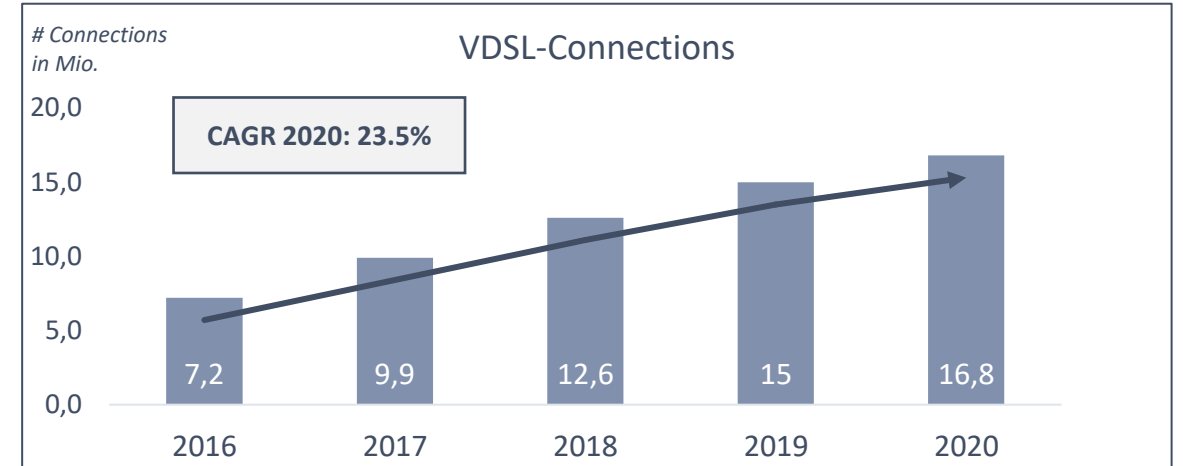
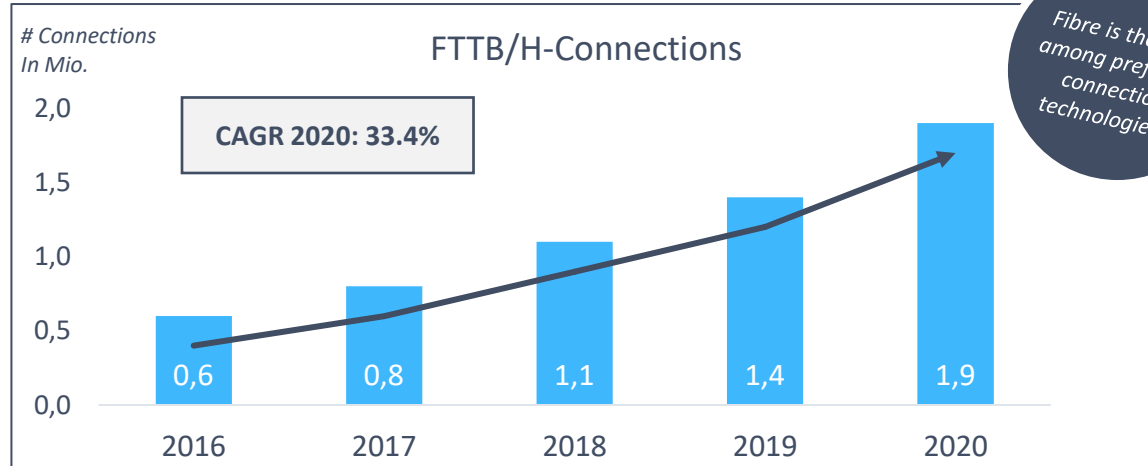
Percentage of available technologies ≥ 200 MBit/s



Source: BMVI (Federal Ministry of Transport and Digital Infrastructure), Broadband Atlas, end of 2020, p. 7; *Data refer to Homes Passed: FTTB/H 2019 & 2020: incl. households, companies and public institutions

Broadband connections by technology

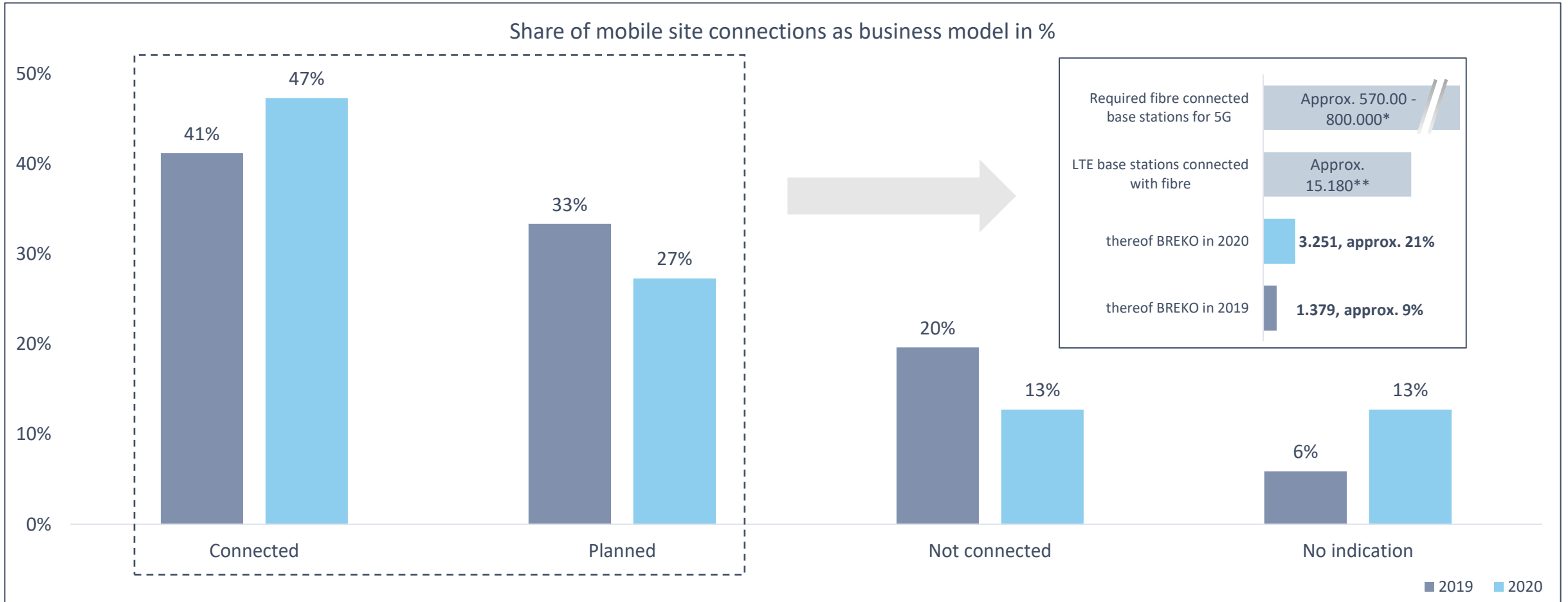
Above-average growth in active fibre connections (Homes Activated)



Source: Bundesnetzagentur, Annual Report 2016 - 2020, p. 45-58; *Cisco Broadband Index.

Fibre connection of mobile sites

Approx. 3/4 of BREKO network operators provide mobile sites with fibre or plan on doing so in the future.



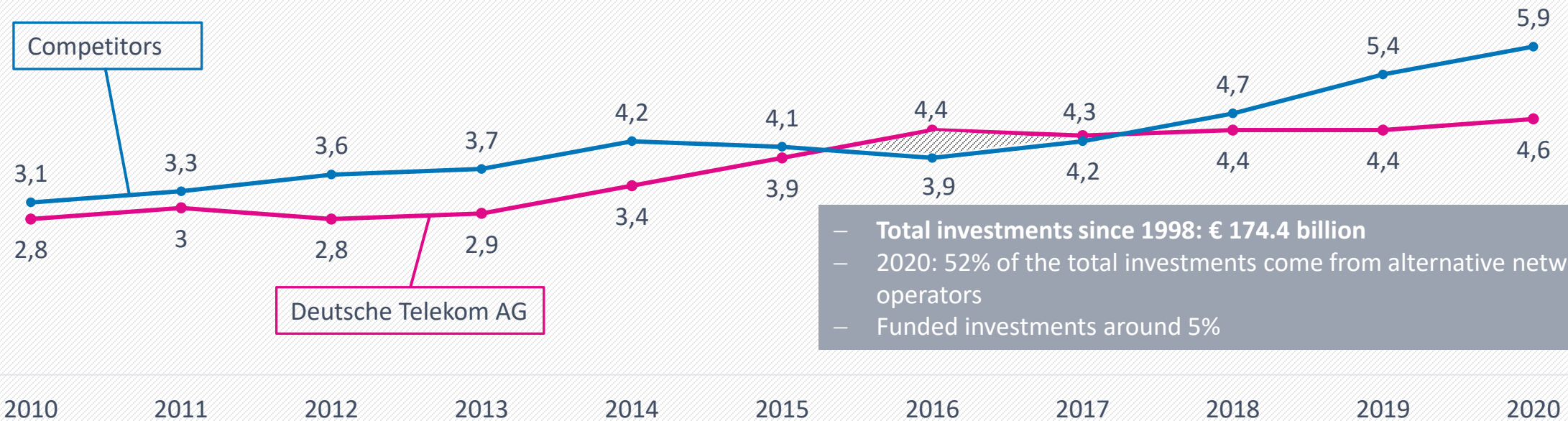
Source: survey of network operators (n=55); *Bitkom 2018; BMU, 2019.; **Statista, 2020: LTE base stations in Germany: 75.901, approx. 20% connected with fibre (15.180).

