



# ROMANIA DATA CENTERS



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# FOREWORD

Just as the 20th century marked a new era in human civilization through the industrial revolution, the 21st century is undeniably all about technology reshaping both our society and our everyday experiences. 23 years ago, at the time of the dotcom bubble burst, only 7% of the global population had internet access. Today, more than 5 billion people are connected to the internet, with an estimated 100 zettabytes of data generated currently per year.

Consequently, this exponential expansion has given rise to a corresponding growth in the data center industry, with more than 8,000 operational data centers worldwide.

In recent times, the energy crisis resulting from the Russia-Ukraine conflict, the need for operators to reduce costs but, most significantly, the impending threat of climate change, have intensified the need to transition toward the development of sustainable data centers. Projections now indicate that by 2025, data centers' energy consumption could contribute to 3.2% of the world's total carbon emissions, potentially consuming as much as 20% of the global electricity supply.

Romania possesses distinct strategic advantages for data center development, including a substantial proportion of renewable electricity sources, energy self-sufficiency and an availability of large land plots at more competitive prices than those found elsewhere in Europe. Since the data center industry in Romania is still in its infancy, with a limited stock, the following report will explore the opportunities Romania provides to data center operators, its strong suits as well as its weak points and the prospective development of the sector in the following years.

# ROMANIA IN NUMBERS



**19.05 M  
INHABITANTS**

52.2% live in urban areas  
79/sqm density

**€286.5 B  
2022 GDP**

€15,039 GDP per capita, 2022

**87%  
FTTP COVERAGE**

37% above EU average

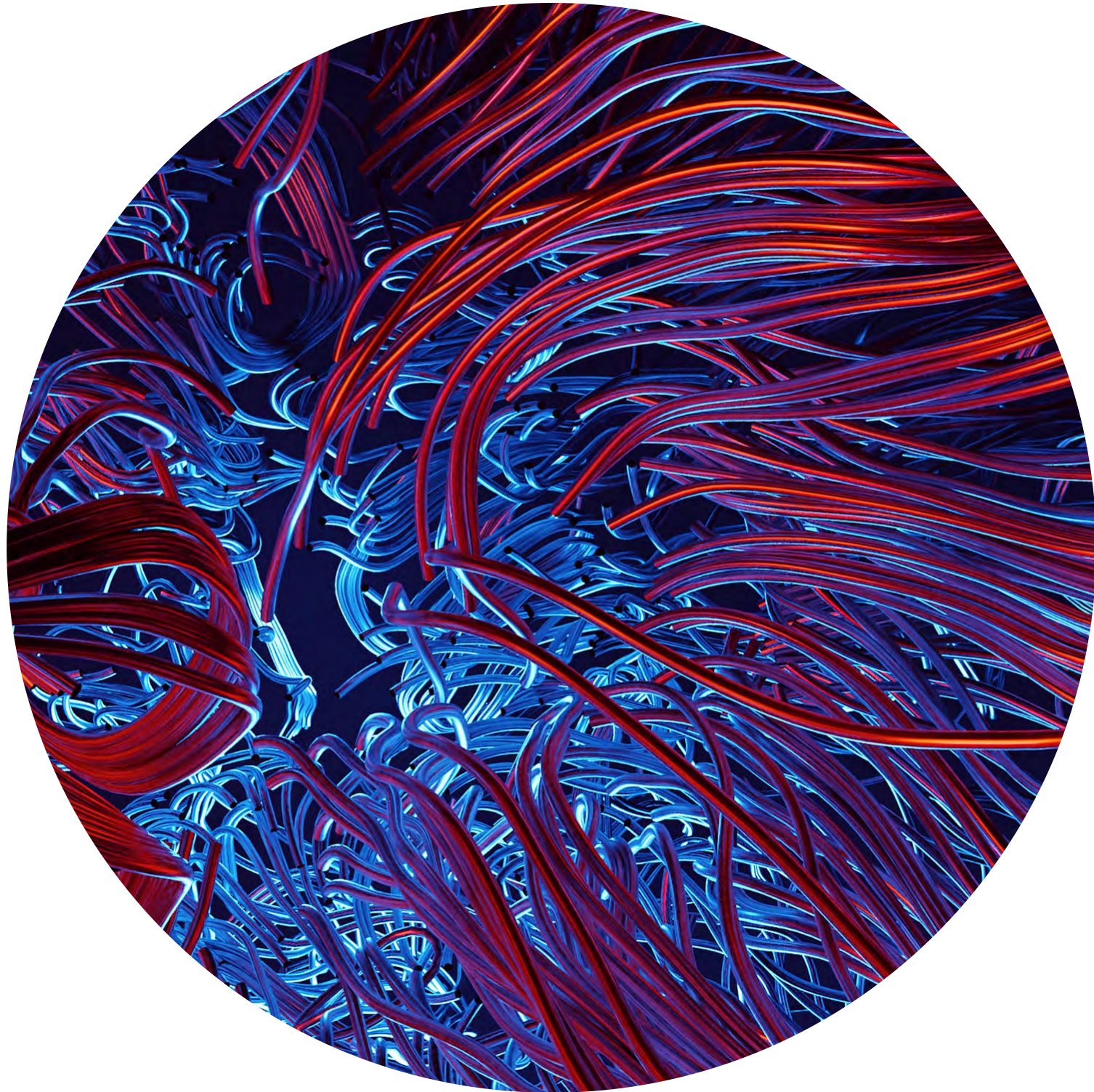
**26.8%  
5G COVERAGE**

54.2% under EU average

**30\*  
DATA CENTERS**

60.8 MW capacity  
37,200 sqm

\*This study relies on Crosspoint Real Estate findings and data provided by TeleGeography for the express purpose of this research. It is important to note that the list of data centers may not be exhaustive.



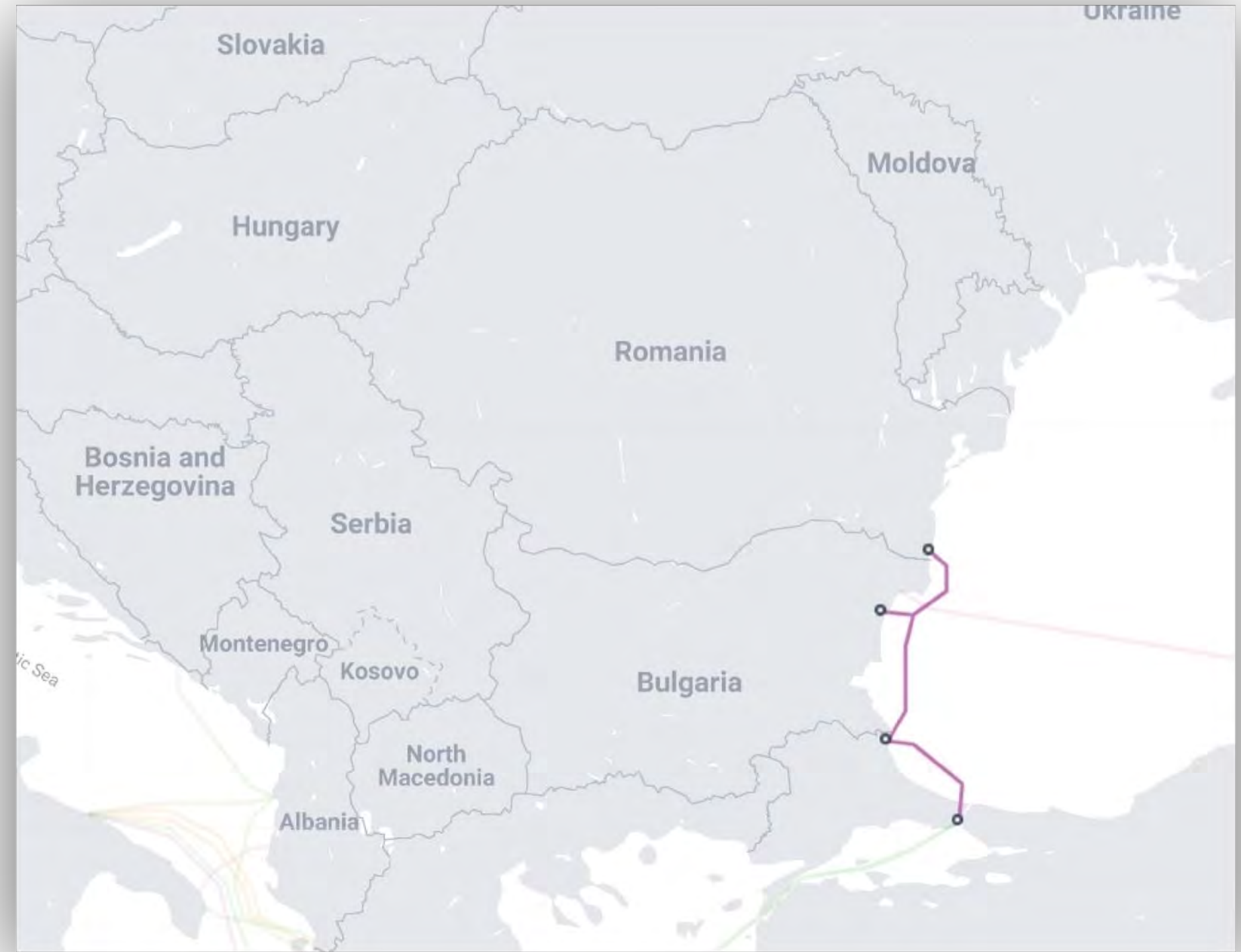
**INFRASTRUCTURE &  
TECHNOLOGY**

# SUBMARINE CABLES

98% of global internet traffic is routed through approximately 430 operational undersea cables worldwide. Of these, nearly 190 submarine cables are connected to Europe, establishing vital links between the continent, the Middle East, Africa, the Asia-Pacific region and the Americas.

Currently, there is only one submarine cable connected to Romania.

While there are no anticipated plans for additional submarine cable projects in Romania, the country's robust internet infrastructure, highly effective internet service providers, and favorable policies overshadow this perceived limitation. As of August 2023, Romania held the 14th position globally in terms of the fastest broadband internet speed, as reported by the Speedtest Global Index.



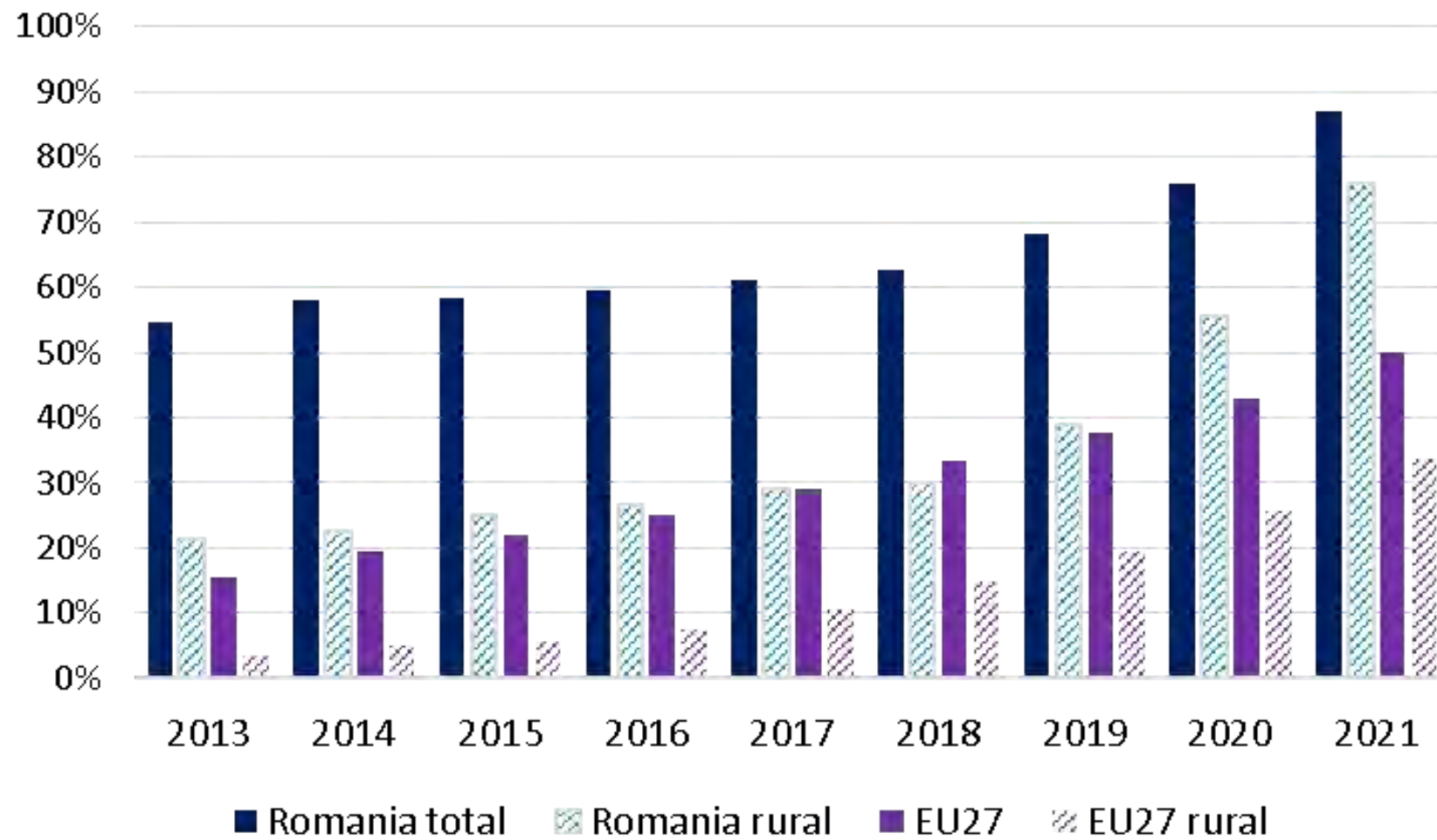
SUBMARINE CABLE NAME/ OWNER	YEAR	LENGTH	LANDING POINTS
KAFOS/ TURK TELEKOM INTERNATIONAL	1997	538 KM	<ul style="list-style-type: none"> <li>• ISTANBUL, TURKEY</li> <li>• IGNEADA, TURKEY</li> <li>• VARNA, BULGARIA</li> <li>• MANGALIA, ROMANIA</li> </ul>

# FTTP & 5G COVERAGE

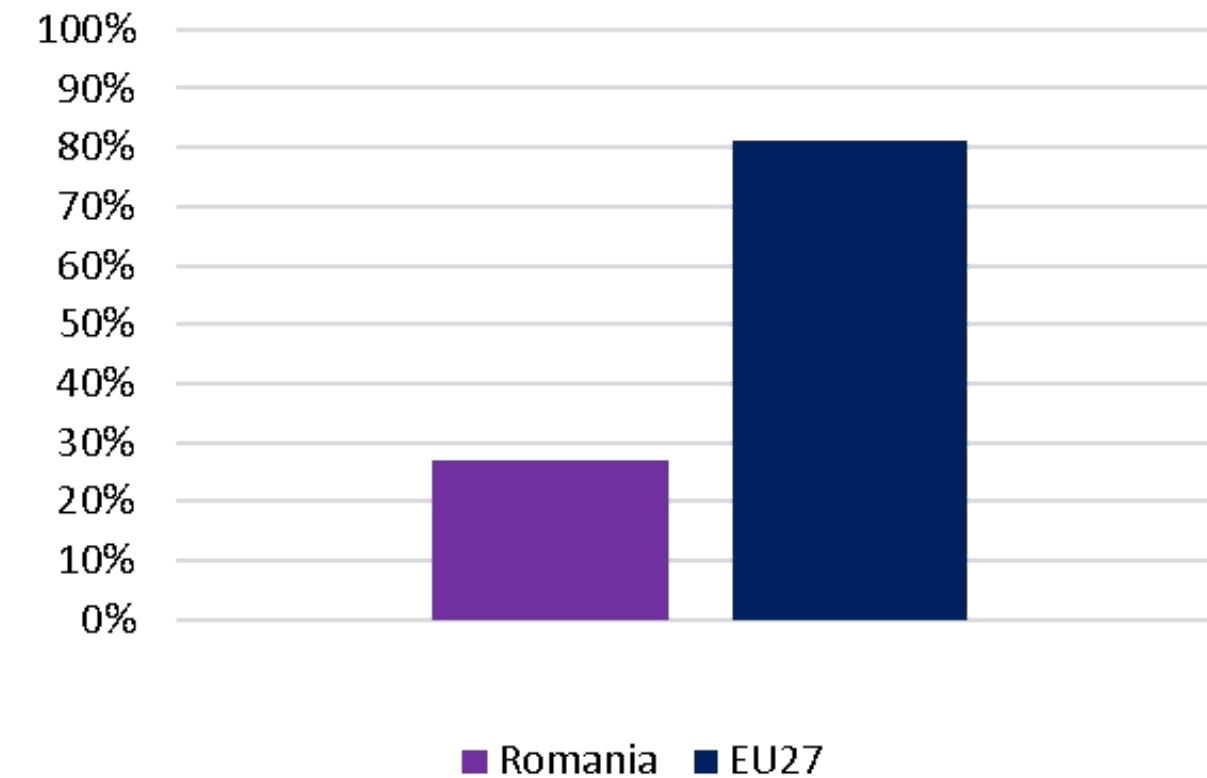
Romania has the 5th most extensive internet coverage in Europe, with 87.1% of households across the country having internet access, including 75.7% of rural households.

5G coverage in Romania lags behind the European average. This can be attributed to several factors, including the country's low population density, a significant rural population percentage, and the widespread availability of FTTP connections, reducing the immediate demand for higher mobile data coverage.

