Atomkraft: im Technologiemarkt irrelevant

Erneuerbare und Speicher dominant

(auf der Basis des World Nuclear Industry Status Report 2025)

www.WorldNuclearReport.org

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Salzburg, 19. November 2025

International, Interdisciplinary Team for a Multi-Indicator Analysis

A Mycle Schneider Consulting Project
Paris, September 2025

The World Nuclear Industry
Status Report 2025

HEINRICH BÖLL STIFTUNG

The World Nuclear Industry
Status Report 2025

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Paris, 2025

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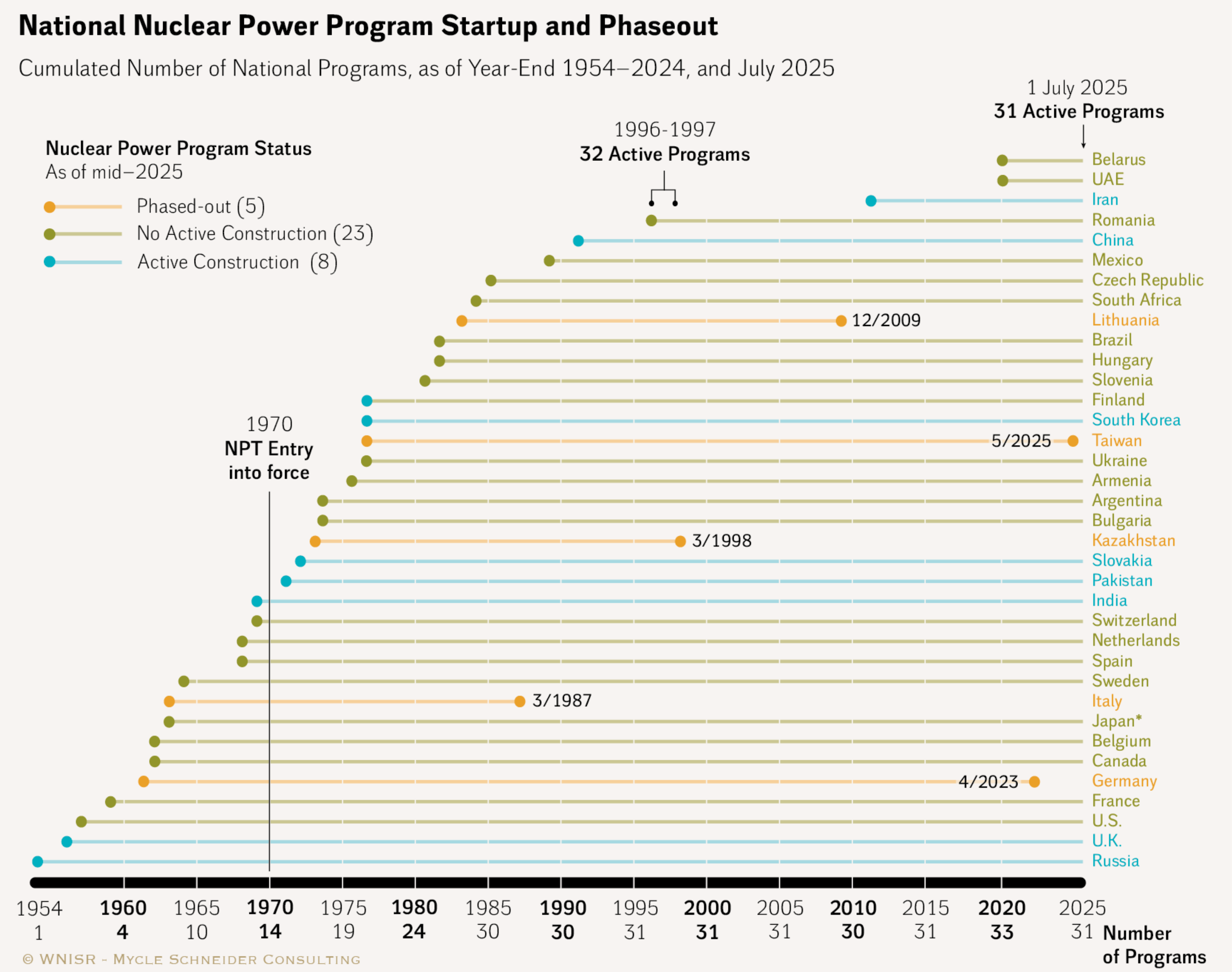
From 2000 to 2010, he was an occasional advisor to the German Environment Ministry. 1998–2003, he was an advisor to the French Environment Minister's Office and to the Belgian Minister for Energy and Sustainable Development.

Mycle Schneider has given evidence or held briefings at national Parliaments in 16 countries and at the European Parliament. He has advised Members of the European Parliament from four different groups over the past 35+ years.

He has given lectures or had teaching appointments at over 20 universities and engineering schools in a dozen countries.

GLOBAL OVERVIEW – Role of Nuclear Power

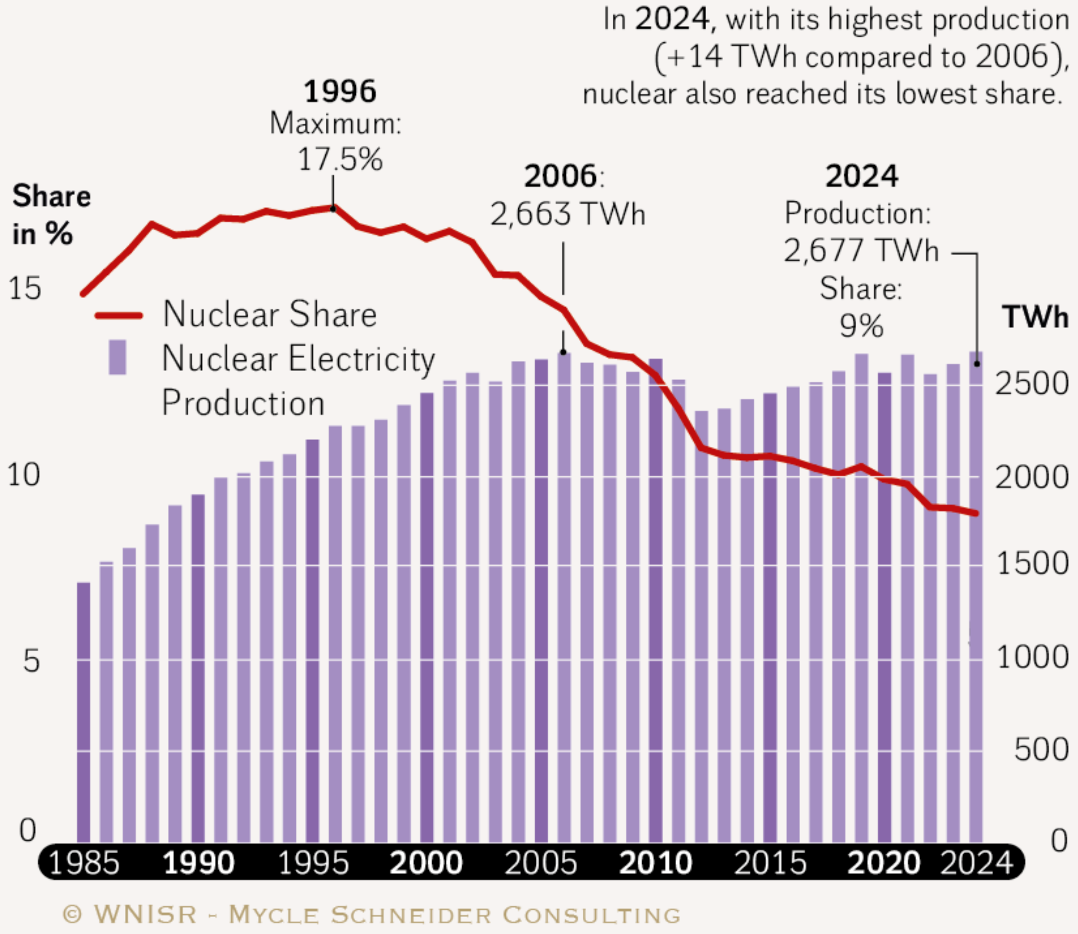


Sources: Various, compiled by WNISR, with IAEA-PRIS, 2025

GLOBAL OVERVIEW – Role of Nuclear Power

Nuclear Electricity Production 1985–2024 in the World...

in TWh (net) and Share in Electricity Generation (gross)



...and in China and the Rest of the World

in TWh (net)

Sources: Energy Institute, 2025

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Nuclear Electricity Production 1985–2024 in the World...

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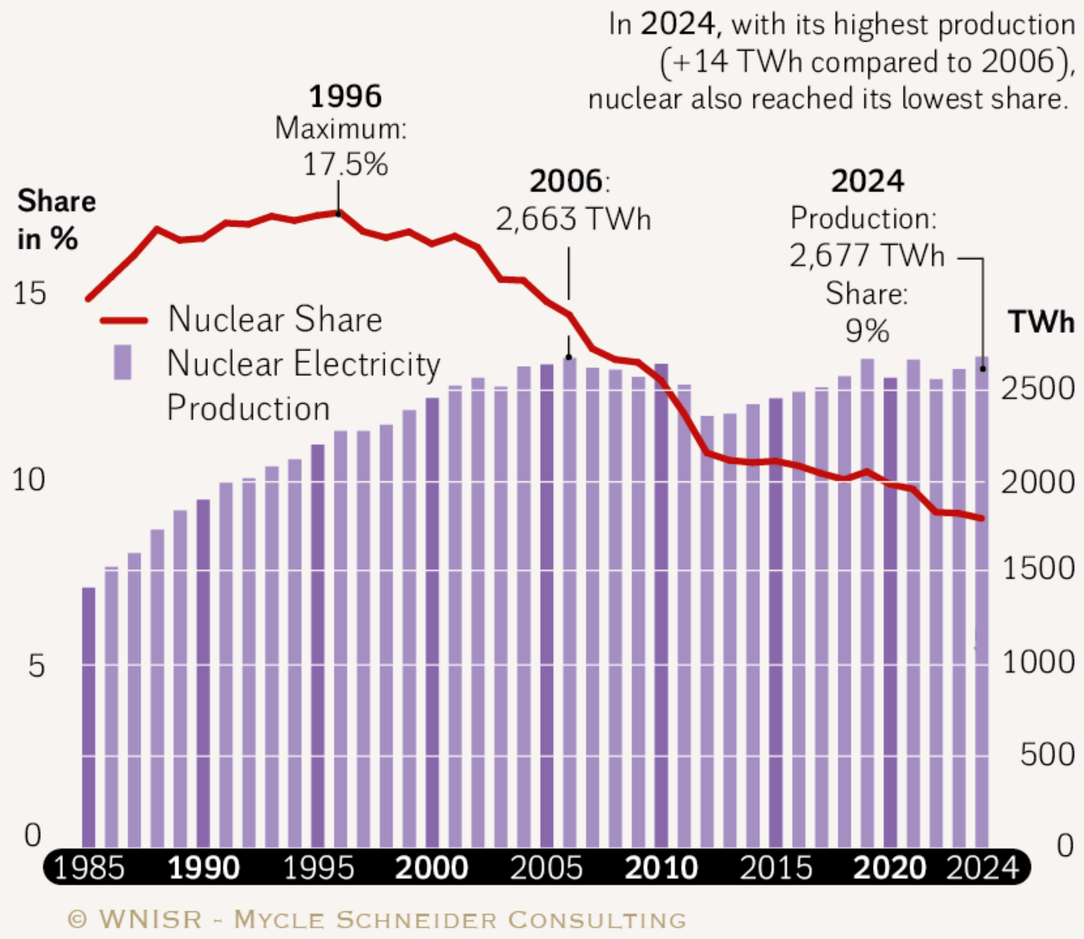
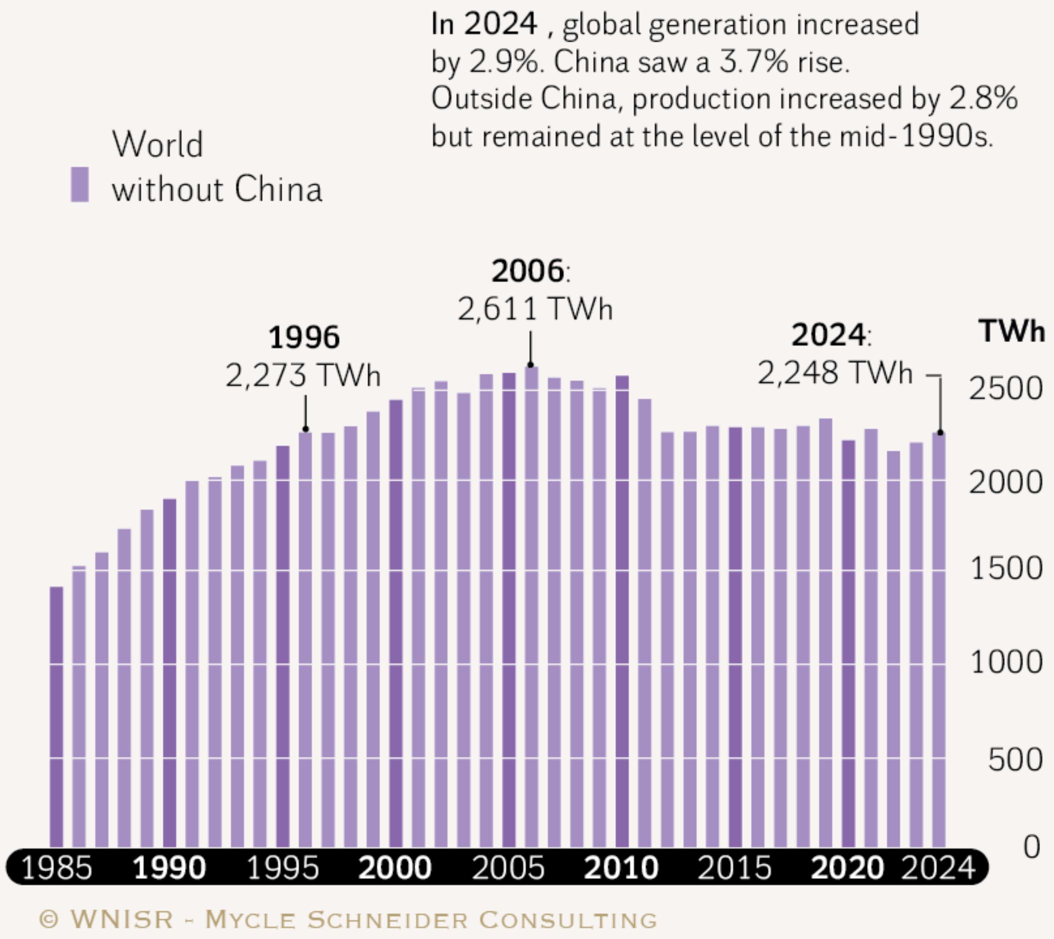


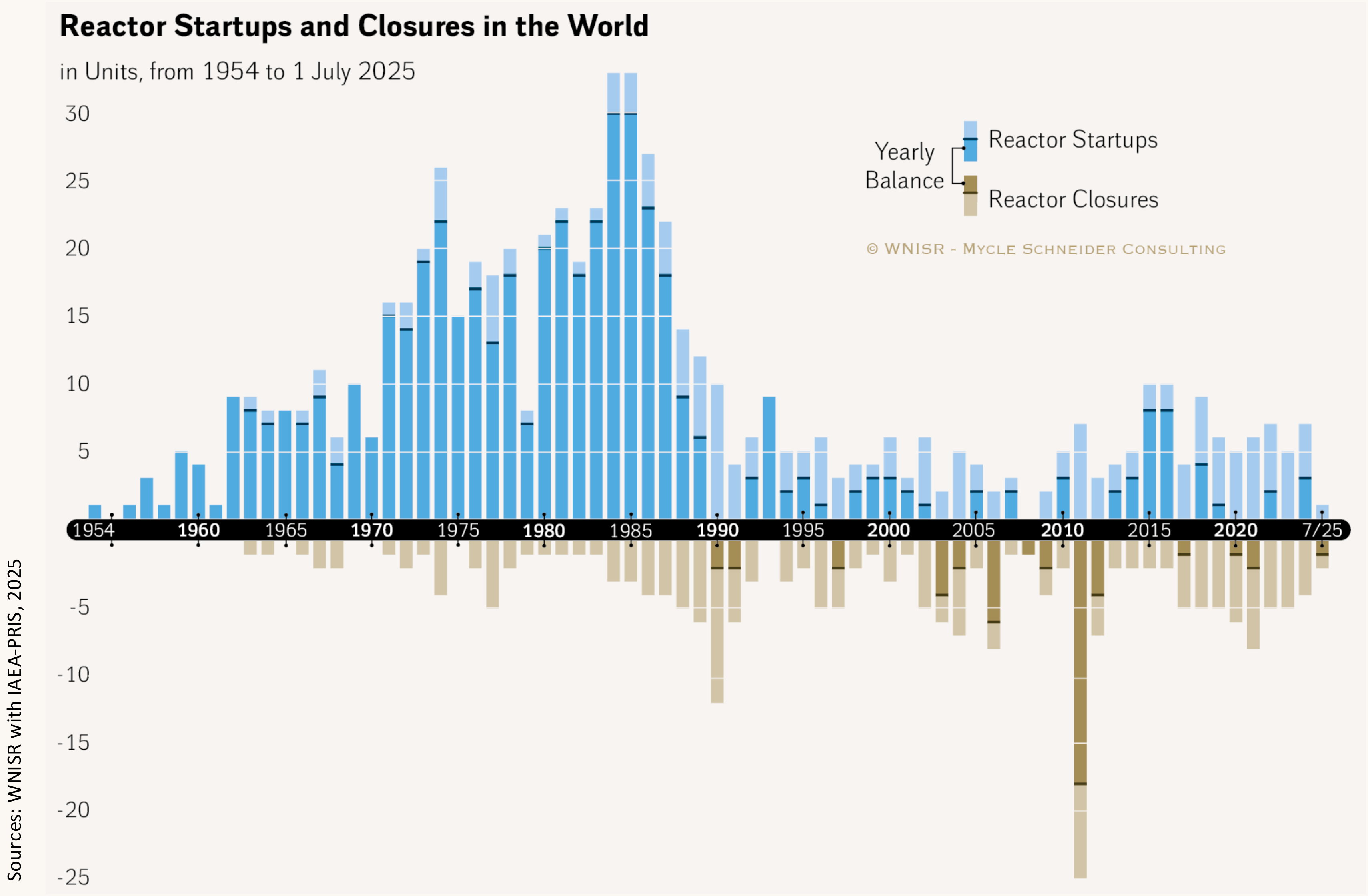
...and in China and the Rest of the World

in TWh (net)



