Study on the Development of the Subsea Cable Market

Presented by

Terabit Consulting, Inc.

www.terabitconsulting.com

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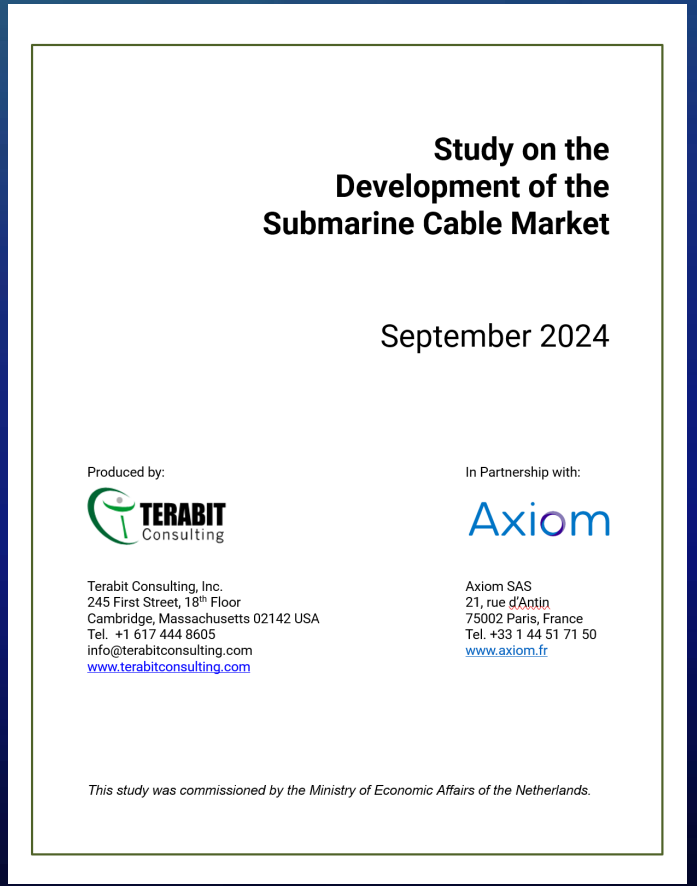
The Study

- Objective
  To perform a detailed analysis of the current and future developments in the local submarine cable market in the Netherlands region as well as globally, in order to provide an empirical underpinning for the prioritization of particularly relevant and interesting subsea cable systems
- The study was performed between May and September 2024.



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September 2024

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TERABIT Consulting

Terabit Consulting, Inc.
245 First Street, 18th Floor
Cambridge, Massachusetts 02142 USA
Tel. +1 617 444 8605
info@terabitconsulting.com
www.terabitconsulting.com

In Partnership with:

Axiom

Axiom SAS
21, rue d'Antin
75002 Paris, France
Tel. +33 1 44 51 71 50
www.axiom.fr

This study was commissioned by the Ministry of Economic Affairs of the Netherlands.