**% OF HOUSEHOLDS WITH FTTP COVERAGE**

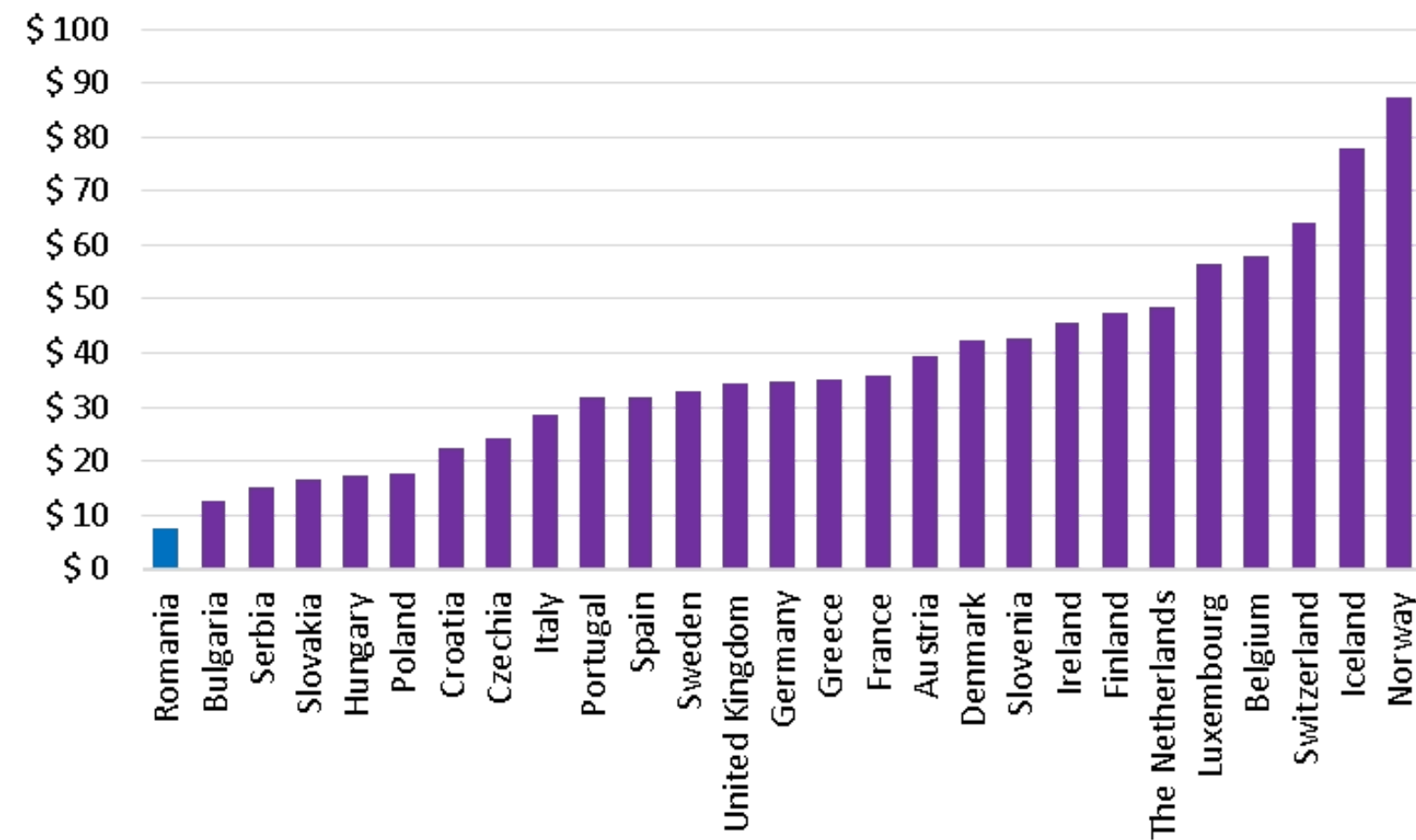


**5G COVERAGE, JULY 2022**



# FTTP & 5G PRICING

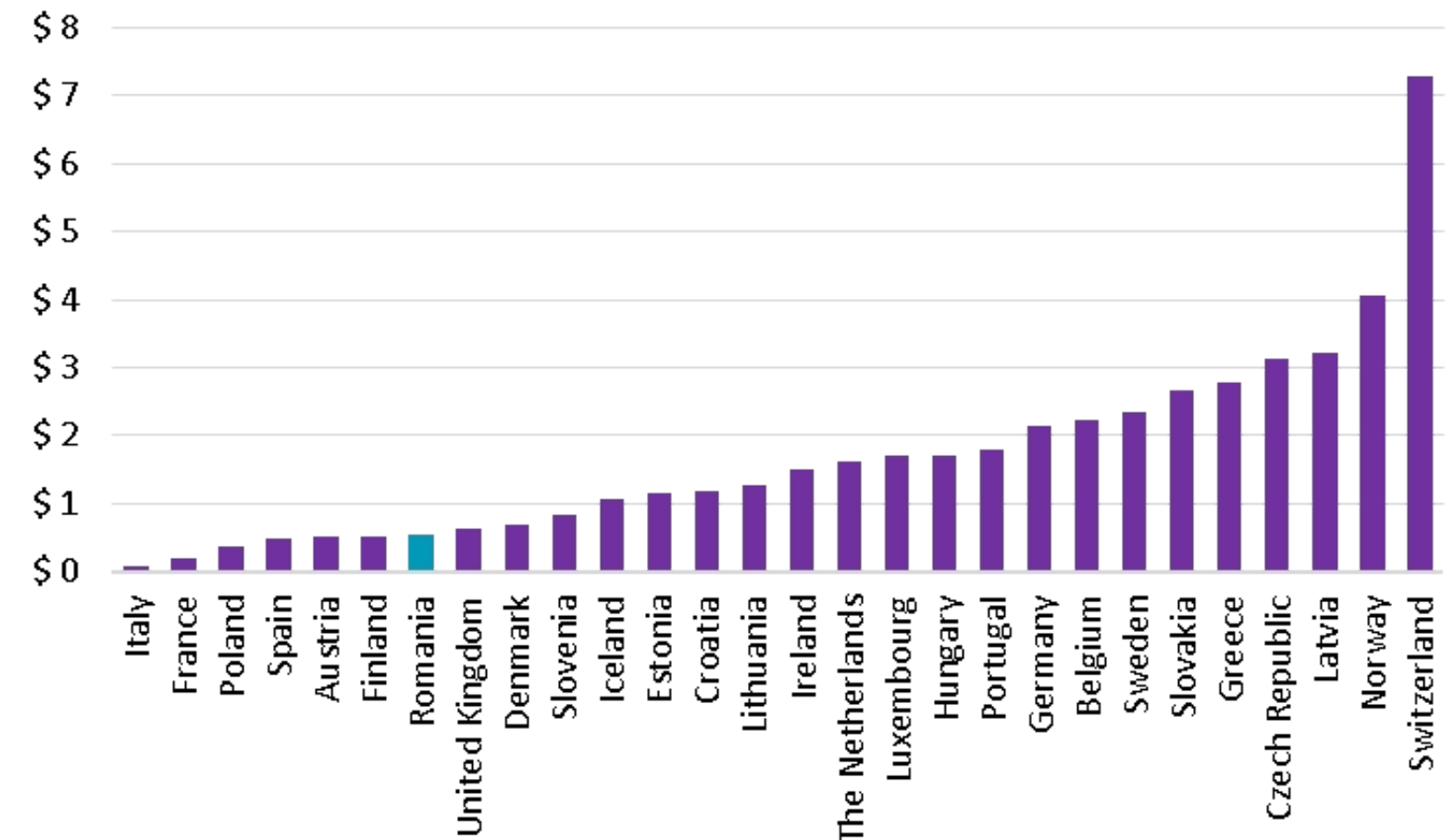
**AVERAGE COST OF BROADBAND, 2023 (USD/MONTH)**



Romania has the lowest cost of broadband in Europe, with an average price of \$7.57/month.

The average price for 1 GB of used mobile data stands at \$0.54, one of the lowest in Europe. Additionally, in SpeedCheck's 2022 5G Speed-Price Index, Romania features five mobile data plans that rank among the top 20 most cost-effective plans in the world.

**AVERAGE COST OF MOBILE DATA, 2023 (USD/GB)**

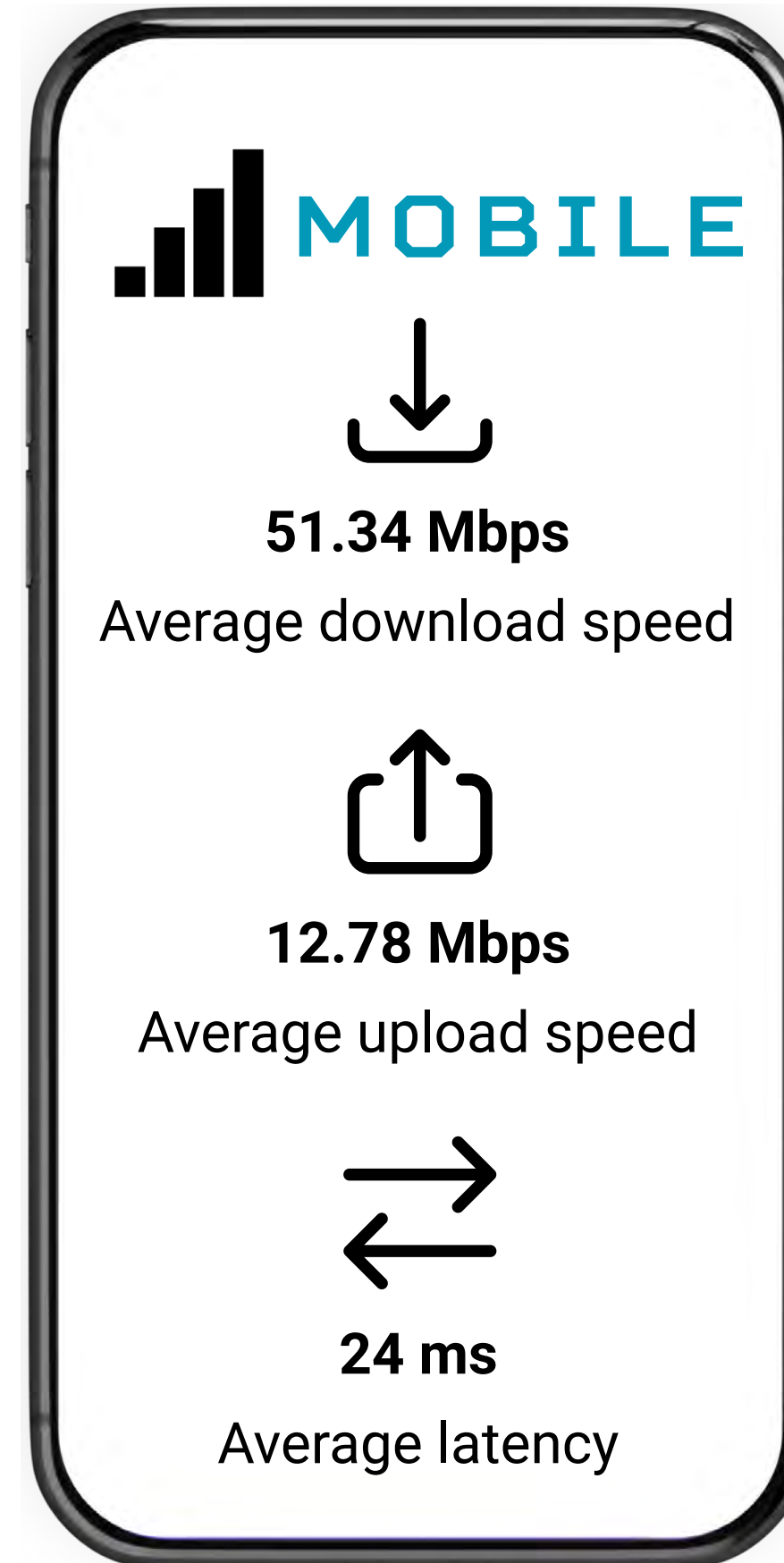
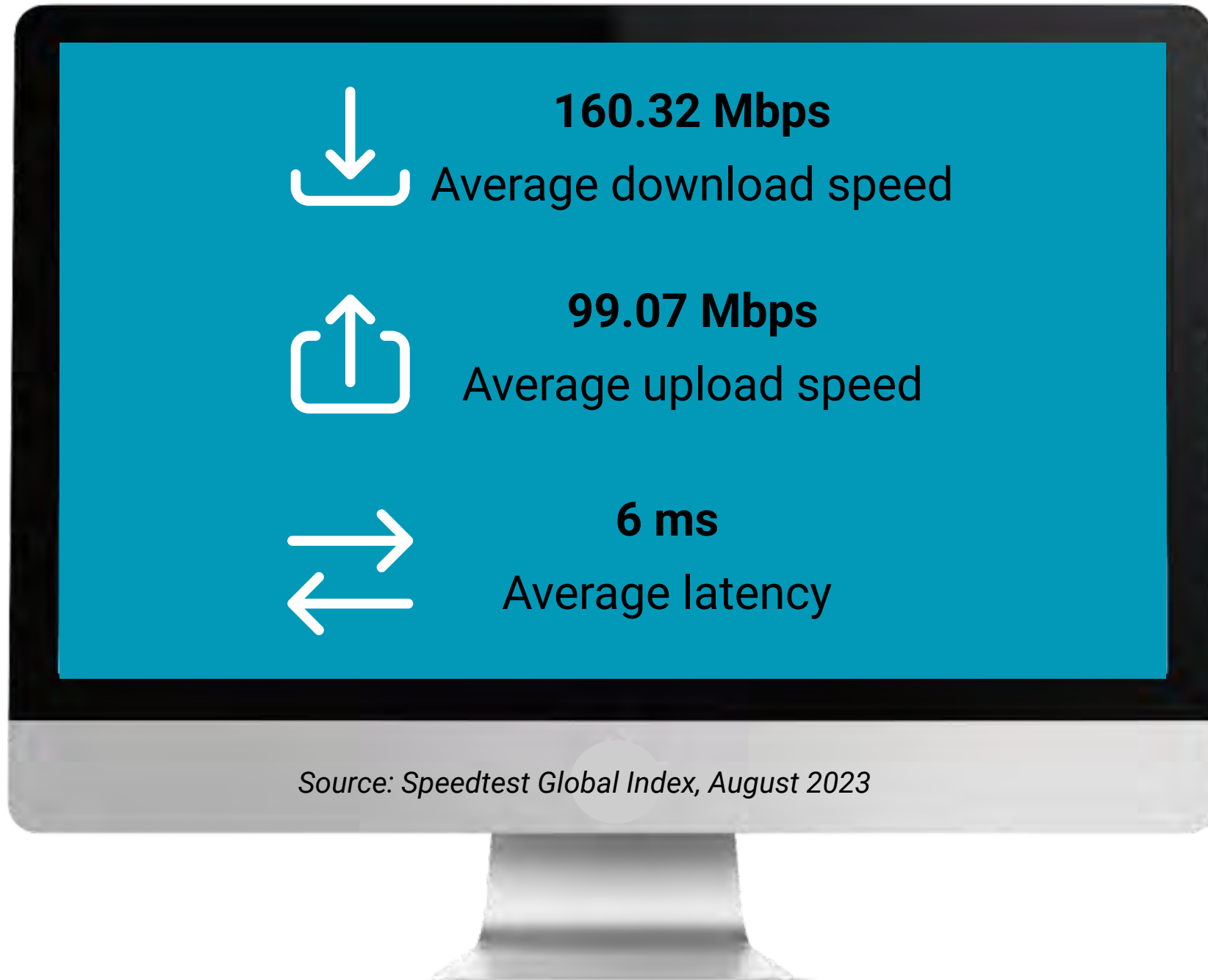




# MEDIAN SPEED



**WORLD RANK  
14**



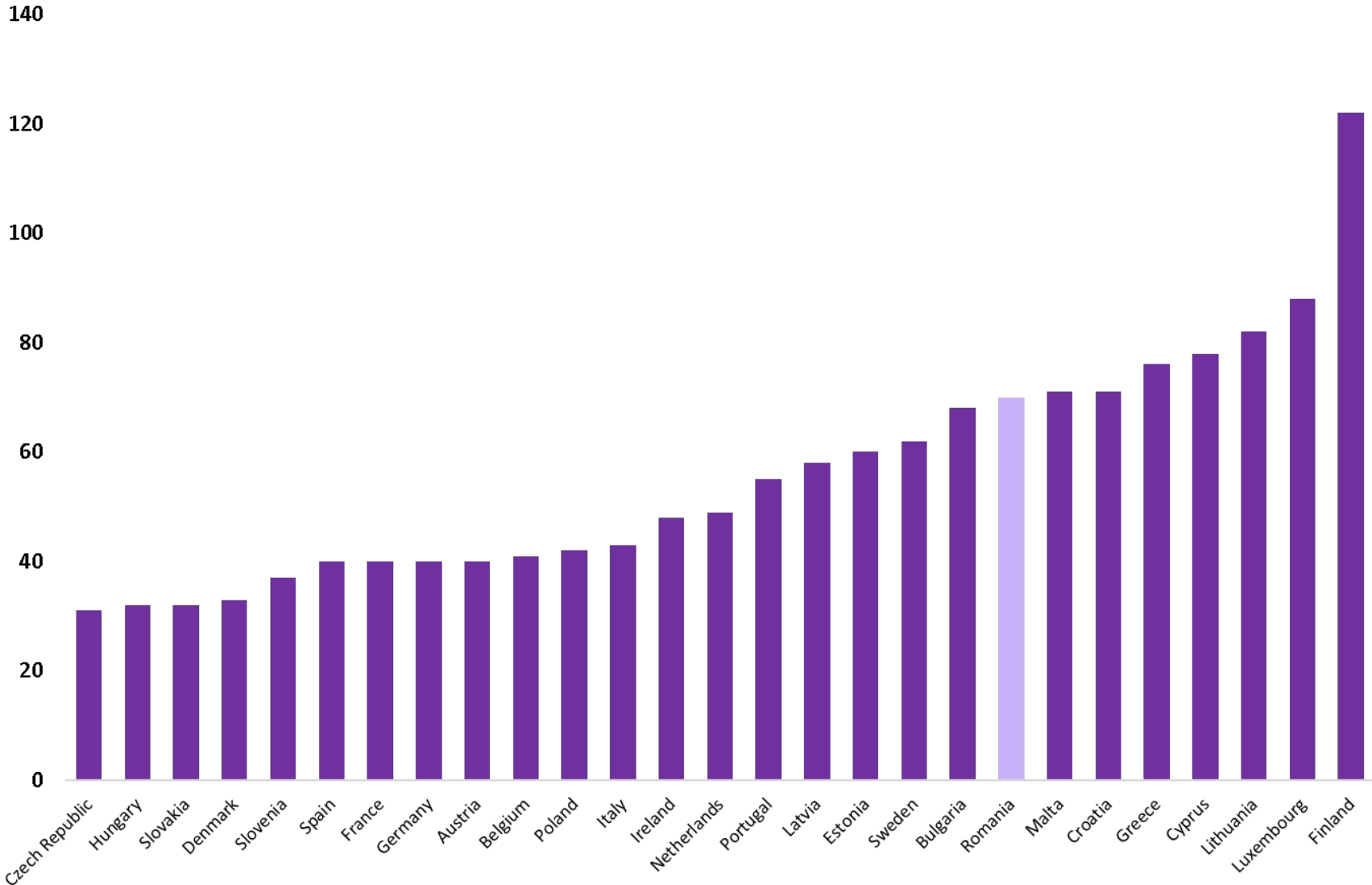
**WORLD RANK  
45**

# DATA LATENCY



The average PING is 70 ms on average in Romania, which is on the high end compared to its CEE peers (42 ms in Poland, 32 ms in Hungary) and above the EU average of 56 ms.

**AVERAGE PINGS IN THE EU, SEPTEMBER 2023 (ms)**

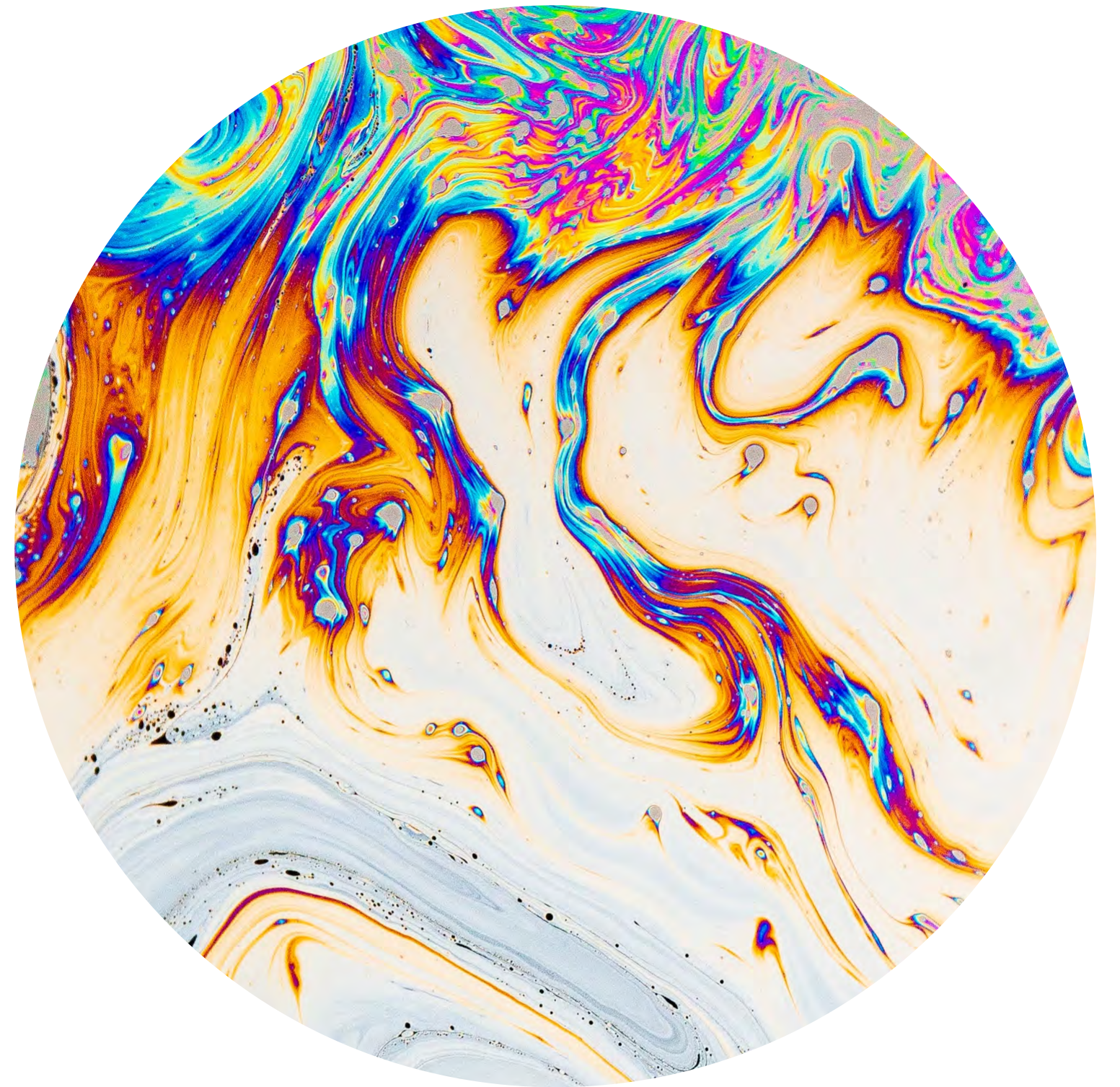


**EUROPEAN ROUND TRIP LATENCY**

<b>ROUTE TYPES</b>	<b>AVERAGE ROUND TRIP DELAY (MS)</b>
<b>Intra-European</b>	<b>9</b>
<b>Mediterranean</b>	<b>12</b>
<b>Trans-Atlantic</b>	<b>63</b>
<b>Europe-Asia</b>	<b>89</b>
<b>Europe-Africa</b>	<b>105</b>

A full-page background of marbled paper with swirling patterns in shades of blue, orange, yellow, and purple. A white circle is centered on the page, containing the text "NATURAL RESOURCES & ENERGY" in a bold, black, sans-serif font.