Sources: Energy Institute, 2025

GLOBAL OVERVIEW – Startups and Closures in the World

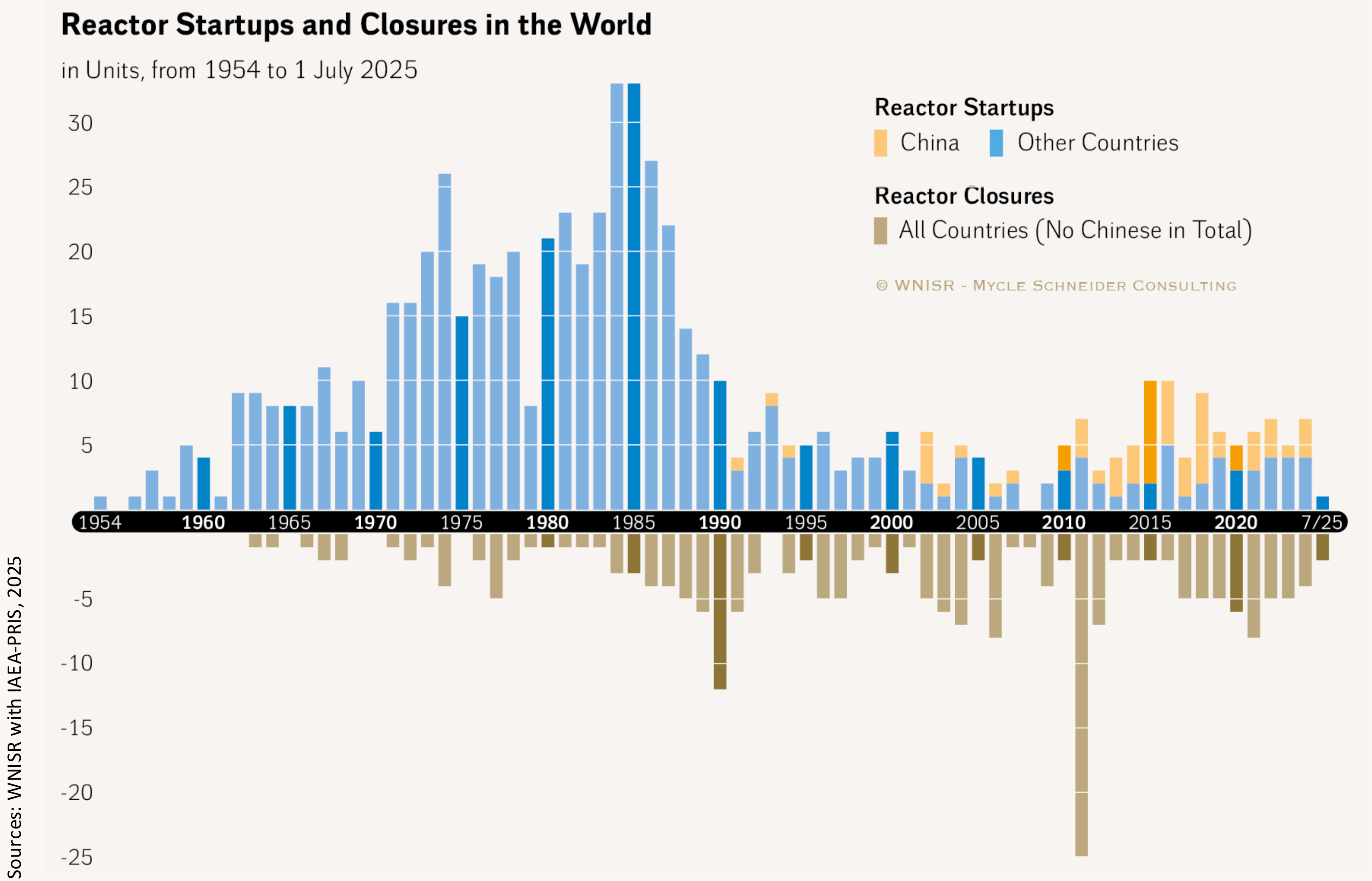


2005–2024

World

- 104 Startups
- 101 Closures

GLOBAL OVERVIEW – Startups and Closures in the World and China



2005–2024

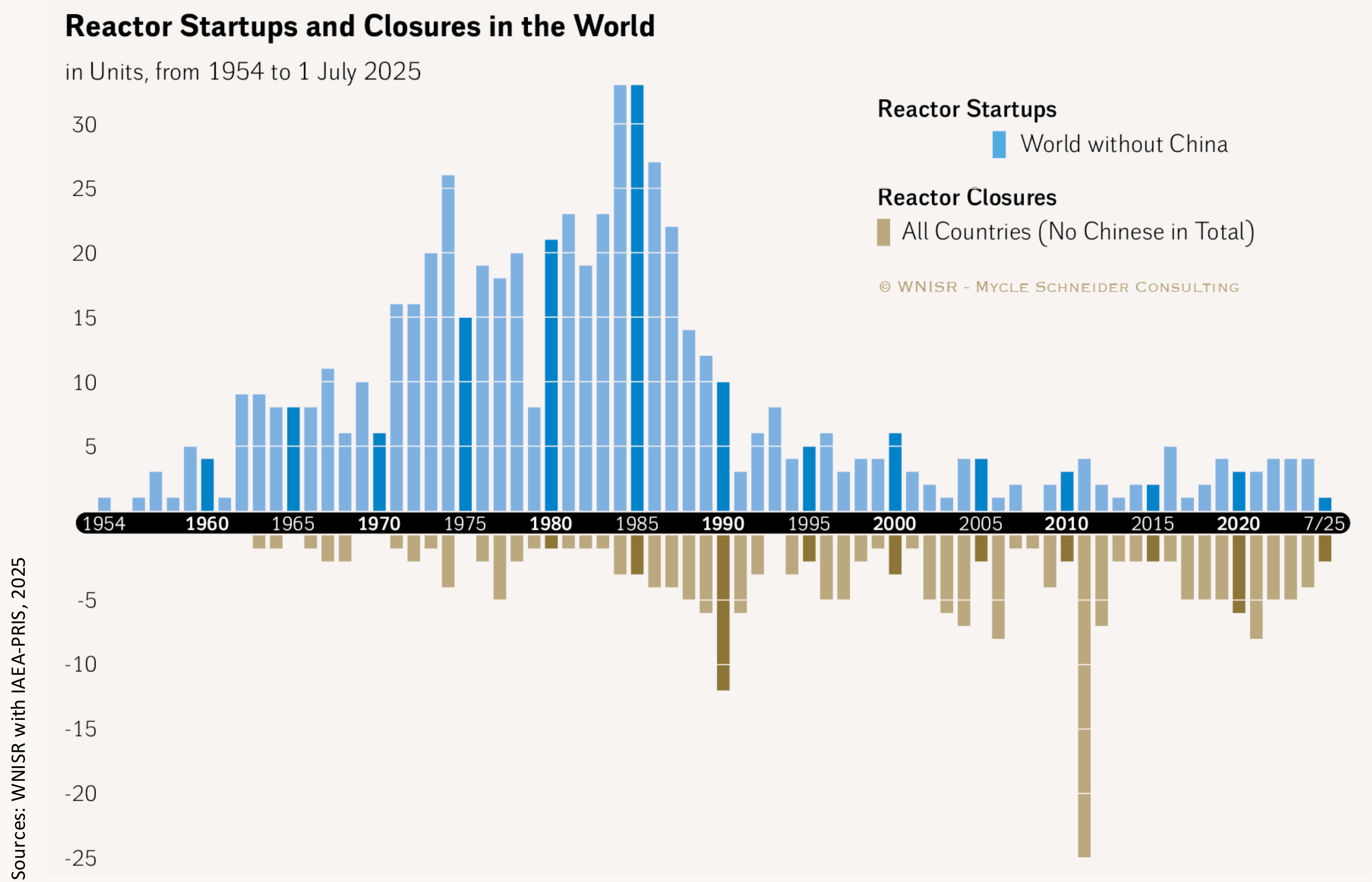
World

- 104 Startups
- 101 Closures

China

- 51 Startups
- No Closure

GLOBAL OVERVIEW – Startups and Closures in the World Outside China



2005–2024

World

- 104 Startups
- 101 Closures

China

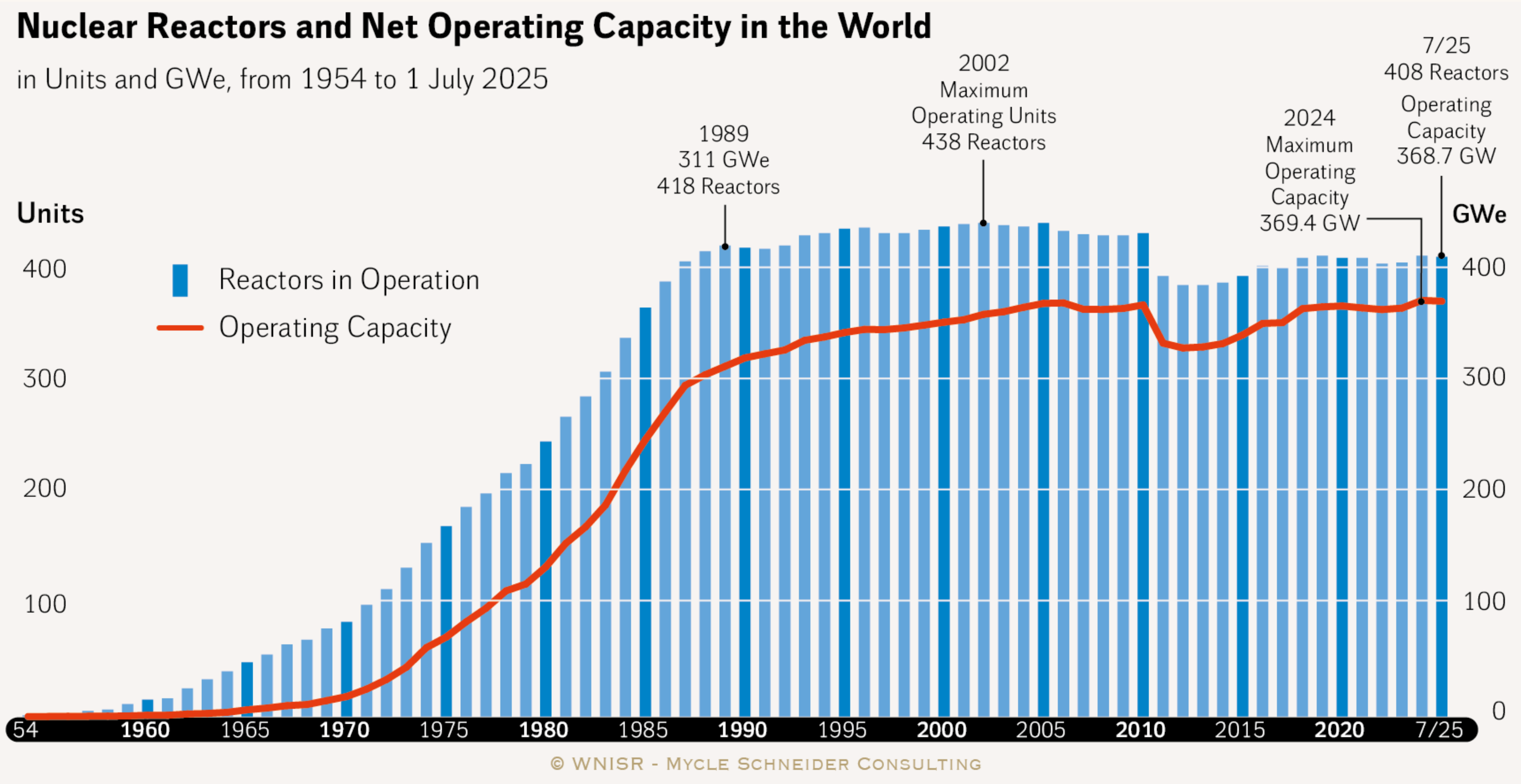
- 51 Startups
- No Closure

World Outside China

- 53 Startups
- 101 Closures

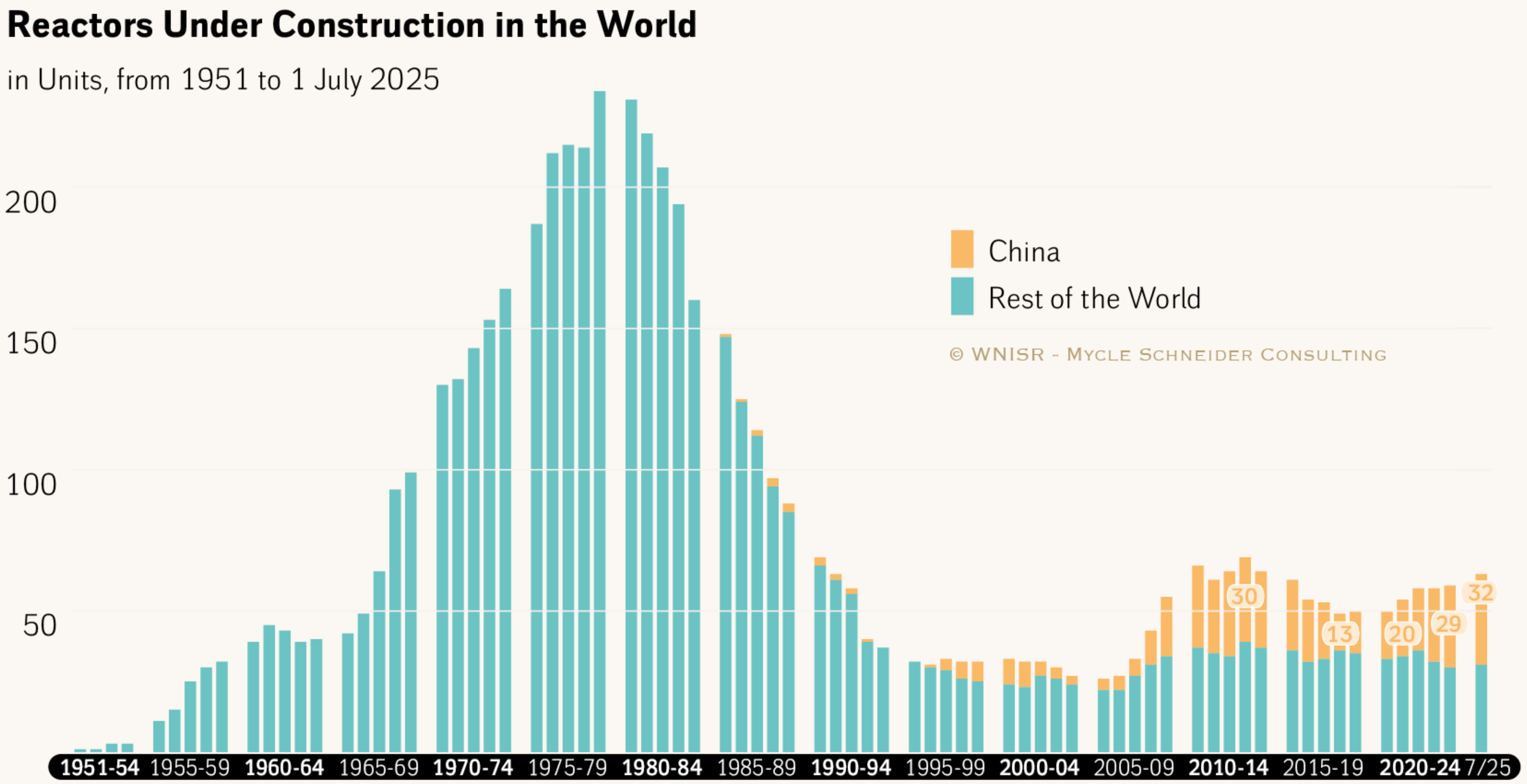
Net Balance –48

GLOBAL OVERVIEW — Evolution of World Fleet



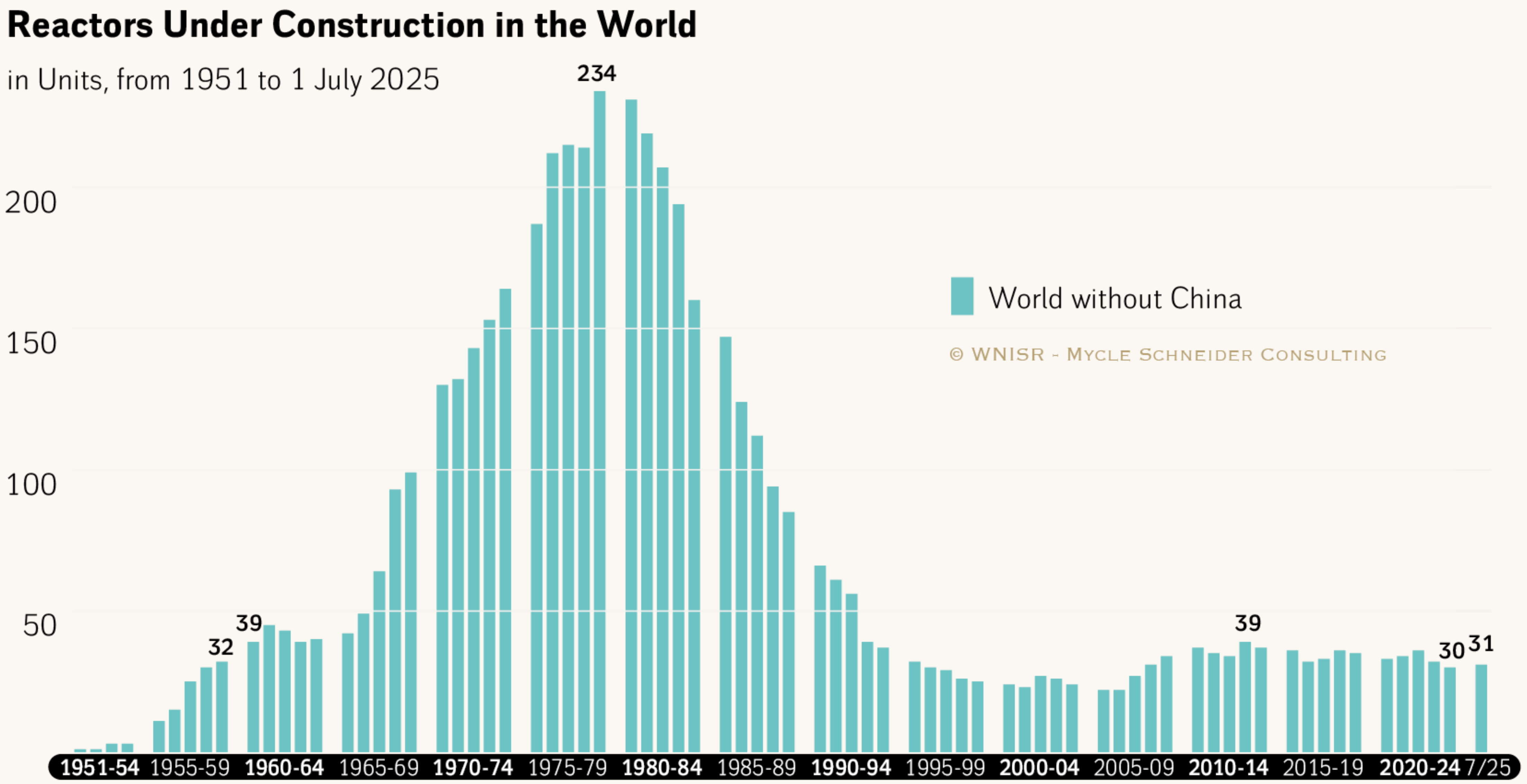
Sources: WNISR, with IAEA-PRIS, 2025

GLOBAL OVERVIEW — Constructions in China and Elsewhere



Sources: WNISR, with IAEA-PRIS, 2025

