

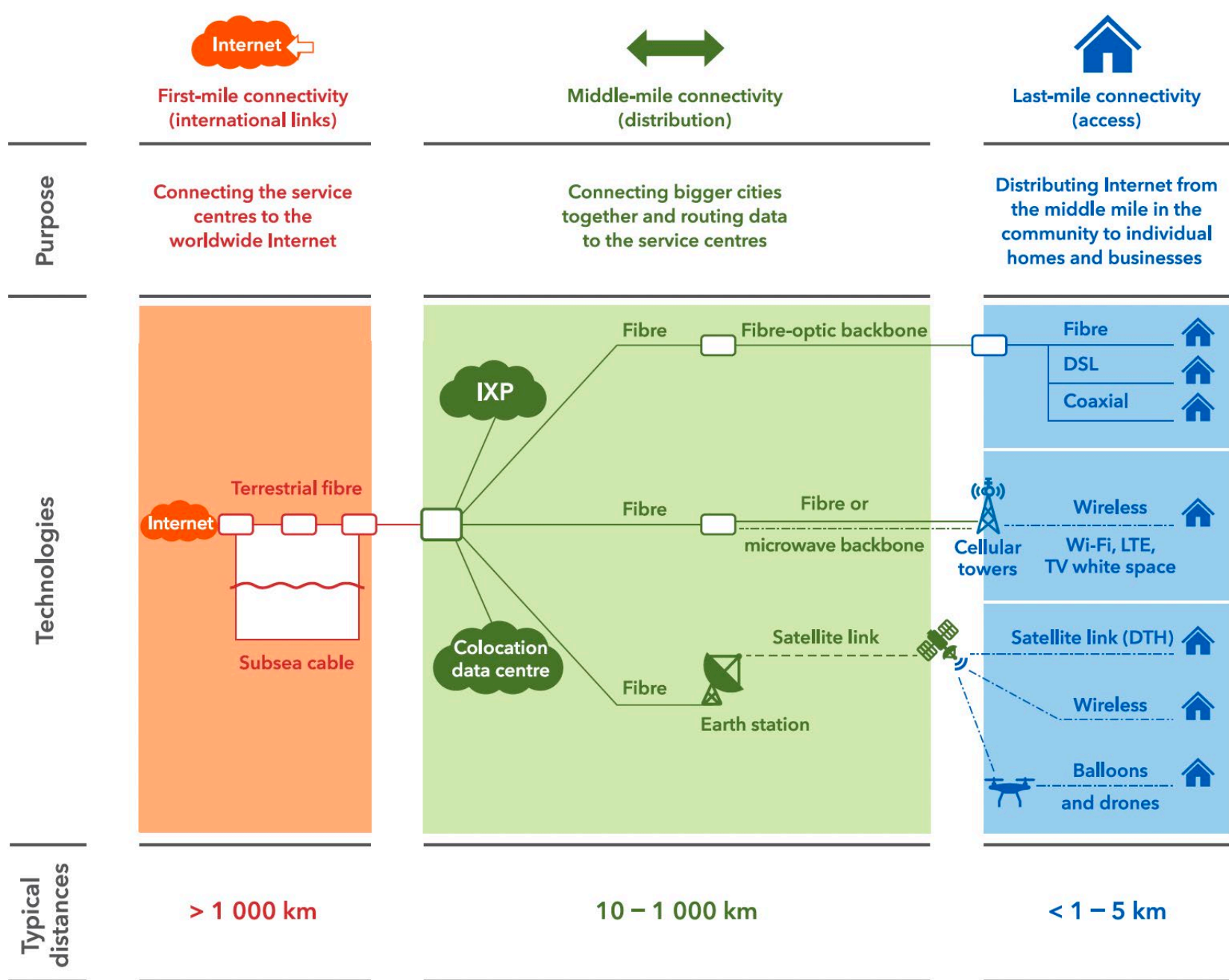
# Middle (invisible) mile connectivity & sustainability

13th meeting of the Expert Group on Telecommunication/ICT Indicators  
(EGTI)