**NATURAL RESOURCES  
& ENERGY**



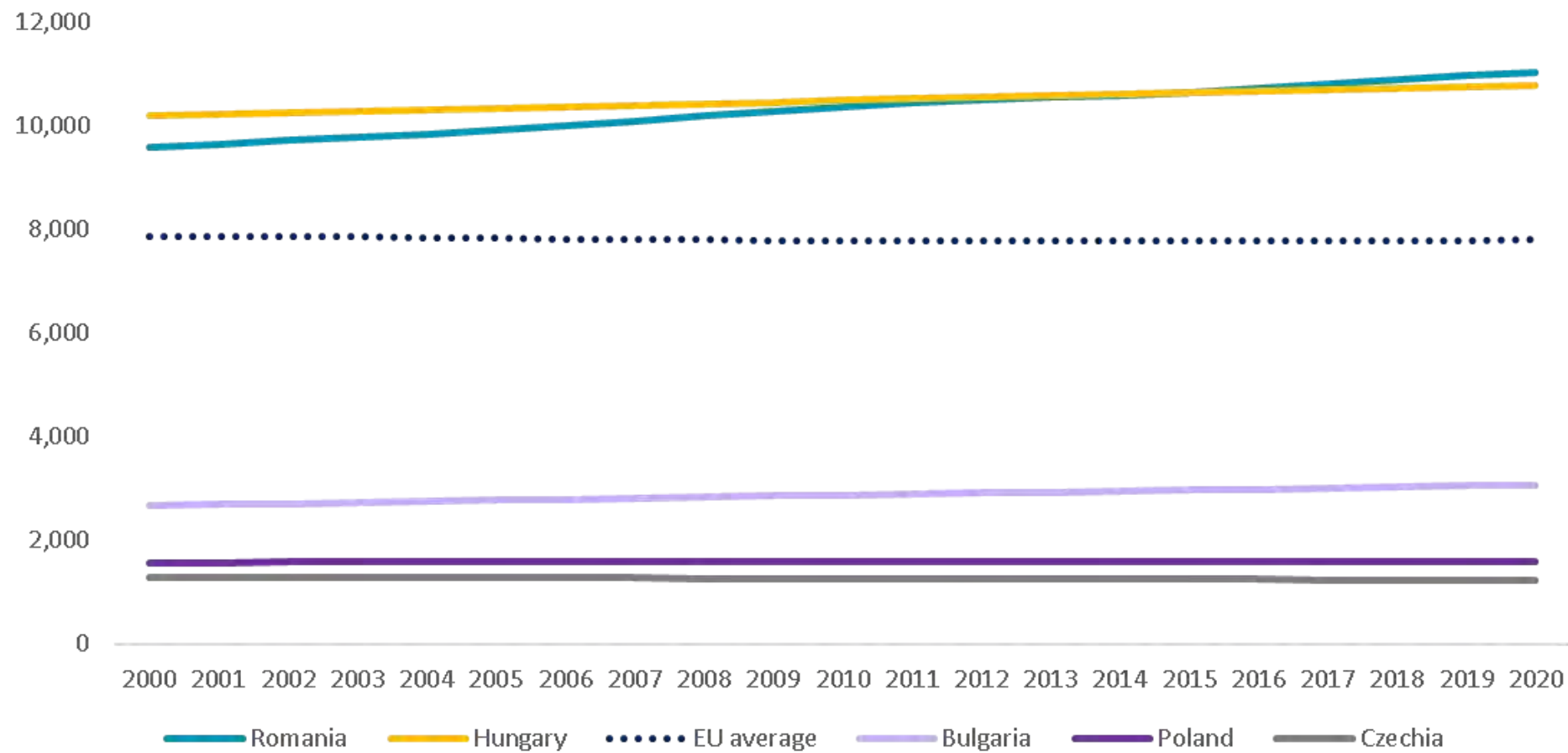
# ELECTRICITY MAP

Lines and cables	Power plants
<b>Different voltages (colours)</b>	<b>Symbols for under operation and under construction</b>
750 kV transmission line	Biogas
500 kV transmission line	Biomass
380-400 kV transmission line	Brown coal/Lignite
300-330 kV transmission line	Coal derived gas
220-275 kV transmission line	Fossil fuel
110-150 kV transmission line	Fossil gas
DC-line	Fossil oil
<b>Different lines (for all voltages) under operation</b>	Fossil peat
1 circuit	Geothermal
Double circuit	Hard coal
Double circuit with 1 circuit mounted	Hydro marine
>= 3 circuits	Hydro mixed pump storage
<b>Additional information for all lines and voltages</b>	Hydro pure pump storage
Under construction (dashed)	Hydro pure storage
Underground (for onshore lines and cables)	Hydro run of river and pondage
Currently used voltage	Mixed fuels
Temporary voltage	Nuclear
Numerals as explained below	Oil shale
<b>Other elements</b>	Other fossil fuel
Connection line	Other (not listed)
Phase shifter	Solar
Substation	Solar photovoltaic
Converter station	Solar thermic
Converter station back-to-back	Waste
Substation(s) & Power plant(s)	Waste (non renewable)
	Waste (renewable)
	Wind farm



# RENEWABLE WATER SUPPLY

**TOTAL RENEWABLE WATER RESOURCES, SELECT CEE COUNTRIES**  
(m<sup>3</sup>/CAPITA/YEAR)



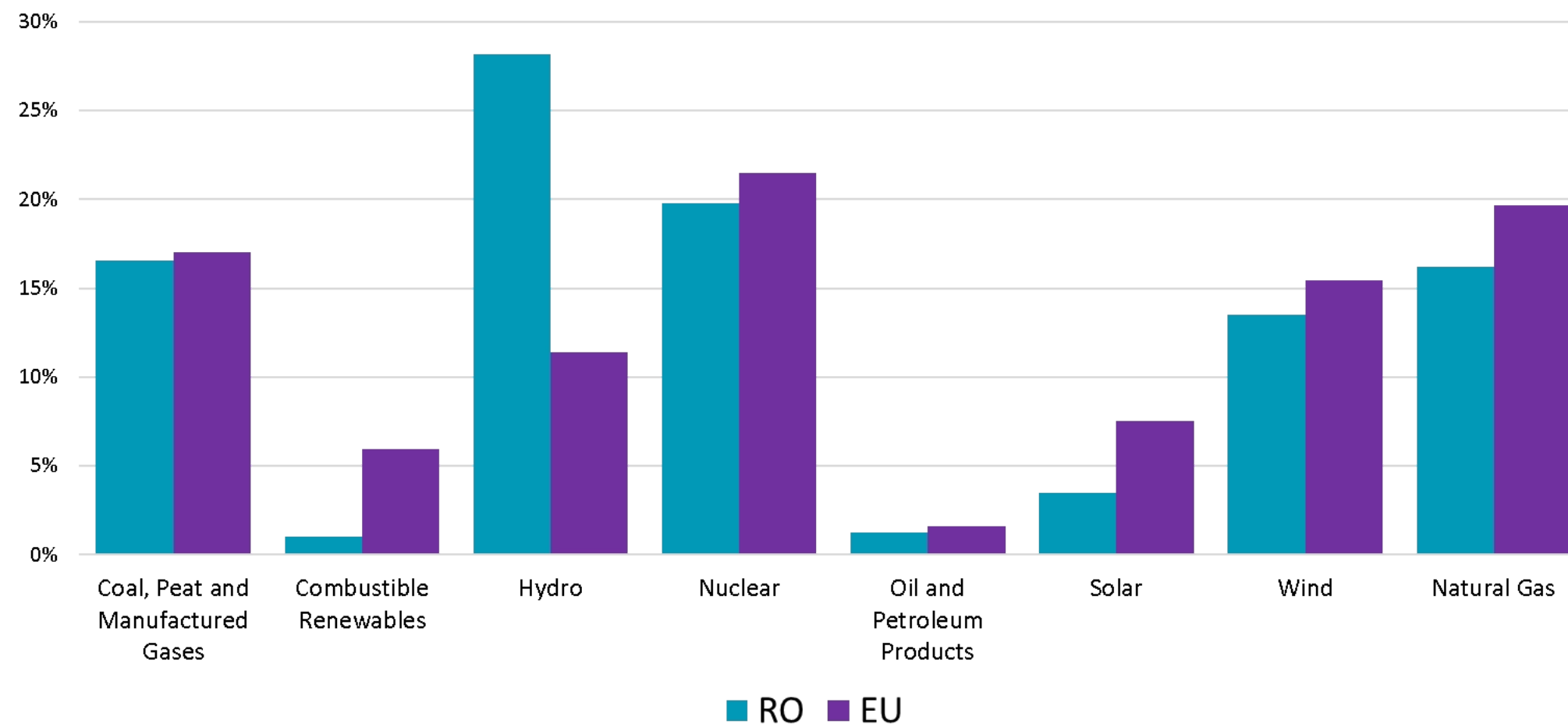
Romania’s renewable water resources stood at 11,021 m<sup>3</sup>/capita/year in 2022, 41% above the EU average. Furthermore, the renewable water supply has increased by 942 m<sup>3</sup>/capita/year in Romania while decreasing by an average of 11% in 17 of the EU-27 countries. Non-EU European countries such as the UK, Switzerland, Iceland and Norway have also recorded decreases in renewable water resources.

Area	2007	2022
Romania	10,079	11,021
Western Europe	4,681	4,634
CEE	7,582	7,587
Northern Europe	124,232	123,383
Southern Europe	2,769	2,772
Baltics	12,075	12,181
Balkans	8,311	8,349

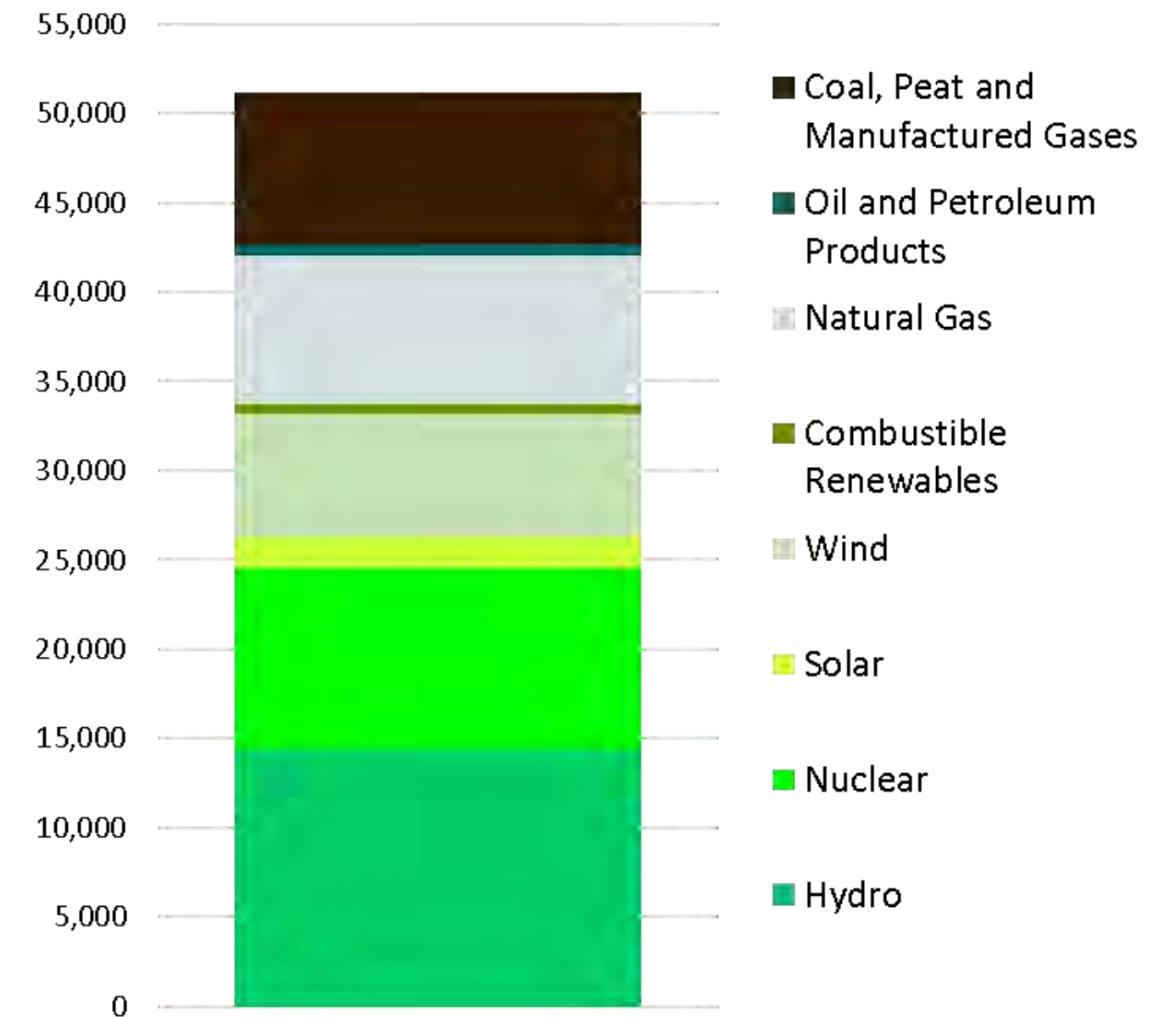
# ELECTRICITY SUPPLY

In Romania, 66% of the produced electricity is derived from green sources, including renewables and nuclear, surpassing the overall EU level. Romania will also expand its nuclear capacity by 1,400 MW through the introduction of two additional reactors by 2030.

SHARE OF SOURCES IN ANNUAL ELECTRICITY PRODUCTION, ROMANIA & EU TOTAL, 2022



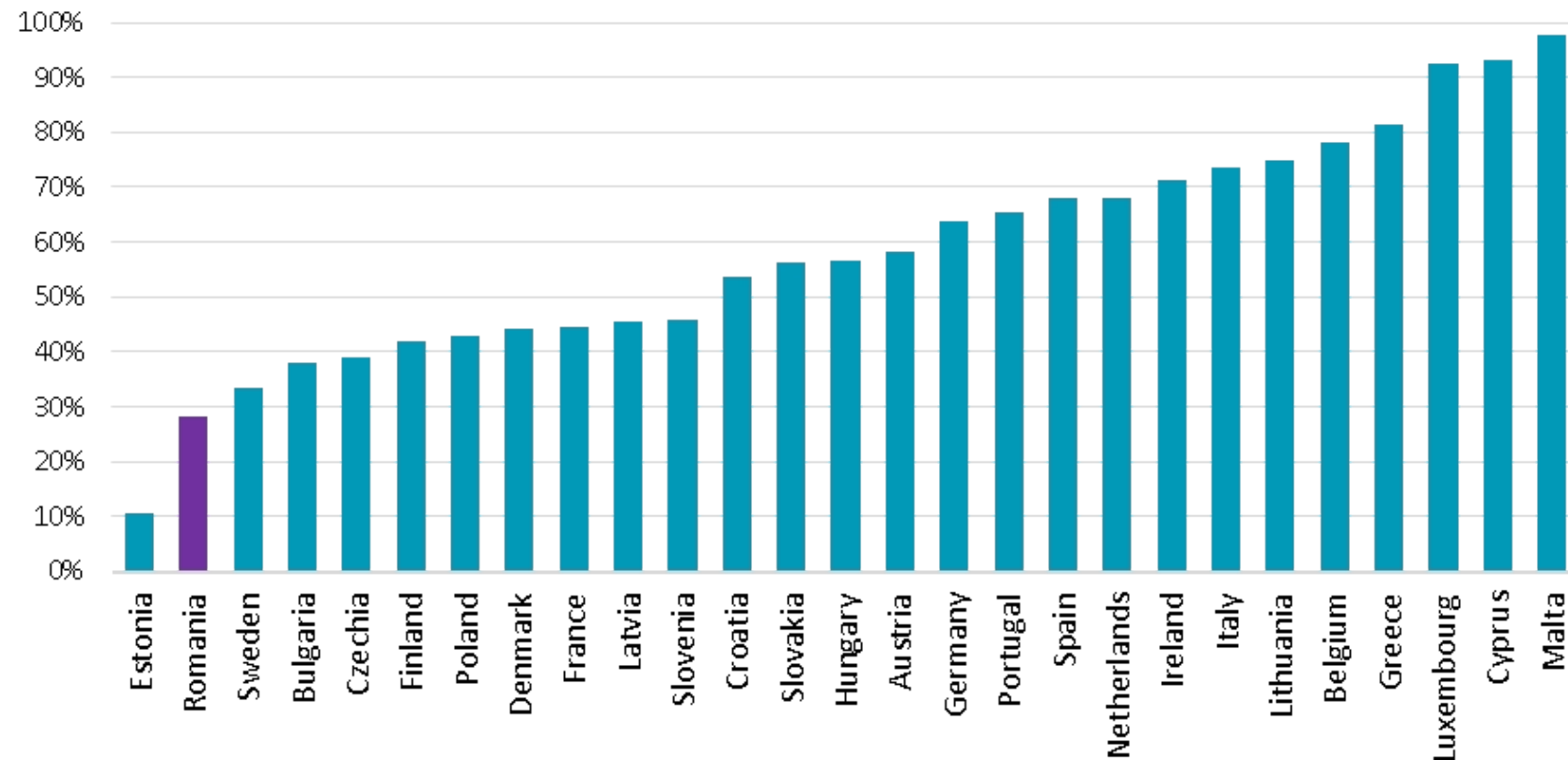
NET ELECTRICITY PRODUCTION (GWH) IN ROMANIA BY PRODUCT TYPE, 2022



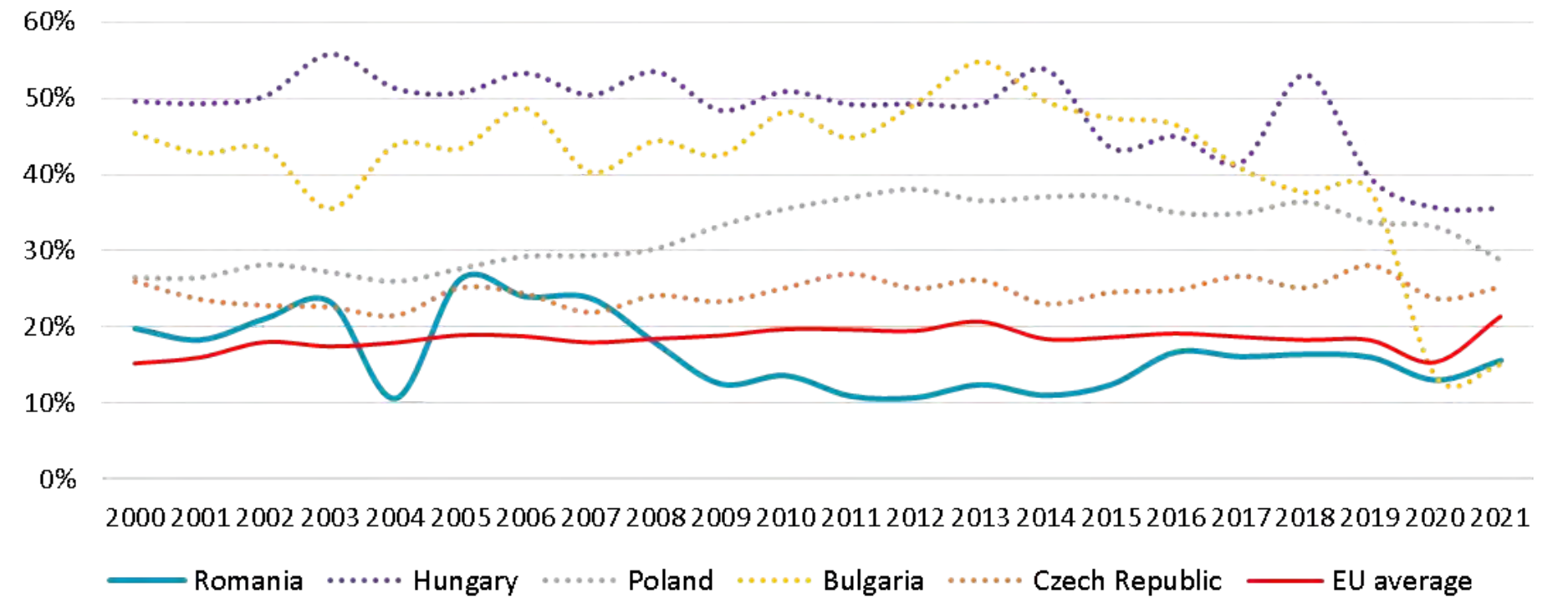
# ENERGY DEPENDENCY

Romania has the second lowest overall energy dependency in the EU, of 28.2%, and a constant low dependency on Russian fuels, under the EU average.