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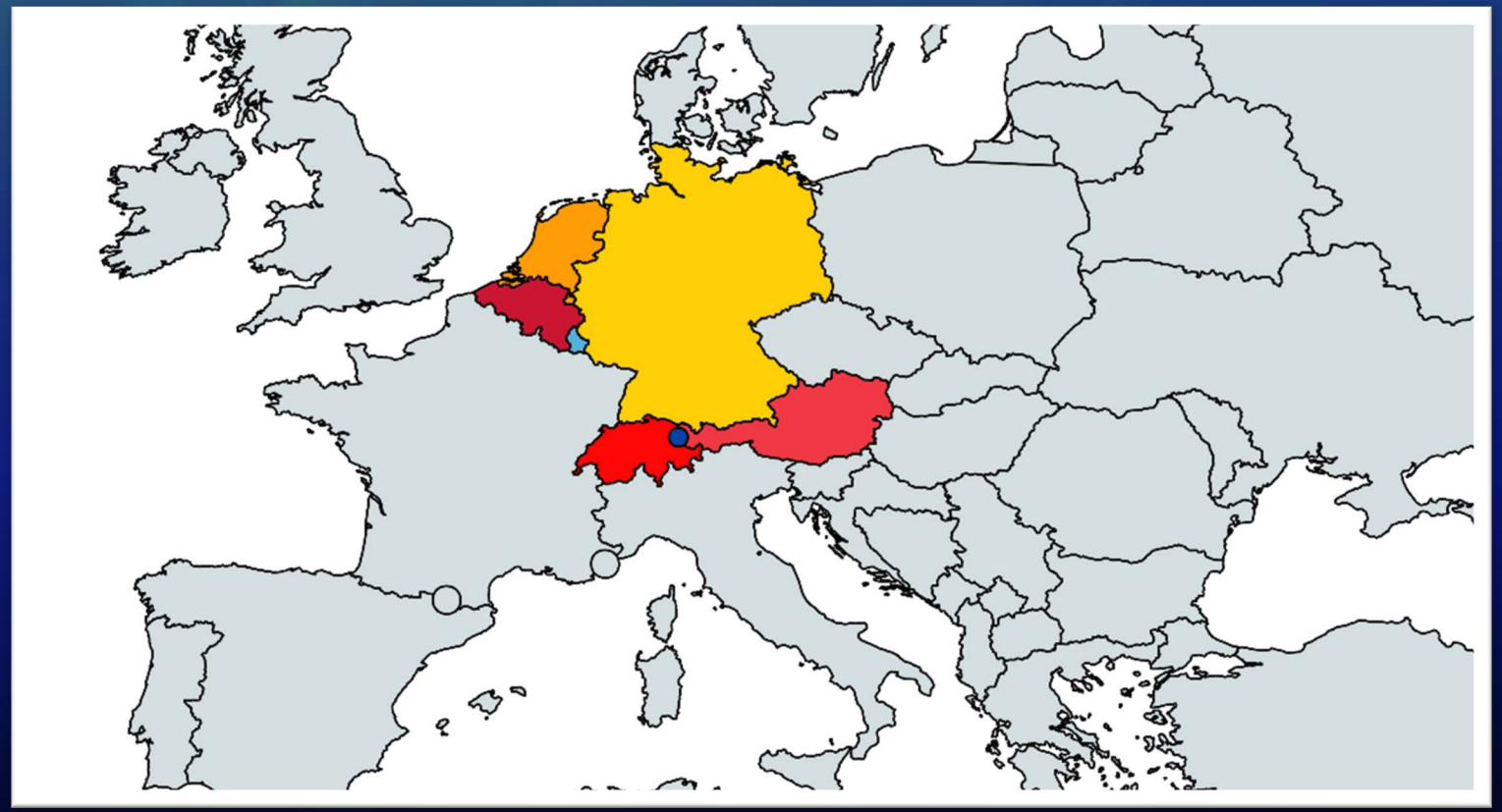
Netherlands Submarine Cable Demand: Modeled Across a 7-Country “Catchment Area”

The Netherlands is a logical and efficient submarine gateway for at least 7 European countries, comprising the Netherlands itself and a “catchment area” of adjacent and nearby markets

1. Netherlands
2. Belgium
3. Luxembourg
4. Germany
5. Switzerland
6. Liechtenstein
7. Austria



The 6 other countries are served in part by terrestrial transit networks that offer connectivity to the Netherlands’ submarine cable infrastructure.

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Demand Analysis: Terabit Consulting Model of International Bandwidth Demand

- Consumer Internet Model
  - Residential peak-hour demand: broadband penetration, access speeds, monthly download volumes, applications, usage patterns
- Business, Institutional, Government, Educational, and Research Model
  - Same variables as above but including sectoral growth
- Data Center/Cloud/Hyperscaler Model
  - Data center locations by type, energy consumption (MW), floor space, interconnection bandwidth, cloud zones/architectures, hyperscaler buildout plans