Question: Is the connection of mobile sites a potential business model for you? If yes, how many mobile sites have you connected already?

Total investments in broadband network infrastructure

Investments increased by 7.1% to € 10.5 billion in 2020, of which 56% is invested by competitors.

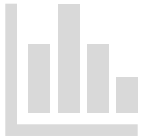
Investments* in broadband network infrastructure** in the telecoms market in € billion



Source: Bundesnetzagentur, Annual Report 2020, p. 53; BMVI (Federal Ministry of Transport and Digital Infrastructure); *incl. Public funding; **Investments in predominantly new, but also in existing broadband networks infrastructure (without mobile communications)
 /// Vectoring dent triggered by the vectoring decision of the German national regulator „Bundesnetzagentur“.

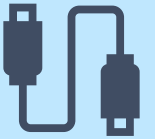
1.

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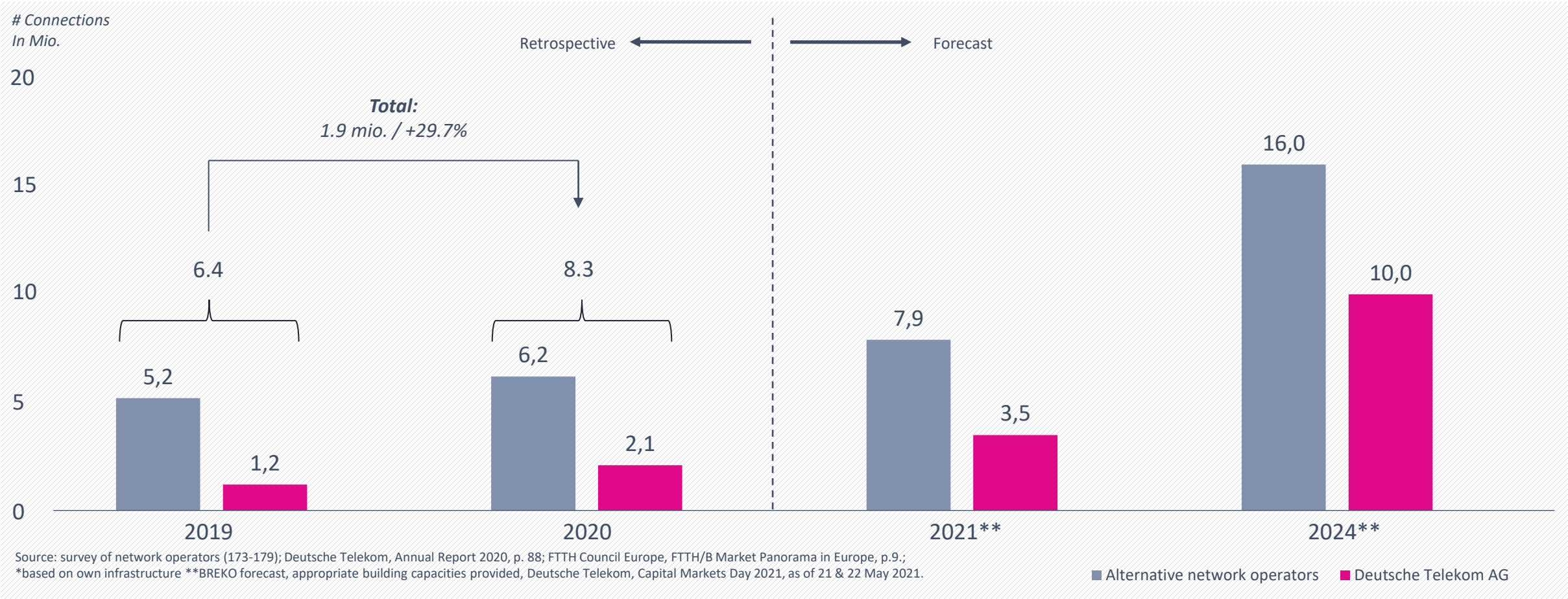
Smart City