**TOTAL ENERGY DEPENDENCY IN THE EU  
2020**

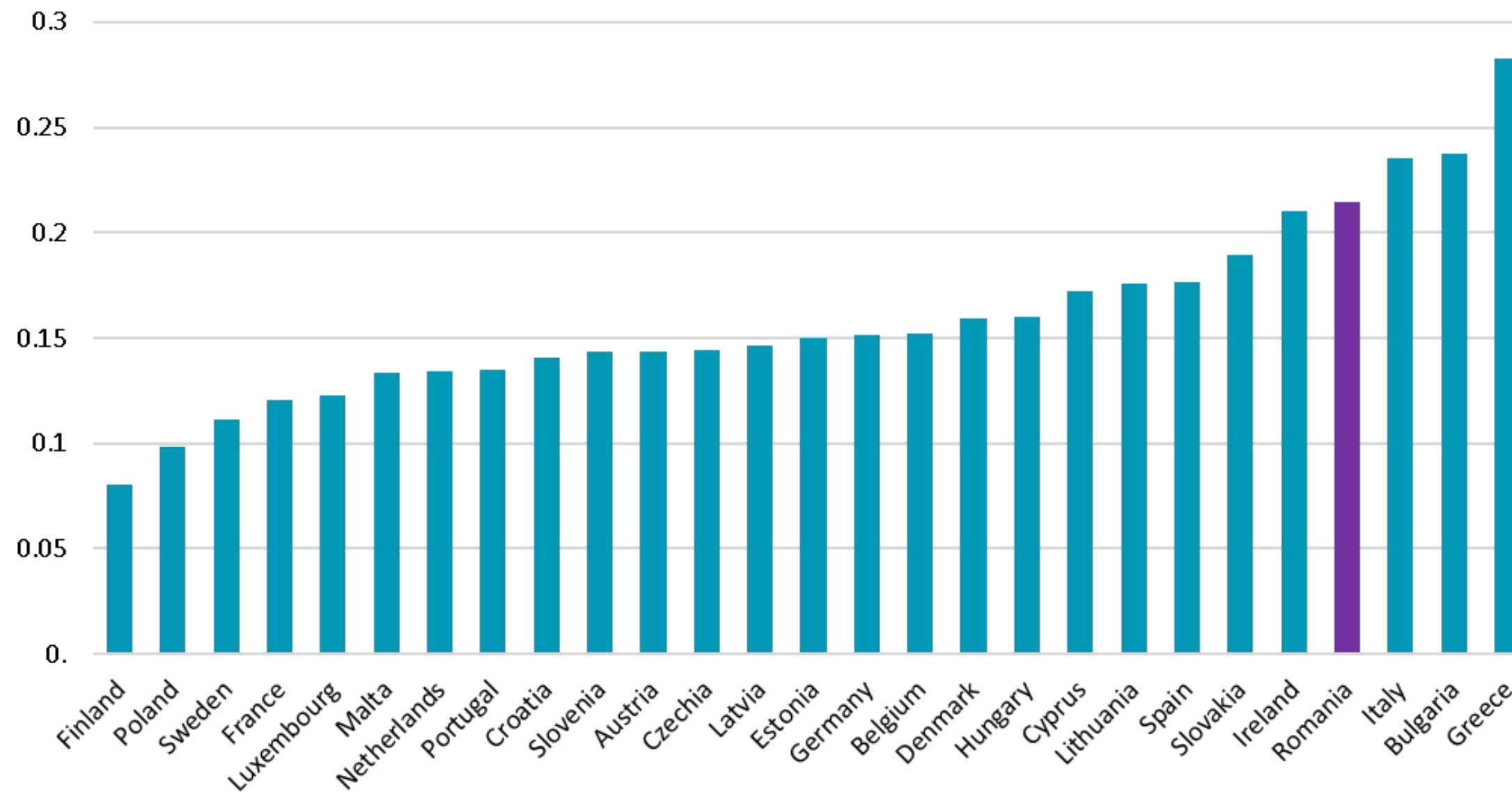


**DEPENDENCY ON RUSSIAN FOSSIL FUELS,  
SELECT CEE COUNTRIES AND EU AVERAGE  
2000-2021**

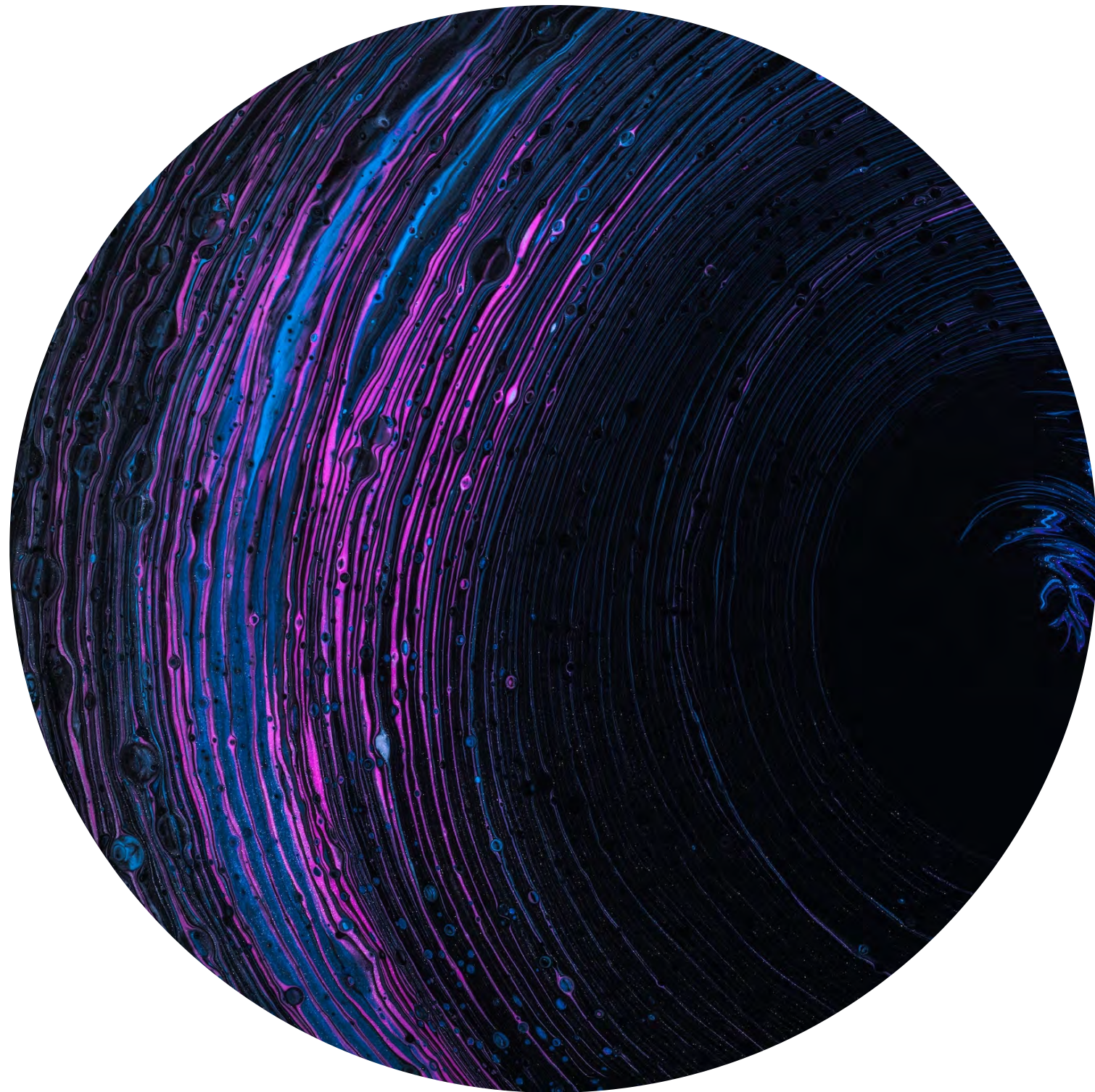


# ENERGY PRICES

Despite its high level of energy independency, Romania has one of the highest electricity prices in the EU for non-household consumers. However, electricity suppliers provide a number of facilities meant to encourage investments and significantly reduce the net electricity costs.







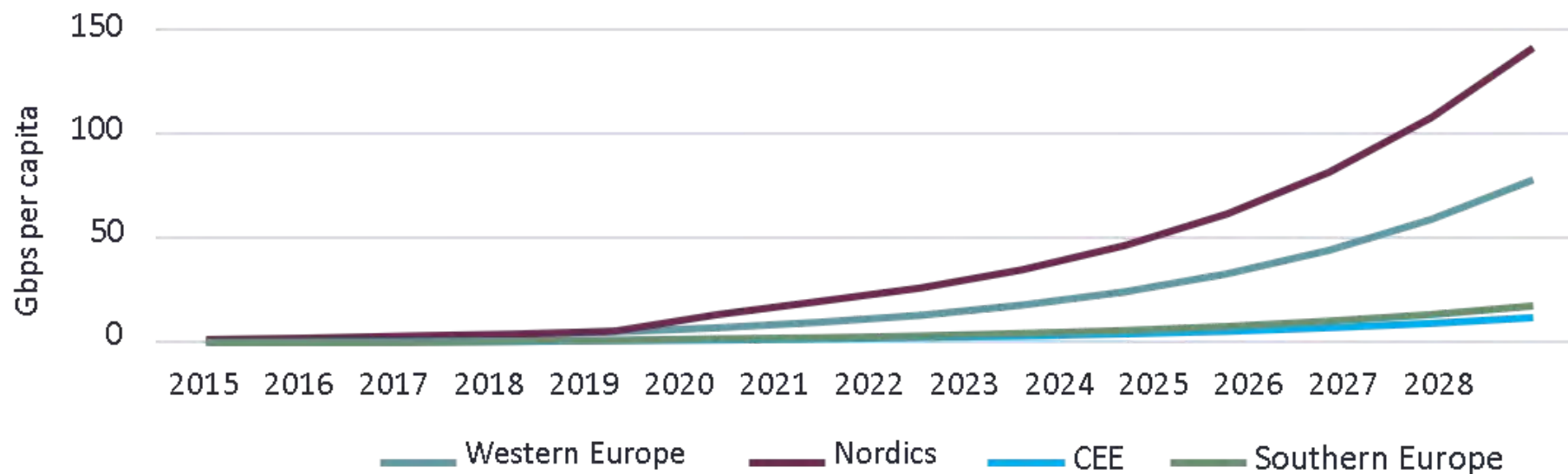
**EXISTING & FUTURE  
DEMAND**



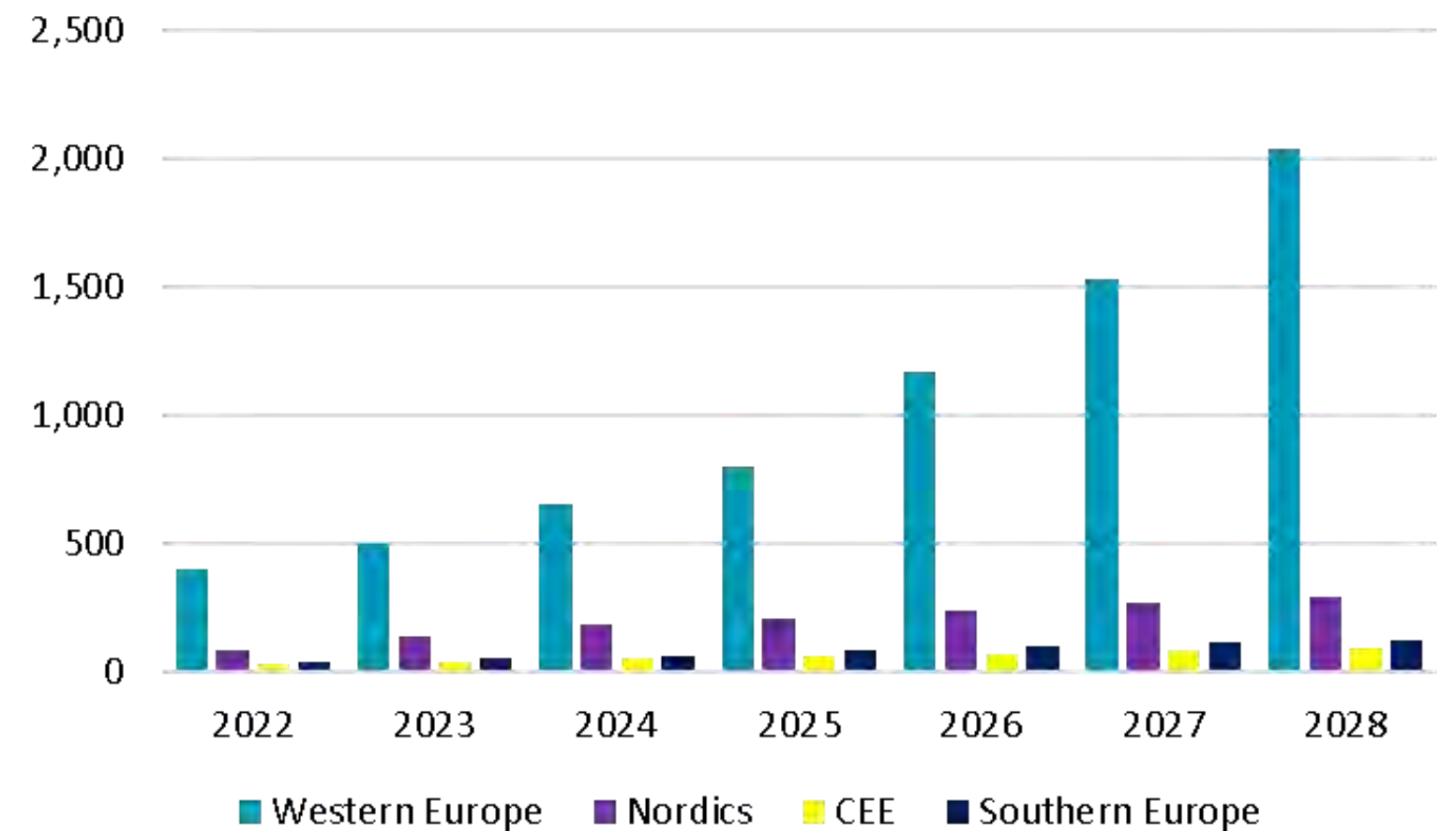
# BANDWIDTH

Bandwidth in Europe is expected to increase up to 2,540 Tbps\* by 2028, with CEE projected to reach nearly 100 Tbps, from 30 Tbps in 2022. Romania's internet bandwidth is estimated at approximately 1 Tbps in 2023\*\*.

**EUROPEAN BANDWIDTH USAGE PER CAPITA  
2015-2028 (Gbps)**



**EUROPEAN BANDWIDTH EVOLUTION, 2022-2028 (FORECAST)  
(Tbps)**



Sources: TeleGeography, IEA, Oxford Economics, ANCOM, ITU

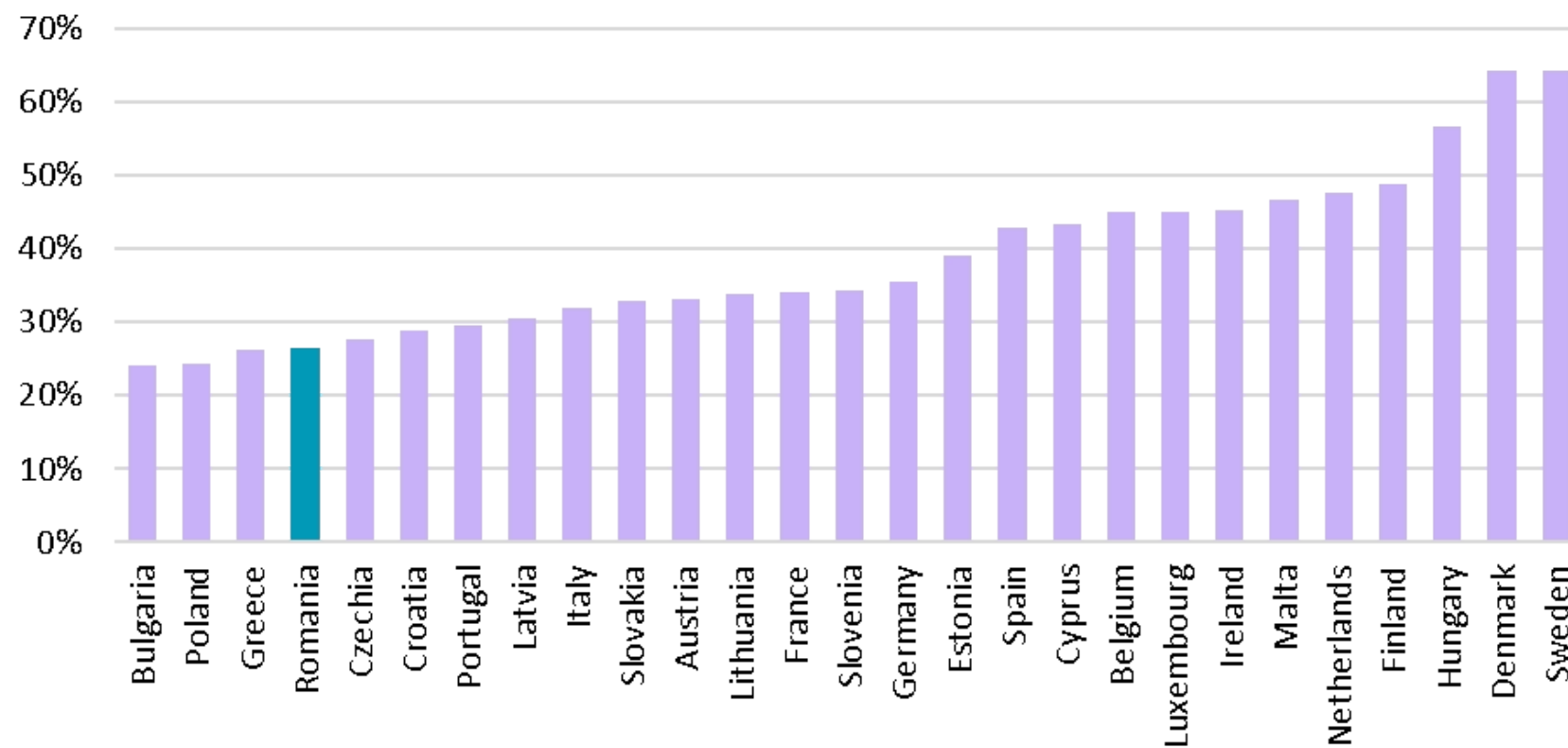
\*In the context of this document, the conversion of data transfer units uses the metric system (1,000 Gbps=1 Tbps), as per the SI (International System of Units) definition.

\*\*Crosspoint Research estimation based on available ANCOM data from 2008-2017, applying the average growth rate recorded during the aforementioned period

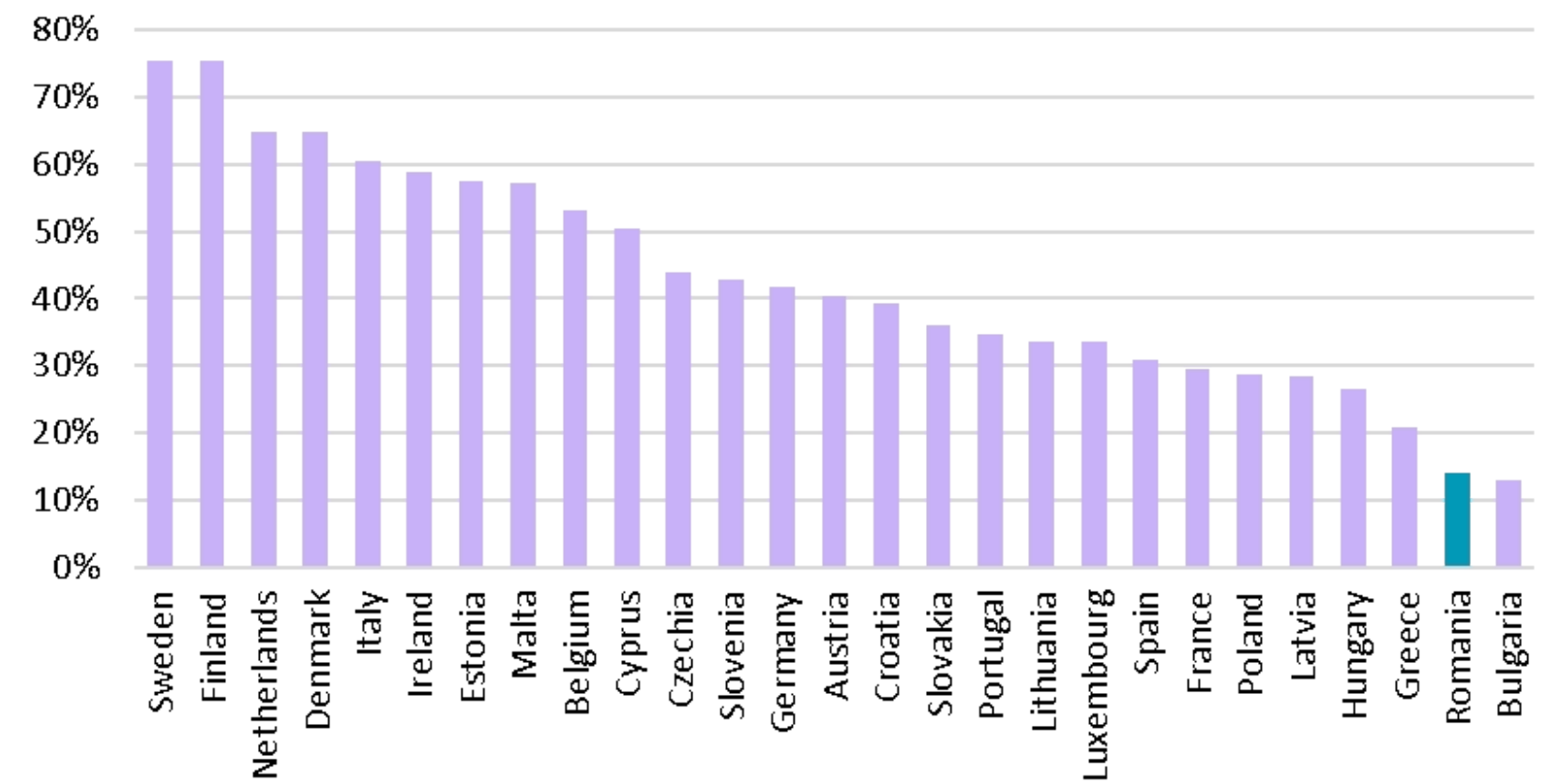
# CLOUD USAGE

Cloud technologies were used by only 26.6% of Romanians in 2020, below the 38.6% EU average. The European average of enterprises using/buying cloud computing reached 39% in 2021 up from 19% in 2014 (+111%). However, Romanian enterprises lag behind their European peers with the second-lowest rate of cloud usage in the EU. In 2021, only 14.1% of Romanian-based enterprises used cloud computing.