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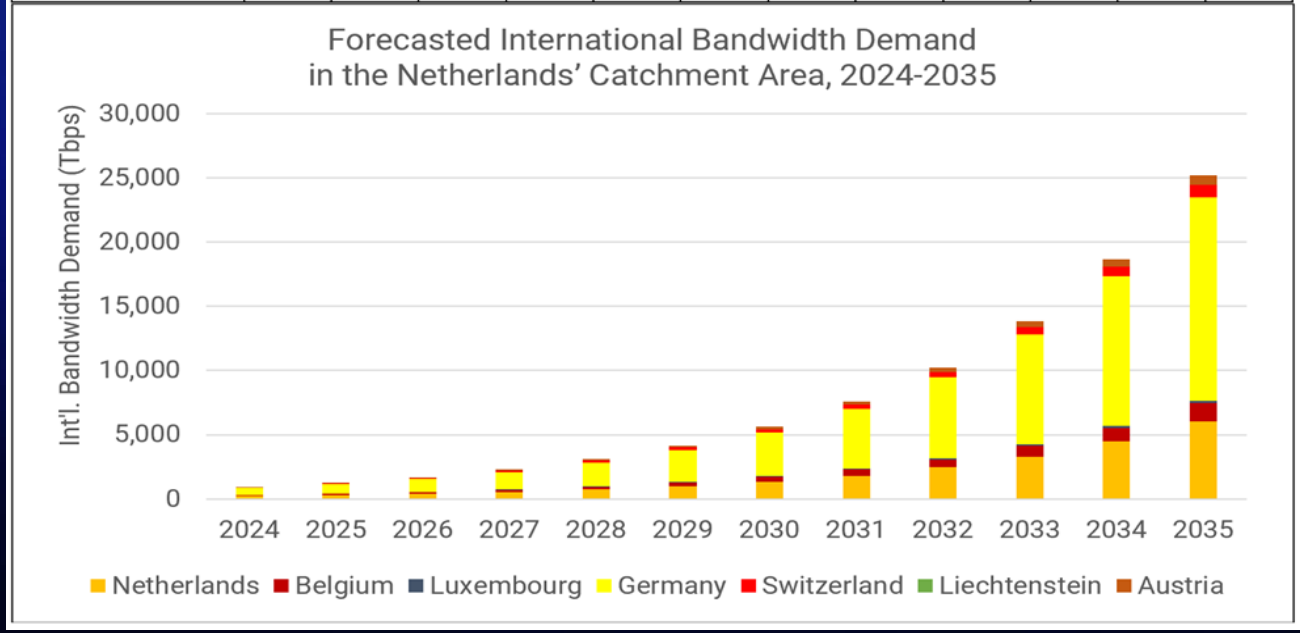
Bandwidth Demand Forecast: Total International Demand by Country

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Netherlands	222	300	405	546	738	996	1,344	1,815	2,450	3,307	4,465	6,027
Belgium	73	95	125	163	214	280	367	481	631	826	1,082	1,418
Luxembourg	13	17	21	27	35	45	58	74	96	123	158	203
Germany	537	731	994	1,351	1,838	2,499	3,399	4,623	6,287	8,550	11,629	15,815
Switzerland	52	68	89	116	151	198	258	336	439	573	748	976
Liechtenstein	0.8	1.0	1.3	1.6	2.1	2.6	3.4	4.3	5.5	7.1	9.1	12
Austria	40	52	68	89	115	150	195	253	329	427	556	722
Total – Netherlands Catchment Area	938	1,264	1,703	2,295	3,093	4,170	5,624	7,587	10,236	13,814	18,645	25,172



- Historical growth (2010-23): 33%
- Forecasted CAGR (2024-35): 35%
  - 938 Tbps => 25.2 Pbps
- Driven by mobile & fixed broadband
  - Especially 5G & fiber
- Also driven by post-pandemic usage patterns
- And data center demand
  - Especially AI