Number of fibre connections in Germany

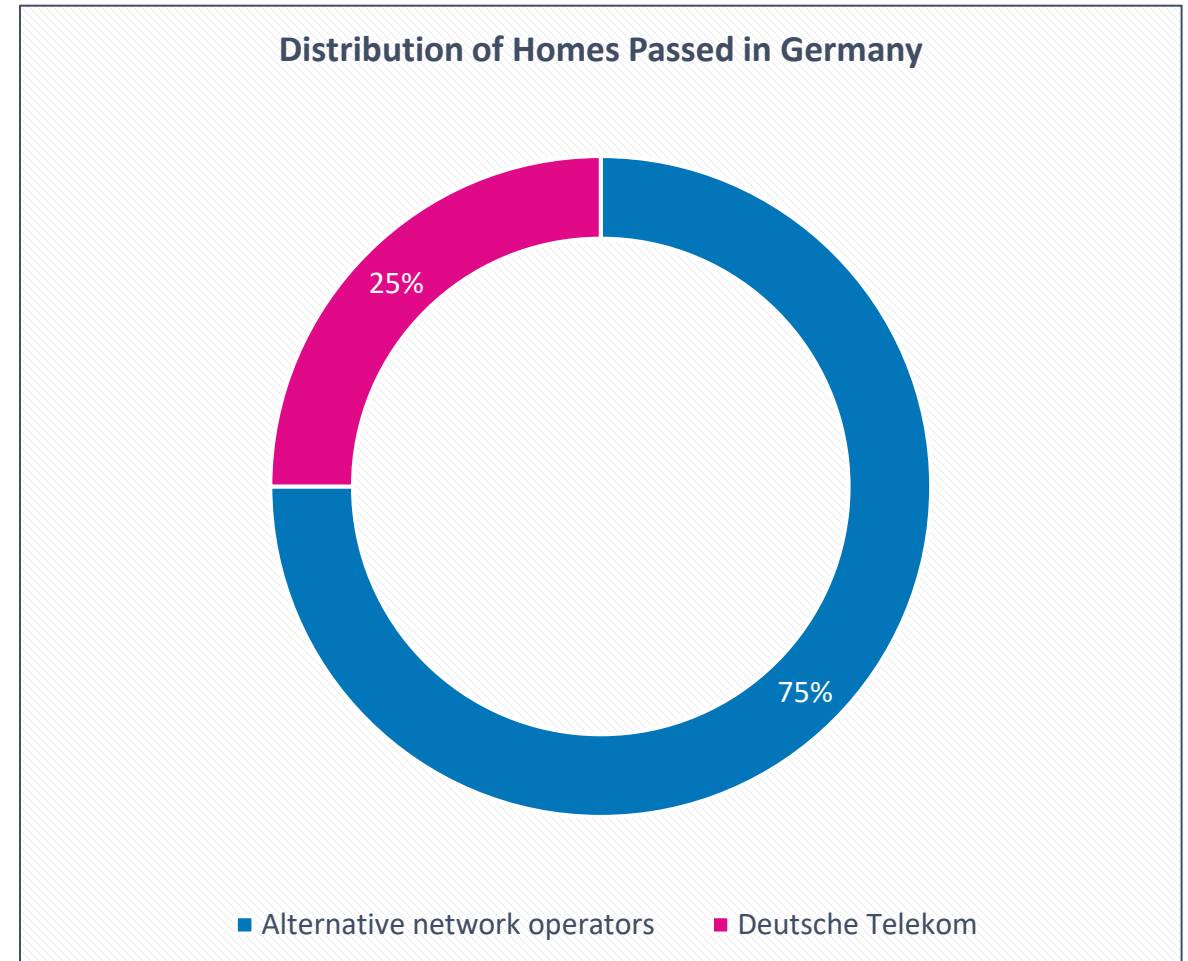
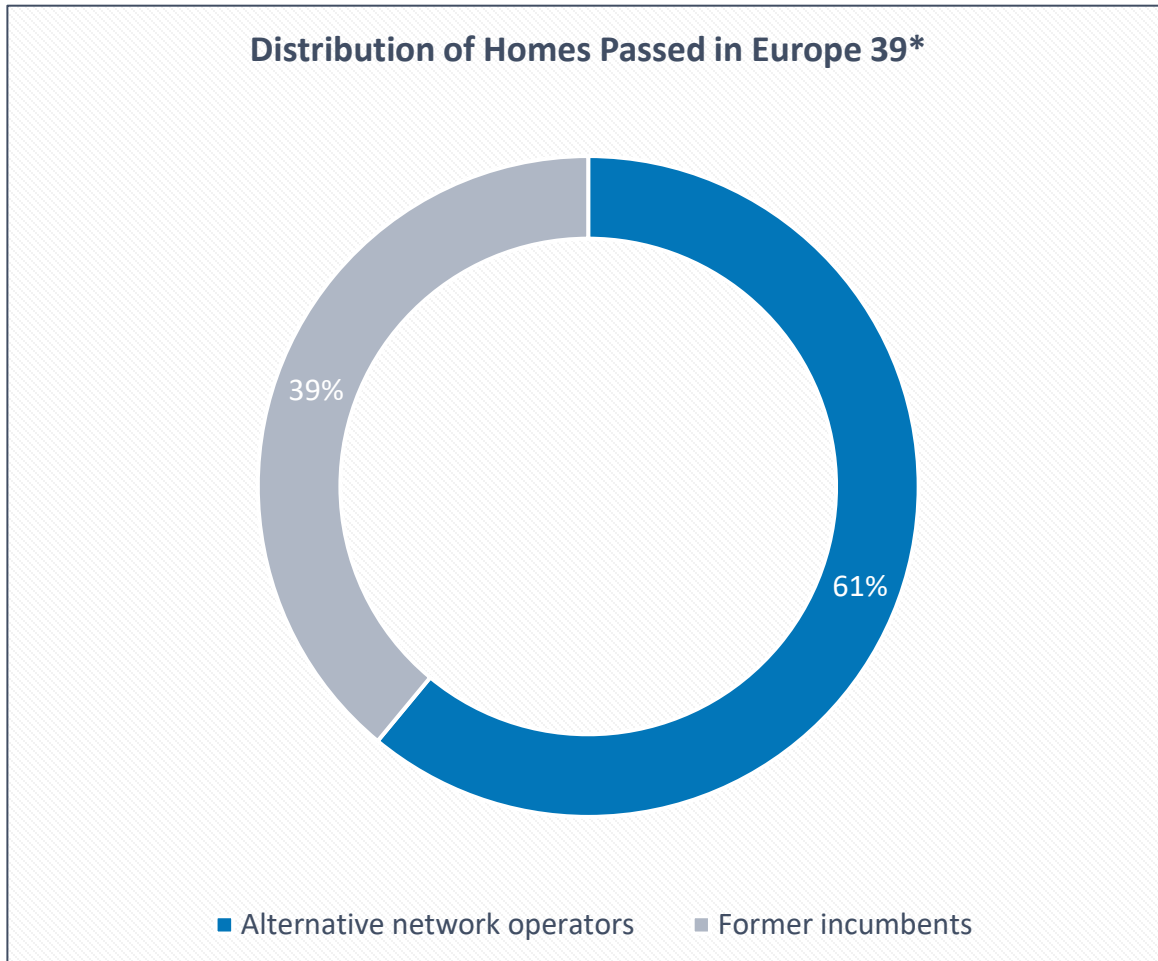
The number of available fibre connections (Homes Passed) increased from 6.4 mio. in 2019 to 8.3 mio. in 2020.

Number of Homes Passed* in millions over time: alternative network operators vs. Deutsche Telekom AG



Share of former incumbents in fibre deployment

The majority of fibre deployment is being carried out by alternative network operators.

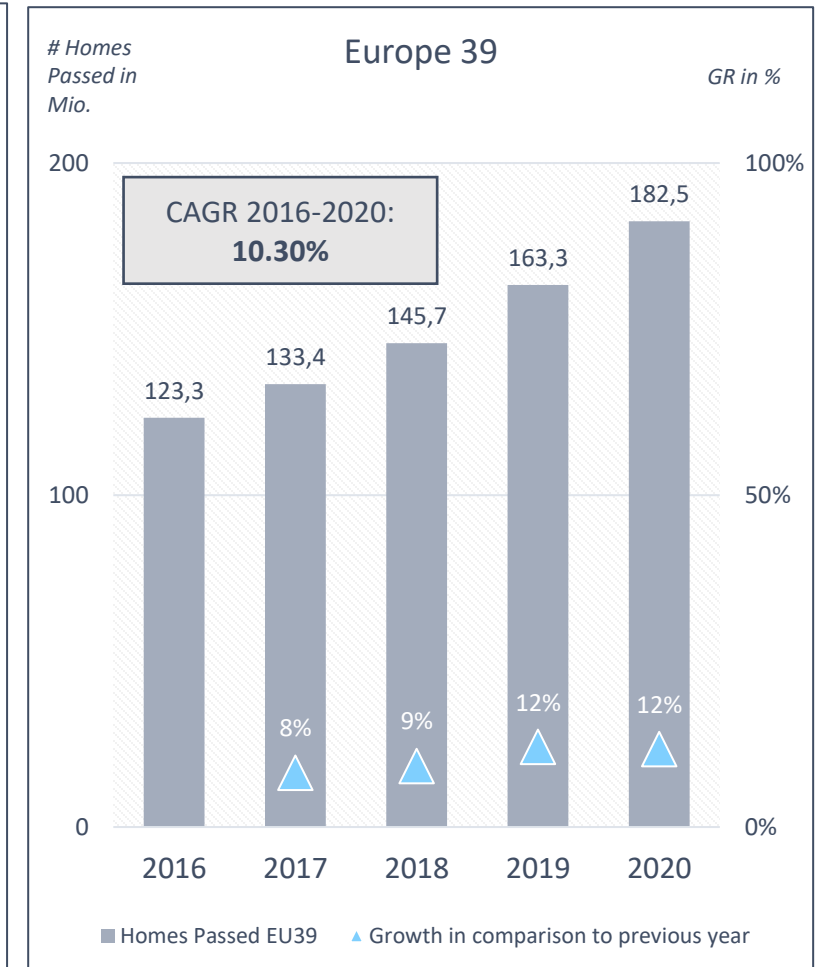
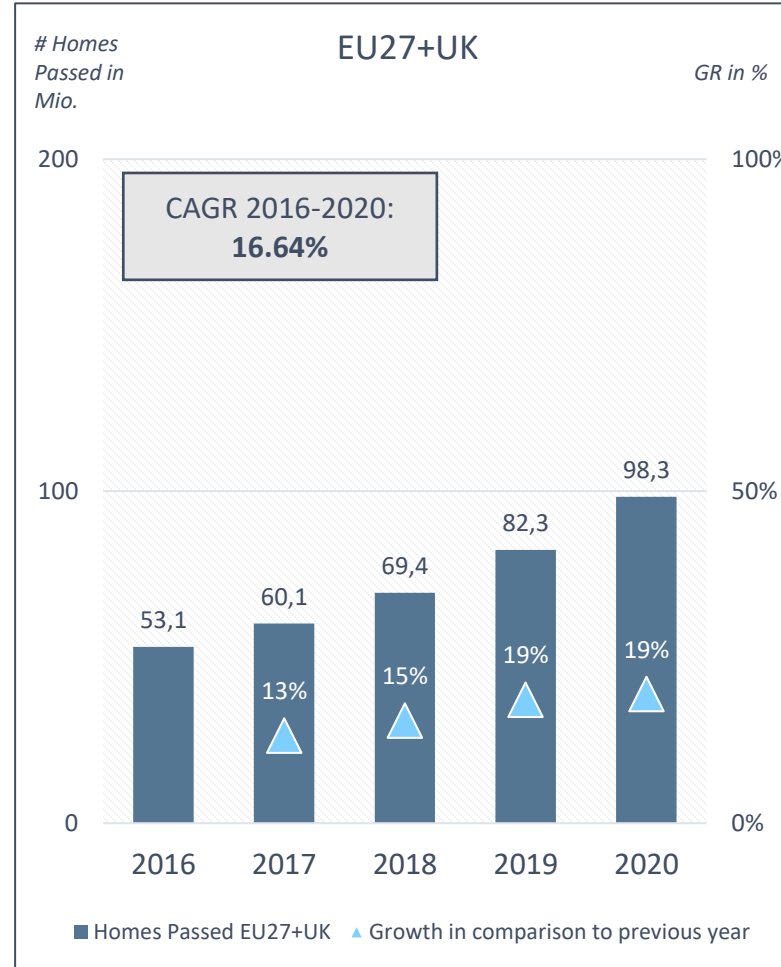


Source: FTTH Council Europe, FTTH/B Market Panorama in Europe, p.9.; *EU27, UK, Belarus, Kazakhstan, Russia, Ukraine, Iceland, Israel, North Macedonia, Norway, Serbia, Switzerland, Turkey.