INDIVIDUAL USE OF CLOUD SERVICES, 2020

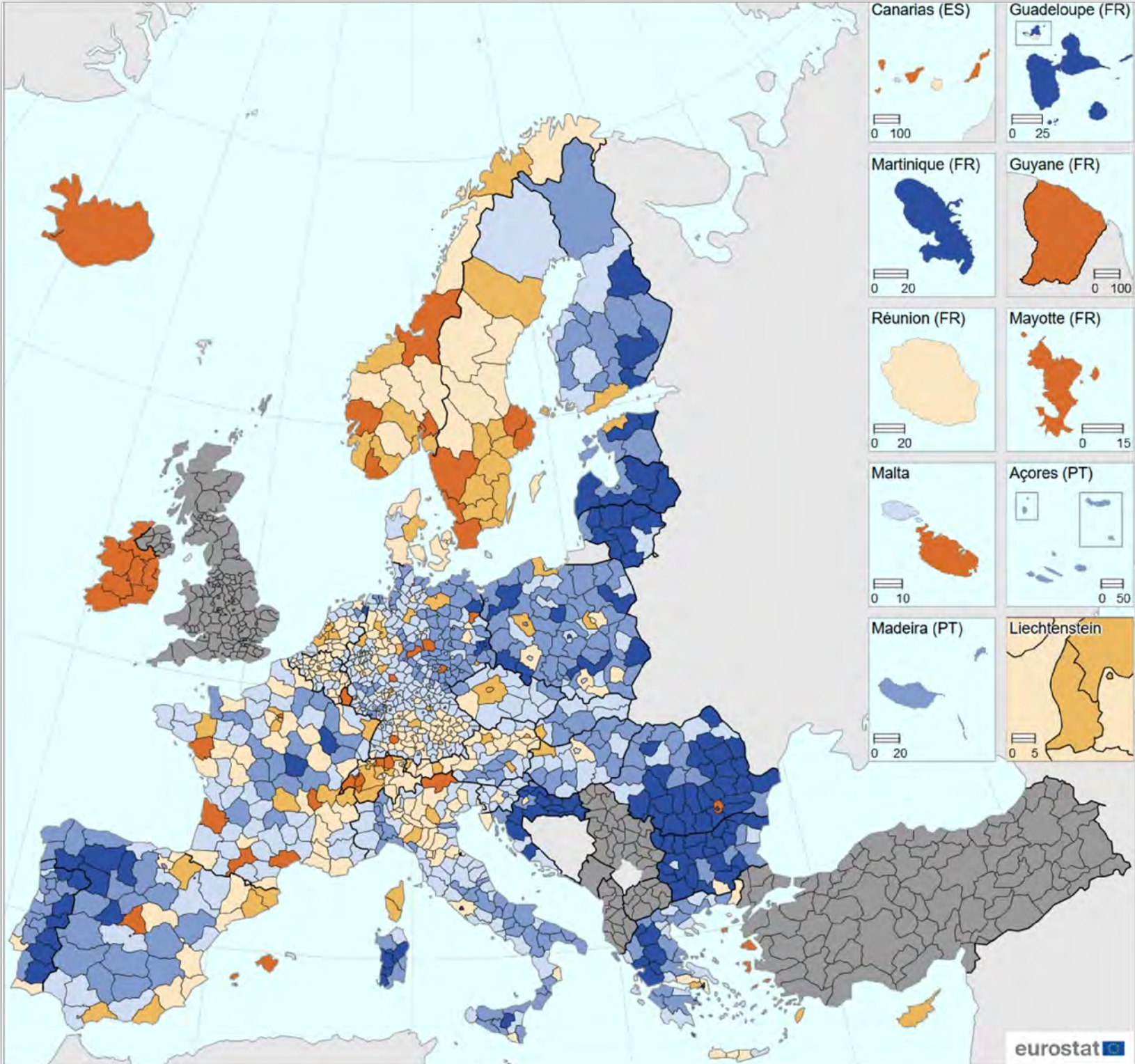


USE OF CLOUD COMPUTING BY ENTERPRISES, 2021

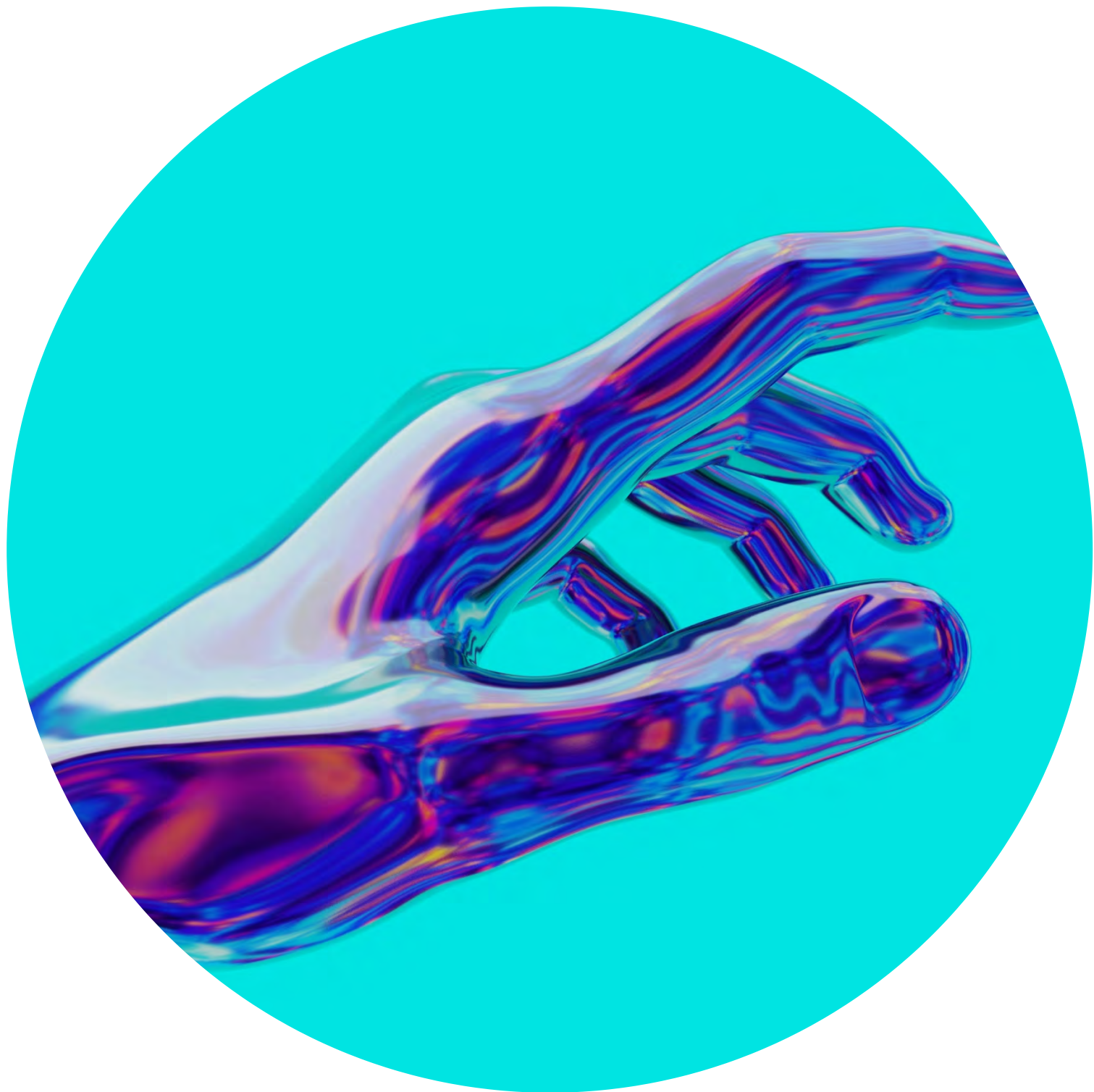


# DEMOGRAPHIC EVOLUTION

PROJECTED RELATIVE CHANGE OF THE EU POPULATION BY  
NUTS 3 LEVEL, 2019-2050

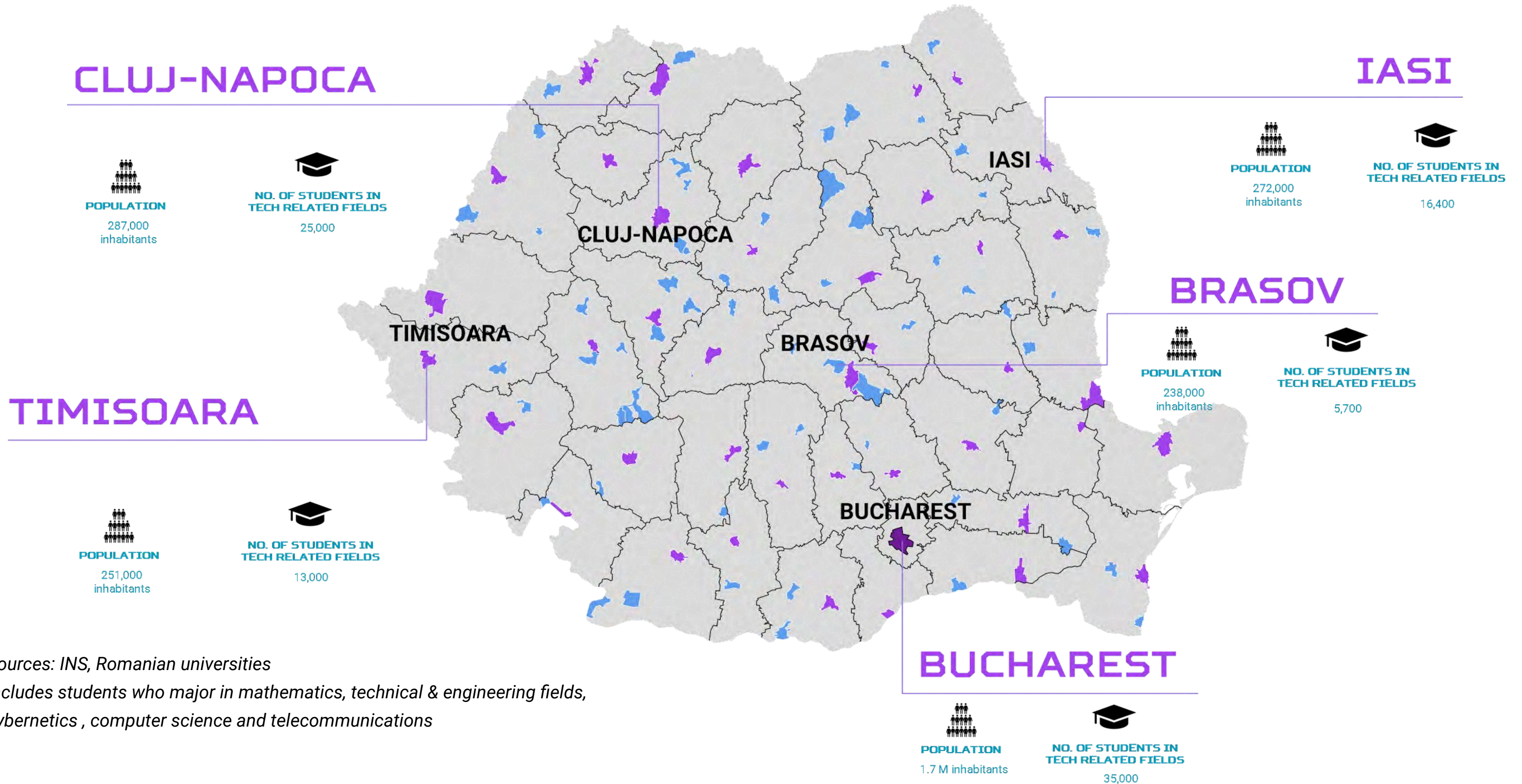


The declining trend in population growth recorded in Romania in the past 10 years is forecasted to continue. Except for Bucharest, where the population is expected to grow by over 20% by 2050, all other areas of the country are projected to record drops in population between 10% to 20%. On a EU level, population is projected to increase in almost three out of five urban regions and to decrease in four out of five rural regions by 2050.



**HUMAN RESOURCES**

# STUDENTS IN TECH



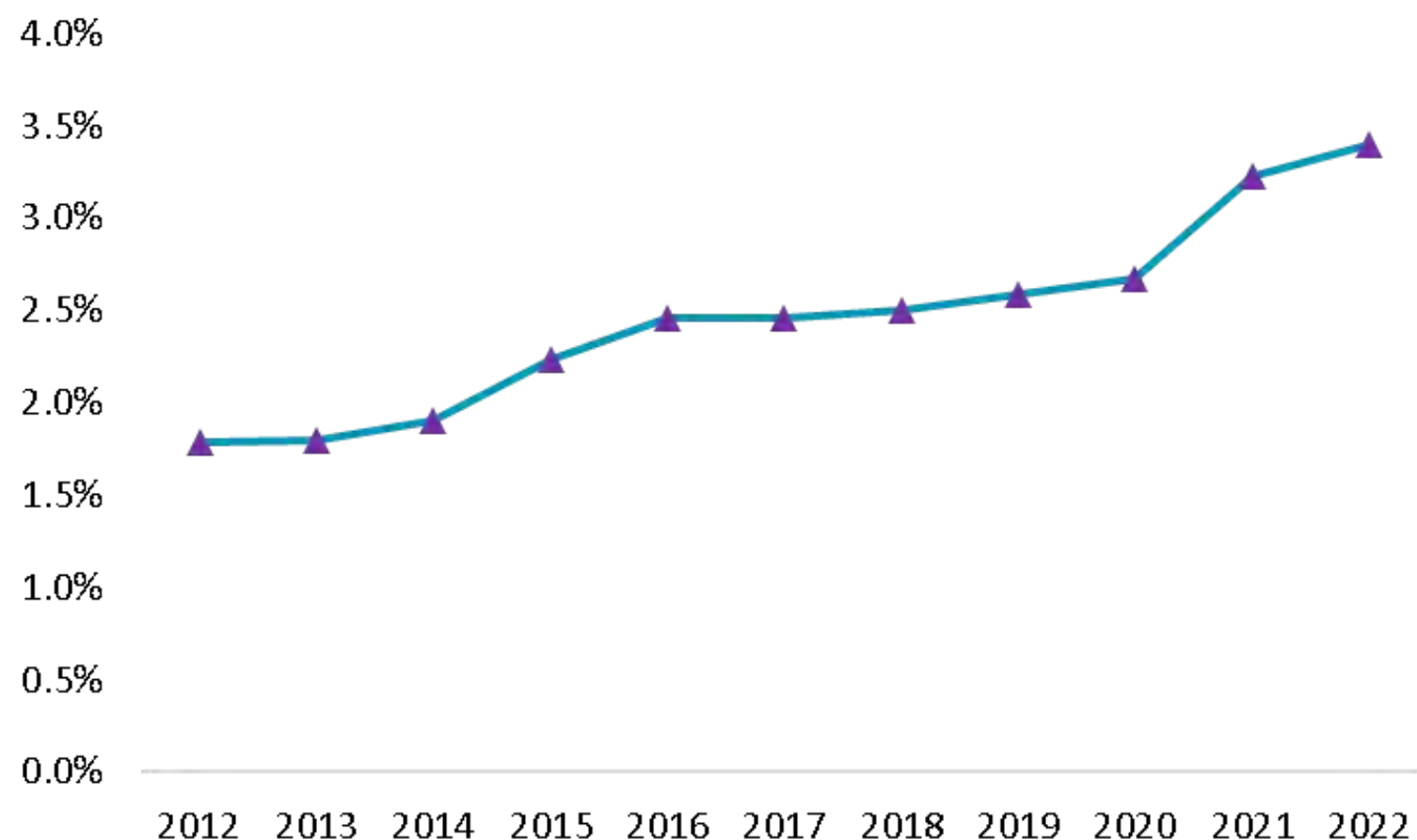
Sources: INS, Romanian universities

Includes students who major in mathematics, technical & engineering fields, cybernetics, computer science and telecommunications

# TALENTS

The ICT professional workforce in Romania has seen significant growth, expanding by 73% since 2012, reaching a total of 265,500 in 2022. Additionally, according to Eurostat data, Bucharest ranks fourth in the EU for the high-technology sector employment share, with 11.3%. 42% of ICT professionals in Romania are women, providing a larger talent pool compared to other EU countries, as well highlighting Romania's commitment to providing equal opportunities. Moreover, Romania has the second largest share in the EU of young people working in ICT (82.4%). This achievement is further supported by the rising enrollment of students in tech-related fields, currently close to 100,000.

## SHARE OF ICT PROFESSIONALS IN TOTAL WORKING POPULATION

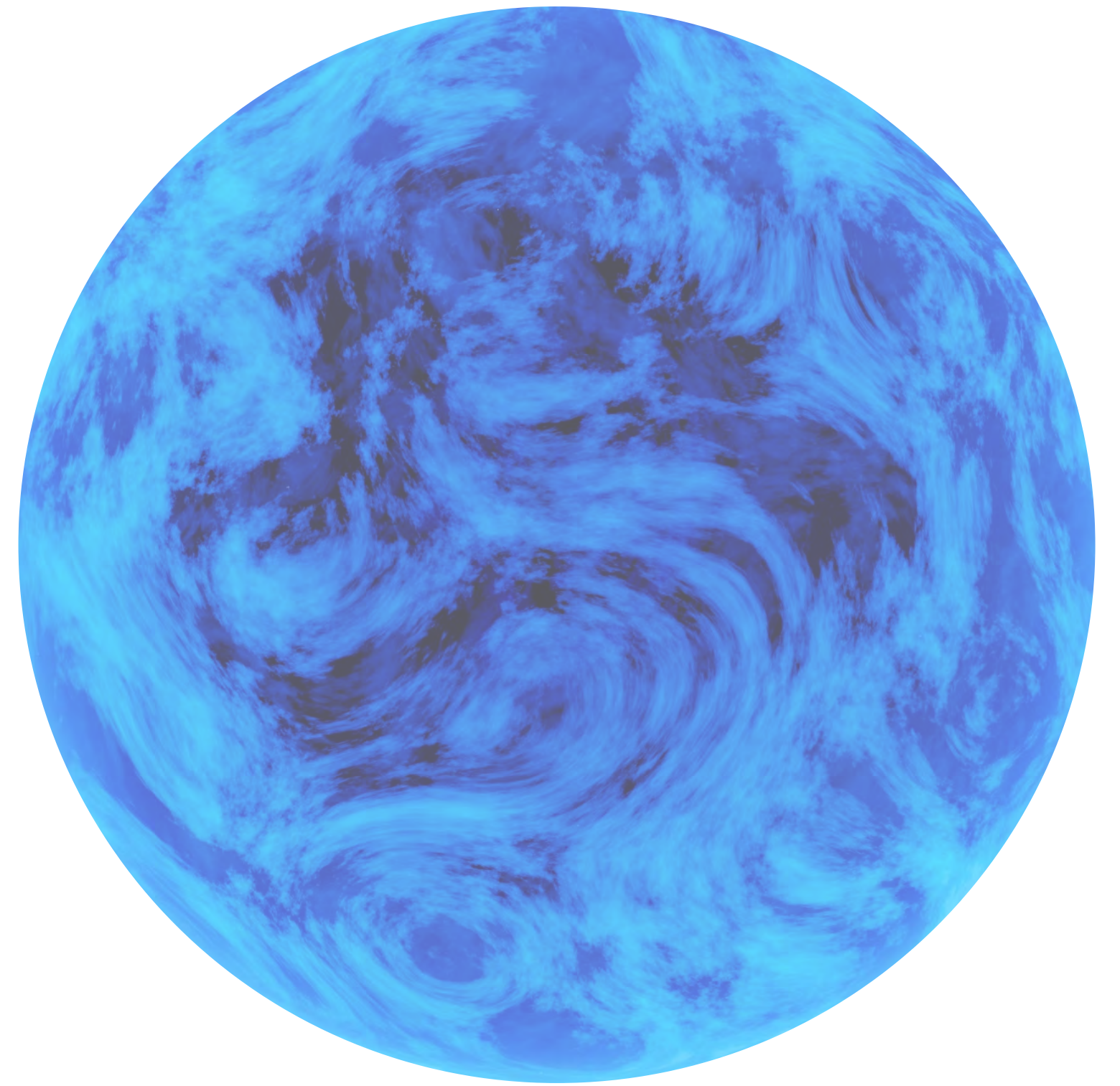


## SHARE OF ICT PROFESSIONALS IN MAJOR TECH REGIONS, 2022

AREA	TOTAL WORKFORCE ('000)	ICT EMPLOYMENT %	WOMEN IN ICT %
<b>Cluj</b>	357	9%	42%
<b>Bucharest-Ilfov</b>	1,459	8%	43%
<b>Timis</b>	333.7	7%	41%
<b>Iasi</b>	267.4	7%	42%



**SECURITY & NATURAL  
HAZARDS**





# SECURITY

Romania has one of the lowest security threat levels in the world, being ranked the 20th safest country in the world in 2023.

## SECURITY THREAT INDEX

1.9/10  
RANK  
157/177  
2023

## ECONOMIC FREEDOM INDEX

65/100  
RANK  
52/177  
2023

Romania has a high degree of economic freedom, above several European countries such as France, Hungary and Italy.

## POLITICAL STABILITY INDEX

0.53/2.5  
RANK  
30/45  
2021

Romania's GCI in 2021 was 76.29, under the EU average of 80.7.

In 2021, Romania had a political stability index of 0.53, under the European average of 0.55.