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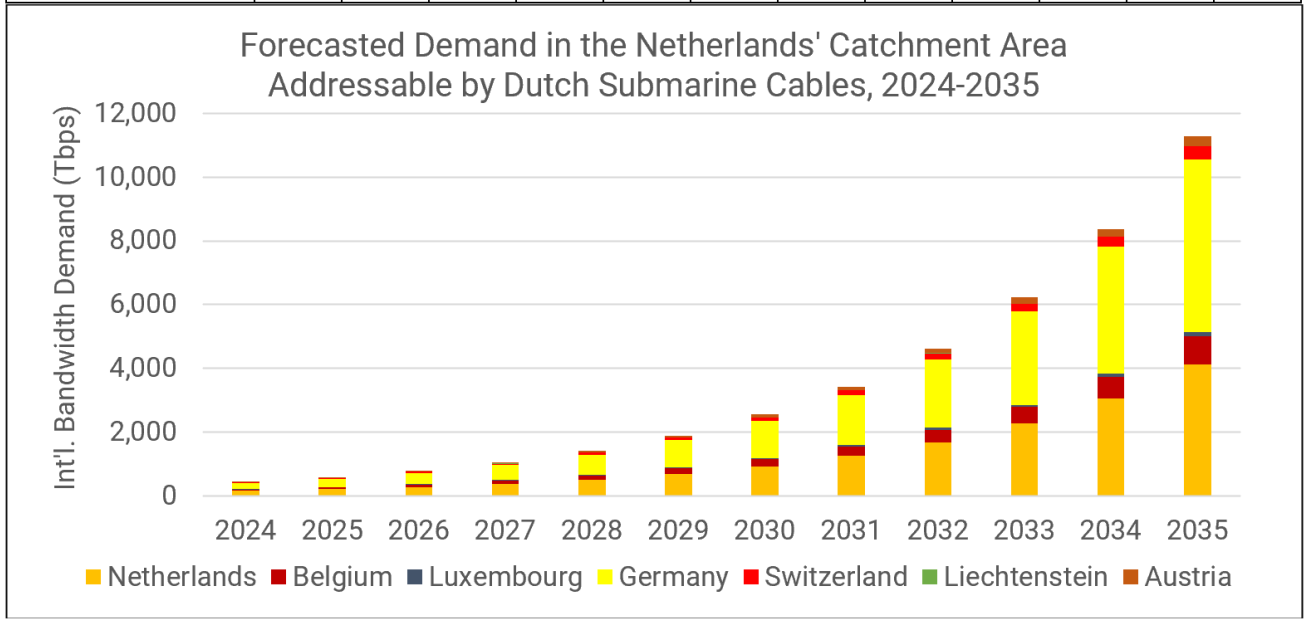
How AI Is Driving Bandwidth Demand

- The average ChatGPT query requires approximately 10x more electricity than a traditional Google query
- AI requires access to enormous datasets during both training & inference
  - Access to many datasets is required in real-time, further driving bandwidth demand
- AI models will soon involve hundreds of trillions of parameters, requiring distributed computing across multiple nodes (from data center to edge), enabled by bandwidth
- Many AI applications are cloud-based, further driving bandwidth demand

Bandwidth Demand Forecast: Netherlands Addressable Market Opportunity

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Netherlands	152	206	278	375	506	683	922	1,244	1,680	2,268	3,062	4,133
Belgium	45	59	78	102	133	175	229	300	392	514	673	882
Luxembourg	7.6	10	13	16	21	27	34	44	56	72	93	119
Germany	184	250	340	463	629	856	1,164	1,582	2,152	2,927	3,981	5,413
Switzerland	23	30	39	51	66	86	113	147	192	251	327	427
Liechtenstein	0.3	0.4	0.5	0.6	0.8	1.0	1.2	1.6	2.0	2.6	3.3	4.2
Austria	17	23	30	38	50	65	84	110	143	185	241	313
Total – Netherlands Catchment Area	430	578	777	1,045	1,406	1,892	2,546	3,429	4,617	6,220	8,380	11,293



- An analysis of BGP data was performed to determine the route of demand
- Demand logically served by terrestrial cables, or otherwise not addressable by Dutch submarine cables, was excluded
- Addressable Dutch submarine cable market opportunity forecast to grow 35% annually
  - From 430 Tbps to 11.3 Tbps

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Supply Analysis: Terabit Consulting Database of All Active, Under-Construction, and Proposed Systems