Source: survey of network operators (n=179); Deutsche Telekom, Annual Report 2020, p. 88.

Germany in comparison to other European countries

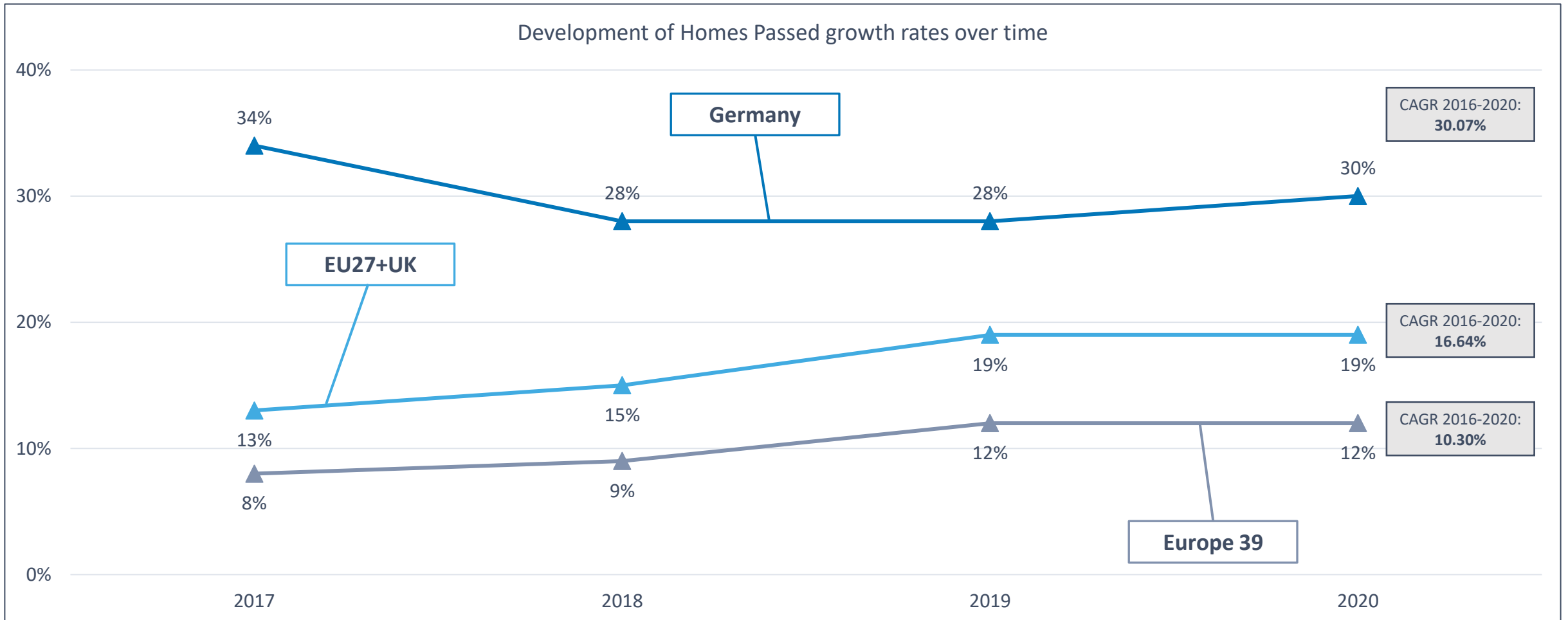
The growth rate for fibre in Germany is above average in comparison to other European countries.



Source: survey of network operators (n=179); Deutsche Telekom, Annual Report 2020, p. 5, p. 88; FTTH Council Europe, FTTH/B Market Panorama in Europe 2021, p.8.; *In relation to the growth of Homes Passed.

Germany in comparison to other European countries

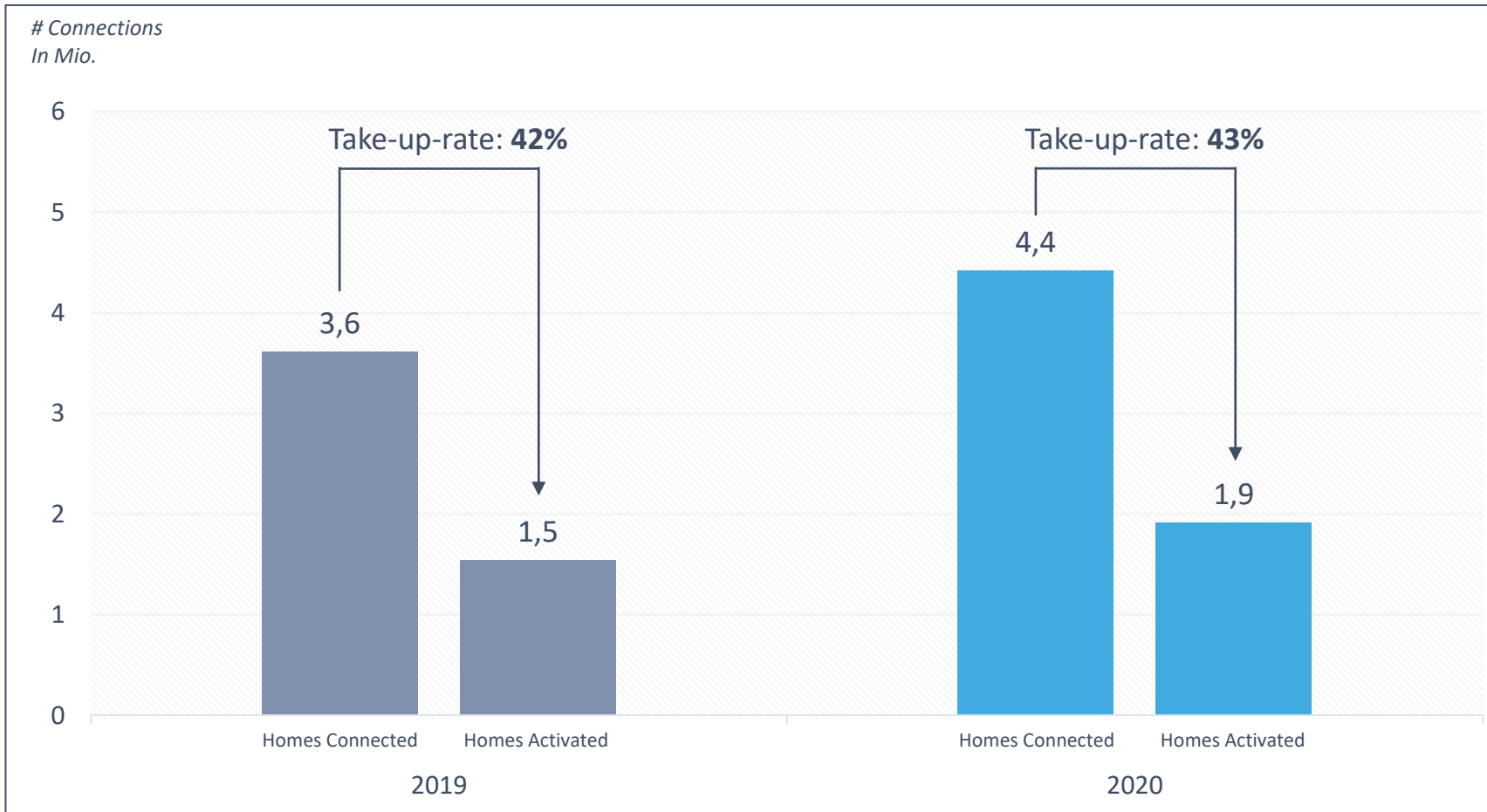
The growth rate for fibre in Germany is above average in comparison to other European countries.



