Middle (invisible) mile connectivity & sustainability

CAREC DIGITAL TRADE FORUM 2022
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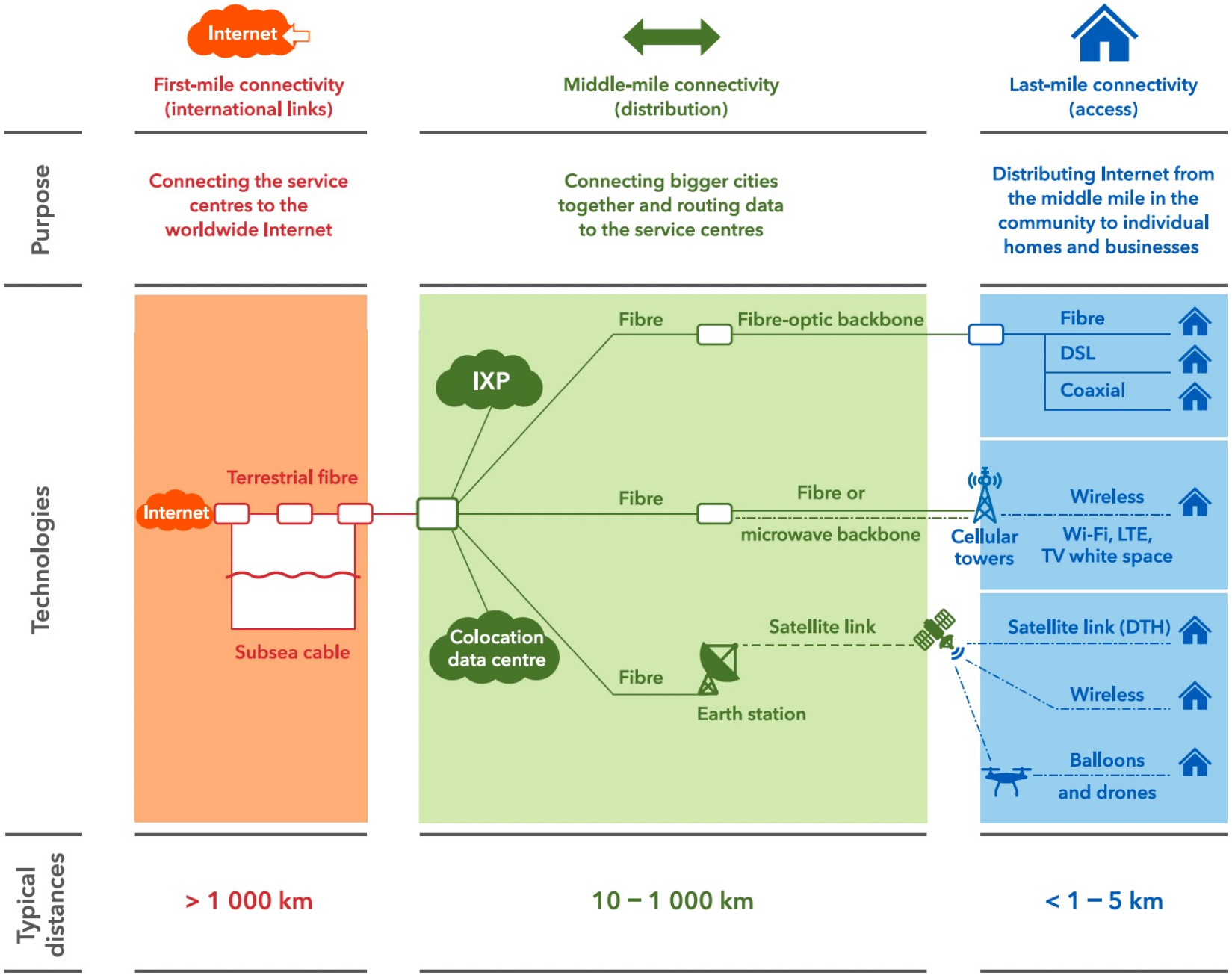
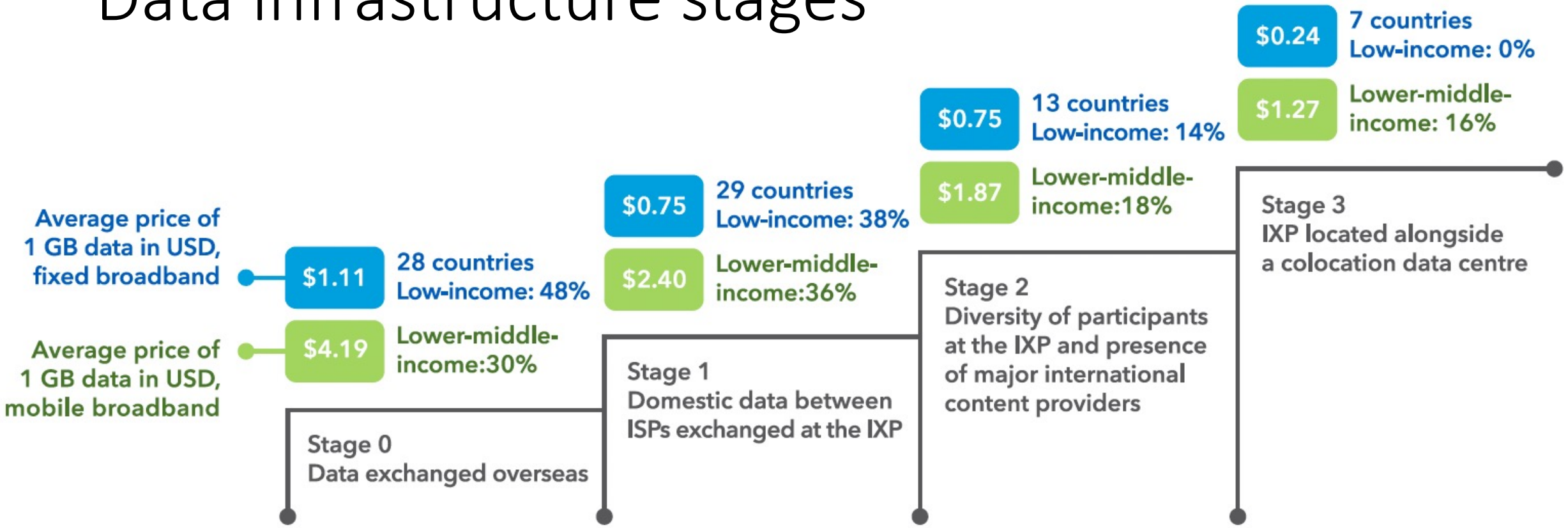