## GLOBAL CYBERSECURITY INDEX

76.29/100  
RANK  
32/46  
2021

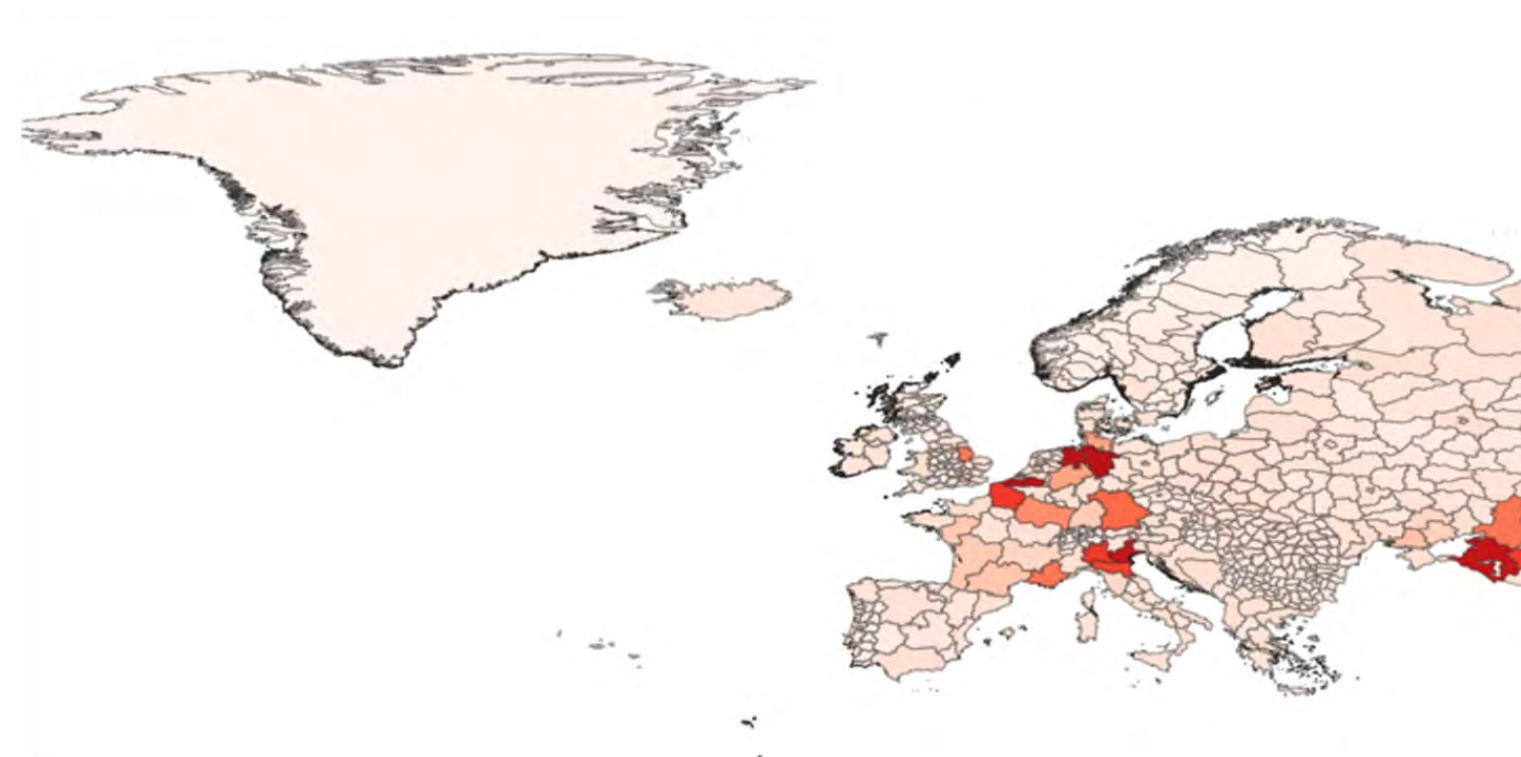
# CLIMATE & NATURAL DISASTERS

Losses from extreme weather in Romania from 1980 to 2022 totaled €17.5 M, translating into € 816 per capita, under the EU average. Extreme weather events had the largest economic impact per capita in Slovenia, Luxembourg and Germany, while Slovakia, Estonia and Malta were the least affected.

According to the 2023 XDI Gross Domestic Climate Risk analysis, Bucharest is ranked 2,214 in 2,639 analyzed territories around the world by the degree of damage escalation risk from 1990 to 2050.

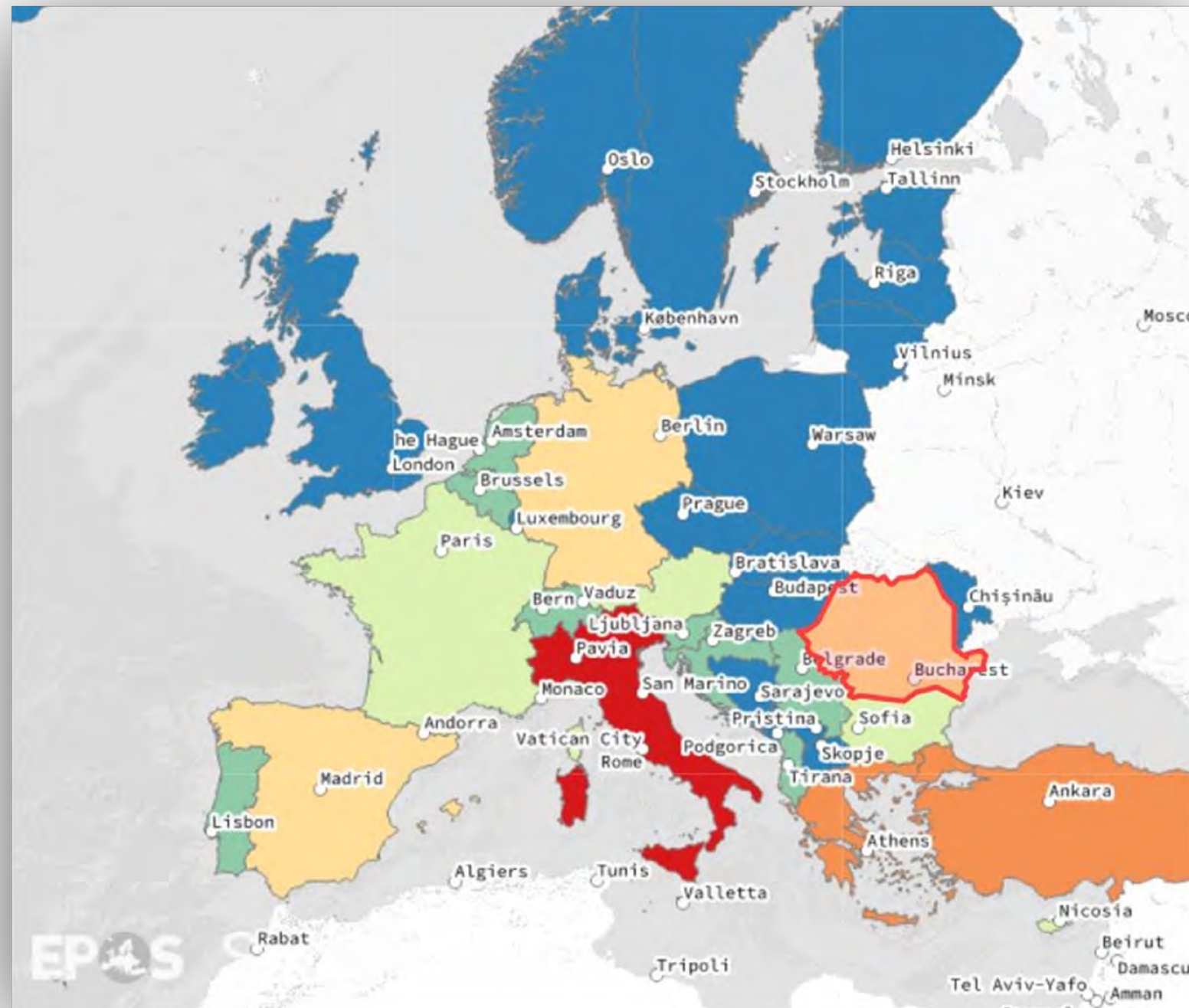
## LOSSES FROM EXTREME WEATHER (1980-2022) SELECT EU COUNTRIES

Country	Total losses (M€)	Insured losses (%)	Losses per capita (€)	Losses per km <sup>2</sup> (€)
<b>Romania</b>	<b>17,525</b>	<b>1%</b>	<b>816</b>	<b>73,513</b>
Germany	167,299	30%	2,065	467,879
Italy	111,110	5%	1,918	367,817
Denmark	8,881	61%	1,646	206,896
Austria	13,216	18%	1,626	157,566
Czechia	16,274	12%	1,567	206,334
Greece	11,934	3%	1,129	90,622
Hungary	8,919	5%	875	95,894
Netherlands	9,996	39%	629	267,420
Bulgaria	4,741	2%	594	42,715
Poland	18,166	7%	480	58,237
Sweden	3,658	26%	402	8,175



Heatmap illustrating the risk of extreme weather events affecting different regions in Europe by 2050

# EARTHQUAKE HAZARD

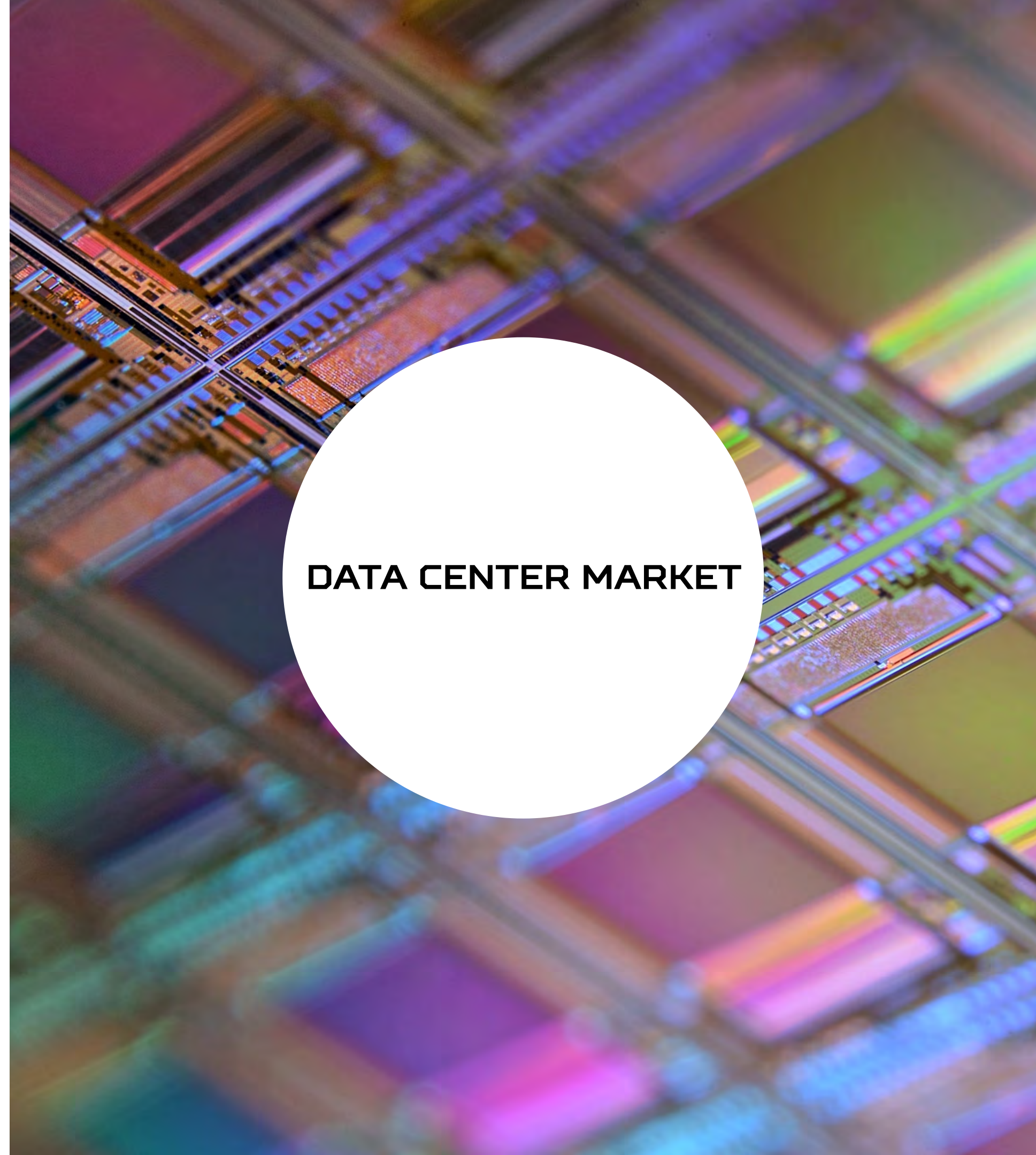
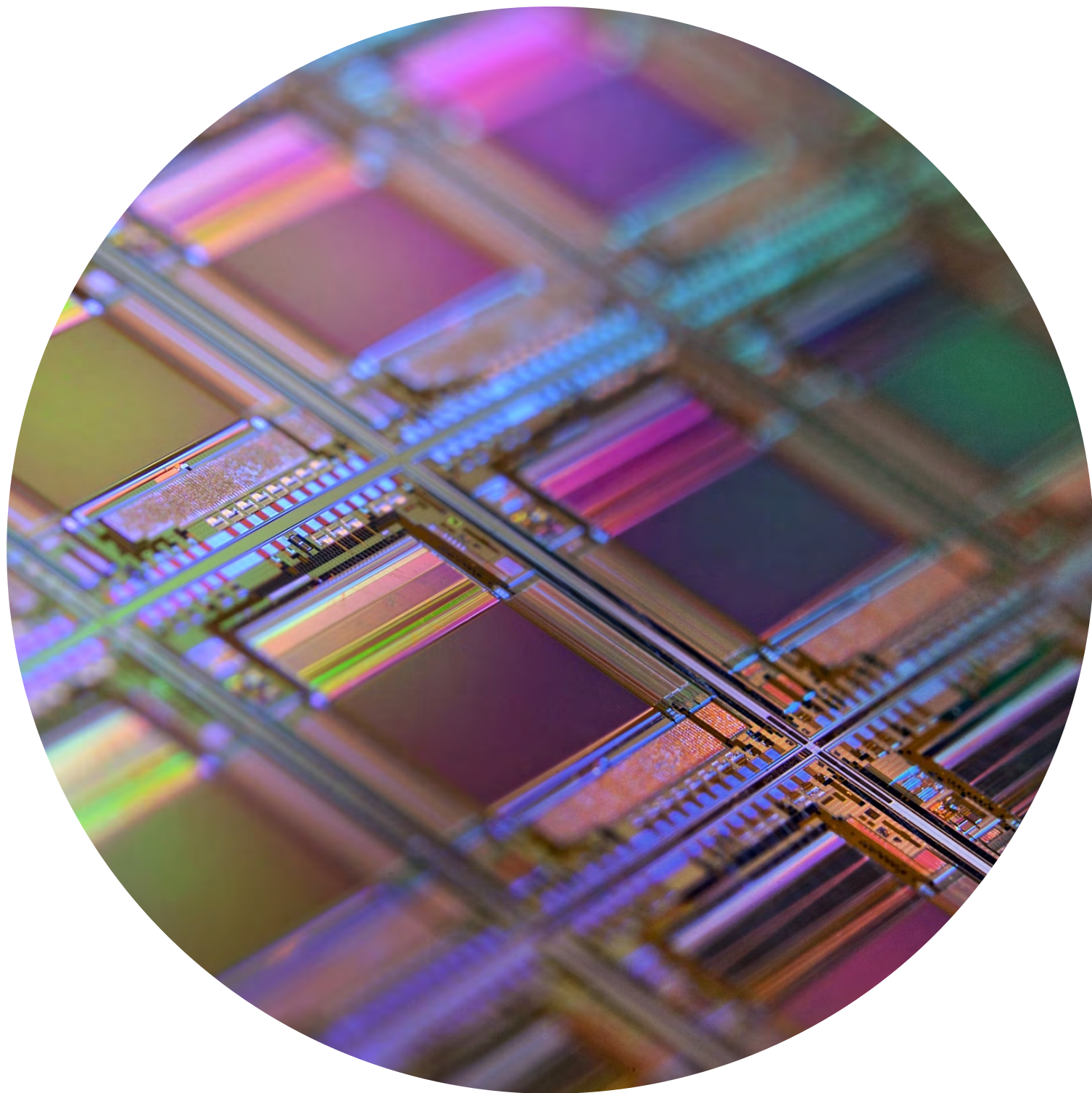


Along with Turkey, Greece, Albania and Italy, Romania belongs to the group of countries with the highest earthquake hazard in Europe, followed by the other Balkan Countries.

Earthquake hazard is also considerable in some regions of Austria, Belgium, France, Germany, Iceland, Norway, Portugal, Slovenia, Spain, and Switzerland.

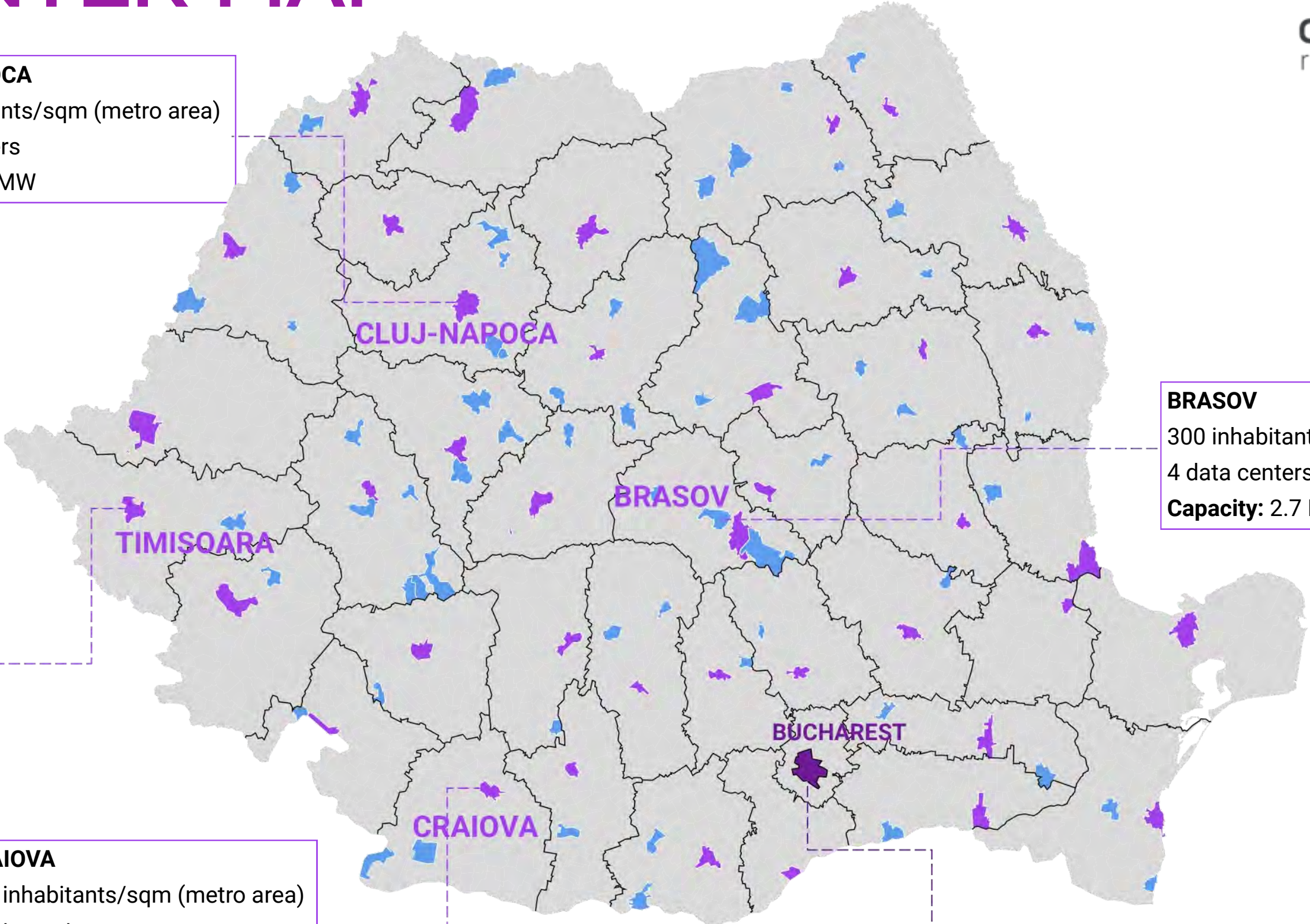
Romania's average annual economic loss (AAL) from earthquakes is estimated at €402 M.