Source: survey of network operators (n=179); Deutsche Telekom, Annual Report 2020, p. 88; FTTH Council Europe, FTTH/B Market Panorama in Europe 2021, p.8.; * In relation to the growth of Homes Passed.

Take-up-rate of the BREKO network operators

In 2020 the take-up-rate increased to 43%.



Source: survey of network operators (n=173-177); FTTH Council Europe, FTTH/B Market Panorama in Europe 2021, p. 20.

Question: Please indicate the number of your gigabit capable connections for the following deployment stages: FTTH/H; HFC; statements refer to your own infrastructure, without leased appliances.

Implications

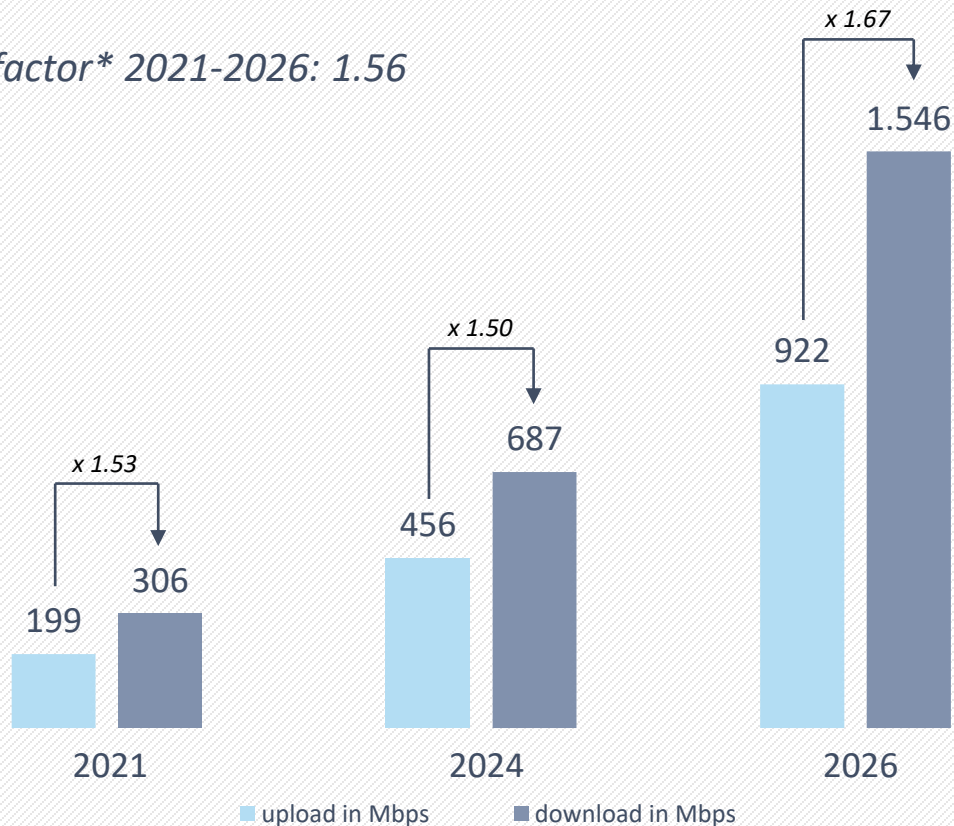
- The take-up-rate for fibre increased **by one percent** despite increasing numbers for Homes Connected and Homes Activated.
- This means that it remains **above the take-up-rate of HFC connections (30%)**.
- The take-up-rate within Europe (Europe 39) is slightly higher (44.9%).

Demand for bandwidth in the next 5 years

The demand for bandwidth is going to increase by a factor of 5-6 in downloads over the next 5 years. Drivers for private customers are IPTV and streaming services, for corporate clients the implementation of cloud architectures.

Corporate clients

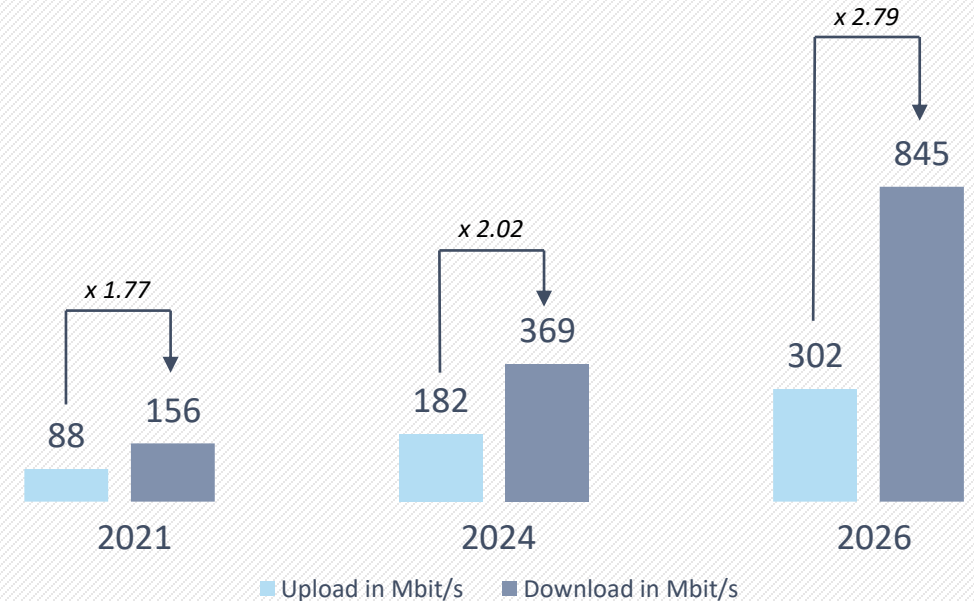
Ø-factor* 2021-2026: 1.56



Source: survey of network operators (n=128). *relation upload to download

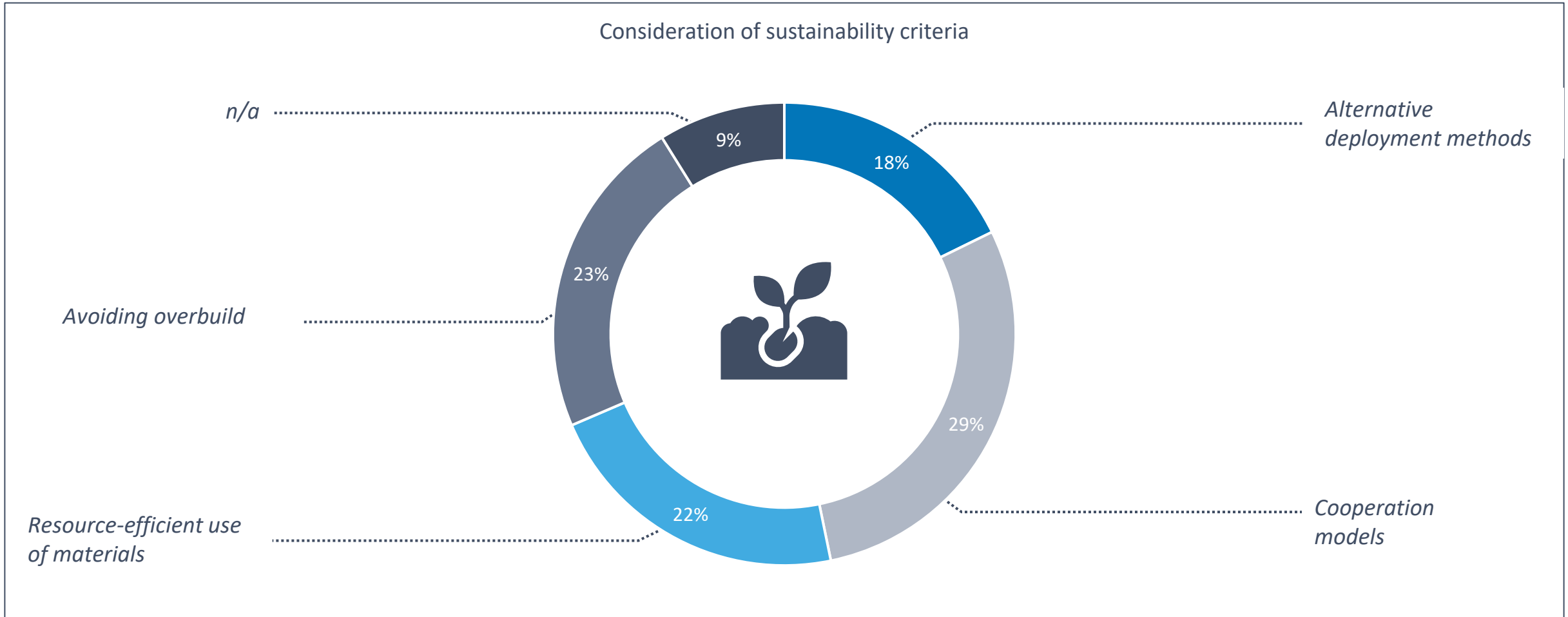
Private customers

Ø-factor* 2021-2026: 2.19



Question: How will the demand for bandwidth develop for corporate clients and private customers in the next years?