GLOBAL OVERVIEW — Constructions in the World Without China



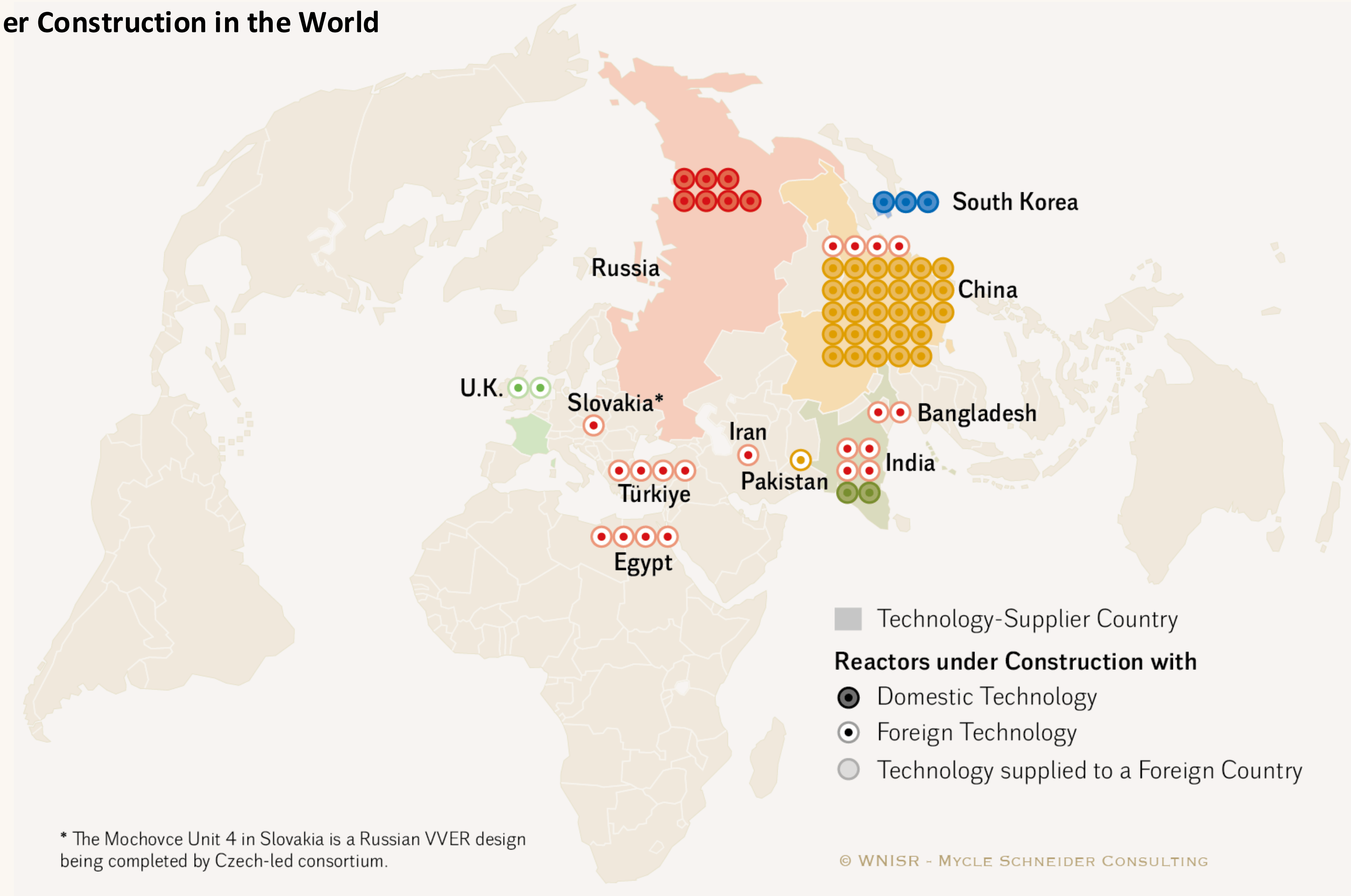
Sources: WNISR, with IAEA-PRIS, 2025

GLOBAL OVERVIEW — Constructions

Nuclear Power Reactors under Construction in the World

Units by Construction Country

as of 1 July 2025



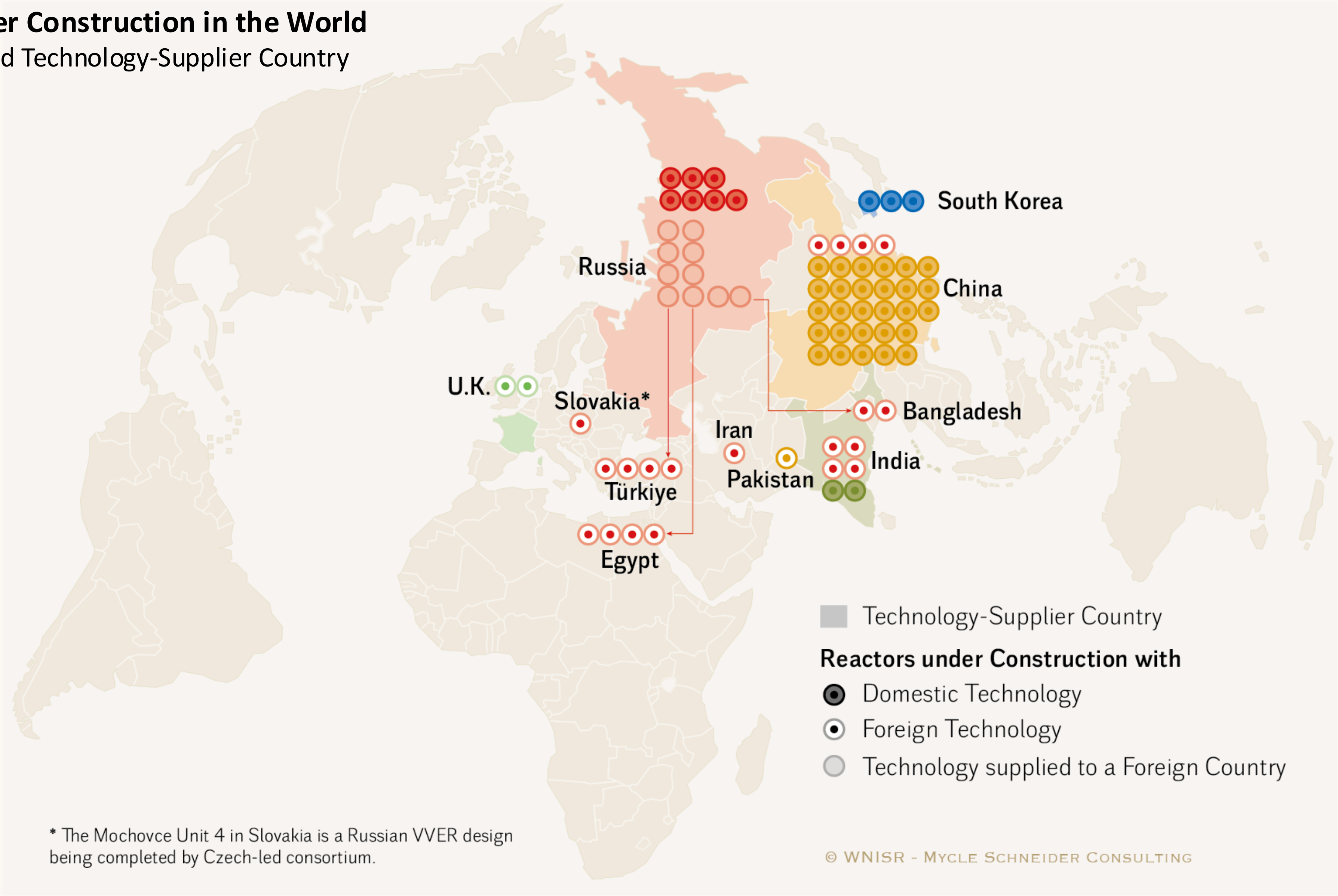
* The Mochovce Unit 4 in Slovakia is a Russian VVER design being completed by Czech-led consortium.

Sources: compiled by WNISR, with IAEA-PRIS, 2025

GLOBAL OVERVIEW — Who is Building? Russia Dominates International Market

Nuclear Power Reactors under Construction in the World

Units by Construction Country and Technology-Supplier Country
as of 1 July 2025



Sources: compiled by WNISR, with IAEA-PRIS, 2025

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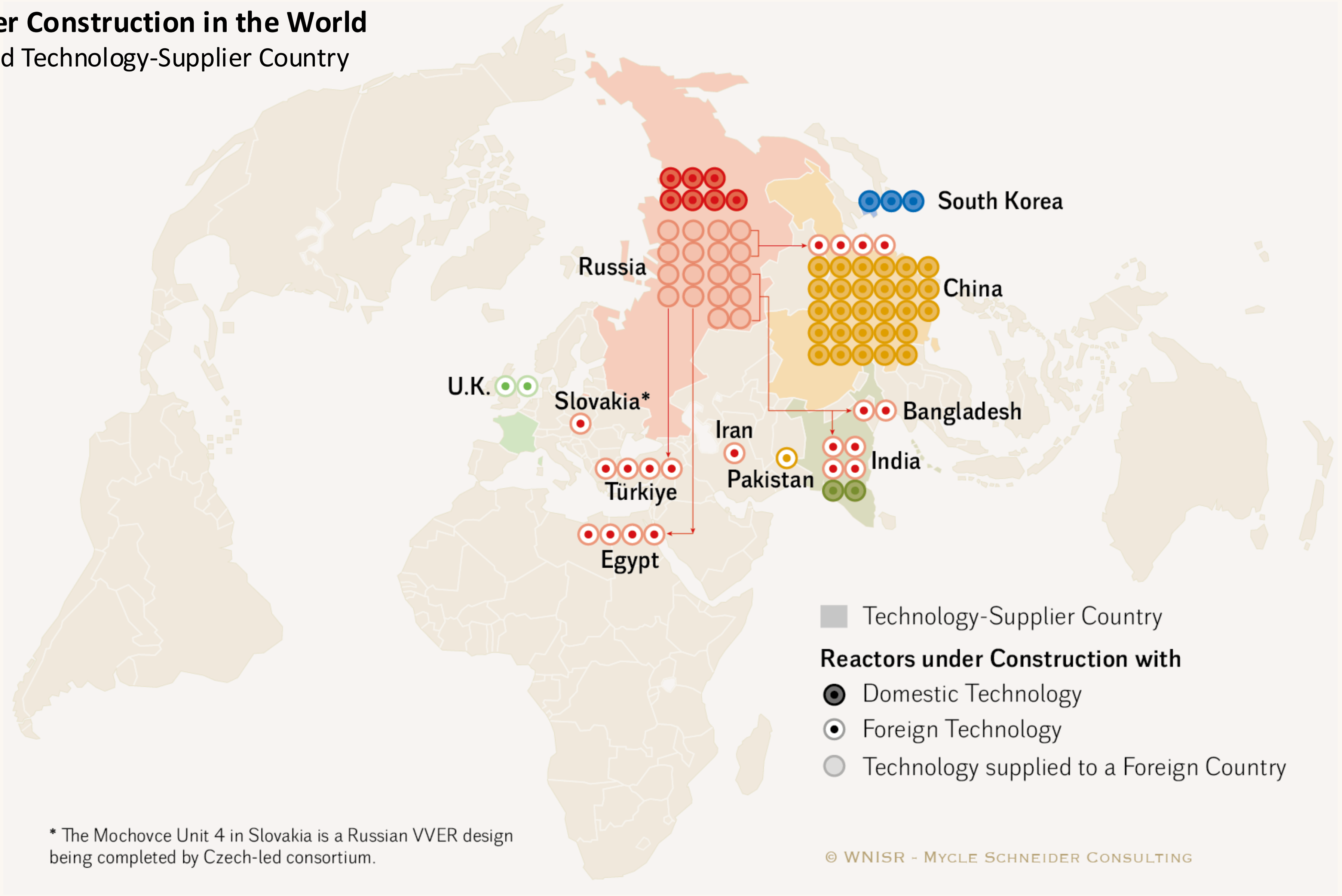

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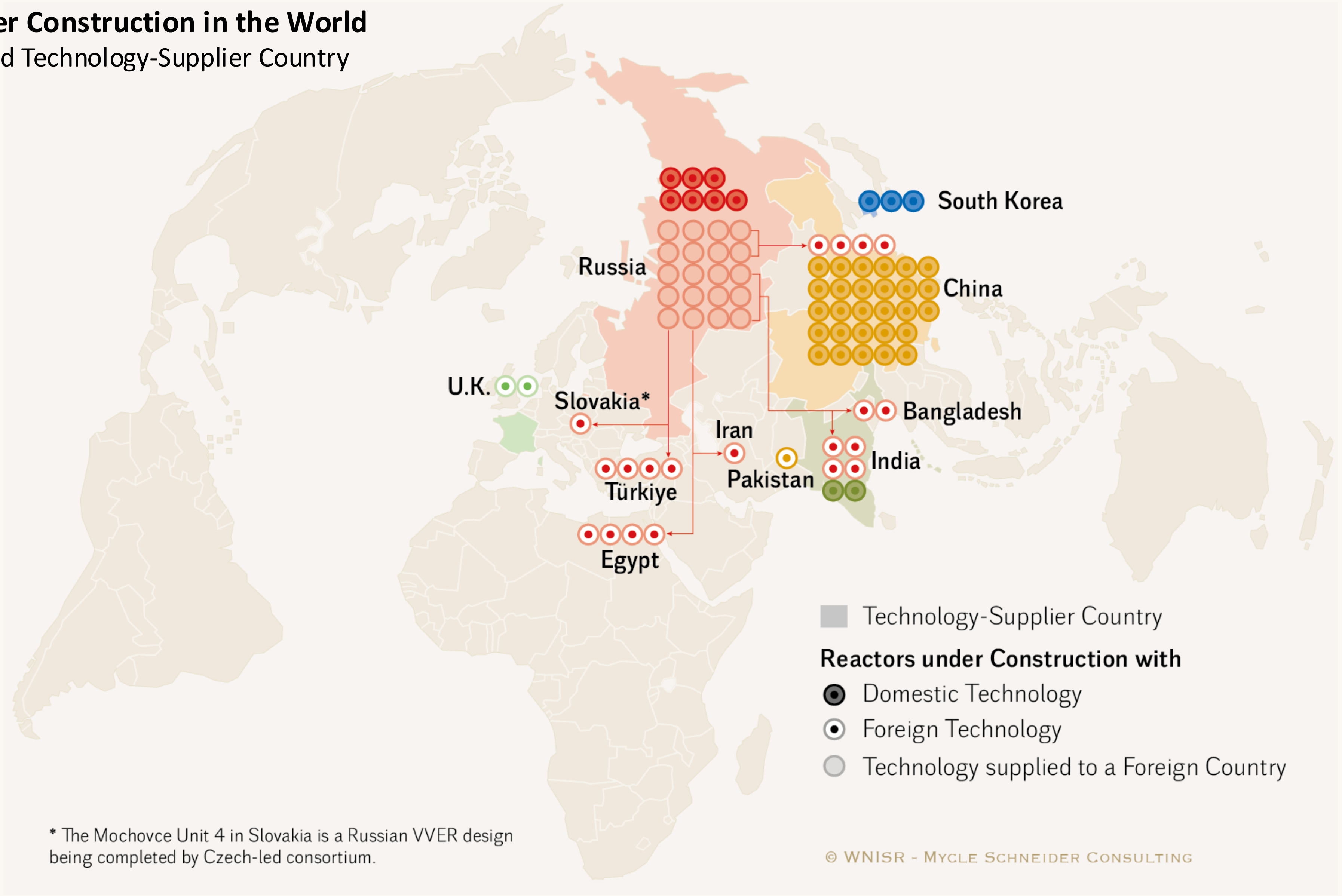