Building type	AAL (€M)
Commercial	45
Industrial	52
Residential	305



**DATA CENTER MARKET**

# DATA CENTER MAP



**CLUJ-NAPOCA**  
246 inhabitants/sqm (metro area)  
4 data centers  
**Capacity: 2 MW**

**BRASOV**  
300 inhabitants/sqm (metro area)  
4 data centers  
**Capacity: 2.7 MW**

**TIMISOARA**  
158 inhabitants/sqm (metro area)  
4 data centers  
**Capacity: 1.35 MW**

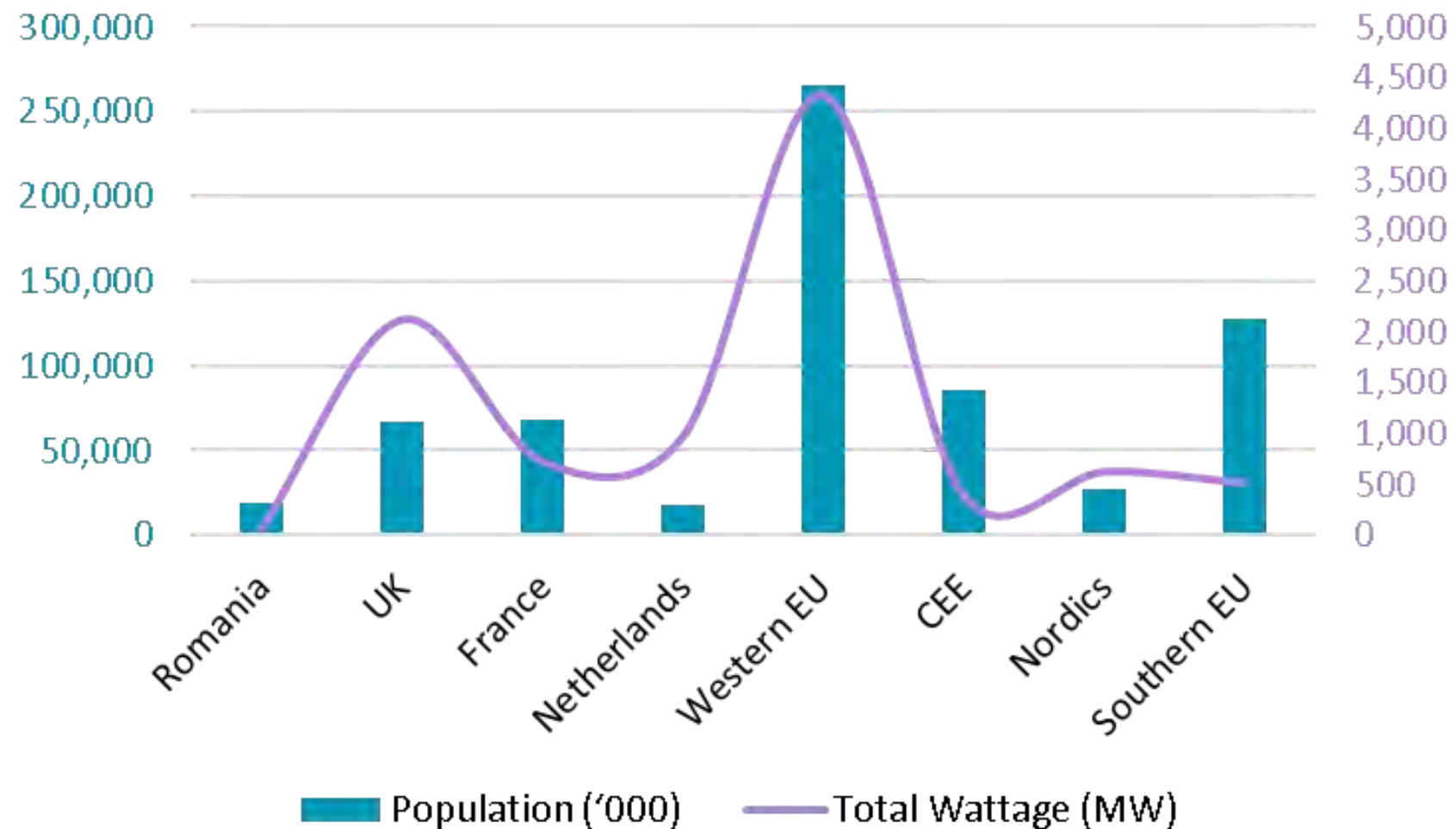
**CRAIOVA**  
233 inhabitants/sqm (metro area)  
3 data centers  
**Current capacity: 35.3 MW**  
Future capacity: 201.3 MW

**BUCHAREST**  
1,242 inhabitants/sqm (metro area)  
15 data centers  
**Capacity: 20.8 MW**

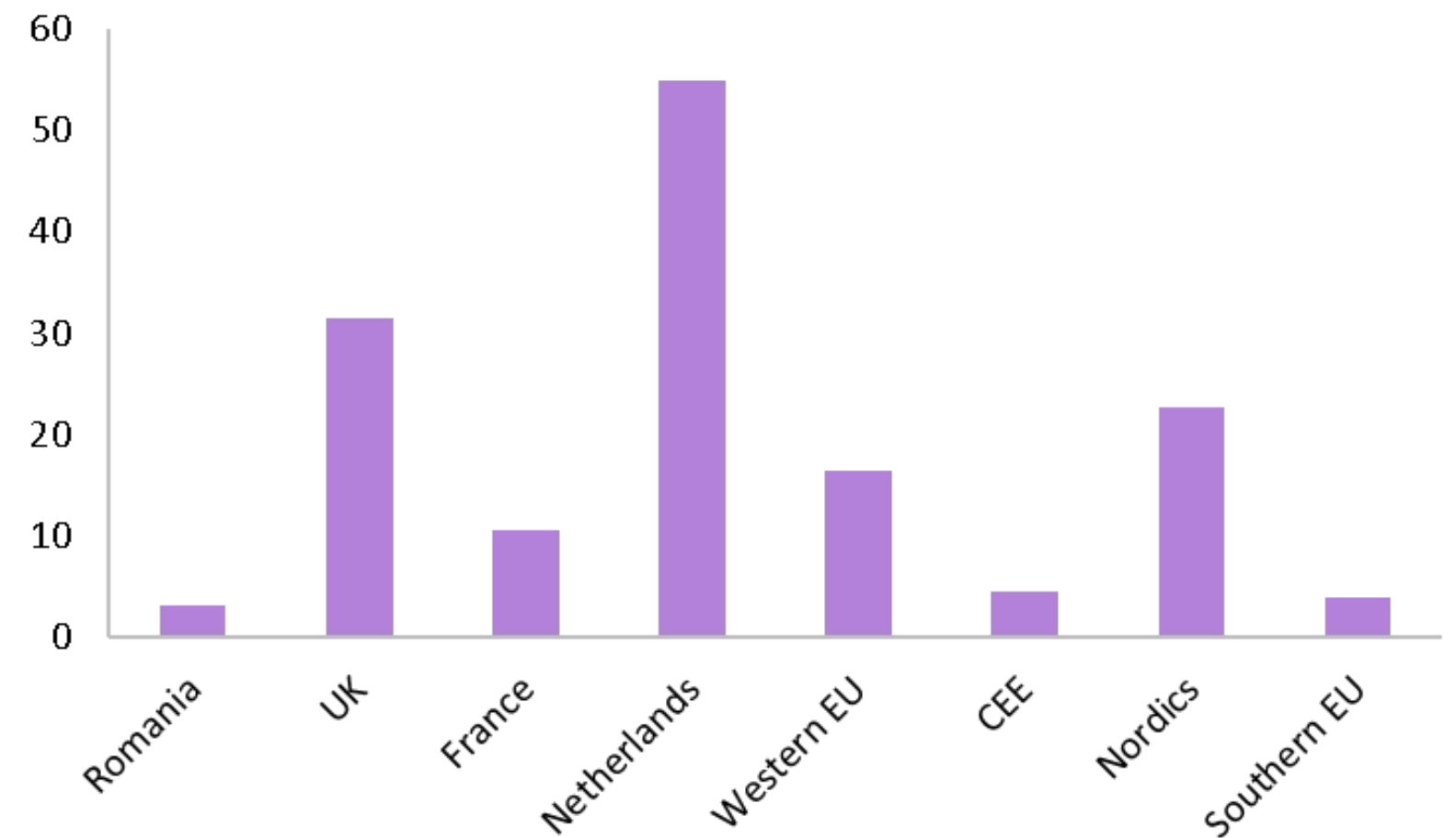
# DC CAPACITY

There are currently 30 data centers present in Romania, with one single major data center, expected to increase its capacity to 200 MW by the end of 2025. Currently, the total data center power capacity in Romania is 60.8 MW, whilst the total floorspace is 37,200 sqm. Most of the data centers are clustered in or around Bucharest and main regional cities. The per capita DC power capacity in Romania is 3.2 W, which falls below the CEE region's average of 4.5 W.

**2023 TOTAL DATA CENTER CAPACITY AND POPULATION**



**2023 DATA CENTER POWER CAPACITY PER CAPITA (W)**



Sources: TeleGeography, Crosspoint Research based on market information

# DC TYPES & OPERATORS



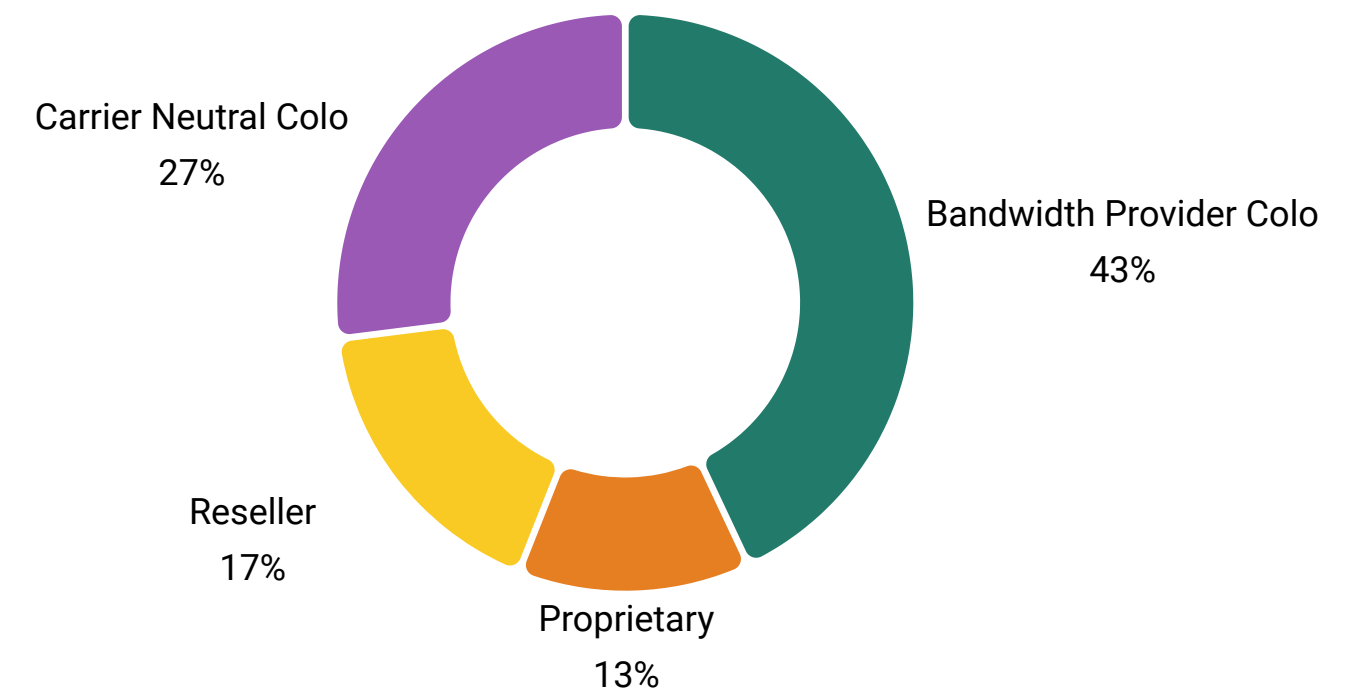
The top 5 data center operators in Romania occupy 92% of the total DC floorspace and hold 85% of total DC capacity. The estimated average power usage effectiveness of data centers in Romania is 1.37, one of the lowest in Europe.

Data center	Locations	Total capacity (MW)	Total floor space (sqm)	PUE*
ClusterPower	Mischii	34 (future expansion to 200)	25,400	<1.1
NXDATA	Bucharest	6.2	5,500	1.5
Telekom	Bucharest Cluj-Napoca Brasov	6	2,000	n/a
Star Storage	Bucharest	2.8	375	1.5
GTS Telekom	Bucharest Cluj-Napoca	2.8	800	1.39

## AVERAGE PUE IN EUROPE

Region	Average PUE
Romania	1.37
Western Europe	1.44
CEE	1.57
Nordics	1.35
Southern Europe	1.73
Baltics	1.55
Balkans	1.55

## NO. OF DATA CENTER OPERATORS BY TYPE



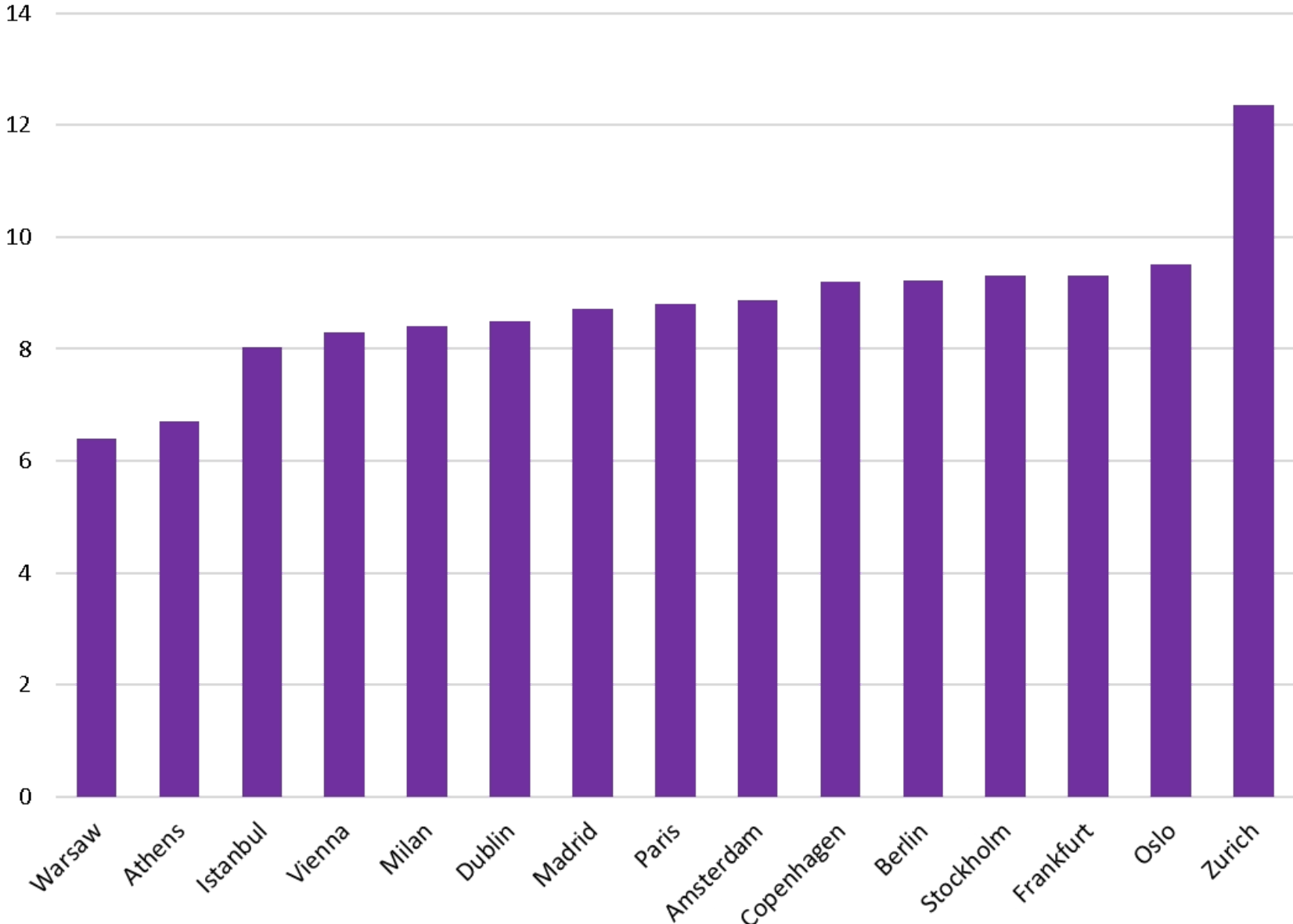
\*Estimation based on available data

Sources: TeleGeography, Tema Energy

# DATA CENTER COSTS



**DATA CENTER CONSTRUCTION COST, 2022 (M USD/MW)**



**AVERAGE DATA CENTER RENTAL COSTS, Q1 2023 (USD)**

Metric	Europe	North America	APAC
Price per KW at 4 KW	425	239	402
Price per KW at 10 KW	410	229	380
Price per KW at 100 KW	393	222	375
Fiber XC MRC	134	240	170
Ethernet XC MRC	67	191	137
Copper XC MRC	65	180	114
Cabinet Install NRC	1,711	1,637	1,347

Sources: Turner & Townsend, TeleGeography





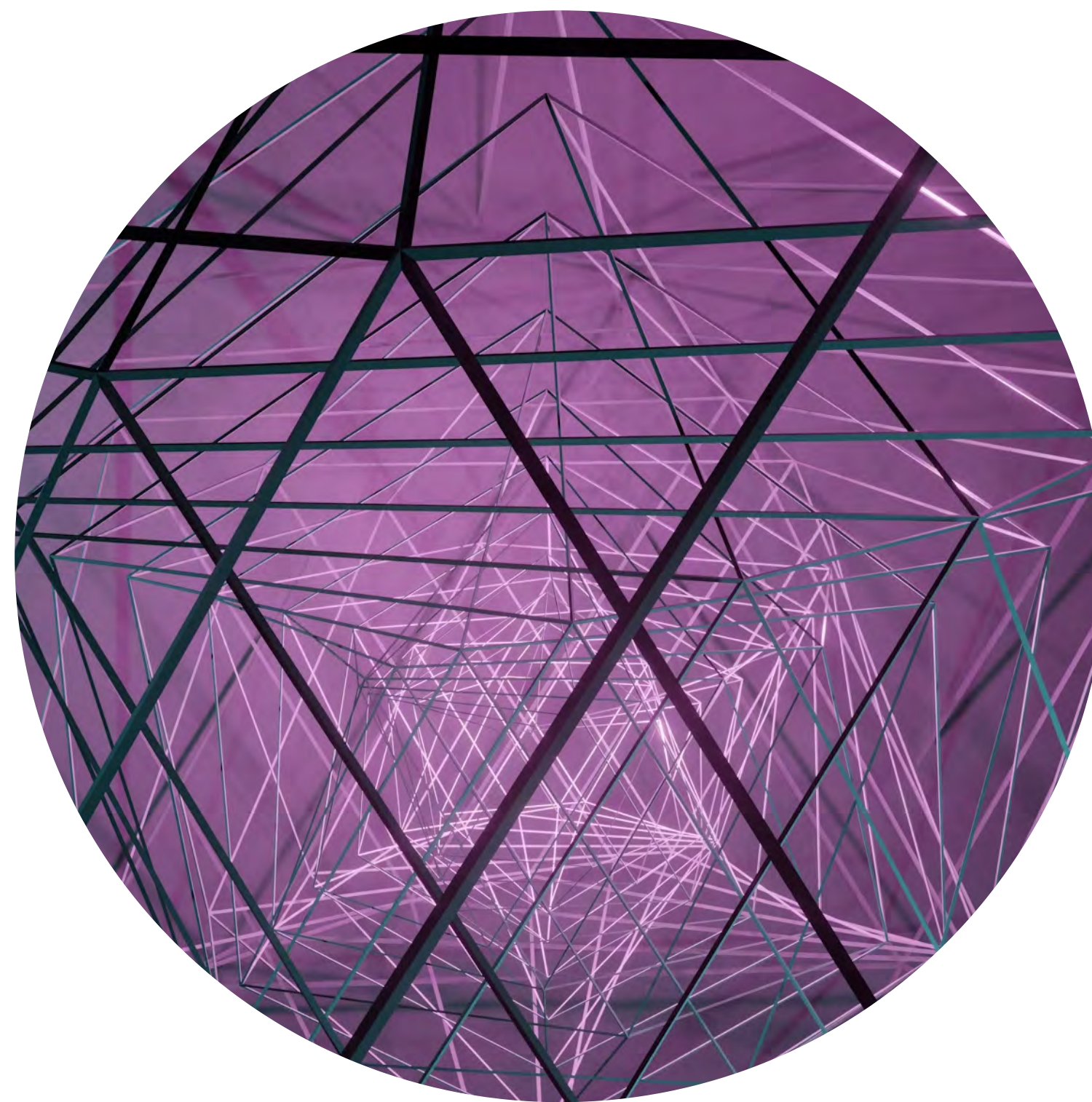
**EUROPEAN DC  
INVESTMENTS**

# EUROPEAN DC DEALS

Deal Name	Location	Date	Buyer	Seller	Price	NIY
Vanda 1	Stockholm, SE	July 2022	InterXion	CatenaAB	£42.8m	c. 3.9%
Vodafone	Bracknell, UK	Jan 2022	Keppel DC REIT	Fiera RE/Sedco	£57m	c. 3.58%
Fujitsu	Stevenage, UK	Dec 2021	LondonMetric REIT	Savills IM	£122.2m	c. 4.3%
Renault DC	Paris, FR	Dec 2021	IDEC	Renault (CBRE)	€8.35m	5.21%
Sussex Junction	Sussex, UK	Nov 2021	Abrdn	Arcus (DTRE)	€30.18m	-
Harbour Exchange	London, UK	Nov 2021	Blackstone (CBRE)	Landsec	£196.5m	4.00%
Keppel DC	Frankfurt, DE	Sept 2021	Iron Mountain	Keppel DC REIT	€76m	-
Vodafone DC	Milan, IT	July 2021	Hayfin	AXA IM (CBRE)	€20.4m	9.46%
Equinix DB5	Dublin, IE	July 2021	GIC	Equinix REIT	€52.25m	-
Atos DC	Andover, UK	June 2021	CBRE Capital Advisors	AXA IM (CBRE)	£38m	5.00%
Project Fairway	UK, NL, FR and CH	March 2021	CapitaLand	Digital Realty (CBRE)	€555m	-