Sustainability gains importance in network deployment and becomes a prerequisite for investments.

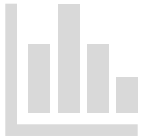


Source: survey of network operators (n=113).; Hamburg Commercial Bank, Fiberweek, 2020.

Question: Are sustainability criteria taken into account in the implementation of fiber optic networks?

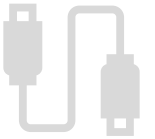
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Market data



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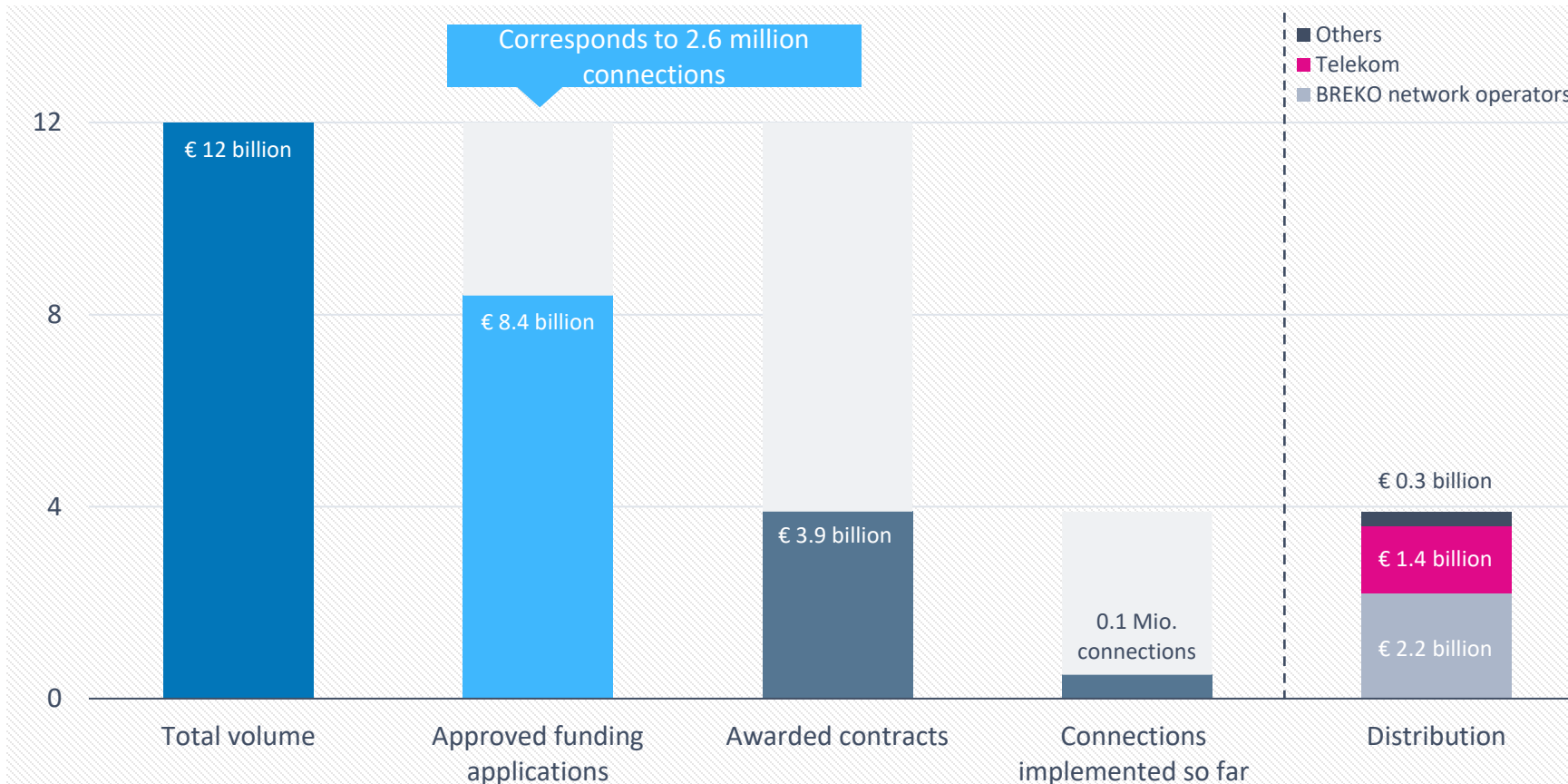
5.

Smart City



BREKO network operators receive € 2.2 billion, which represents 57% of the total amount of funding.

Funding of the federal funding programme



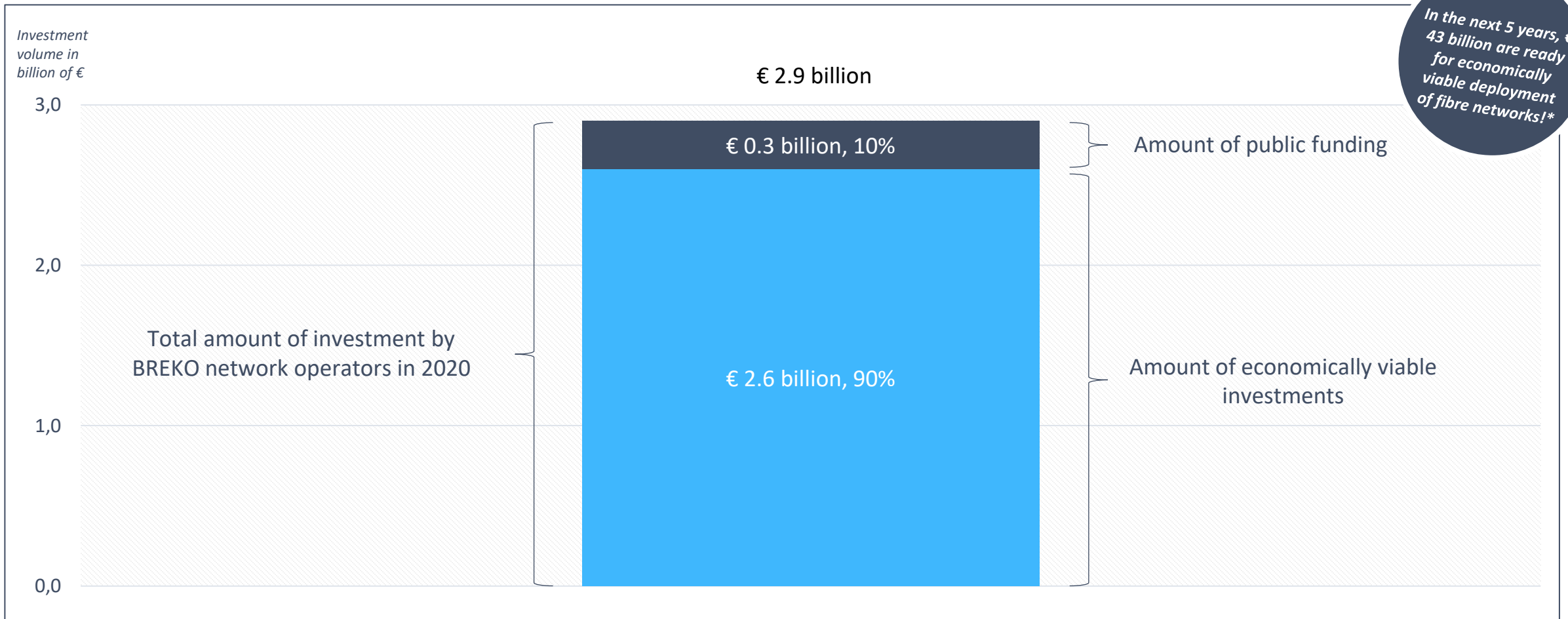
Implications

- The approved volume of € 8.4 billion corresponds to 2,230 projects.
- 2.6 million fiber-optic connections to be built
- The committed volume (awarded contracts) of € 3.9 billion corresponds to 572 roll-out projects
- So far, 122,054 connections have been built with the help of the funding programme.
- The sums are the federal government's share of funding, corresponding to around 50% of the total investment volume.