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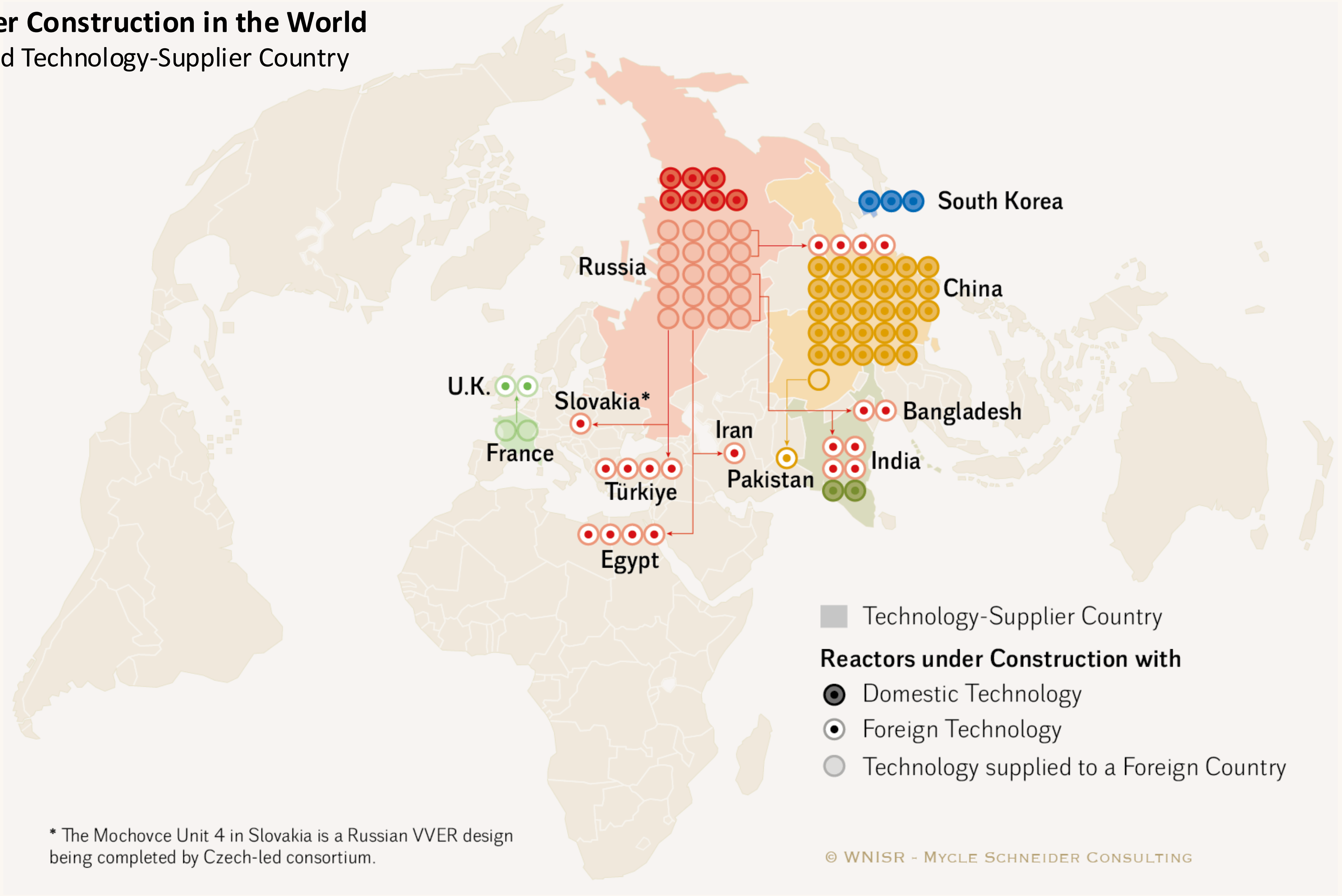
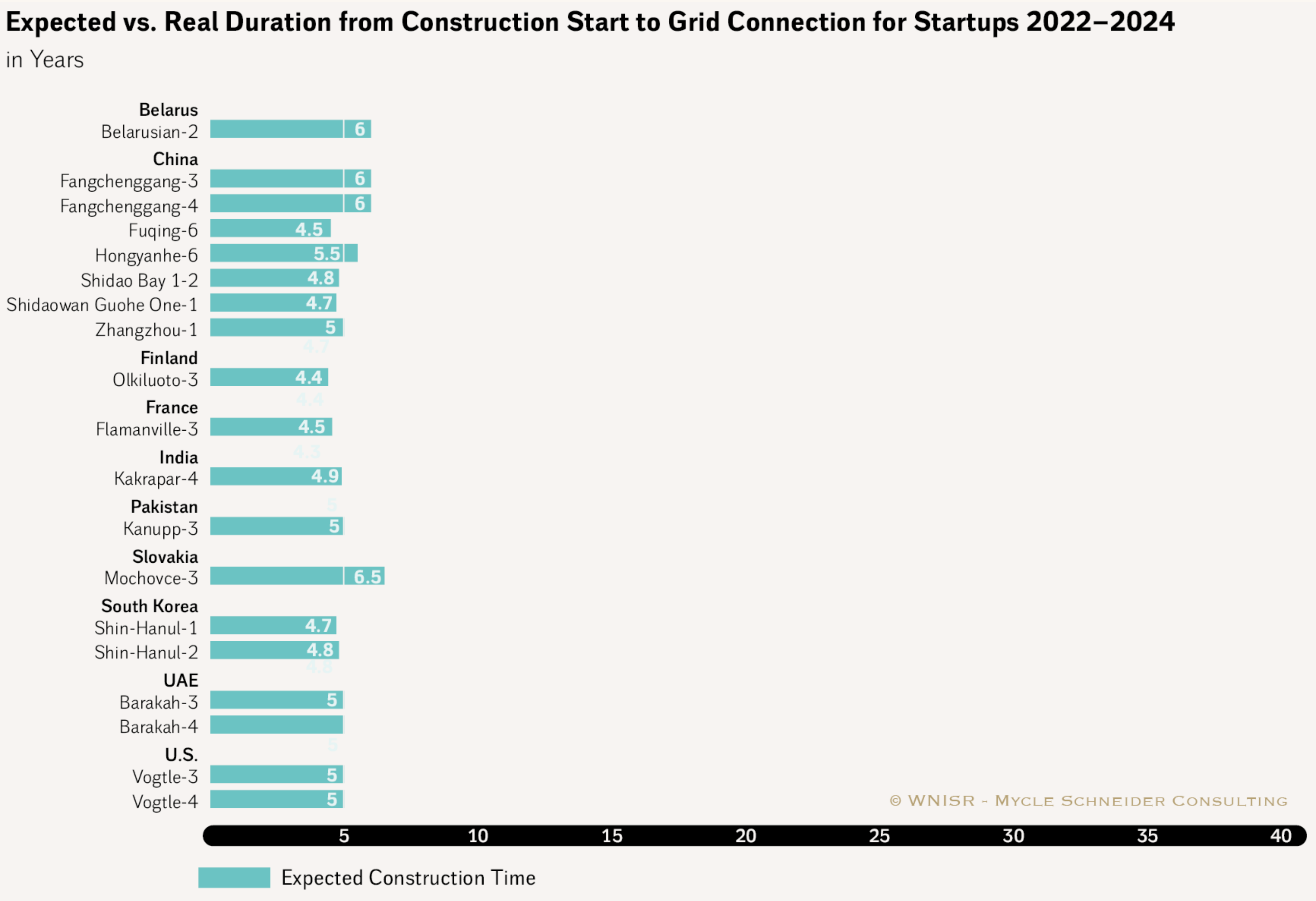


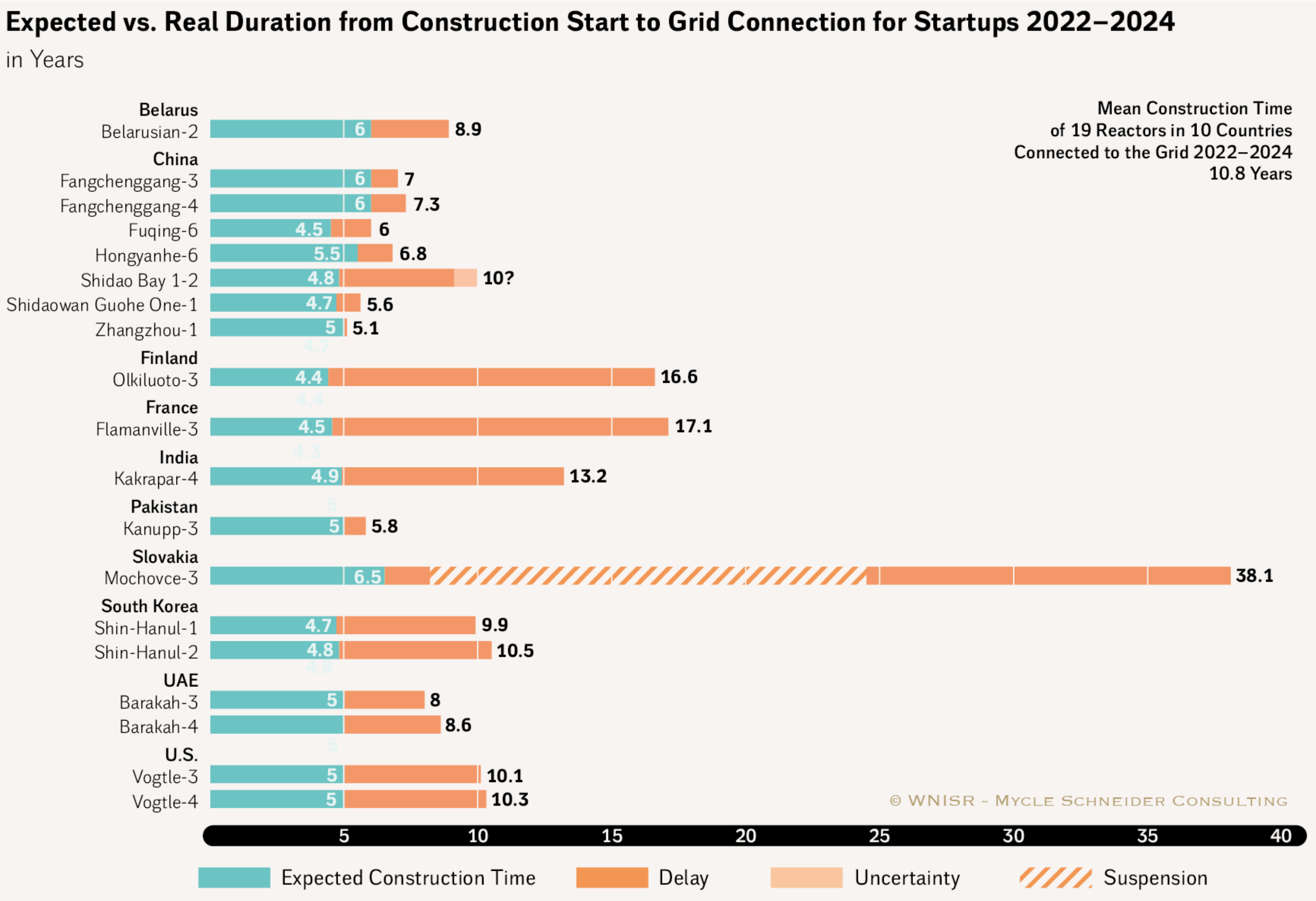
Sources: compiled by WNISR, with IAEA-PRIS, 2025

GENERAL OVERVIEW — Construction Times



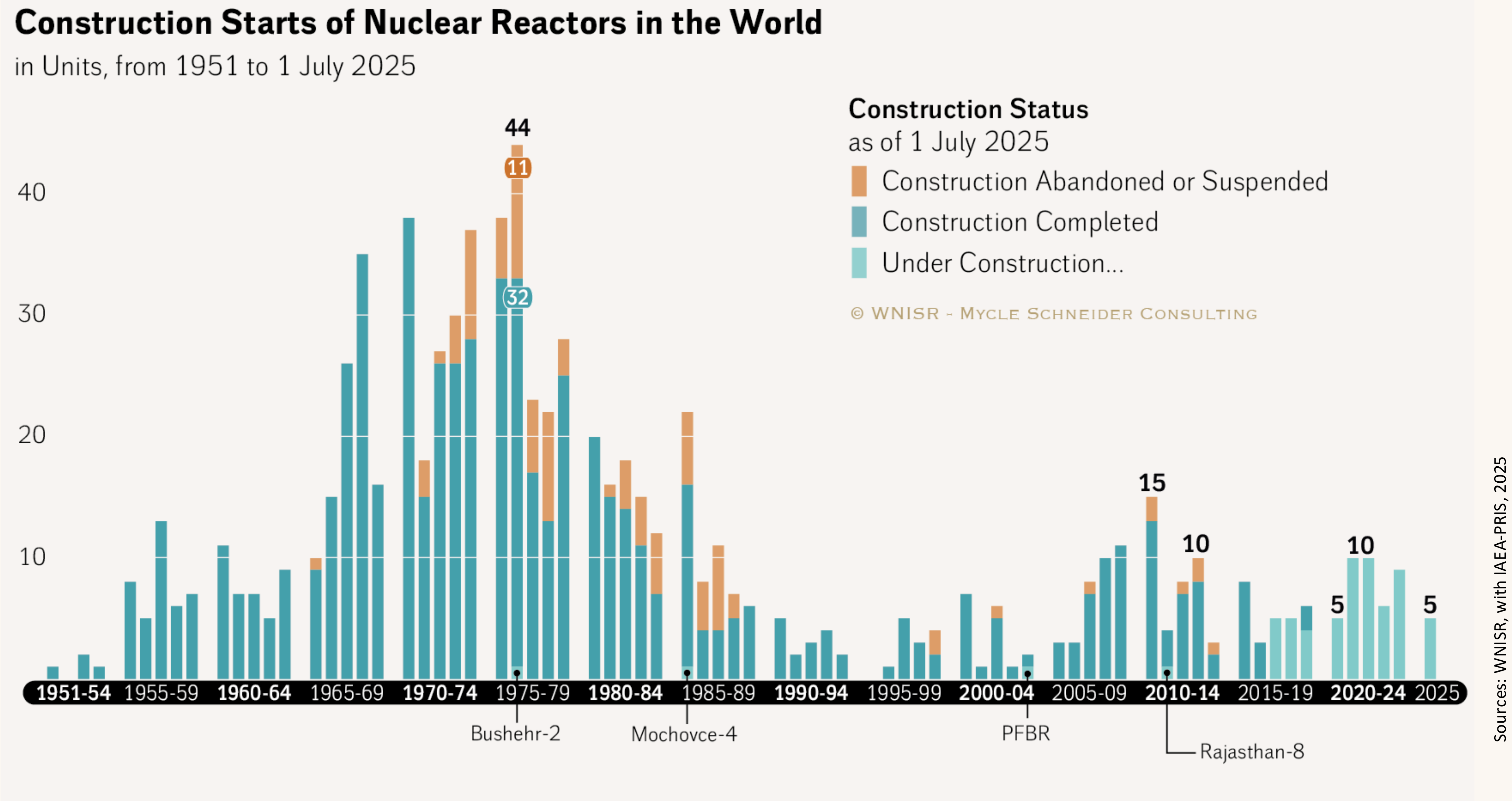
Sources: Various, compiled by WNISR, 2025