Note: IXP = Internet exchange point; DSL = digital subscriber line; DTH = direct-to-home; LTE = Long-term Evolution.
Source: Adapted from World Bank (2021).

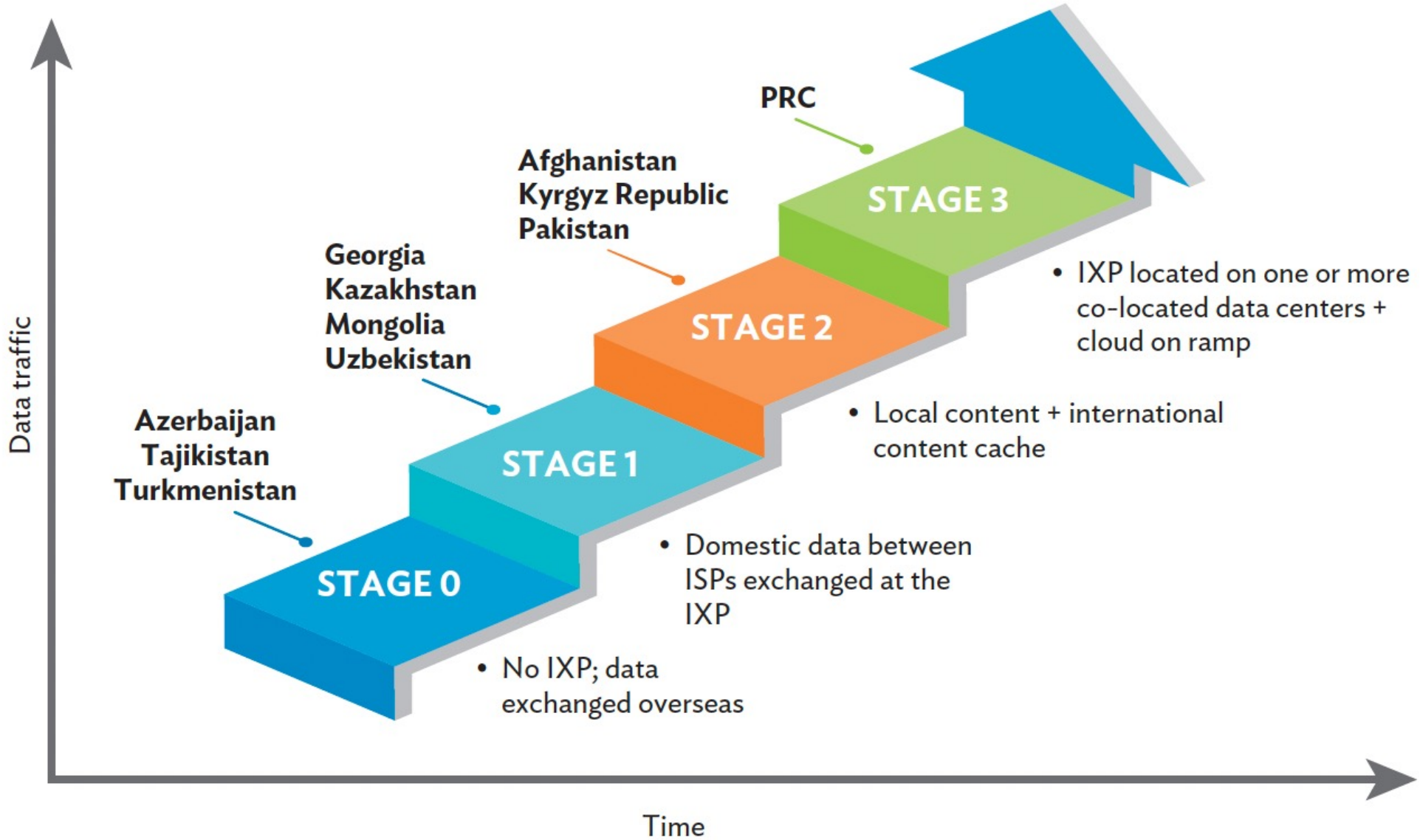
Data infrastructure in context of digital trade (e-commerce)

- Data infrastructure plays three key roles in e-commerce.
  - First, it transmits orders from purchaser to seller—which generally does not require much data and has little impact on a country's telecommunications capacity.
  - Second, it hosts online shops. Although hosting in the business' home country can build up the domestic digital economy by creating demand for data centers, many CAREC countries lack this hosting capacity, and their online shops are hosted abroad.
  - Third, it involves distributing and processing growing amounts of big data for use in ancillary activities such as inventory management, delivery route optimization, and analysis of online shopping habits. The third role is still emerging in most CAREC countries.