12 – 14 September 2022

Michael Minges

Research Lead, Digital Inclusion Benchmark



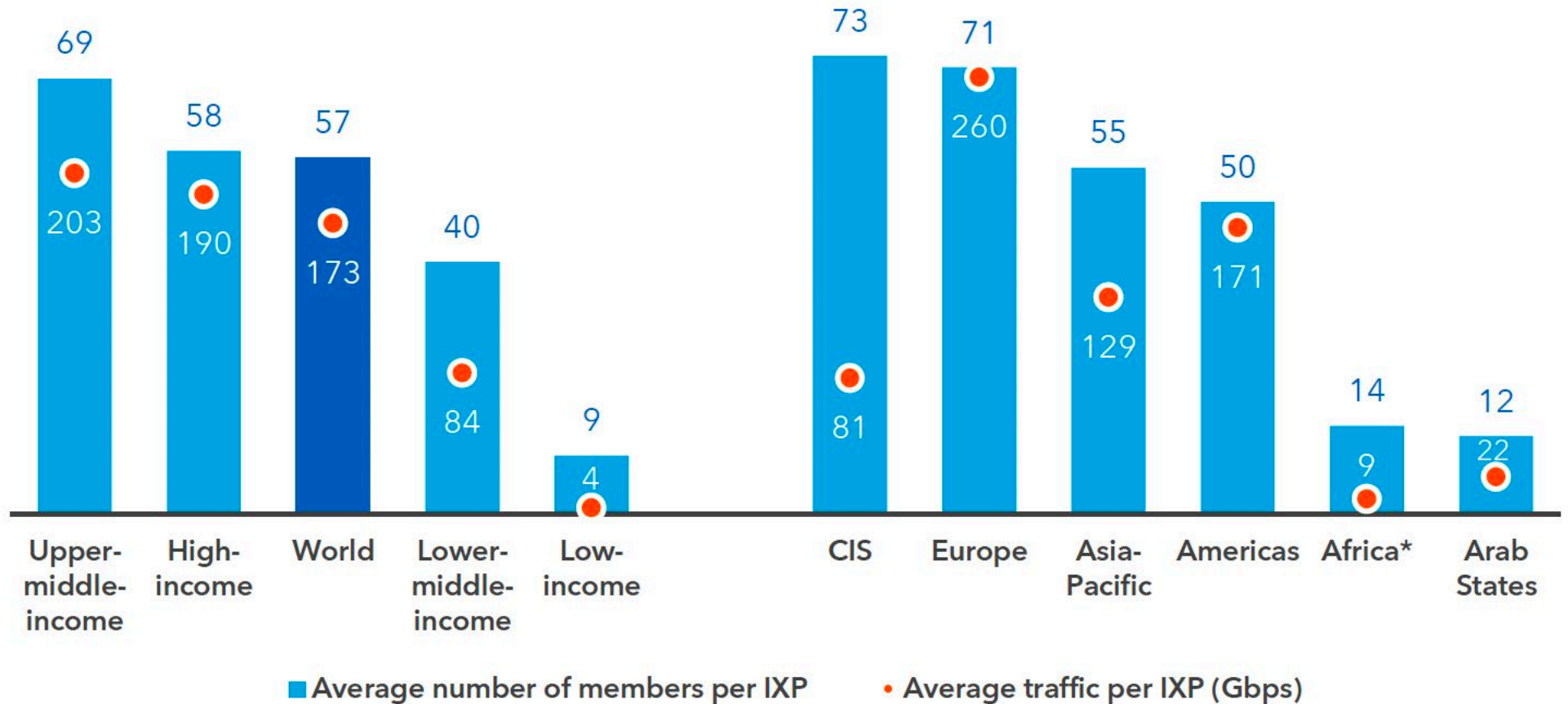
Note: IXP = Internet exchange point; DSL = digital subscriber line; DTH = direct-to-home; LTE = Long-term Evolution.  
 Source: Adapted from World Bank (2021).