Source: BMVI (Federal Ministry of Transport and Digital Infrastructure), list of beneficiaries, 1 July 2021 ; federal government's reply to the parliamentary question by delegates Uwe Schulz, Joana Cotar, Dr. Michael Esendiller and the AfD parliamentary group, 26 Mai 2021.

Investments in network deployment

The distribution of public funding is progressing slowly. The main reason is complex procedures.

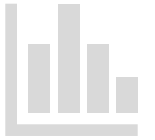


Source: survey of network operators (n=80); *BREKO-forecast

Question: Please indicate your total investments in network deployment in 2020 (in €).

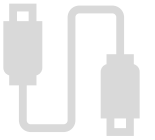
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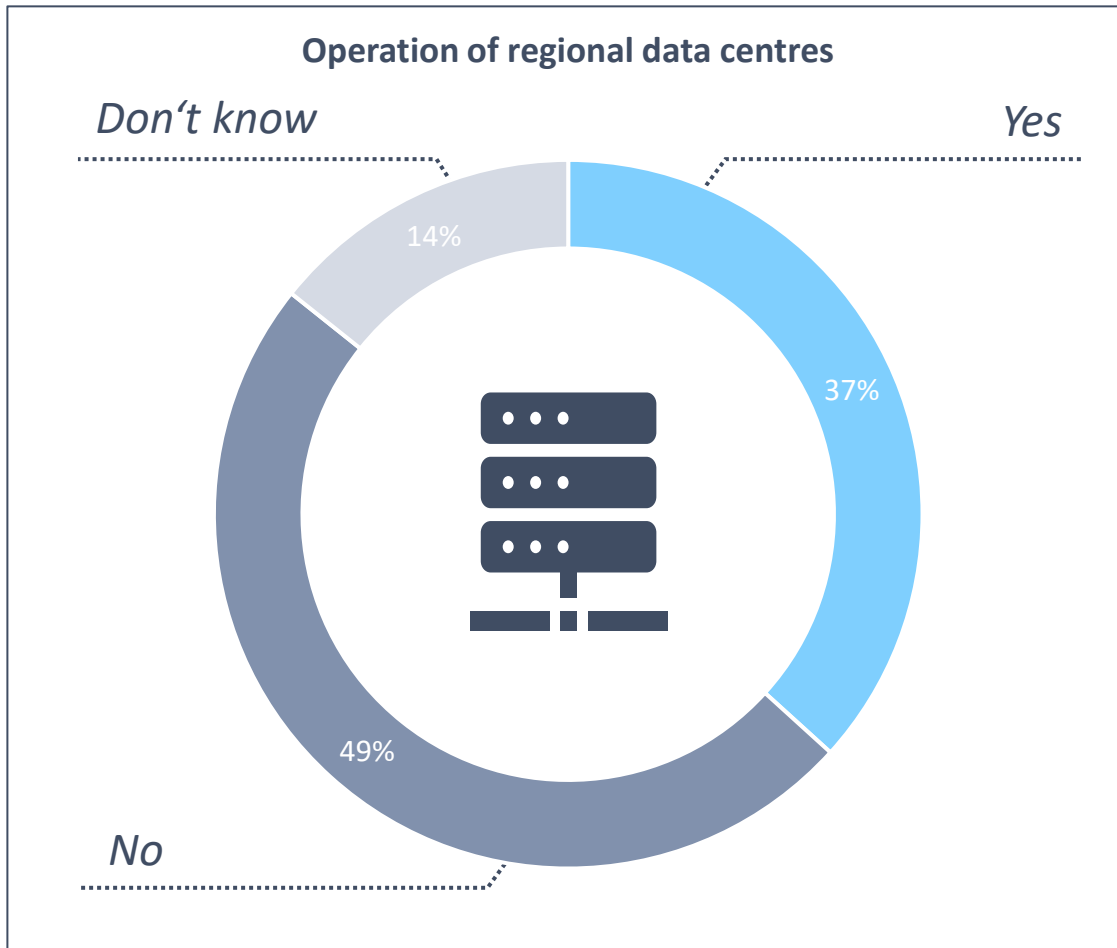
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Smart City



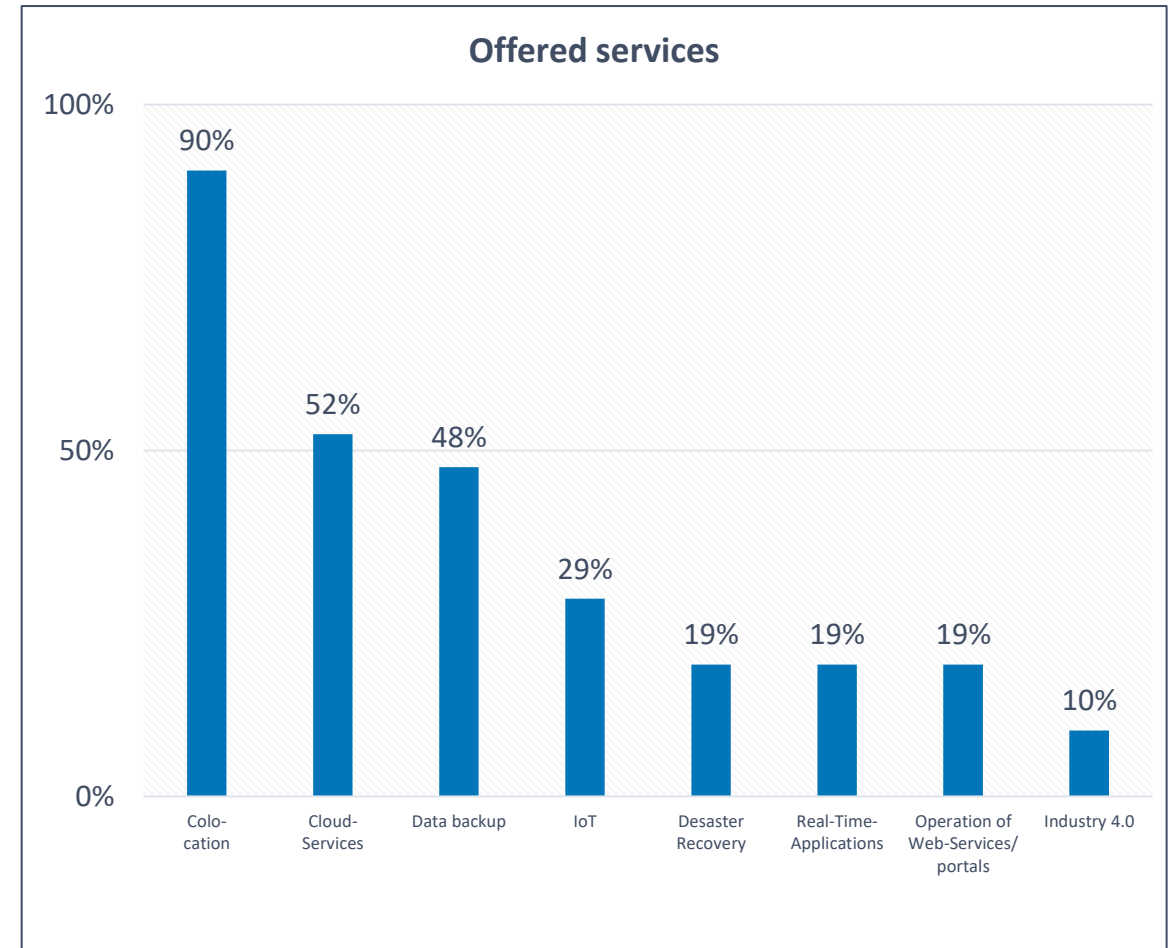
Regional data centres

37% of BREKO network operators operate regional data centres with a broad range of services.



Source: survey of network operators (n=49).

Question: Do you operate regional data centres or do you plan on operating them?

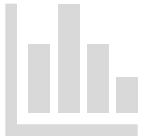


Source: survey of network operators (n=21). Multiple answers possible.

Question: Which services do you offer or plan on offering?