Transatlantic

Cable System	RFS	Status	Route KM	wnership Typ	Owner(s)	Cost ($Mil)	Supplier(s)	Design Architecture	Fiber Pairs	Capacity per Fibre Pair (Tbps)	Design Capacity (Tbps)
Atlantic Crossing-1 (AC-1)	1999	Active	14,000	At RFS: Inv	At RFS: Gl	$750	AT&T-SSI/	8 fiber pairs	8	1	8
Yellow (formerly Yellow / Atlantic Cross	2000	Active	6,960	At RFS: Inv	At RFS: Gl	$400	TSSL (Sub	4 fiber pairs	4	3	12
FLAG Atlantic-1 (FA-1)	2001	Active	12,800	At RFS: Inv	At RFS: FL	$1,100	Alcatel (Alc	12 fiber pai	12	3	38
EXA Atlantic (formerly Hibernia Atlanti	2001	Active	11,700	At RFS: Inv	At RFS: 36	$770	TSSL (Sub	8 fiber pairs	8	3	20
TGN-Atlantic (formerly TyCom Global	2001	Active	12,915	At RFS: Su	At RFS: Ty	$800	TyCom (Su	8 fiber pairs	8	5	41
Apollo	2003	Active	13,000	Carrier / Su	At RFS: Ca	$900	Alcatel (Alc	8 fiber pairs	8	8	64
Greenland Connect	2009	Active	4,780	Carrier / Go	Tele Green	$135	Alcatel-Luc	2 fiber pairs	2	6	13
EXA Express (formerly Hibernia Expre	2015	Active	4,600	At RFS: Inv	At RFS: Hi	$300	TE SubCor	6 fiber pairs	6	9	53
AEC-1 (formerly America-Europe Con	2016	Active	5,536	Investor	Aqua Comr	$300	TE SubCor	4 fiber pairs	4	13	52
Marea	2018	Active	6,605	Consortium	Telxius (Te	$240	TE SubCor	8 fiber pairs	8	28	224
Havfrue / AEC-2 (formery America-Eu	2020	Active	7,726	Consortium	Aqua Comr	$300	TE SubCor	6 fiber pairs	6	18	108
Dunant	2021	Active	6,600	Content Pro	Google / O	$360	TE SubCor	12 fiber pai	12	21	250
EllaLink	2021	Active	9,300	Investor	EllaLink (M	$185	Alcatel Sub	4 fiber pairs	4	18	72
Grace Hopper	2022	Under cons	7,200	Content Pro	Google	$300	SubCom	16 fiber pai	16	21	336
Amitie	2023	Under cons	6,792	Consortium	Meta / Aqu	$300	Alcatel Sub	16 fiber pai	16	20	322
TOTAL		**15**	**130,514**			**$7,140**			**122**		**1,613**
Proposed											
Leif Erickson	2024	Proposed	4,200	Investor	Bulk Infrast	$180	TBD	TBD	TBD	TBD	TBD
Meta/M4	TBD	Proposed	TBD	Content Provider		Meta	NEC	24 fiber pai	24	21	500

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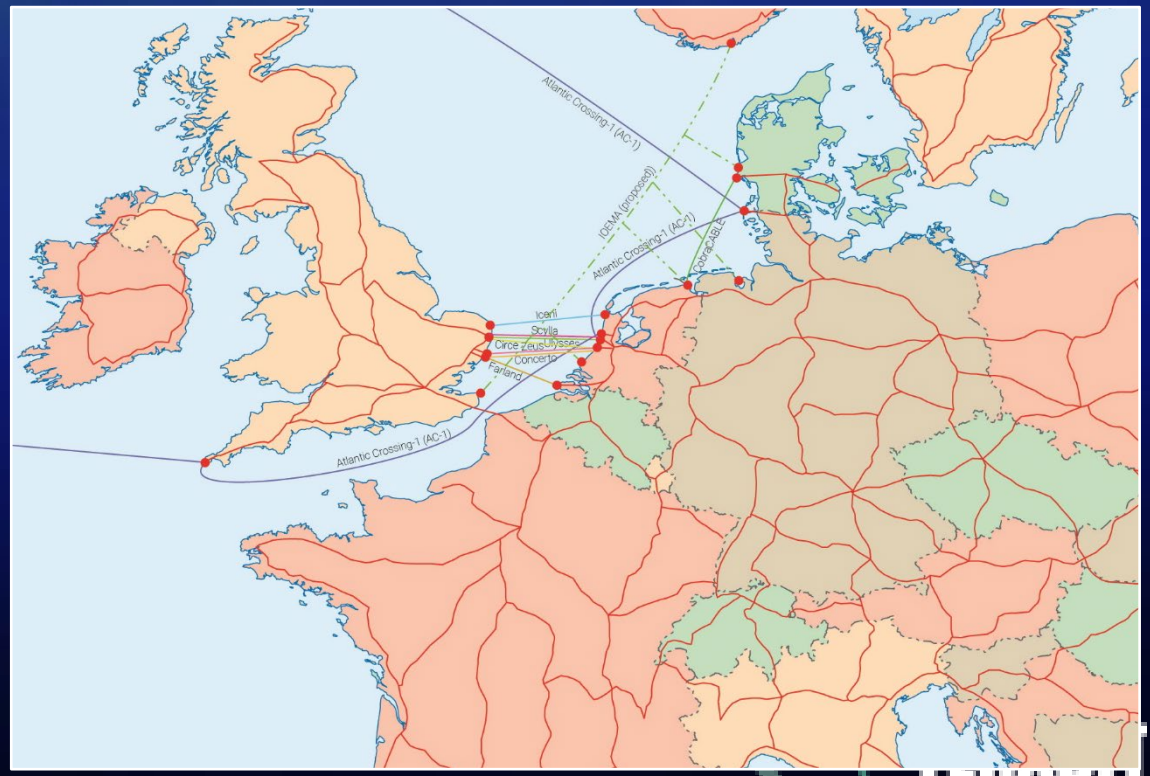
Existing & Planned Submarine Cable Systems Serving the Netherlands