## Average members and traffic per IXP, December 2021

# IXPs

By income group

By region



Notes: \* Excluding South Africa. Chart shows the average of peak traffic based on available data. CIS = Commonwealth of Independent States.

Source: Packet Clearing House ([www.pch.net/ixp/dir](http://www.pch.net/ixp/dir)).

# Indicators and sources, IXPs

## **Indicators**

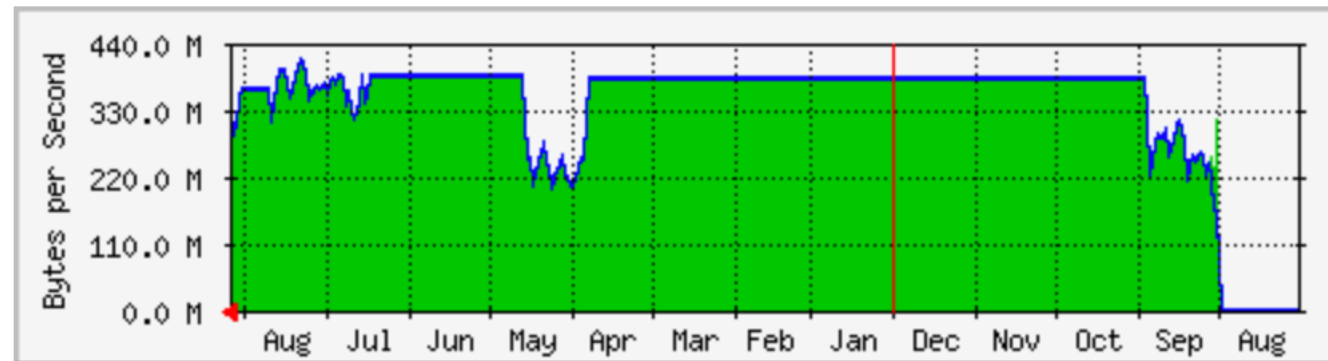
- Number of IXPs
- Number of participants (ASNs)
- Peak (Max) traffic

## **Sources**

- Packet Clearing House (PCH)
- PeeringDB
- Euro-IX

# Rwanda Internet Exchange statistics

## 'Yearly' Graph (1 Day Average)



	Max	Average	Current
<b>In</b>	410.4 MB/s (3.3%)	361.1 MB/s (2.9%)	321.8 MB/s (2.6%)
<b>Out</b>	409.9 MB/s (3.3%)	359.9 MB/s (2.9%)	323.1 MB/s (2.6%)

15

ASNs

48

Ports

To view the RINEX Traffic, please click [here](#)

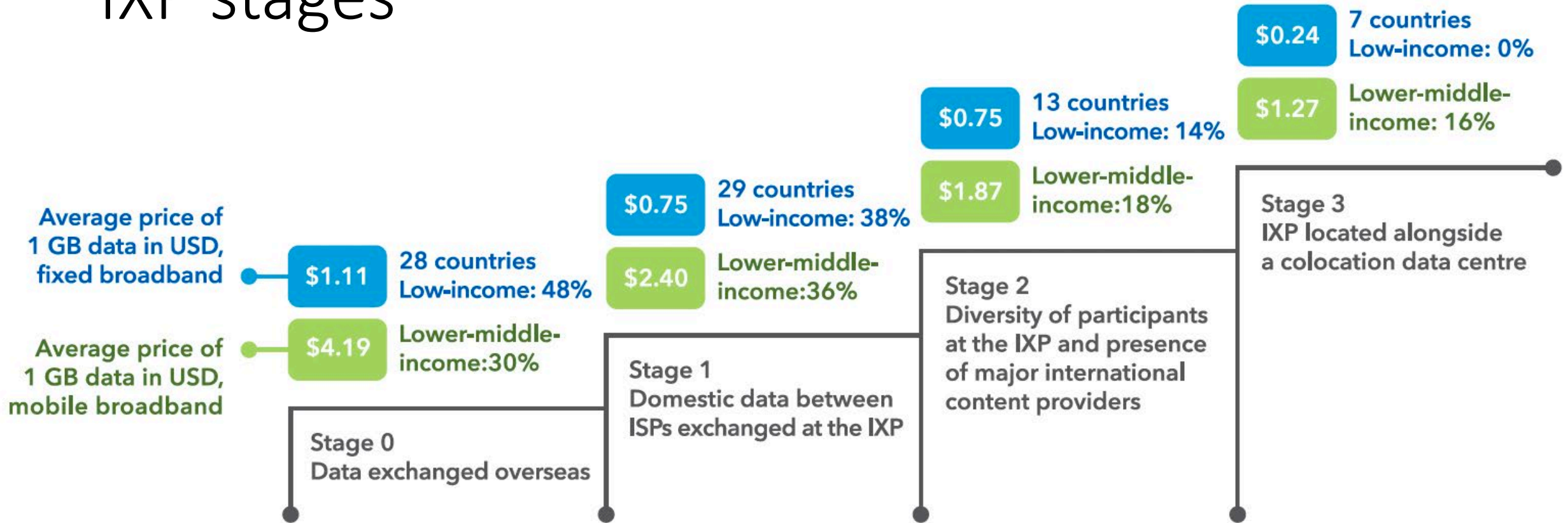
To view the RINEX Looking Glass, please click [here](#)