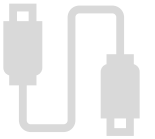
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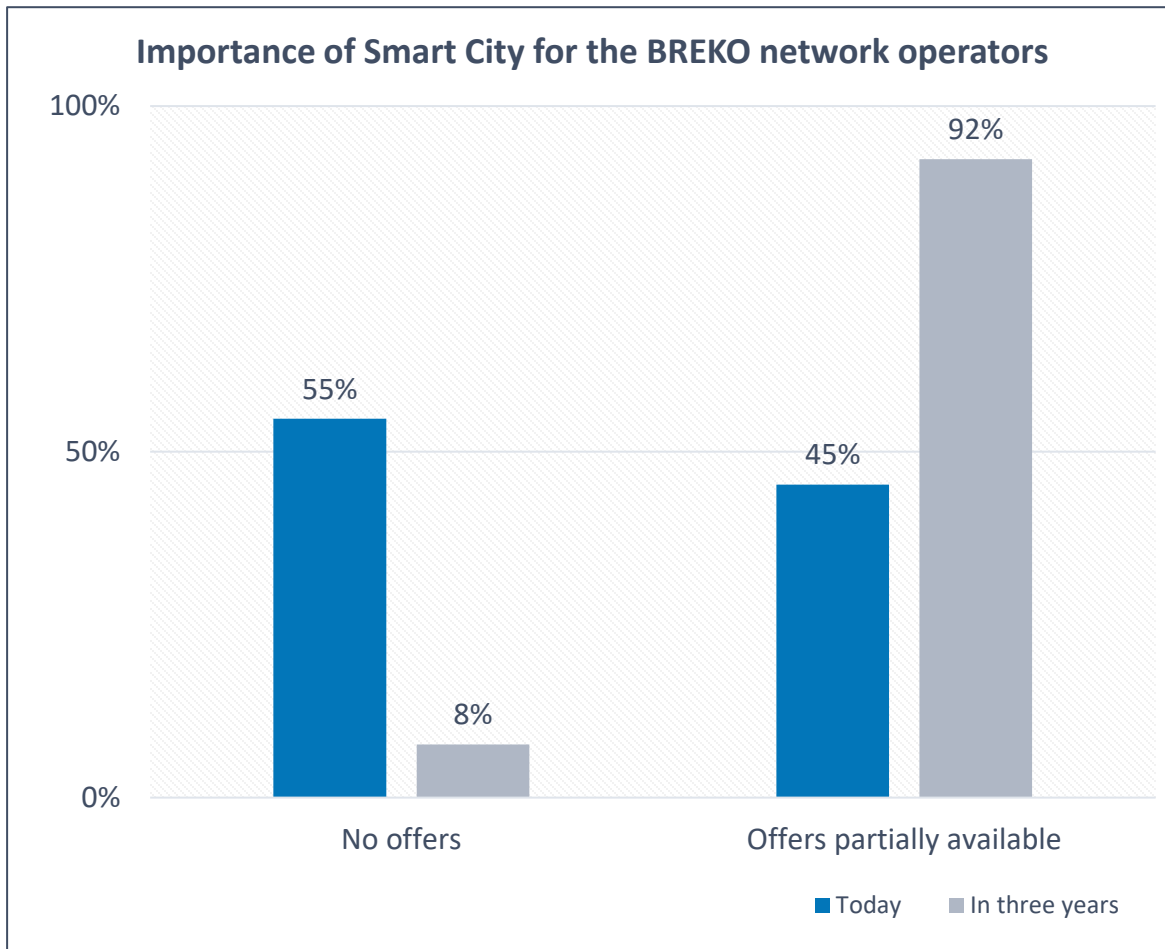
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Smart City



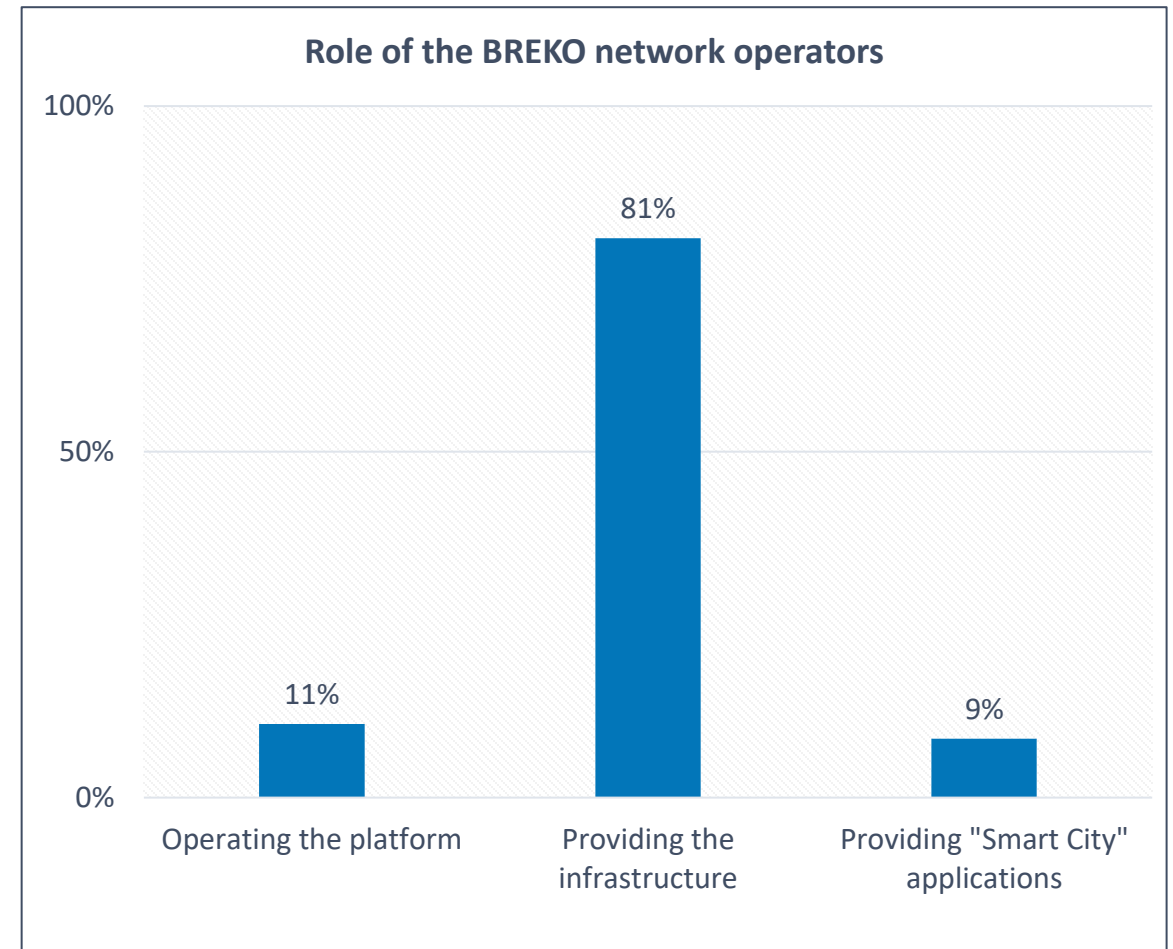
Importance of Smart City

Smart City becomes increasingly important for the BREKO network operators – the focus lies on providing the infrastructure.



Source: survey of network operators (n=39-42).

Question: What role does „Smart City“ play for your company?



Source: survey of network operators (n=47).

Question: How do you assess your role concerning „Smart City“?

The fibre market has a positive trend – investments are being made, supply and demand are increasing.

- Reality exceeds expectations – demand for high bandwidths is coming faster than expected.
- Financing for nationwide fibre deployment in Germany is secured.
- Positive investment climate: The market is developing – investors are making their contributions.
- 2020: Highest investments in telecommunications-infrastructure to date.
- Public funding is being „put into perspective“: The scope for economically viable deployment is growing.
- A new standard connection is developing (esp. for business clients): 1 GBit/s, almost symmetrical.
- Alternative network operators are increasingly offering data centre services with the goal of strengthening digital sovereignty.

BREKO



Dr. Stephan Albers

Managing Director

 albers@brekoverband.de

 +49 (0) 228 24 999 – 70



Anna Nass

Director Strategy and Economics

 nass@brekoverband.de

 +49 (0) 228 24 999 – 70

BOECKER ZIEMEN



Prof. Dr. Jens Böcker

Scientific Advisory Board

 boecker@boecker-ziemen.de

 +49 2241 26101 – 81



Nicholas Hayer

Consultant

 hayer@boecker-ziemen.de

 + 49 2241 26101 – 93