Data infrastructure stages



Srinivasan, S., N. Comini and M. Minges (2021). “The Importance of National Data Infrastructure for Low and Middle-Income Countries”


Data traffic
Time
STAGE 0
STAGE 1
STAGE 2
STAGE 3
Azerbaijan
Tajikistan
Turkmenistan
Georgia
Kazakhstan
Mongolia
Uzbekistan
Afghanistan
Kyrgyz Republic
Pakistan
PRC
• No IXP; data exchanged overseas
• Domestic data between ISPs exchanged at the IXP
• Local content + international content cache
• IXP located on one or more co-located data centers + cloud on ramp

An Phríomh-Oifig Staidrimh Central Statistics Office

RURA Inspiring development — RWANDA UTILITIES REGULATORY AUTHORITY

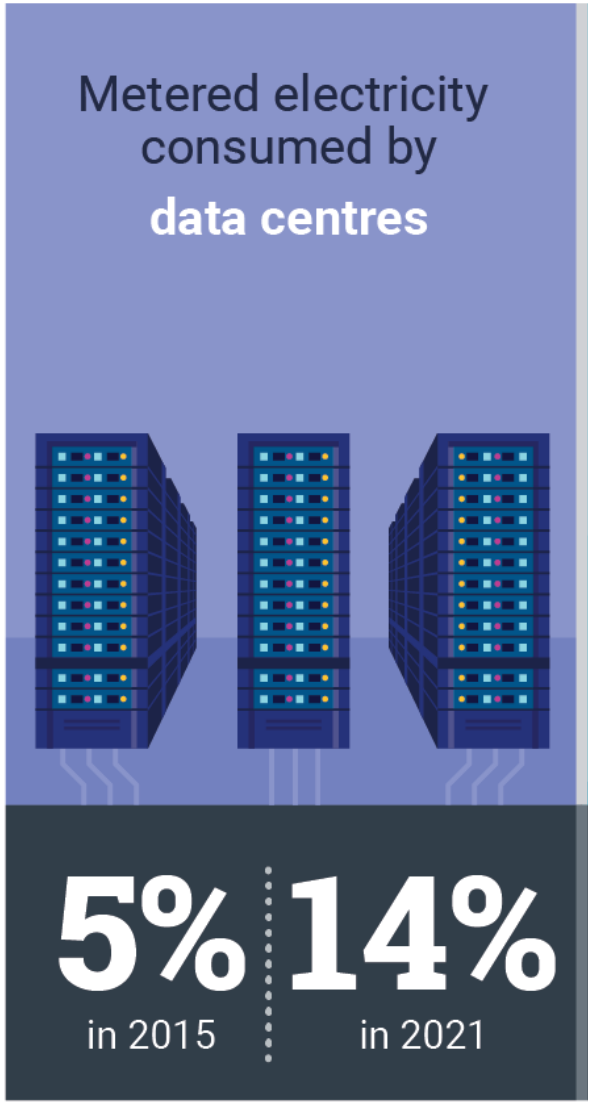


Table 3: Trends of electricity sold (kWh) per type of customer from Q1 to Q4 2020

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
Total	**176,212,919**	**164,035,183**	**182,252,906**	**192,499,858**	**715,000,867**

Telecom towers + commercial data centers = 6.6%

Observations

- Most CAREC countries do not have IXPs, and the ones that exist handle too little data.
  - This owes to market structures where large retail ISPs with dominance over international bandwidth often do not participate.
  - There is also distrust of cooperative models and a lack of awareness of the cost and performance benefits.
  - The operations of IXPs can also be improved by encouraging all ISPs to participate and by hosting IXPs in neutral colocation data centers to attract diverse participants, including content providers.
- The shortage of data centers and access to cloud computing affect the ability of business and entrepreneurs to host e-commerce sites domestically.
  - There is an overreliance on overseas e-commerce platforms and outgoing payments for telecommunications transport.
  - Lack of core internet infrastructure inhibits the ability of CAREC countries to boost domestic e-commerce and hinders development of their digital economies.
  - An enabling environment for investment in world class data centers is needed.
- Data infrastructure uses notable amounts of electricity raising sustainability concerns.
  - When electricity consumption not matched by renewables, GHG emissions will increase.
  - Governments need to liberalize energy markets while companies need to enhance energy efficiency, use their scale to procure renewables and establish emissions reduction targets.
  - Stock markets and regulators require ICT companies to disclose of environmental data