960

Switching Capacity (Gb/s)



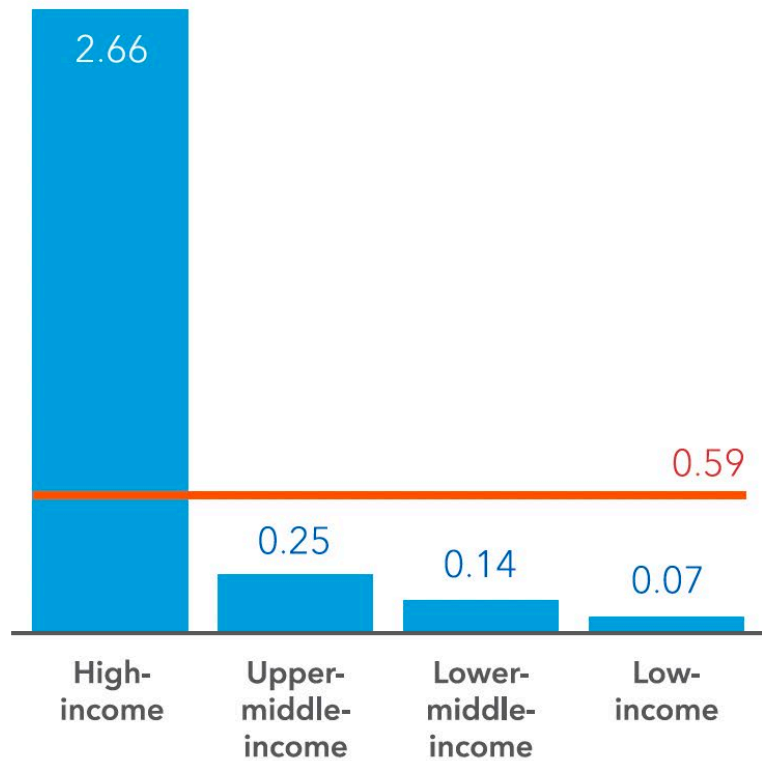
# IXP stages



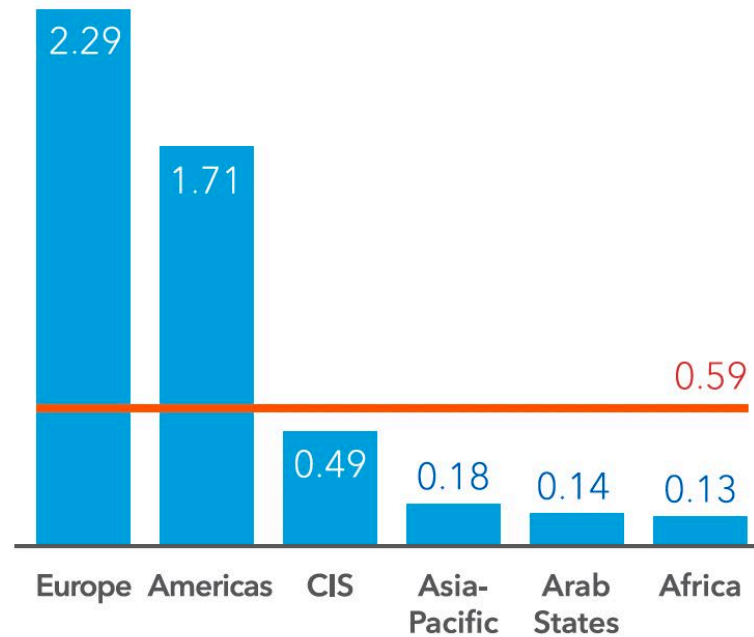
# Data centers

Connected data centres per 1 million people, 2021

By income group



By region



■ Connected data centres per 1 million people    — World

Notes: *Connected data centre* refers to any kind of data centre connected to the Internet. CIS = Commonwealth of Independent States.

Source: PeeringDB.

# Indicators and sources, data centers

## **Indicators**

- Number of data centers
- Power use (MW)
- Size (m<sup>2</sup>)

## **Sources**

- PeeringDB (data centers connected to the Internet)
- Cloudscene & other non-official data
- National data center associations