GENERAL OVERVIEW — Construction Times

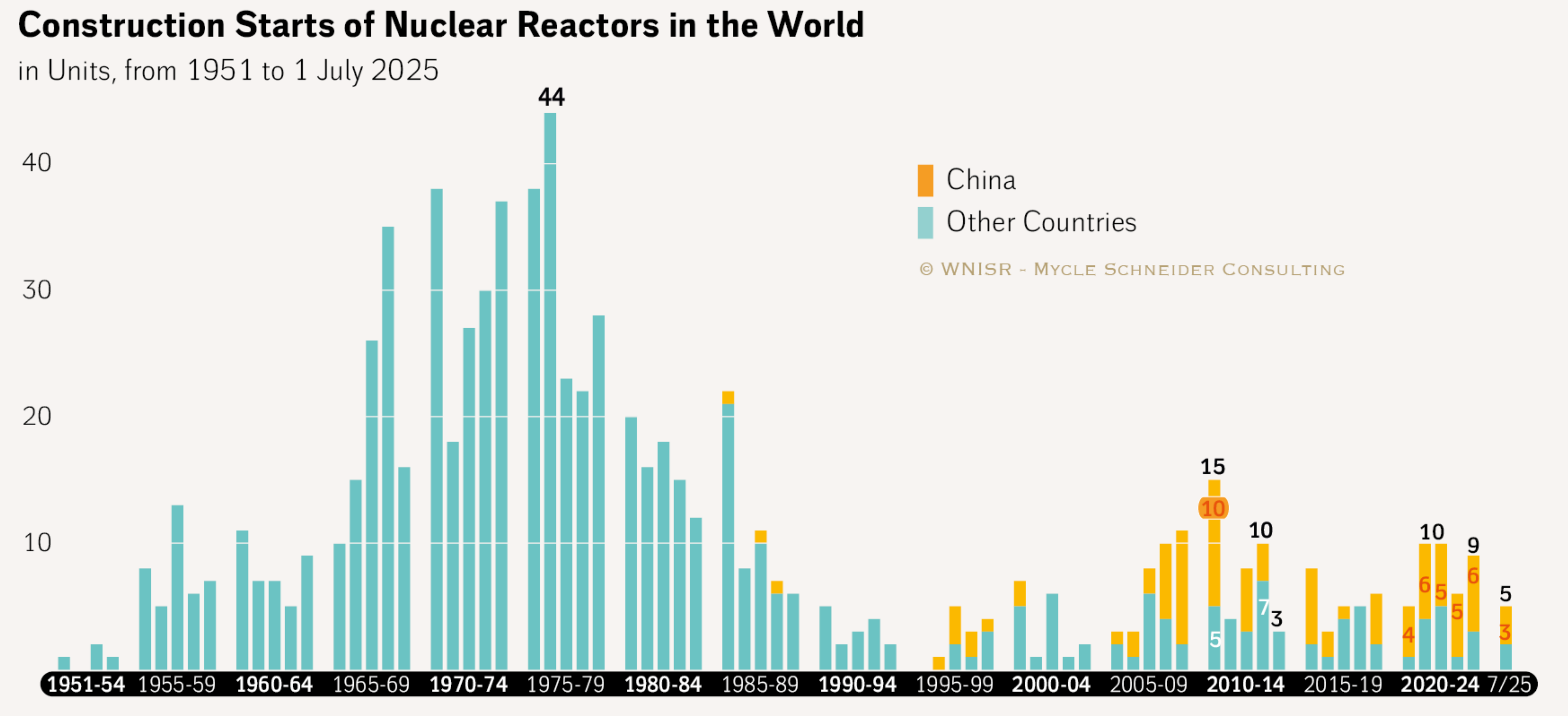


Sources: Various, compiled by WNISR, 2025

GENERAL OVERVIEW — Construction Starts in the World

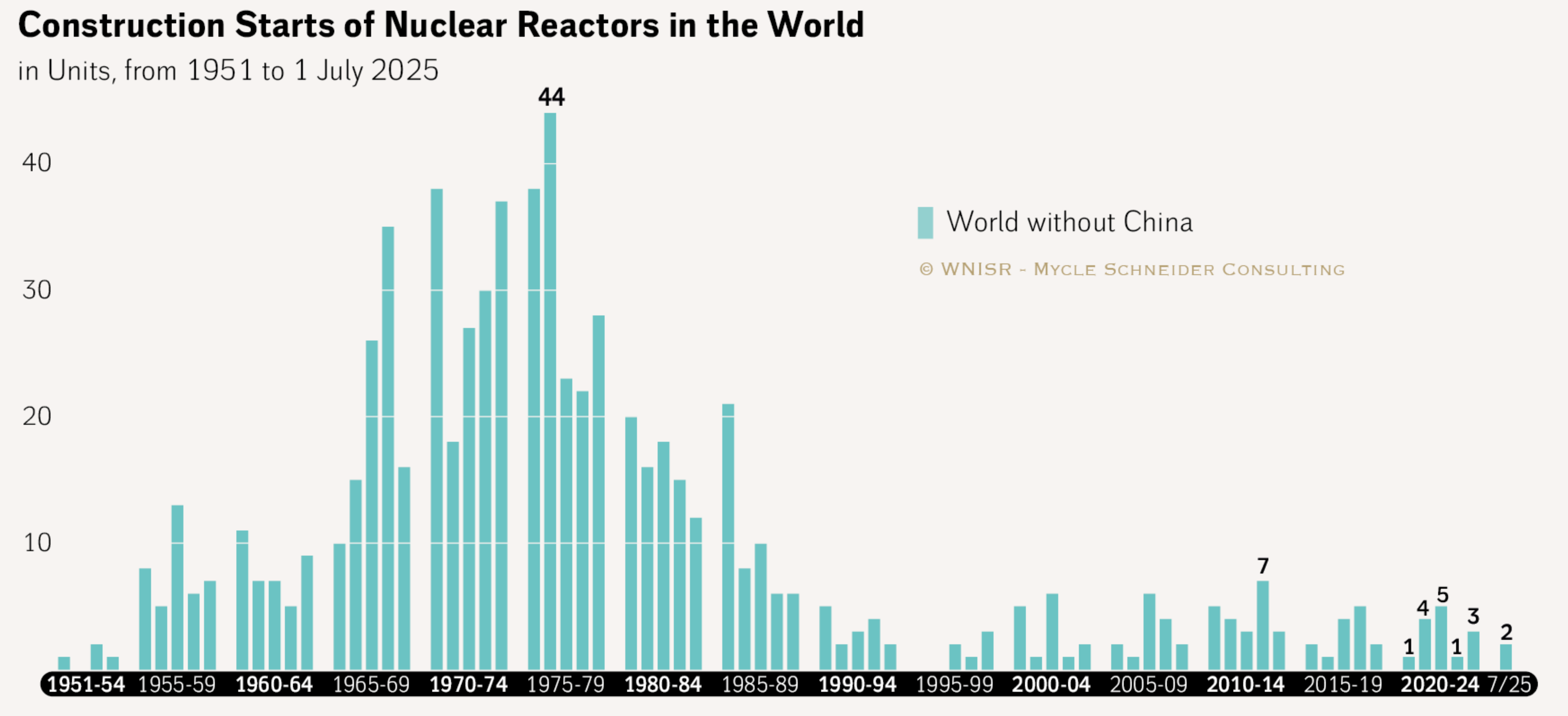


GENERAL OVERVIEW — Construction Starts in China and Elsewhere



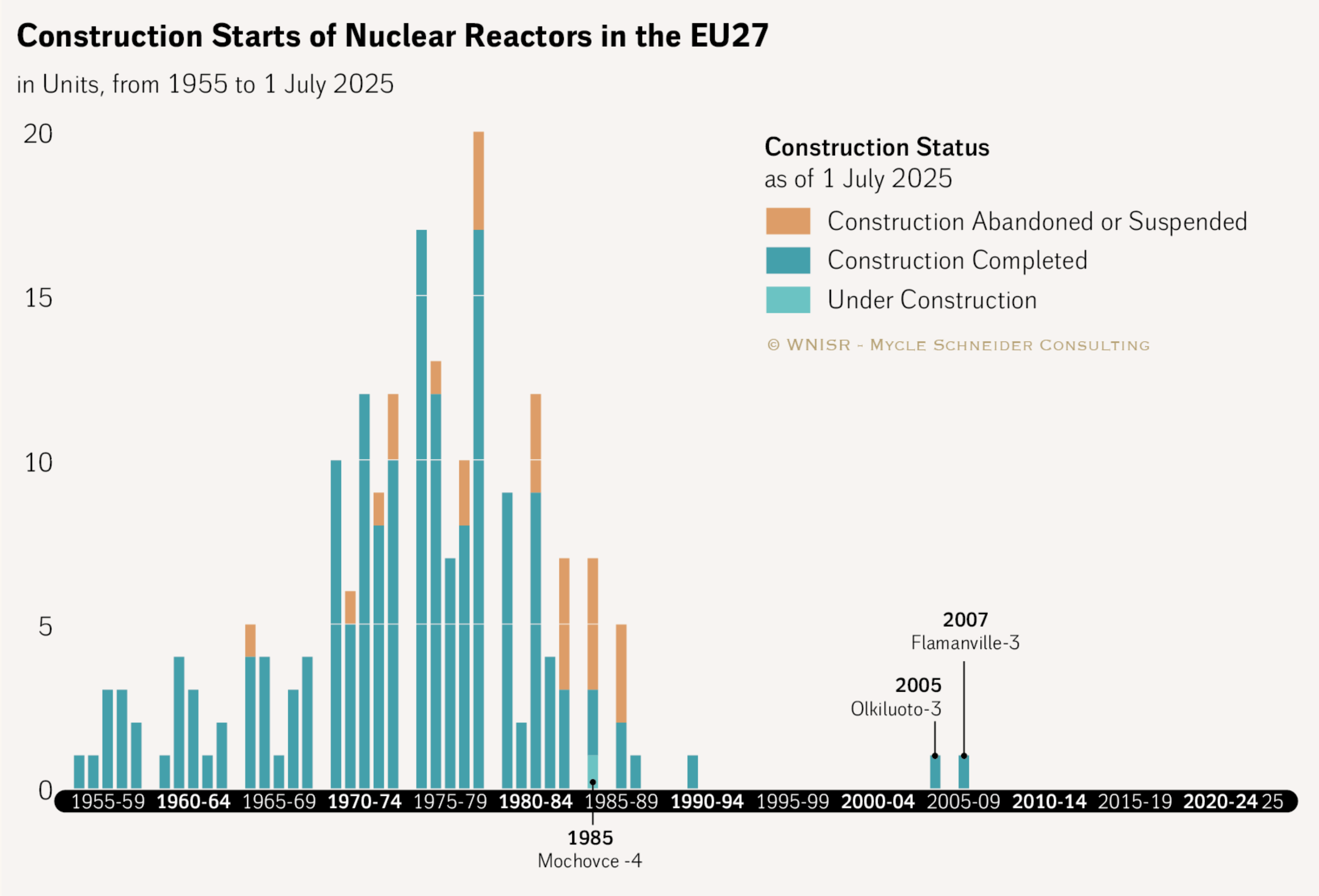
Sources: WNISR, with IAEA-PRIS, 2025

GENERAL OVERVIEW — Construction Starts World Without China



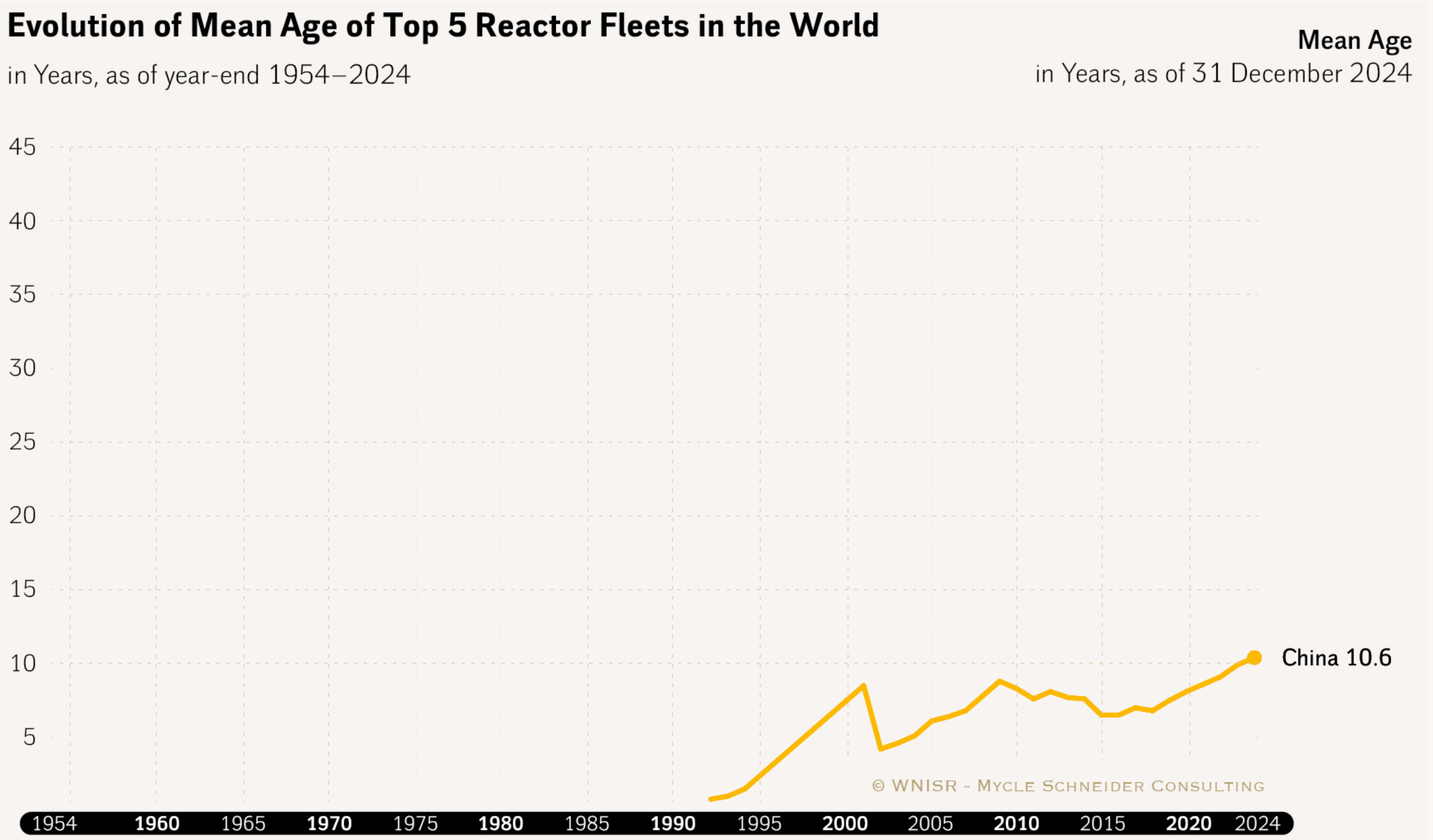
Sources: WNISR, with IAEA-PRIS, 2025

EUROPEAN UNION (EU27) – Construction Starts



Sources: WNISR with IAEA-PRIS, 2025

GLOBAL OVERVIEW – Nuclear Fleets Age



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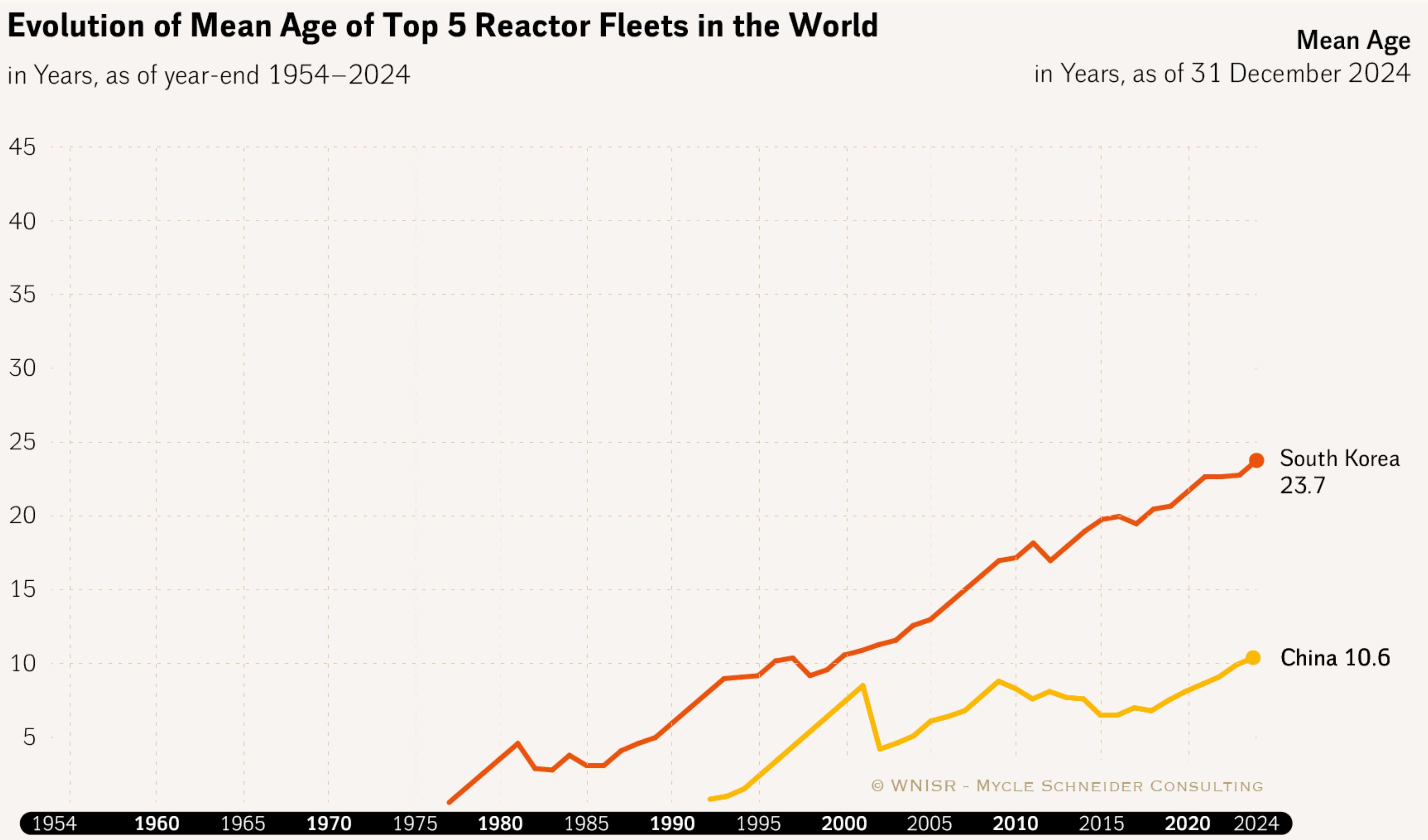
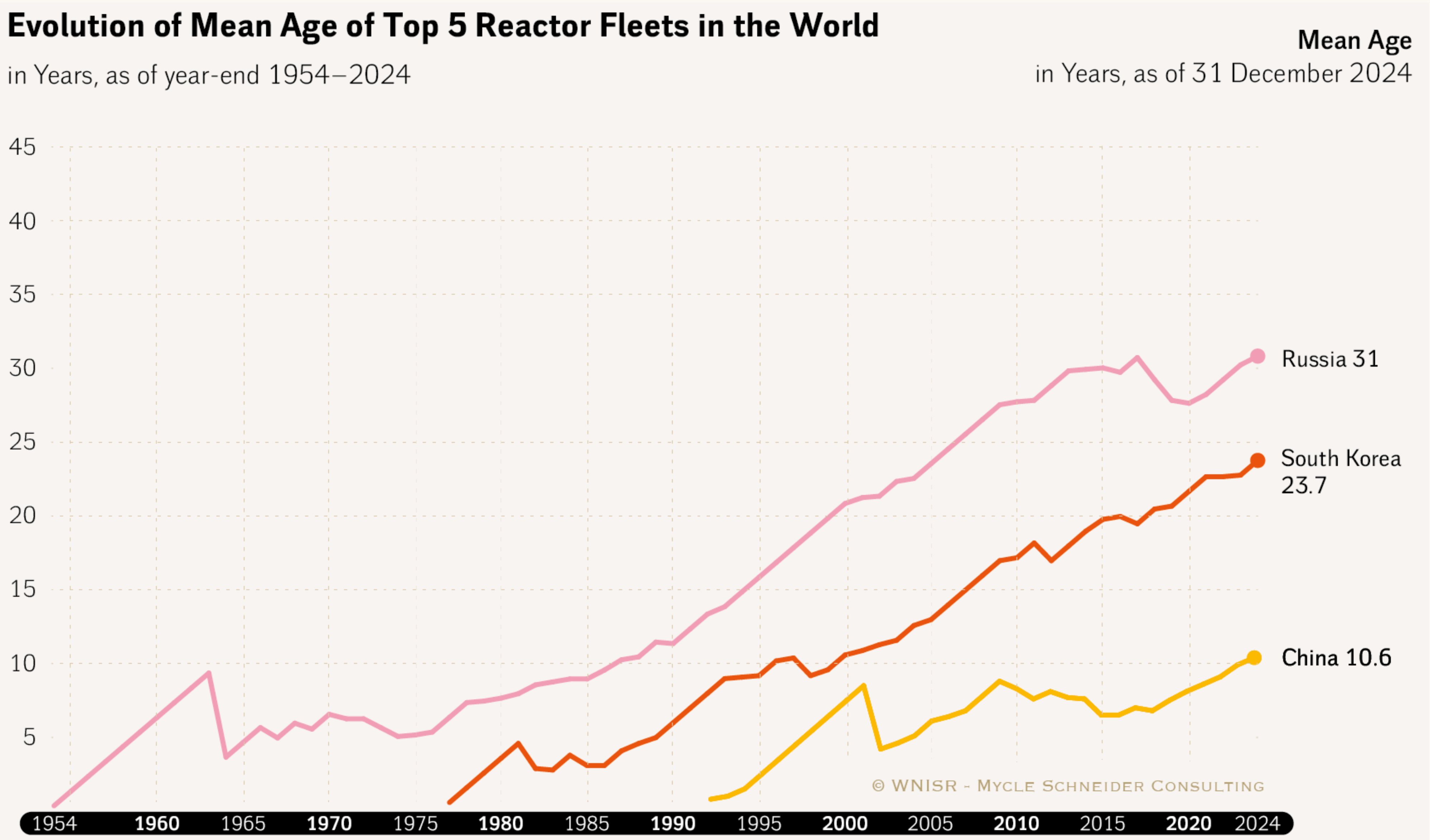