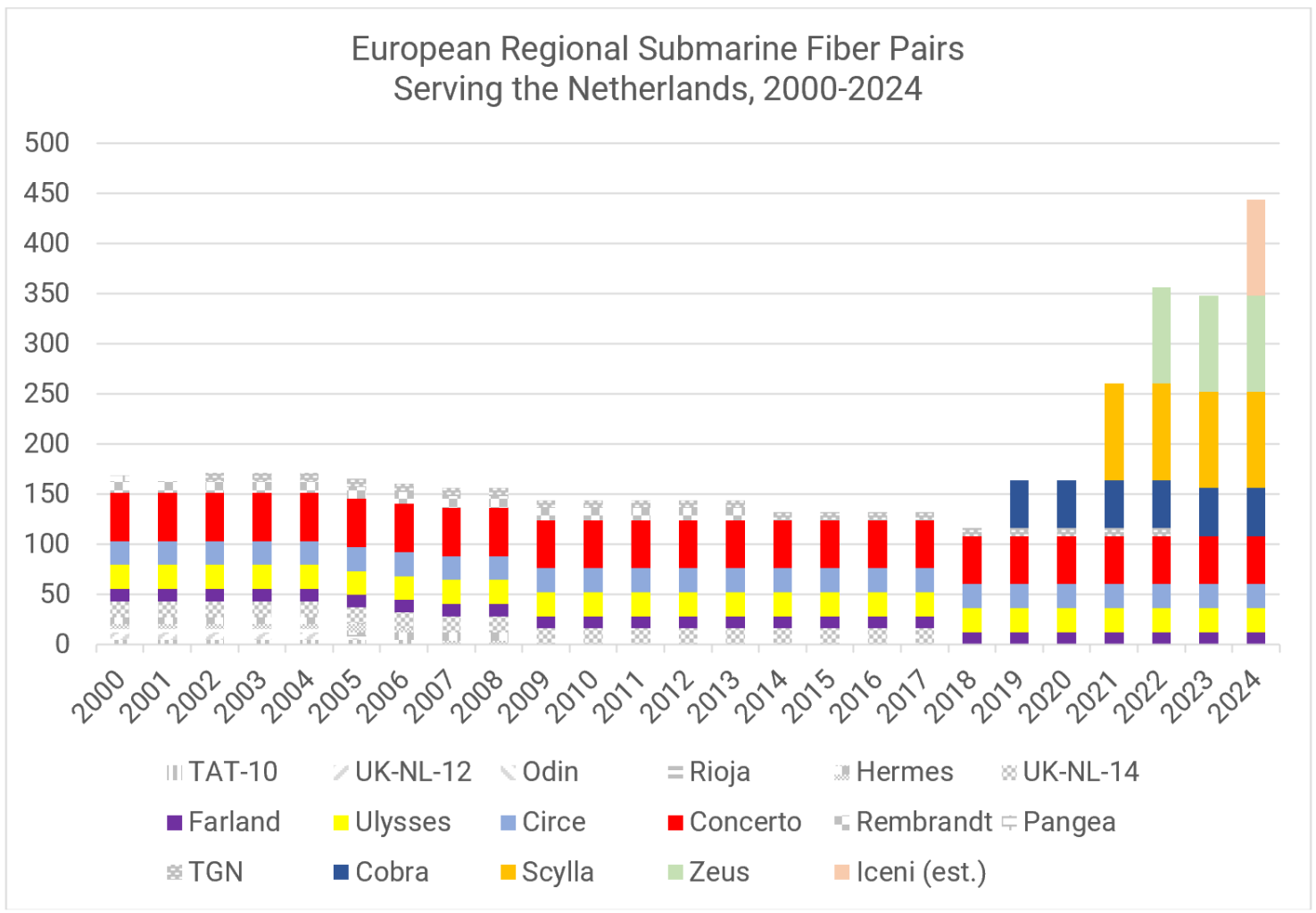
Cable System	RFS	Status	Route KM	Ownership / Financing	Owner(s)	Design Architecture
Farland (UK-Netherlands)	1998	Active	150	Carrier	BT (originally through its Farland BV subsidiary)	12 fiber pairs
Ulysses (UK-Netherlands)	1998	Active	200	Carrier	Verizon Business (acquired following Worldcom bankruptcy)	24 fiber pairs
Atlantic Crossing-1 (AC-1)	1999	Active	14,000	Carrier	Colt (Originally Global Crossing / CenturyLink / Lumen)	8 fiber pairs (4 north and 4 south) x 1 Tbps
Circe North (UK-Netherlands)	1999	Active	218	Wholesalers	euNetworks (50%) / Zayo (50%) (Originally Viatel)	24 fiber pairs
Concerto (UK-Netherlands)	1999	Active	200	Wholesaler	Exa Infrastructure (Originally Flute / Interoute)	48 fiber pairs
COBRAcable (Netherlands-Denmark)	2019	Active	325	Power company	TenneT NSO / Energinet (dark fiber commercialized via their joint venture Relined Fiber Network)	48 fiber pairs
Scylla (UK-Netherlands)	2021	Active	211	Wholesaler	euNetworks	96 fiber pairs
Zeus (UK-Netherlands)	2022	Active	200	Wholesaler	Zayo	96 fiber pairs
Iceni (BT North Sea)	2024	Under construction	210	Carrier	BT	96 fiber pairs (est.)
IOEMA	TBD	Proposed	1,371	Investor	IOEMA	48 fiber pairs