**DATA CENTER TRENDS**

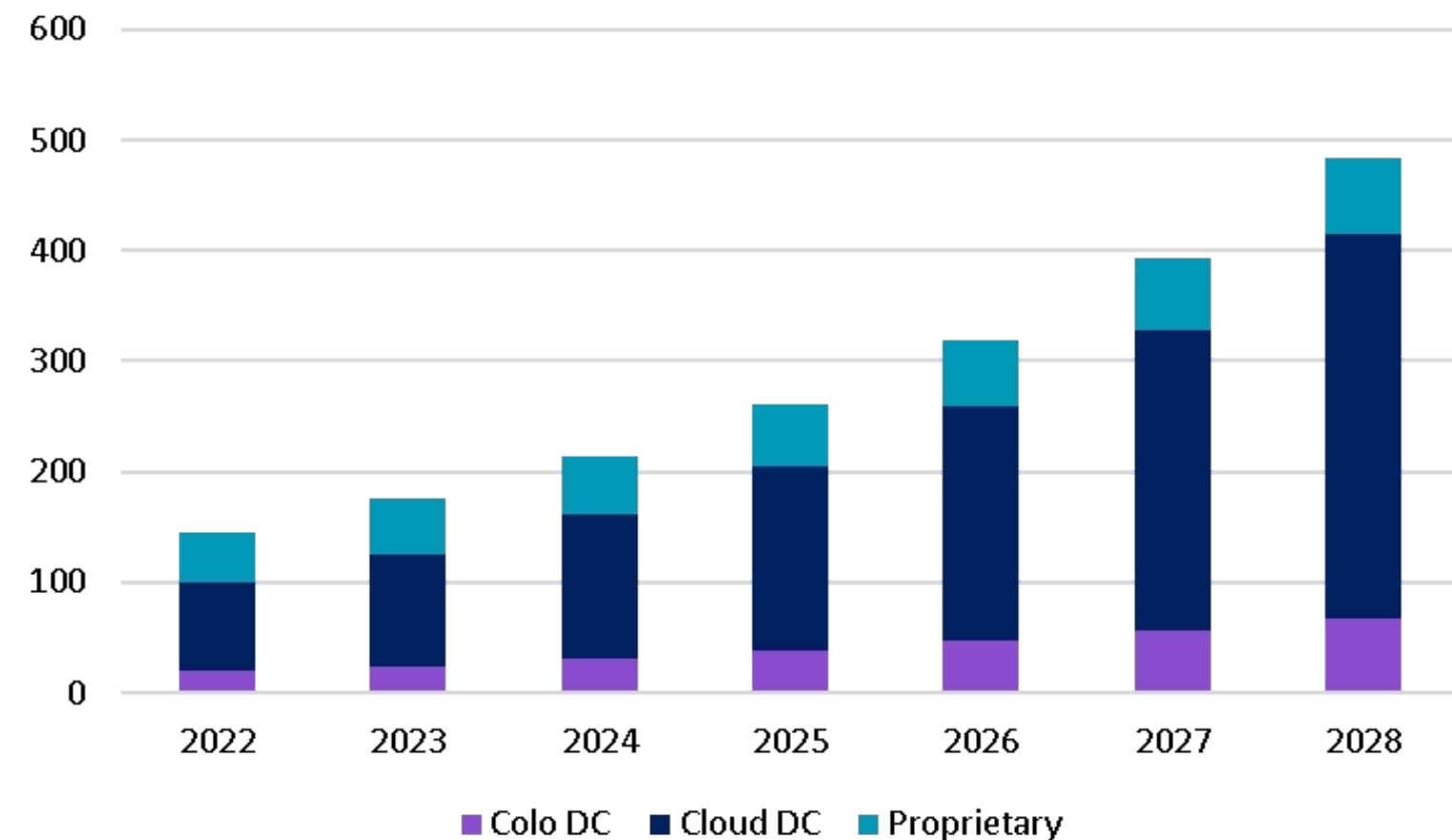


# EXPANSION TO SECONDARY MARKETS

Data centers are rapidly becoming a key alternative asset sector for investors all around the world. As traditional sectors experience growing hardships (the post-pandemic office market has recorded a steep decline, with historical low occupancy rates), investors turn their attention to the data center industry. According to a Financial Times analysis, Blackstone, one of the world's biggest buyers of real estate, has started to sell a large part of its assets in order to raise liquidity for data center investments, allocating \$8 B to the development of hyperscale data centers for some major tech companies.

But regulatory constraints, ESG requirements, the need for efficiency optimization and increasing development and operating costs are encouraging the data center industry to expand to untapped areas around the world. According to a recent study by Uptime Institute, **distributed data center resiliency** (i.e. the ability of applications, data and traffic to shift across geographies according to business needs, performance, cost and availability) is the trend most likely to impact the data center market in the following years, followed by **chiller-free** and **micro-modular facilities**, **implementation of AI** in operation and management, **open-source infrastructure** and the introduction of **new technologies** (storage class memory, direct liquid cooling and Li+ batteries).

DATA CENTER MARKET ESTIMATED GROWTH (USD B)

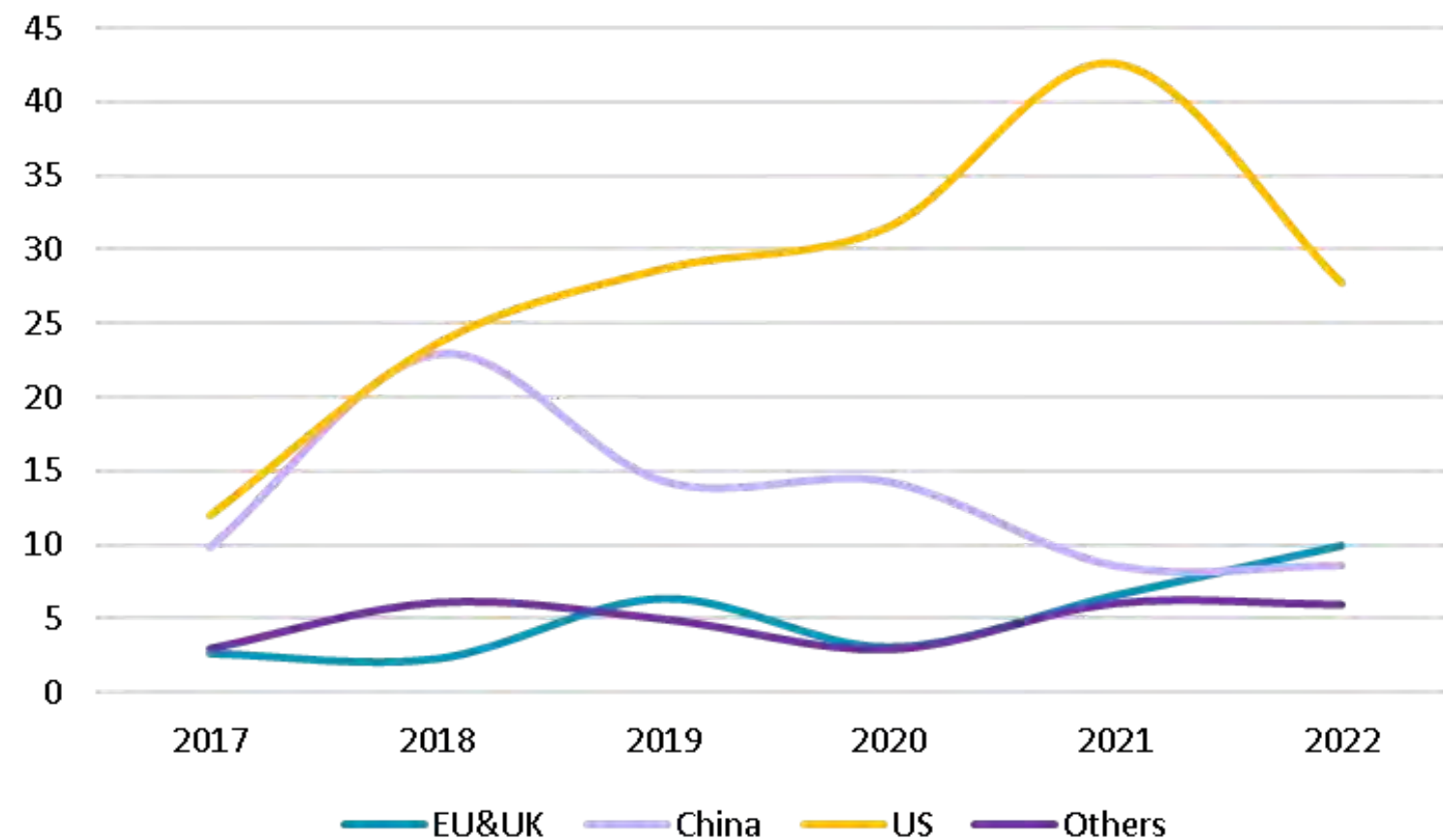


Sources: Uptime Institute, PrecedenceResearch.com, Structure Research

# AI AND THE DEEP LEARNING ERA

2023 is going down in history for marking the boom of generative AI. In August 2023, just 9 months after its public launch, ChatGPT had reached 180.5 million users and DALL-E generated 2+ million images per day. By 2030, over 10% of the vehicles used worldwide will be self driving. Companies are resorting to AI to compensate for labor force shortages and to improve cost effectiveness: earlier this year, IBM announced it will replace 7,800 jobs with AI and estimates that within five years, over 30% of non-customer-facing roles will be fully automated. Private investments in AI, totaling over \$100 B in 2022, are expected to rise exponentially in the coming years. This will lead to an unprecedented need for a worldwide expansion of the data center market.

**PRIVATE INVESTMENTS IN AI BY WORLD REGIONS (USD B)**



**TOP 10 AI INVESTMENT SECTORS EU&UK, 2017-2022**

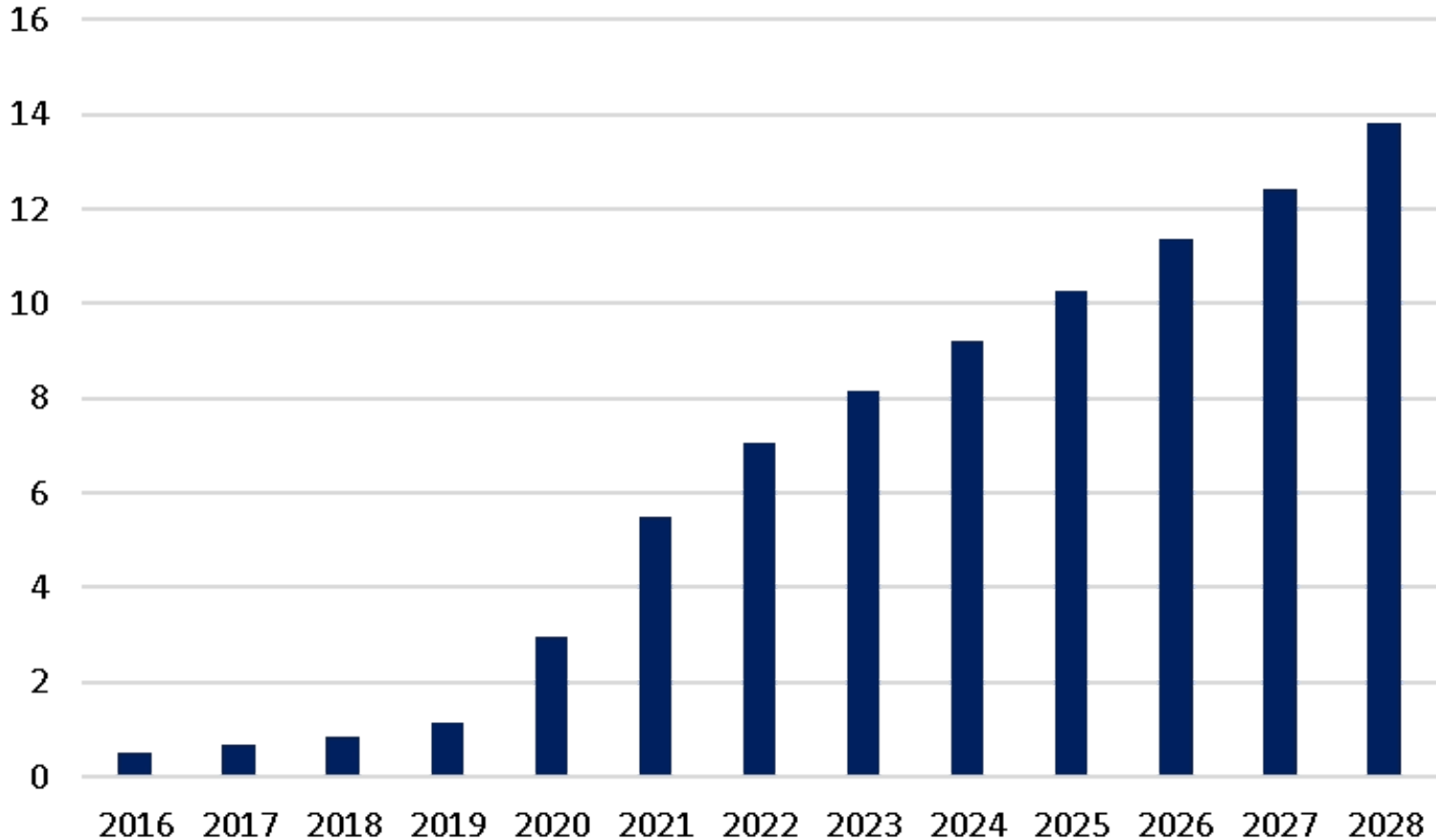


Source: Stanford University

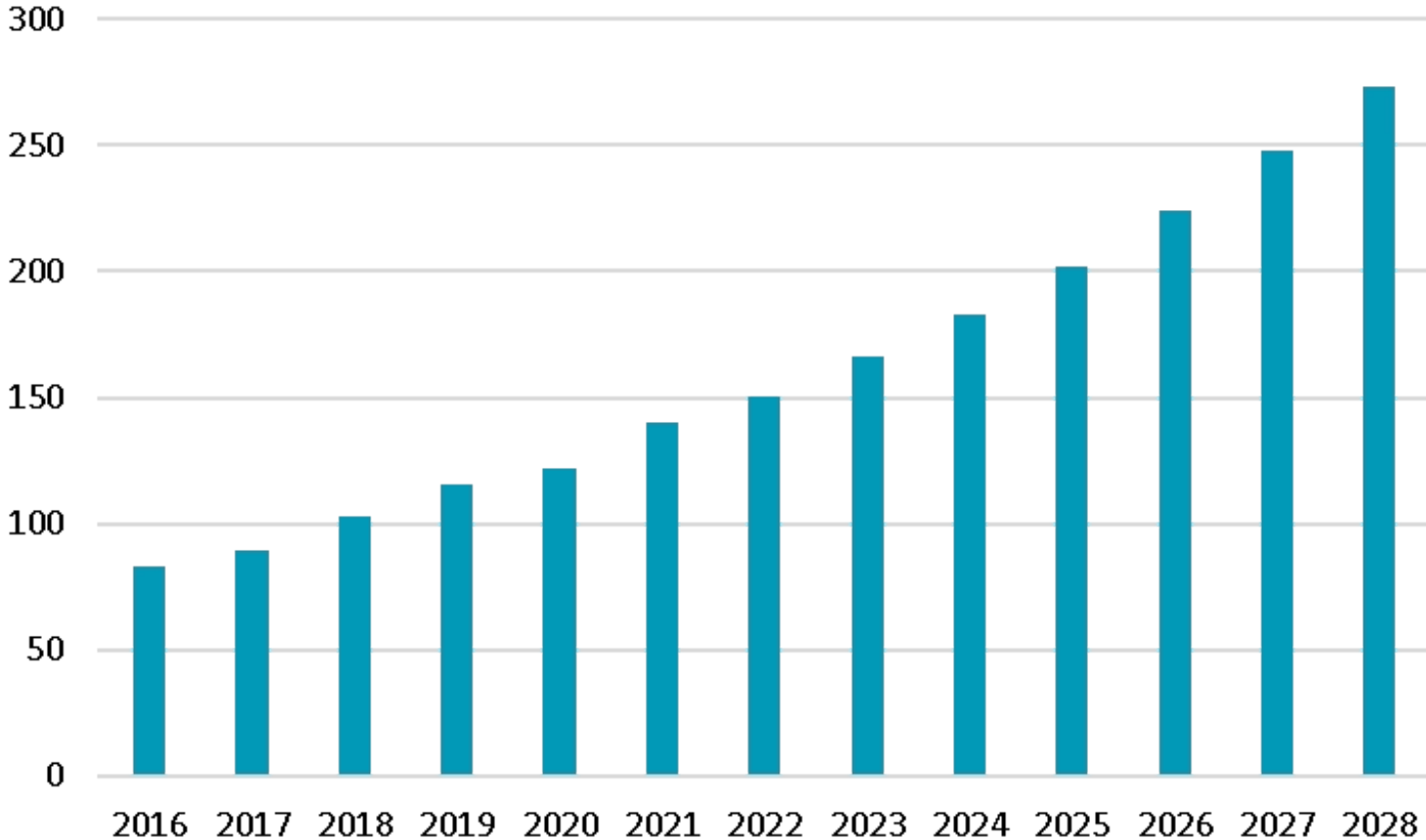
# RISING DEMAND FOR CYBERSECURITY

As global connectivity, digital transformation and remote work are rapidly evolving, so is the threat of cyber attacks. Companies, governments and individuals will need to increase the level of protection for their data and digital assets. The expansion of the cybersecurity industry is interconnected to the data center industry, as data centers provide data storage and protection, increased security, redundancy and disaster recovery, ensuring operational continuity.

**ESTIMATED COST OF CYBERCRIME (USD T)**



**ESTIMATED EVOLUTION OF THE CYBERSECURITY SECTOR (TURNOVER, USD B)**



# CONCLUSIONS

Romania holds a number of crucial resources essential for the future development of the data center industry and can become a target location for players in this market in the coming period. Most of its weaknesses can be addressed and improved as long as, on the one hand, investors in this asset class take their time to analyze the unique advantages it has to offer and, on the other hand, the public sector in Romania understands the importance that data centers hold for the future and actively supports investments in this area.

## STRENGTHS

- **Stable economic growth** - Romania is expected to be one of Europe's leaders in economic growth both in 2023 and 2024, with a GDP growth of 2.3% and 3% respectively
- **Extensive internet coverage**
- **Fast internet speeds**
- **Competitive internet prices**
- High degree of **energy independency**
- **Large talent pool**, under continuous expansion
- **High security level**, zero terrorism threat
- **Low climate change risk**
- **Competitive** construction and operating **costs**

## WEAKNESSES

- **High energy prices**
- **Limited bandwidth** compared to the rest of Europe
- **Limited usage of cloud** services by both enterprises and individuals
- **Low level of digitalization** of government agencies
- **Declining population**
- **Political instability**, low degree of transparency and cooperation from public institutions
- **Average** level of **cybersecurity**

# APPENDIX - DEFINITIONS



### SUBMARINE CABLES

A submarine communications cable is a cable laid on the seabed between land-based stations to carry telecommunication signals across stretches of ocean and sea.

### DATA LATENCY & PING

Latency is the amount of time that data transmission takes, from its source (such as an IoT device) to its destination.

You can assess latency using a ping (Packet Internet or Inter-Network Groper) test, which measures the round-trip time for a message to travel from a source to its destination and be echoed back to the source.

### ENERGY DEPENDENCY RATE

The energy dependency rate shows the proportion of energy that an economy must import. It is defined as net energy imports divided by gross available energy, expressed as a percentage. A negative dependency rate indicates a net exporter of energy while a dependency rate in excess of 100 % indicates that energy products have been stocked. It can be defined for all products total as well as for individual fuels (for example: crude oil, natural gas).

### RENEWABLE WATER SUPPLY

Renewable water supplies are water supplies that are continually replenished. Fresh water, which makes up 3% of the surface water on earth, is renewable. The sources of renewable water are precipitation from the atmosphere in the form of mist, rain and snow. Underground water is not renewable.

### AVERAGE ANNUAL ECONOMIC LOSS

The long-term mean economic loss value per year due to earthquake ground shaking. Economic loss is defined as losses due to direct damage caused by earthquake ground shaking in the residential, commercial and industrial building stock, considering structural and non-structural components and building contents

### POWER USAGE EFFECTIVENESS (PUE)

Power usage effectiveness (PUE) is a metric used to determine the energy efficiency of a DC. PUE is determined by dividing the total amount of power entering a data center by the power used to run the IT equipment within it. PUE is expressed as a ratio, with overall efficiency improving as the quotient decreases toward 1.0.

### GROSS DOMESTIC CLIMATE RISK

The Gross Domestic Climate Risk profiles reflect risk to the built environment by climate change hazards: riverine and surface flooding, coastal inundation, extreme heat, forest fire, soil subsidence (in drought), extreme wind (synoptic and tropical cyclones) and freeze thaw.

### EUROPEAN REGIONS

Country	Region	Country	Region
Belgium	Western Europe	Estonia	Baltics
Germany	Western Europe	Latvia	Baltics
Ireland	Western Europe	Lithuania	Baltics
France	Western Europe	Denmark	Nordics
Luxembourg	Western Europe	Finland	Nordics
Netherlands	Western Europe	Sweden	Nordics
Switzerland	Western Europe	Iceland	Nordics
United Kingdom	Western Europe	Norway	Nordics
Bulgaria	CEE	Greece	Balkans
Czechia	CEE	Croatia	Balkans
Hungary	CEE	Montenegro	Balkans
Austria	CEE	North Macedonia	Balkans
Poland	CEE	Albania	Balkans
Romania	CEE	Serbia	Balkans
Slovenia	CEE	Turkey	Balkans
Slovakia	CEE	Bosnia and Herzegovina	Balkans
Spain	Southern Europe	Kosovo	Balkans
Italy	Southern Europe		
Cyprus	Southern Europe		
Malta	Southern Europe		
Portugal	Southern Europe		



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