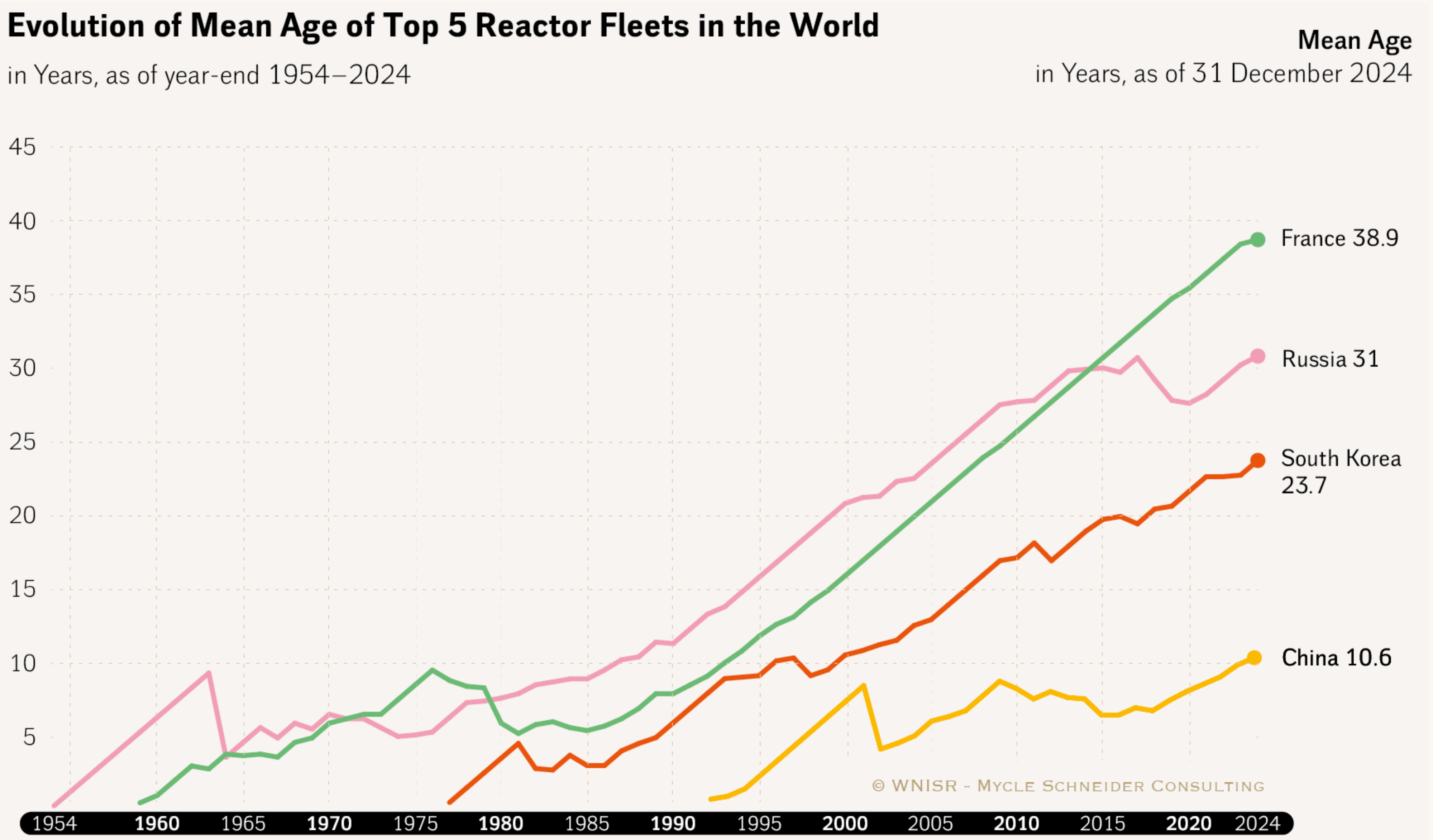
Sources: WNISR, with IAEA-PRIS, 2025

GLOBAL OVERVIEW – Nuclear Fleets Age



Sources: WNISR, with IAEA-PRIS, 2025

GLOBAL OVERVIEW – Nuclear Fleets Age



Sources: WNISR, with IAEA-PRIS, 2025

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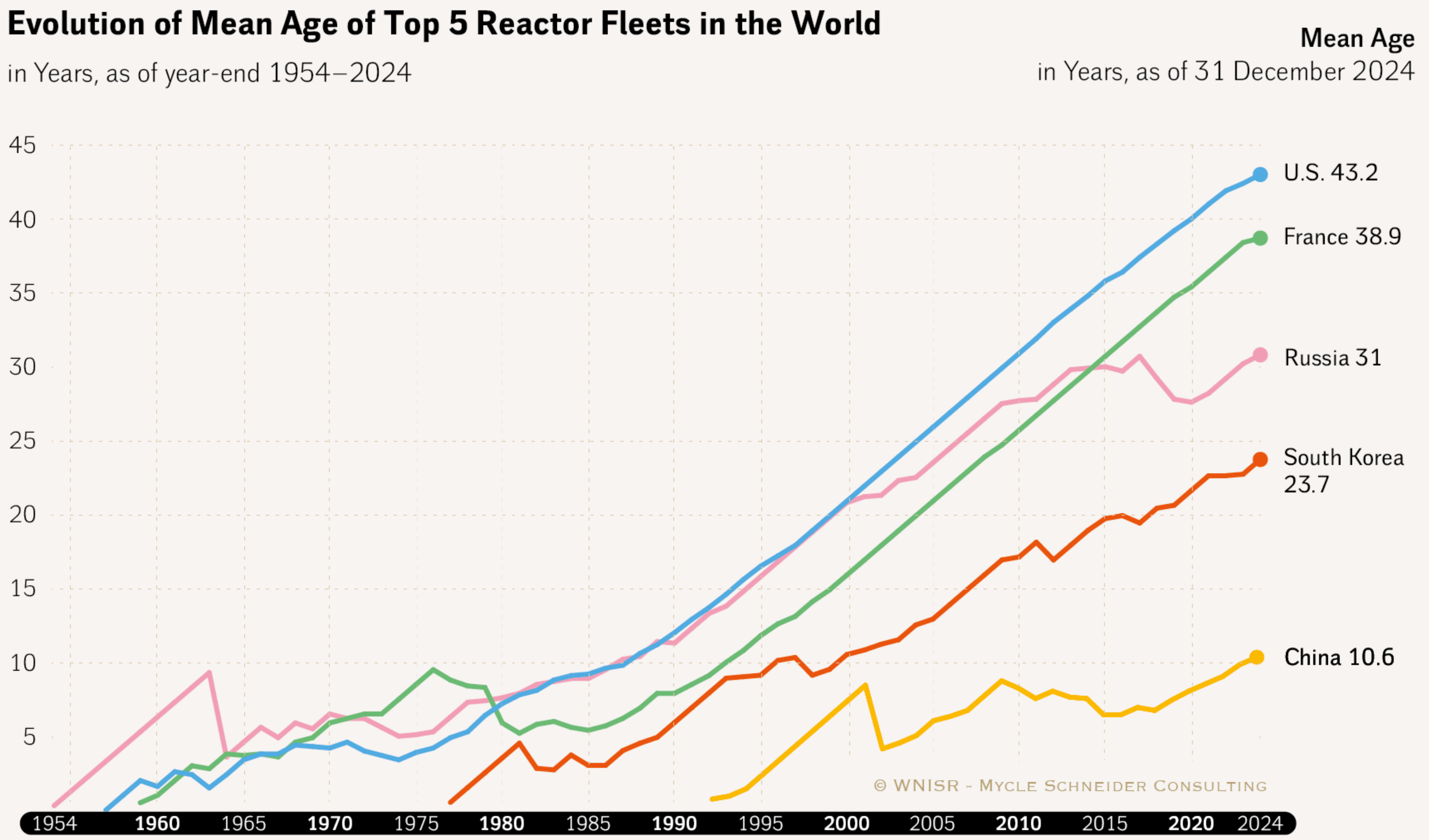
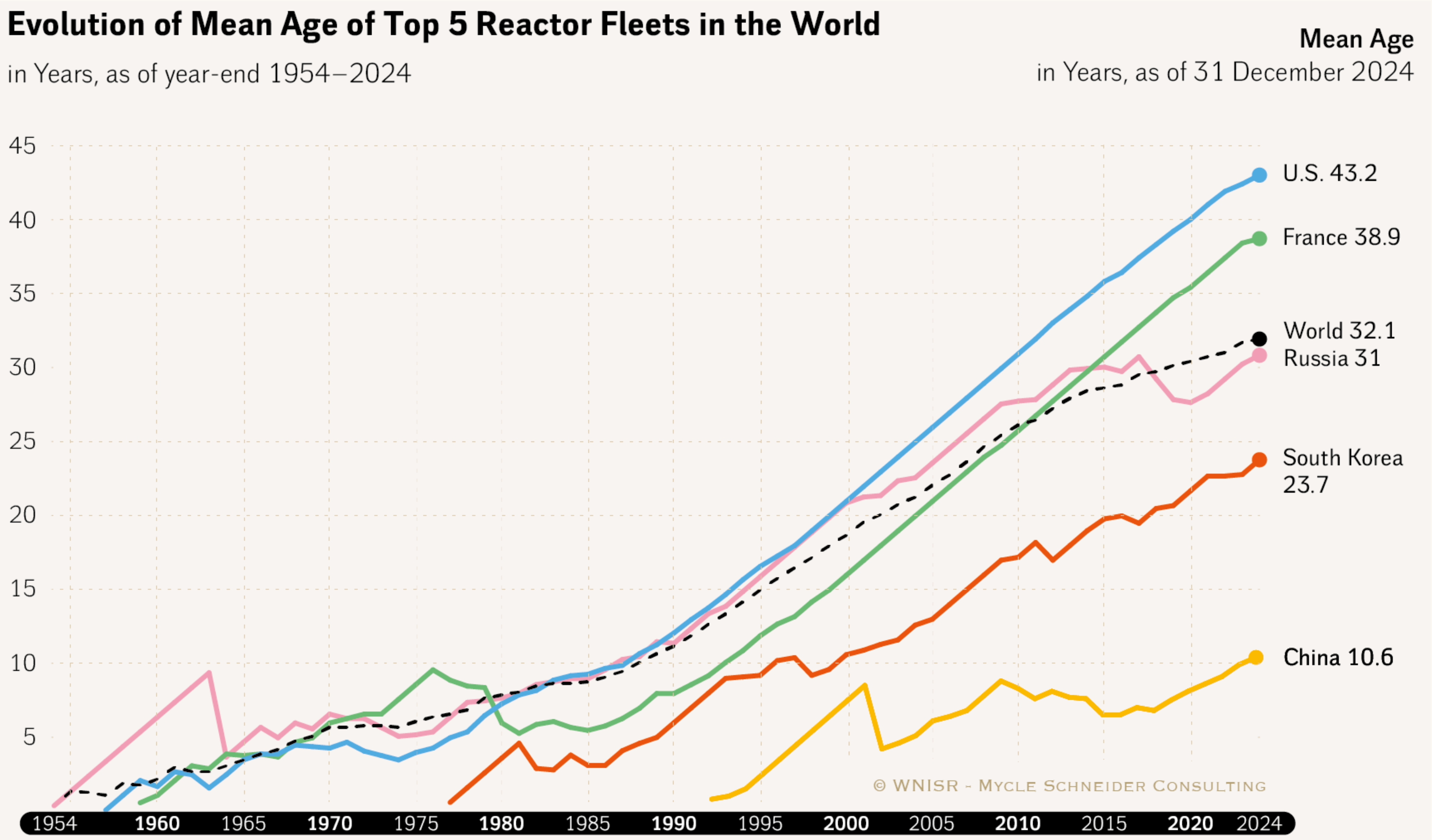


Sources: WNISR, with IAEA-PRIS, 2025

GLOBAL OVERVIEW – Nuclear Fleets Age



Sources: WNISR with IAEA-PRIS, 2025

SMALL MODULAR REACTORS (SMRs) – High Costs, Low Performance

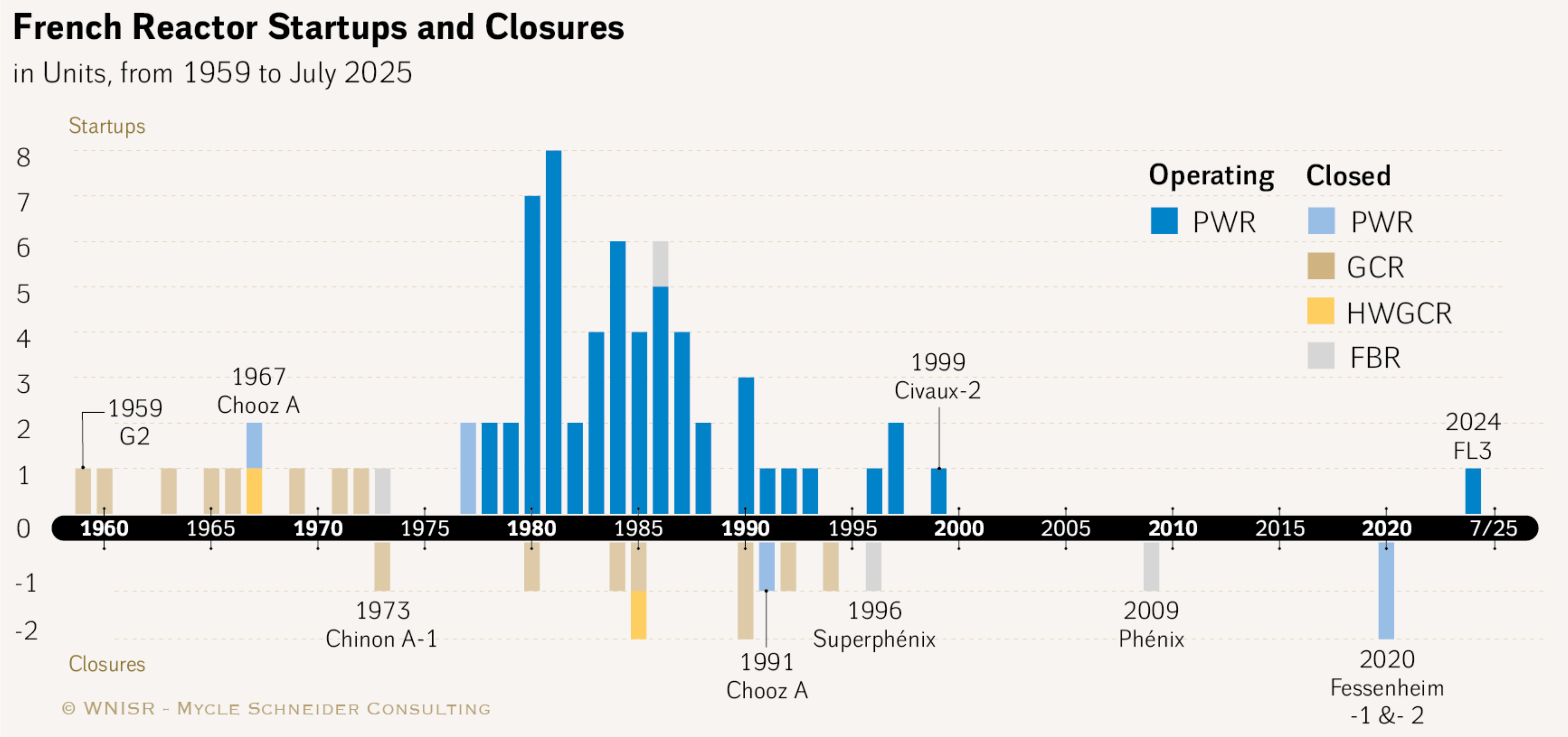
Cancellations and Poor Performance

- CAREM reactor design under development in Argentina since the 1980s has been abandoned after 10-year construction efforts
- Micro Modular Reactor proposed as Canada's first SMR and to be built at the Chalk River site appears to have stalled
- Only 2 x 2 operating SMRs have had low performance: Akademik Lomonosov in Russia, lifetime loadfactors of 36.2% and 28%; HTR-PM in China, lifetime load factor of 26.9%

Investment and Economics

- OECD's NEA estimates US$15.4 billion in worldwide funding—only US$5.4 billion private sources—spread out across 127 designs (average funding inadequate)
- CSIRO (Australia) estimates of LCOE from SMRs are 3-4 times LCOE of wind+solar+storage