As of mid-2024, the Netherlands was served by eight submarine cable systems

- 7 regional European cables (1 under construction)
- 1 transatlantic cable



European Submarine Capacity to the Netherlands



- As of year-end 2024 (following the completion of Iceni), there will be a total of 444 available fiber pairs in active submarine cable systems connecting the Netherlands to European destinations
  - 396 fiber pairs link to the United Kingdom exclusively
  - the remaining 48 link to Denmark on the COBRACable

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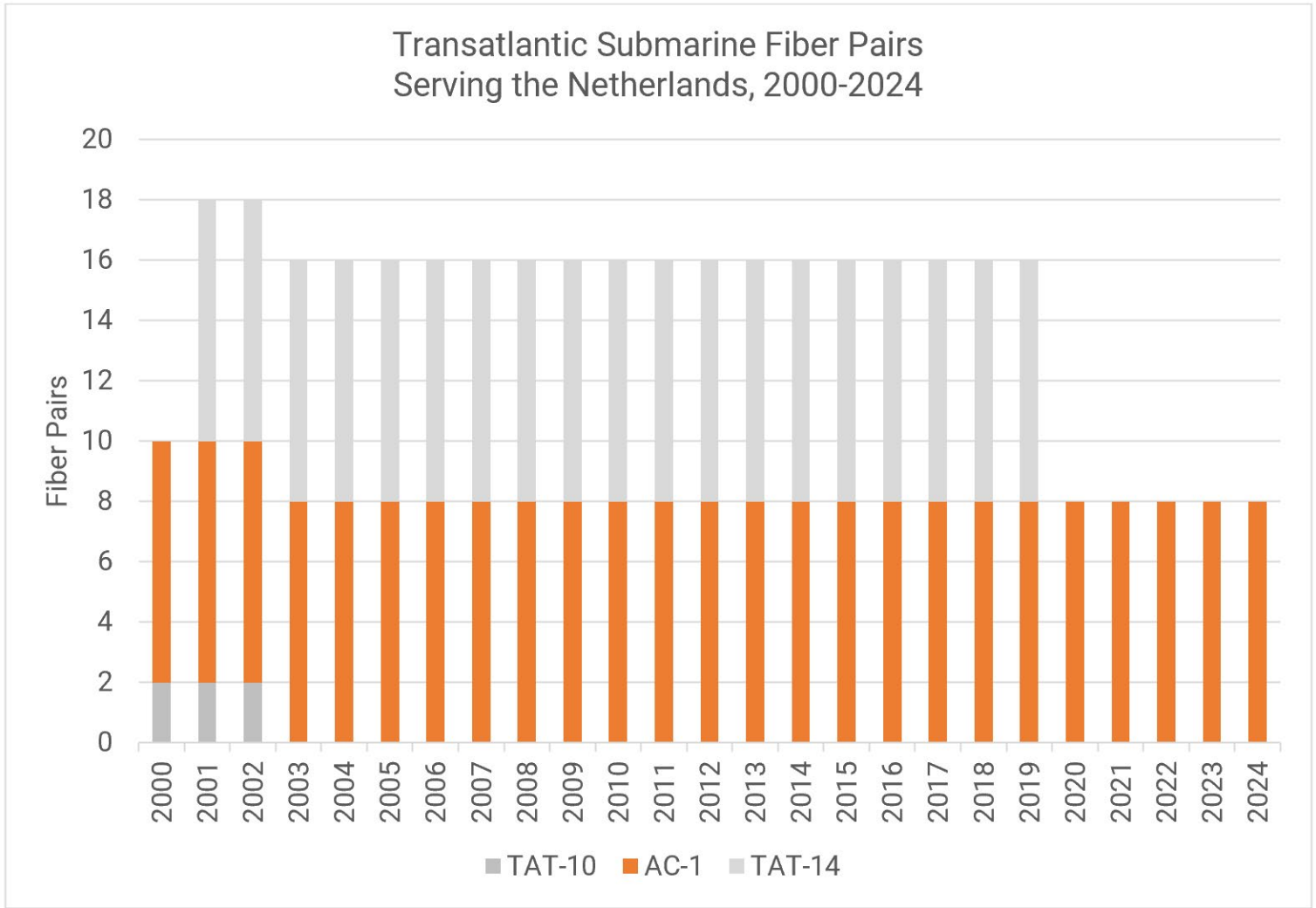
Transatlantic Capacity to the Netherlands