# Dutch Data Center Association statistics

Table 1: Sizing the Dutch colocation data center market

	2017	2018	2019	2020	2021	2022
Gross surface (incl. office space, etc.)	464.000	506.000	571.000	650.000	713.000	762.000
Net surface (data floor)	242.000	267.000	328.000	353.000	369.000	377.000
Data center facilities (#)	205	198	189	189	184	185
Colocation providers (#)	125	118	111	102	96	97

Table 2: Dutch data center market, data floor (1000 m<sup>2</sup>), IT power (MW), 2022 - 2027

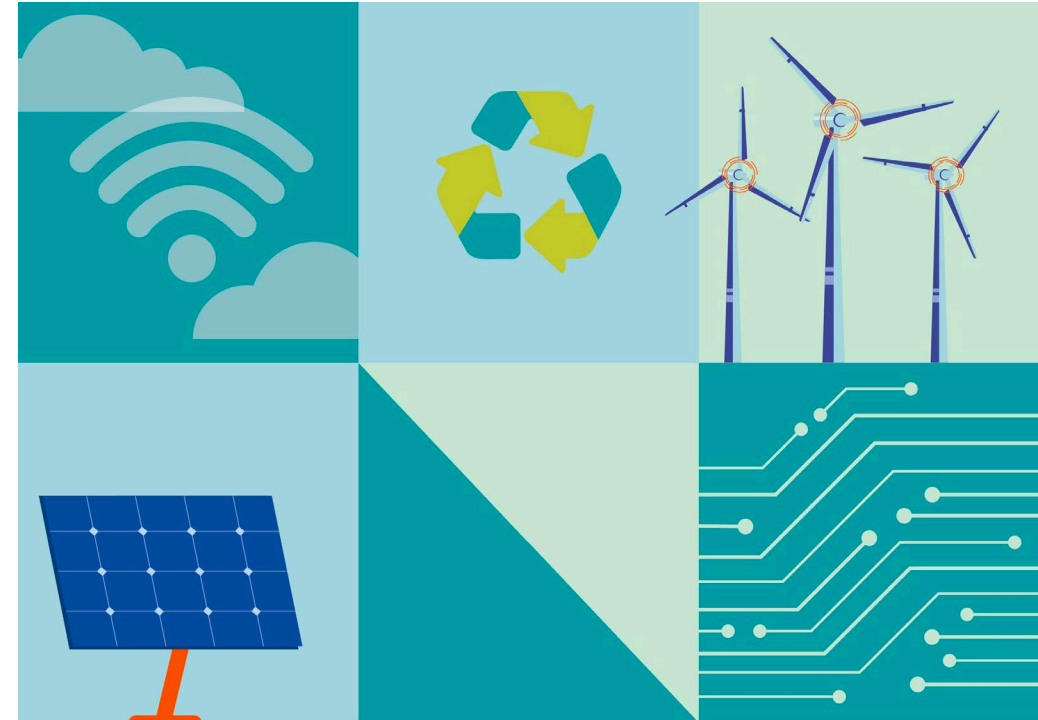
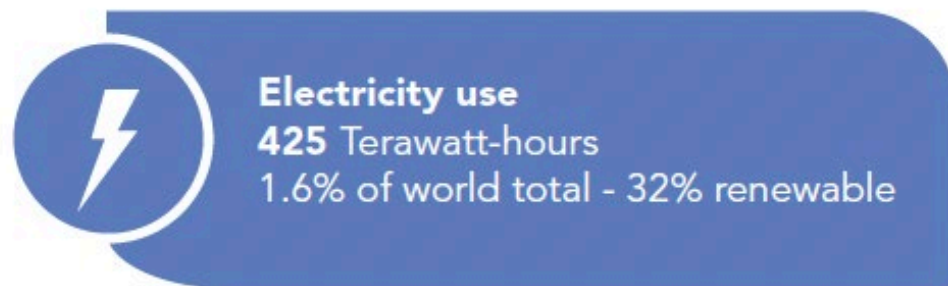
	2022	2023	2024	2025	2026	2027	CAGR 2022-2027
Data floor (1000 m <sup>2</sup> )	377	392	416	449	486	525	6,8%
MW	765	807	873	969	1079	1197	9,4%