FRANCE FOCUS – STARTUPS and CLOSURES

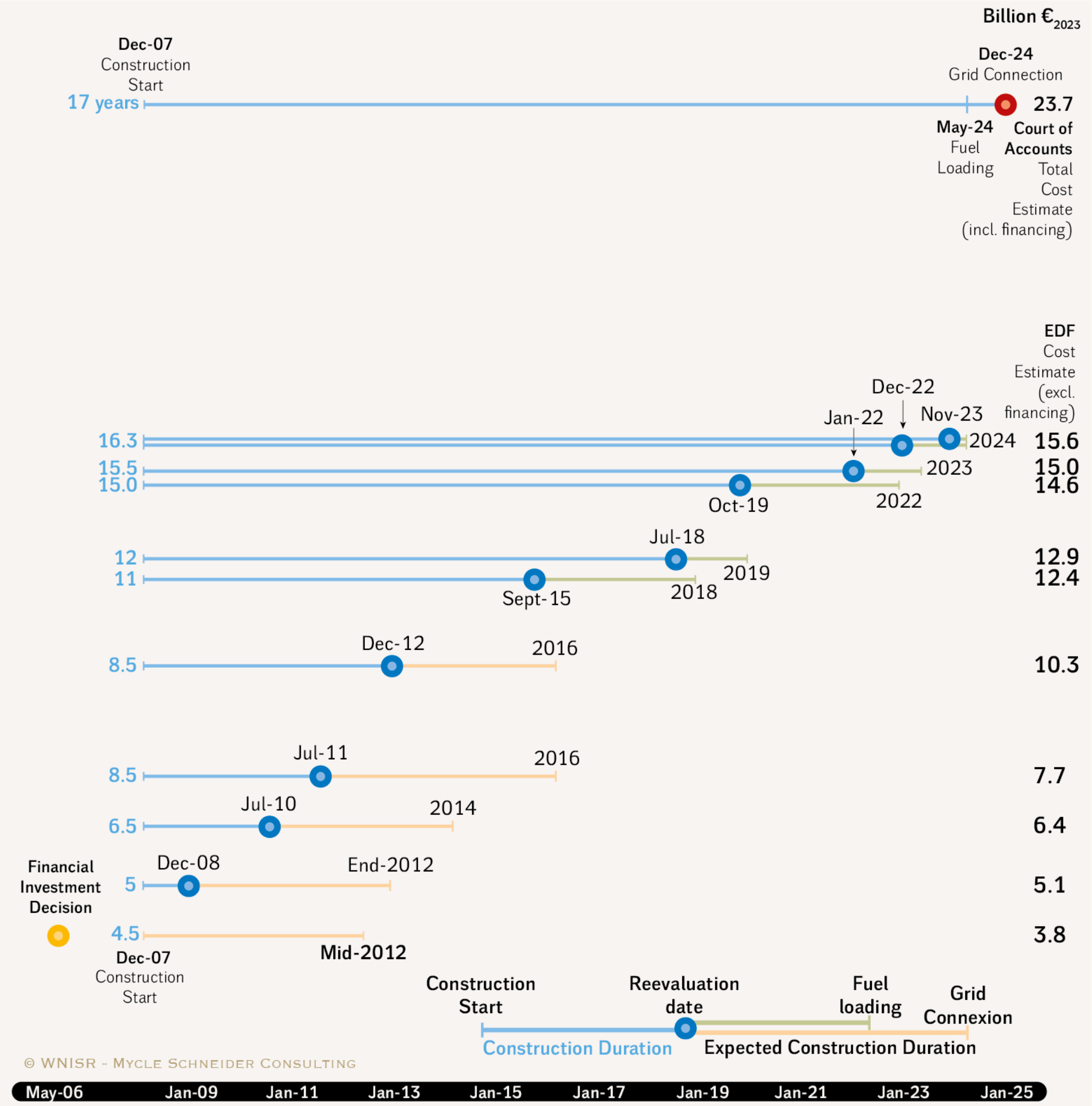


Sources: WNISR with IAEA-PRIS, 2025

FRANCE FOCUS – EPR Flamanville-3: 12 Years Delay, 5 x Over Budget

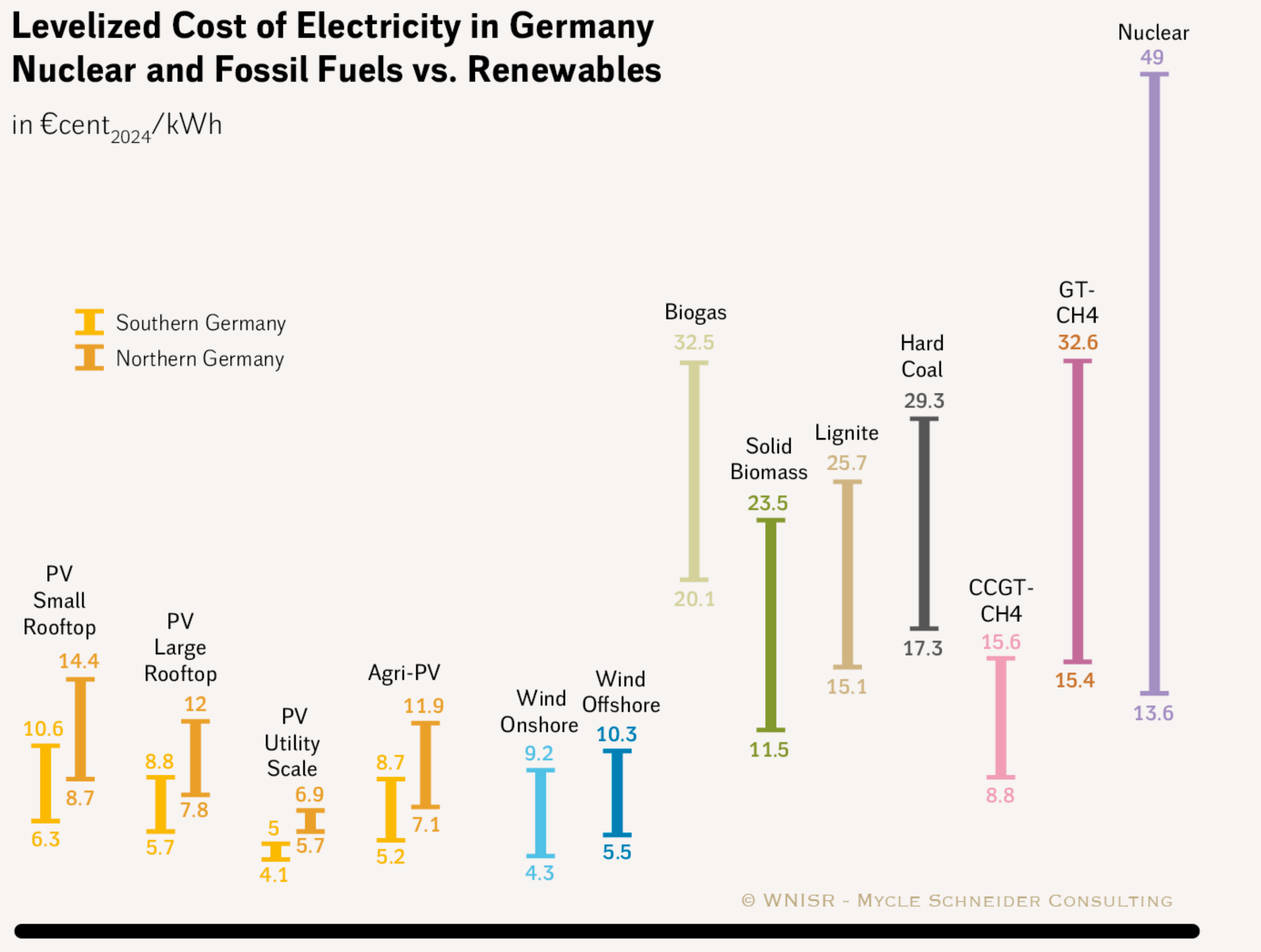
Evolution of Construction Duration and Cost Estimates for the Flamanville-3 EPR

in Years and Billions €2023



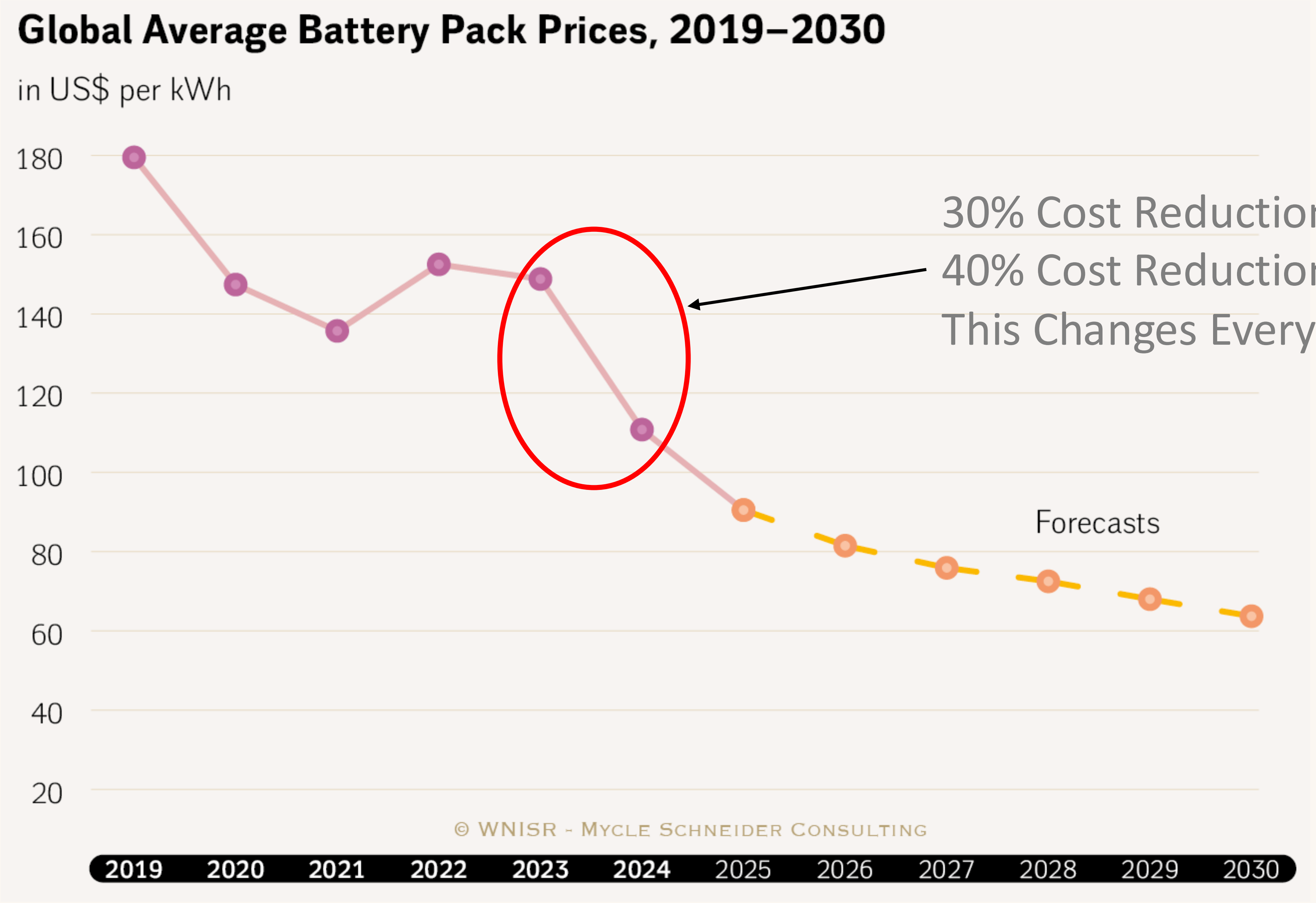
Source: Cour des Comptes, 2025

NUCLEAR vs. RENEWABLES DEPLOYMENT – RE Are Cost-effective



Source: Fraunhofer ISE, 2024

NUCLEAR vs. RE DEPLOYMENT – Storage Has Reached a Tipping Point



30% Cost Reduction for Car Battery Packs

40% Cost Reduction for grid BESS

This Changes Everything!

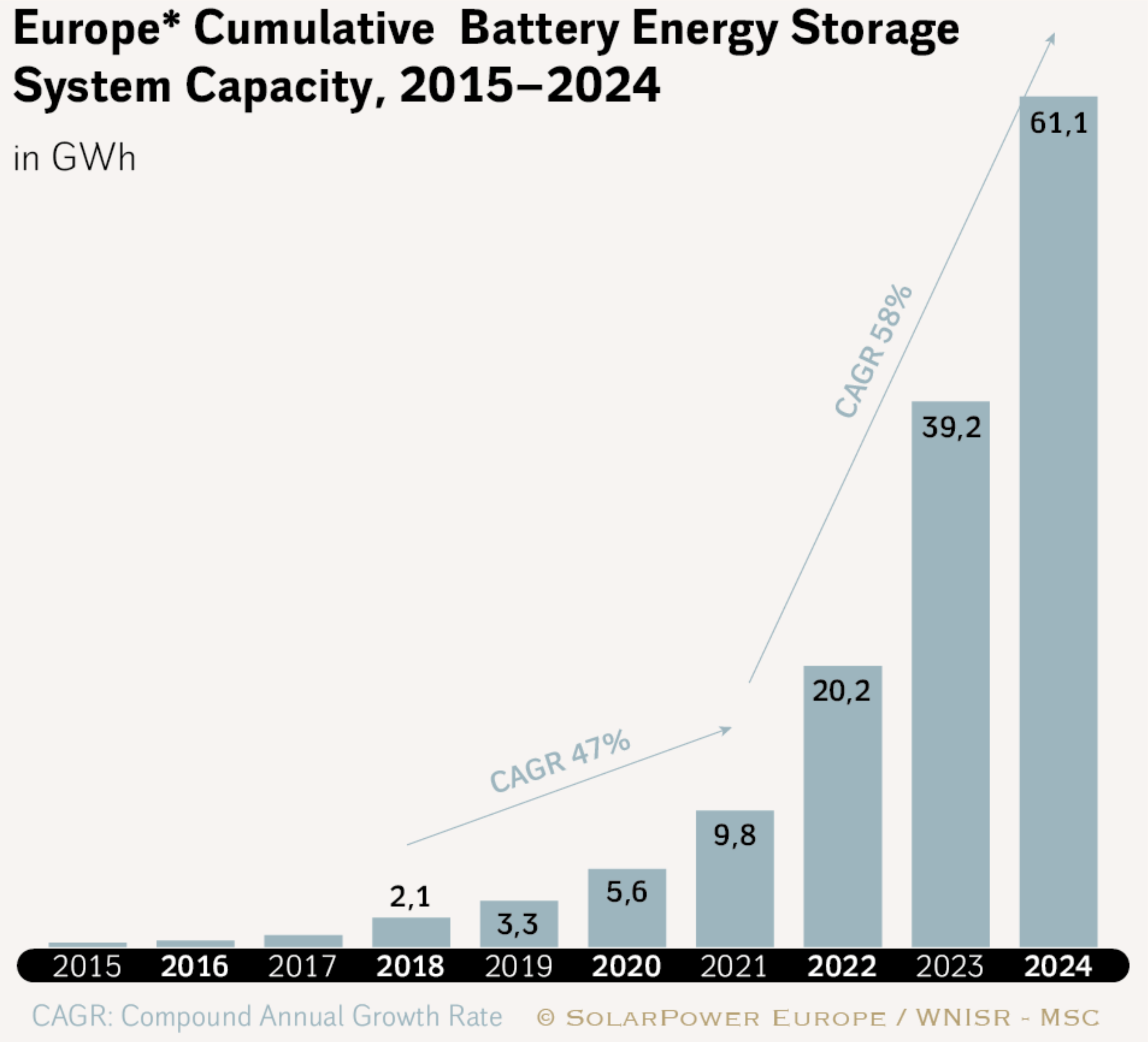
Source: Goldman Sachs, 2025

Home storage system costs US$250/kWh, lasts 20 years

→

daily storage for US$c3.4/kWh

NUCLEAR vs. RE DEPLOYMENT – Battery Energy Storage Booms

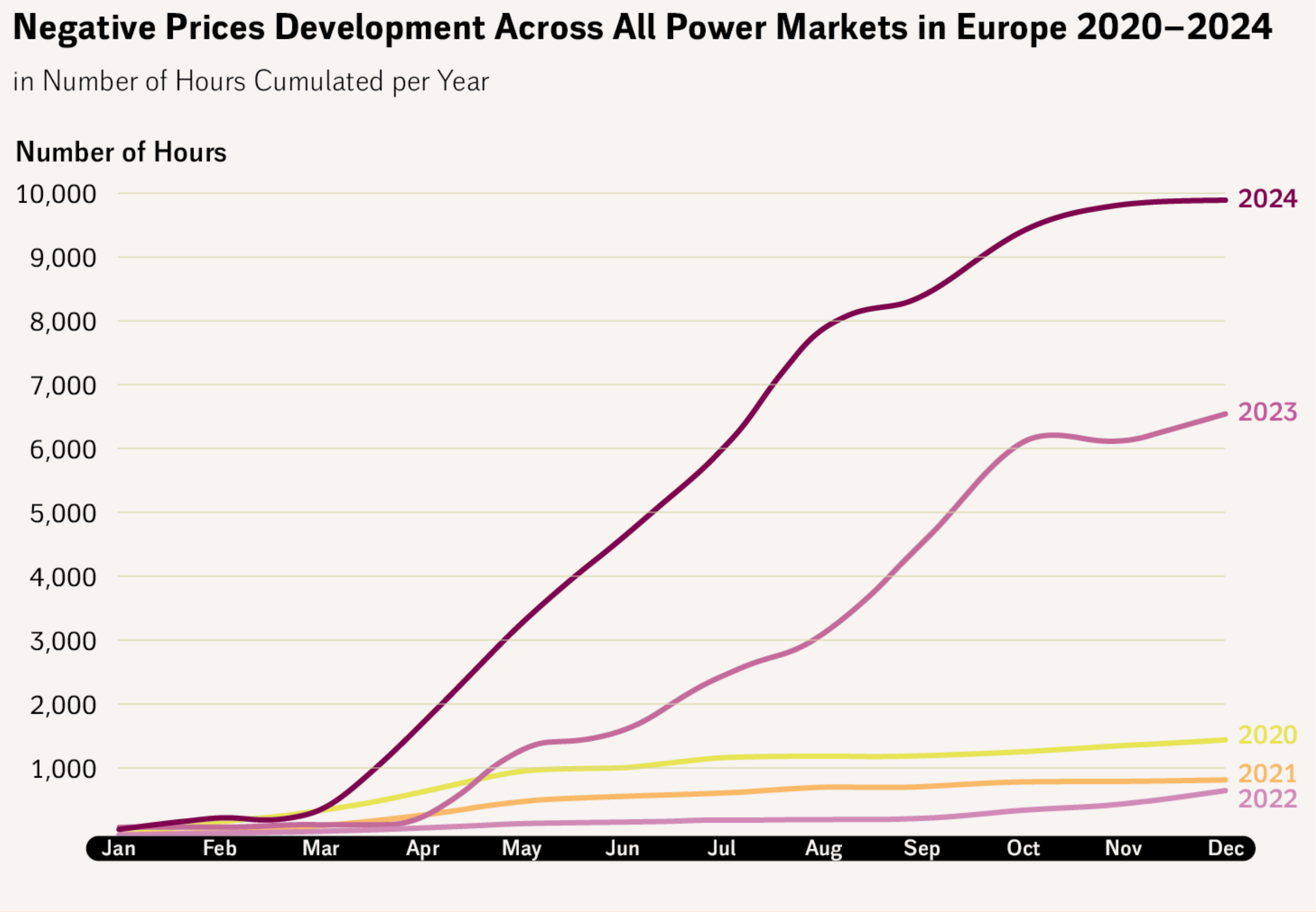


*EU27, U.K., Switzerland

- Solar power available around the clock
- PV behind the meter more attractive, prosumers more independent
- Grid expansion needs (due to electrification) considerably reduced