- Following the retirement of TAT-14 in 2020, the Netherlands has had only 8 active transatlantic fiber pairs
  - via AC-1 (RFS 1999), which is likely to be retired within the next two to three years

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The Netherlands' Submarine Infrastructure Is Not Sufficient

- Year-end 2024: Netherlands will be served by 8 European cables + 1 transatlantic cable
- These systems are not considered to be collectively sufficient for the Netherlands' future international capacity requirements
- The Netherlands' only transatlantic system, Atlantic Crossing-1, entered service in 1999 and has already exceeded its planned technical lifespan
- Four of the country's regional European systems are also at least 25 years old
  - this could present potential technical limitations on the use of new transmission technologies going forward
- This effectively leaves the Netherlands with only four next-generation submarine cables
  - controlled by a small group of operators, as three are single-owner systems connecting to the UK and the fourth is a two-investor system linking to Denmark

The Case for New Submarine Cable Deployment to the Netherlands

- Terabit Consulting's model of global submarine cable demand forecasts demand for the following new cables (2025-2032):
  - 12 new transatlantic cables
  - 8 new Europe-to-Asia cables
  - 5 new South American intercontinental cables
  - 1 new African intercontinental cable
- Conservative forecast of Netherlands catchment area demand indicates that 22.7% of transatlantic demand is efficiently served via the Netherlands
  - This demand justifies construction of at least 2 new transatlantic submarine cables to the Netherlands by 2032
- There is also a business case for involving the Netherlands in cable projects serving other routes, such as Europe-Asia (including trans-Arctic)

Conclusions

- As one of the most robust digital ecosystems in the world, the Netherlands' internet, IXP, data center, and transit network infrastructure will continue to drive strong growth in demand for international submarine cable bandwidth
- At the same time, the health of that digital ecosystem, and its ability to flourish, will be dependent on the development of next-generation, diverse, high-capacity submarine bandwidth connecting the Netherlands to Europe, North America, and beyond
- Although the country's existing submarine infrastructure offers nominal bandwidth capacity of more than 450 fiber pairs, it is insufficient for future demand because of deficiencies in its modernity, the concentration of its ownership, and limited geographic reach
- Investment in new regional and long-haul submarine cables is clearly justified by the current and forecasted bandwidth demand of the Netherlands and its adjacent markets, and an analysis of bandwidth pricing and cable construction costs did not identify any obstacles to the Netherlands' competitiveness in attracting investment
- Strategic collaboration between the public and private sectors, including initiatives like the Dutch Subsea Cable Coalition and the coordinated efforts of regional and EU partners, will be crucial for advancing the country's submarine cable development and enhancing the value of the Netherlands' digital hub

Thank you!

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