Source: Dutch Data Center Association. 2022. *State of the Dutch Data Centers*.

<https://www.dutchdatacenters.nl/en/publications/state-of-the-dutch-data-centers-2022/>

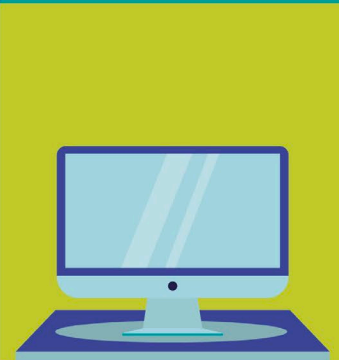
**IMPORTANT CAVEAT: ONLY ICT SECTOR OPERATED DATA CENTERS!!!**

# Sustainability



## Greening digital companies:

Monitoring emissions and climate commitments





An  
Phríomh-Oifig  
Staidrimh

Central  
Statistics  
Office



RWANDA  
UTILITIES  
REGULATORY  
AUTHORITY

Inspiring development

Metered electricity  
consumed by  
data centres



5% | 14%

in 2015

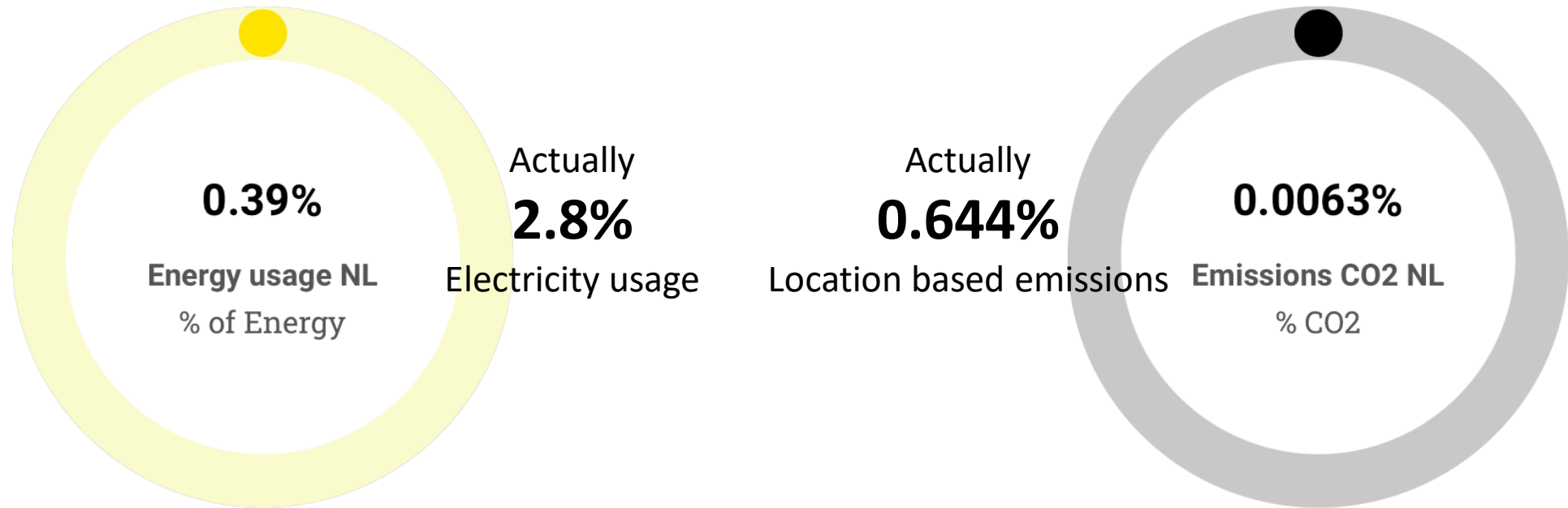
in 2021

**Table 3: Trends of electricity sold (kWh) per type of customer from Q1 to Q4 2020**

Customer category	Q1 2020	Q2 2020	Q3 2020	Q4 2020	2020
Residential	32,238,451	32,315,760	34,331,307	35,021,780	133,907,296
Non-residential	53,841,742	44,618,051	49,049,688	52,082,590	199,592,071
Water pumping stations	7,476,566	11,134,684	10,463,935	8,984,277	38,059,463
Water treatment plants	6,948,114	6,861,352	7,518,296	8,977,342	30,305,104
Broadcasters	1,067,477	1,066,072	1,091,253	1,137,579	4,362,381
Health facilities	3,730,834	3,815,653	3,915,074	4,106,220	15,567,782
Telecom towers	10,645,352	11,453,147	11,740,158	11,882,984	45,721,642
Hotels	9,542,411	4,109,677	5,974,954	7,846,432	27,473,474
Commercial data centers	-	337,256	363,269	366,186	1,066,711
Industries	50,721,972	48,323,530	57,804,972	62,094,467	218,944,942
<b>Total</b>	<b>176,212,919</b>	<b>164,035,183</b>	<b>182,252,906</b>	<b>192,499,858</b>	<b>715,000,867</b>

**Telecom towers + commercial data centers = 6.6%**

# Data center greenwashing in the Netherlands



In 2020, 3.2 TWh (11.52 PJ) of electricity was supplied to data centers. That is 0.39% of total energy consumption in the Netherlands (2,943 PJ).

*The data center sector is a fully electrified industrial sector with hardly any direct greenhouse gas emissions.*

<https://www.dutchdatacenters.nl/en/dashboard/>

# Climate sustainability indicators for the ICT sector

1. Scope 1 emissions (tCO<sub>2</sub>e)
  2. Scope 2 location-based emissions (tCO<sub>2</sub>e)\*
  3. Scope 2 market-based emissions (tCO<sub>2</sub>e)\*\*
  4. Scope 3 (15 categories) (tCO<sub>2</sub>e)
  5. Energy use (MWh)
  6. Energy use (% renewable)
  7. Electricity use (MWh)
  8. Electricity use (% renewable)
- 
- Operational emissions
- Upstream & downstream emissions

Note: \* Actual emissions from electricity. \*\* Emissions as if company was getting all the renewable energy it pays for.

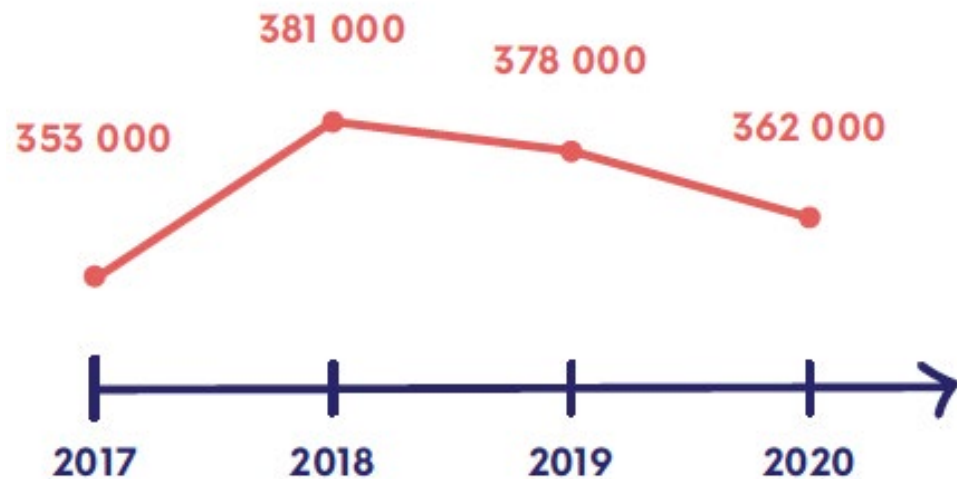
Source: Adapted from GHG Protocol Corporate Accounting and Reporting Standard

# French regulator collecting environmental indicators



## Ensemble des émissions de GES

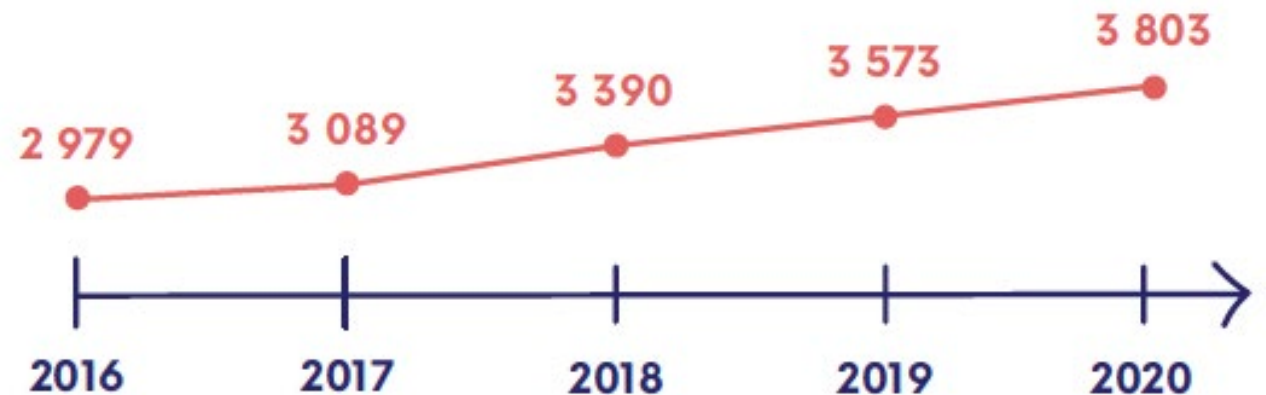
GHG emissions (tCO<sub>2</sub>e)



Émissions GES en tonnes équ. CO<sub>2</sub>

## Consommation énergétique des réseaux fixes et mobiles

Energy consumption (GWh)



Consommation énergétique en gigawattheures

# Conclusions

- IXPs and data centers critical components of the digital economy but are largely invisible in ICT sector statistics
- National regulatory agencies should supplement existing telecom indicator collection to include IXPs and data centers
- Reach agreement on indicators needed for IXPs and data centers
- Given the importance of mitigating climate change and the significant amount of electricity consumed by the ICT sector, NRAs should also collect environmental sustainability indicators