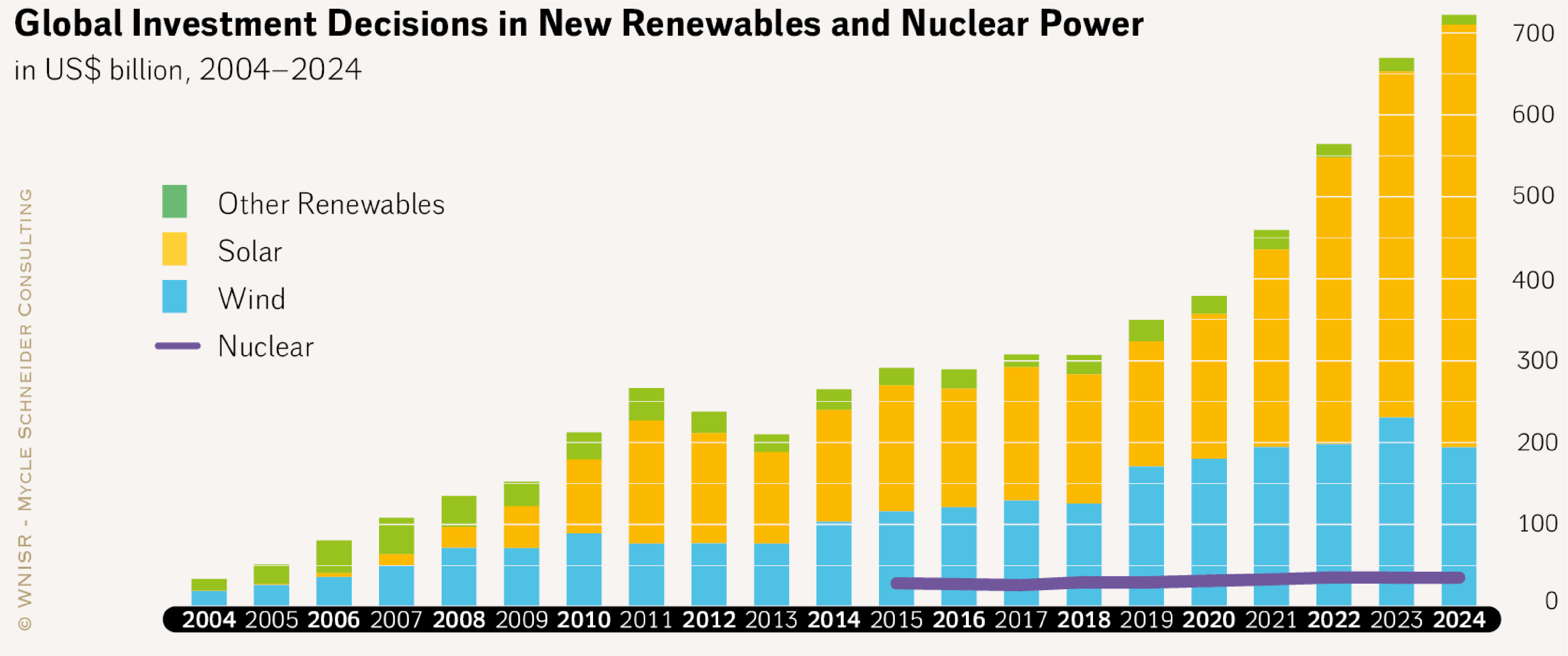
Source: SolarPower Europe, 2025

NUCLEAR vs. RE DEPLOYMENT – Negative Power Prices Surge Across Europe



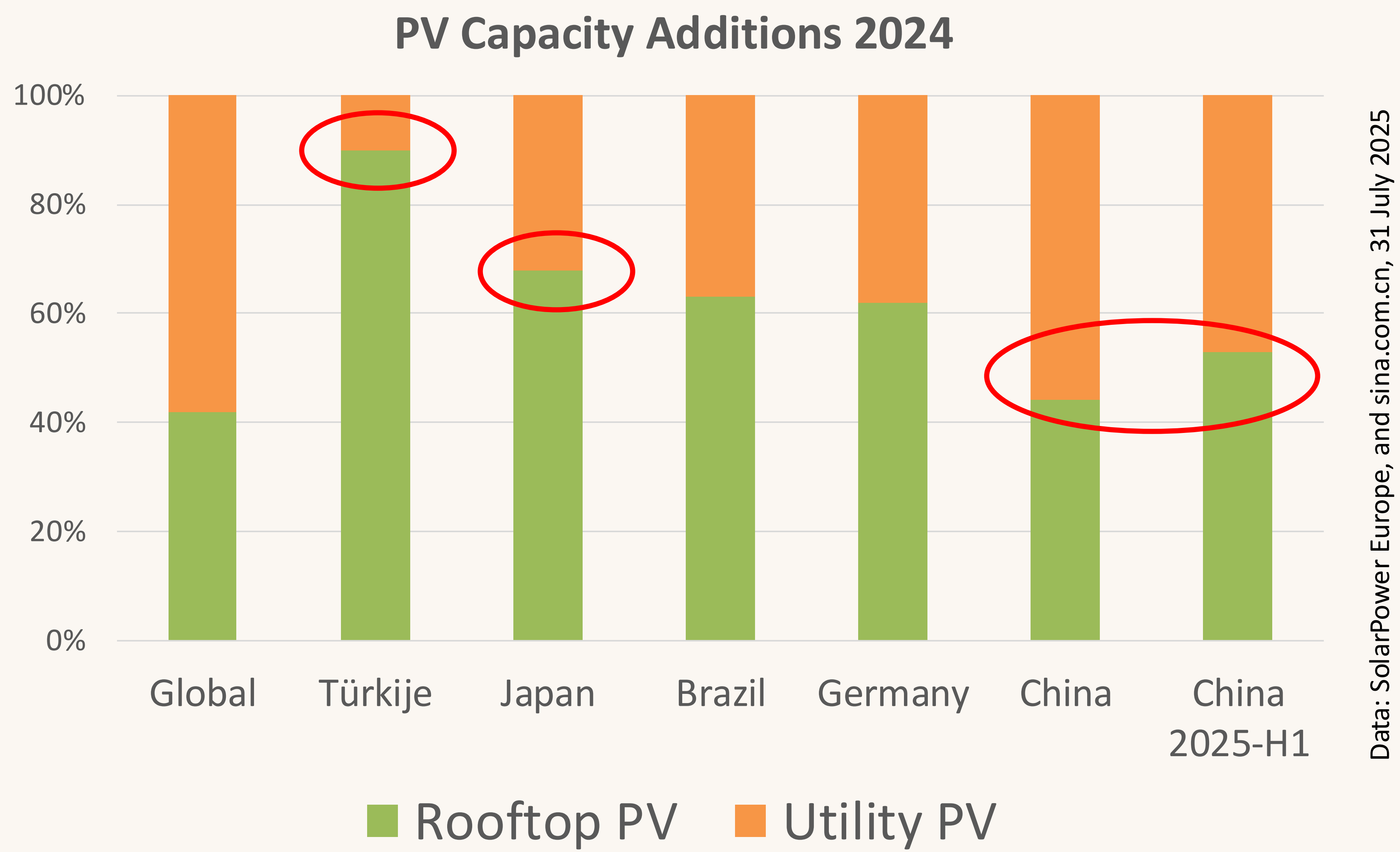
Source: Rystad Energy 2025

NUCLEAR vs. RE DEPLOYMENT – RE Invest. >20 x Nuclear Invest.

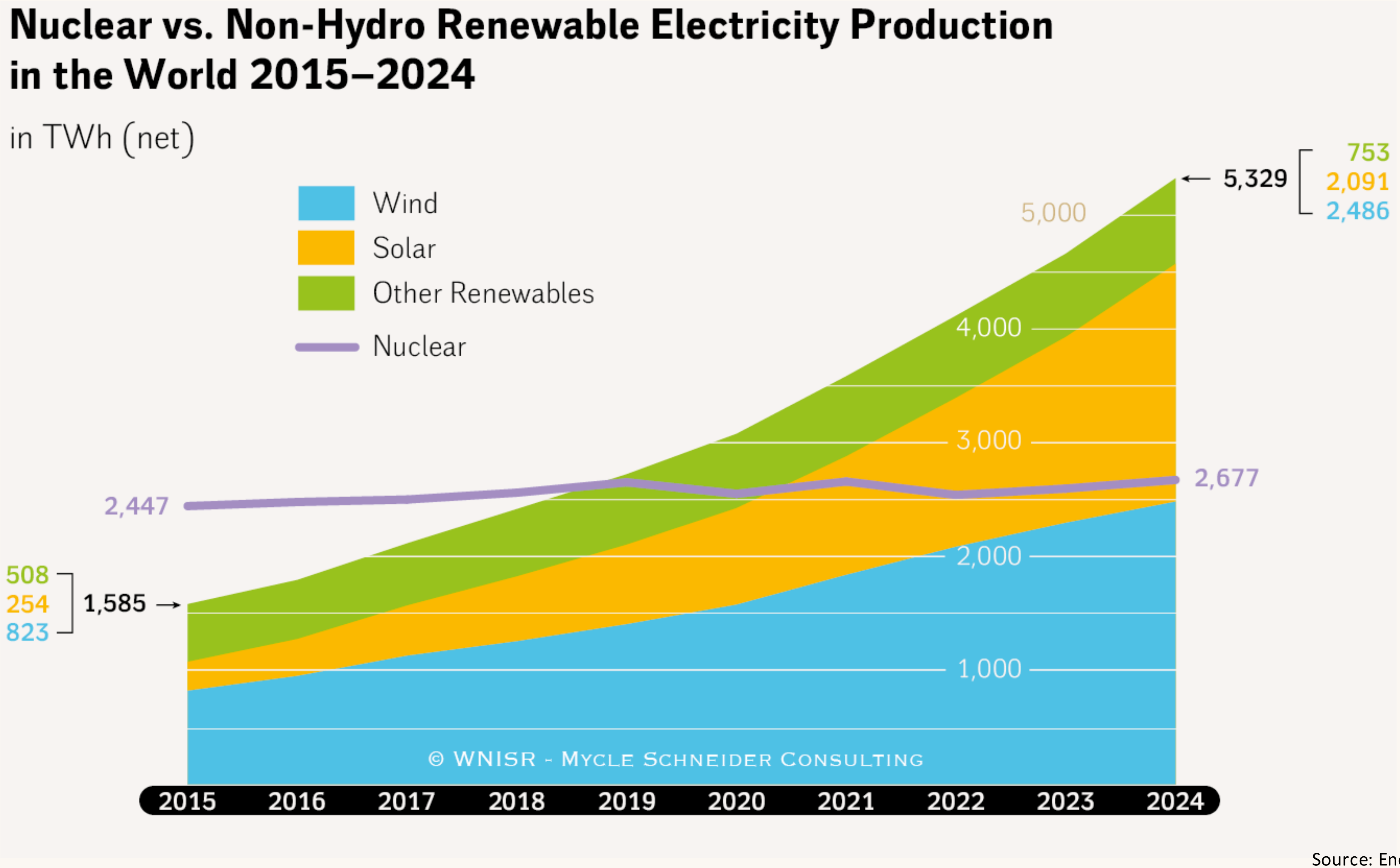


Source: BloombergNEF, 2025

NUCLEAR vs. RE DEPLOYMENT – PV Revolution Behind the Meter



NUCLEAR vs. RE DEPLOYMENT – Wind Catches up with Nuclear Production

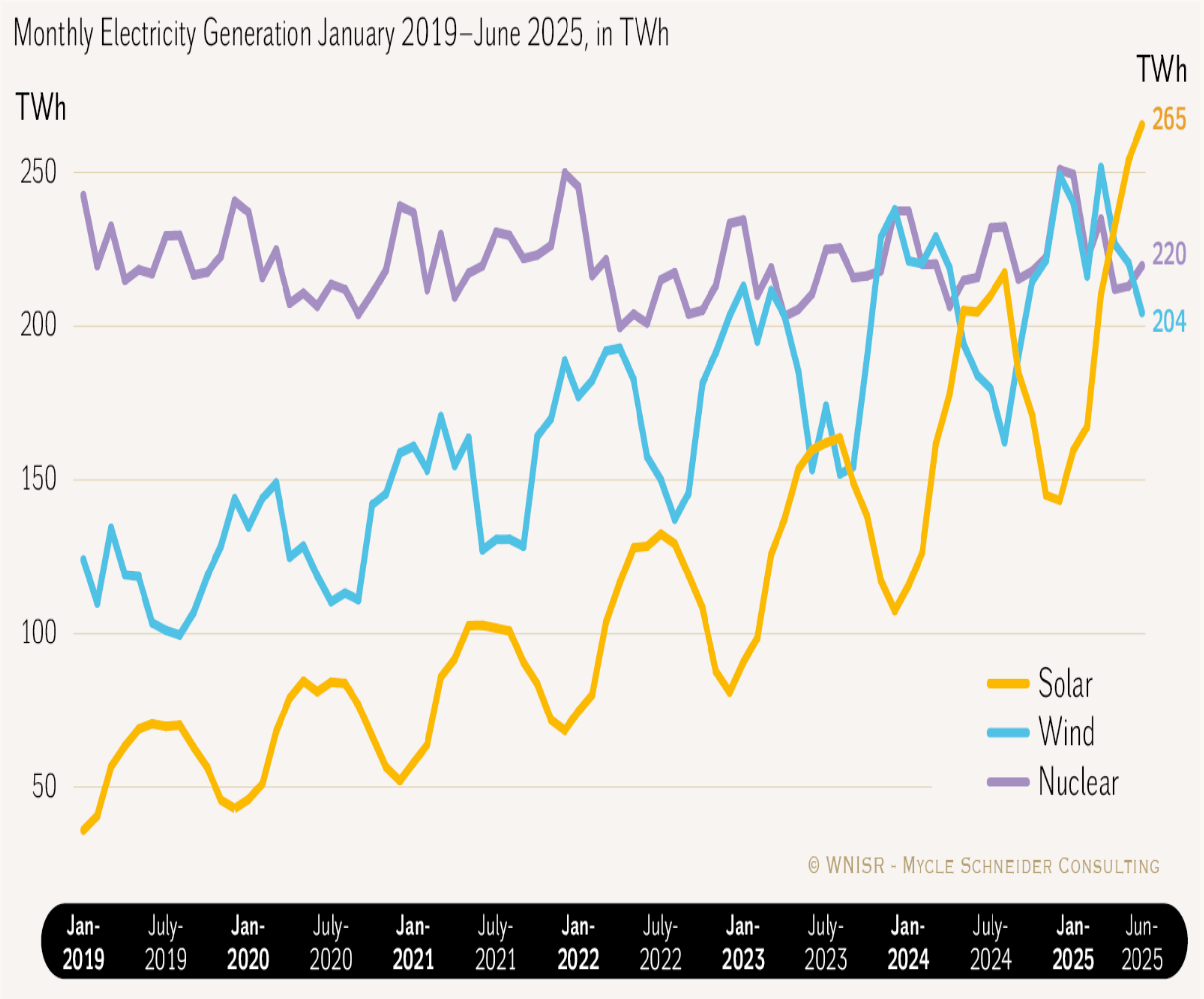


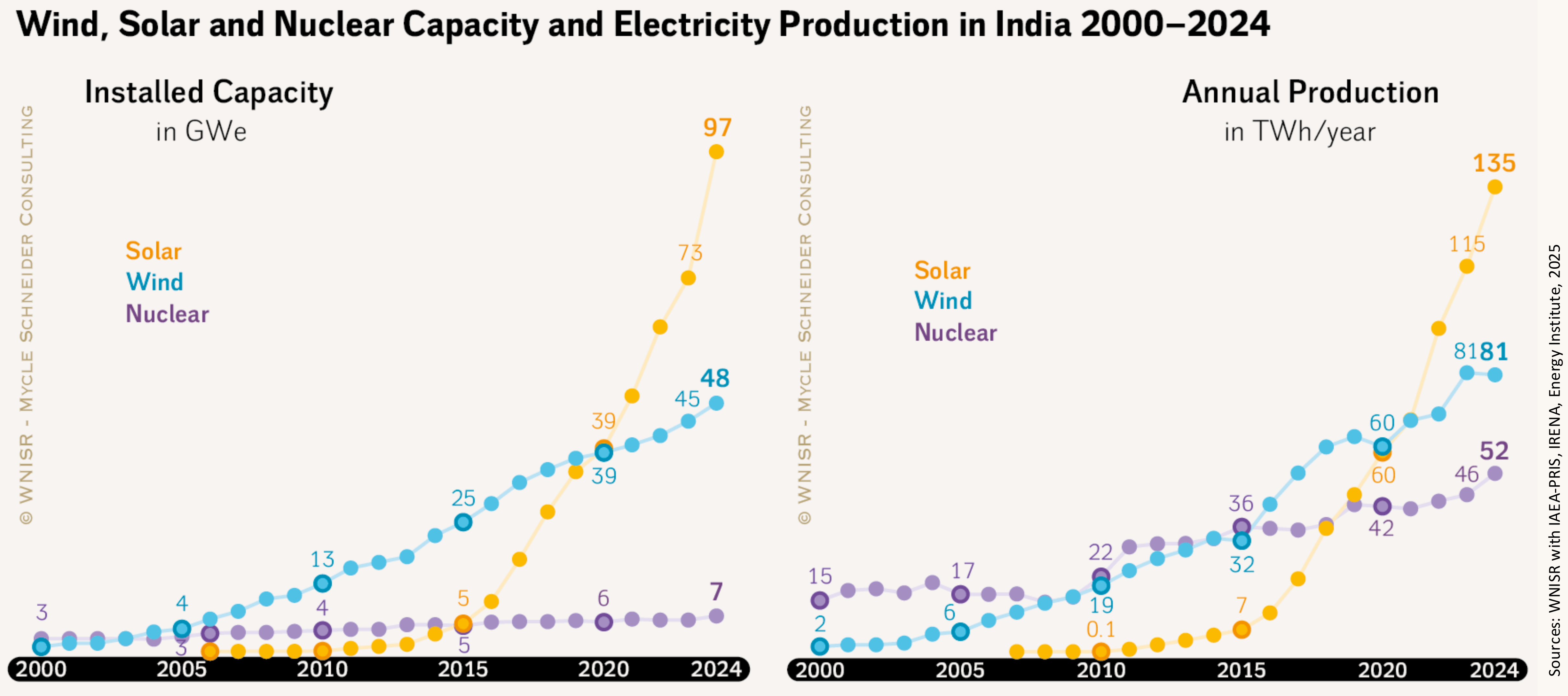
Source: Energy Institute, 2025

SYSTEMIC CHALLENGES FOR NUCLEAR POWER – Changed Context

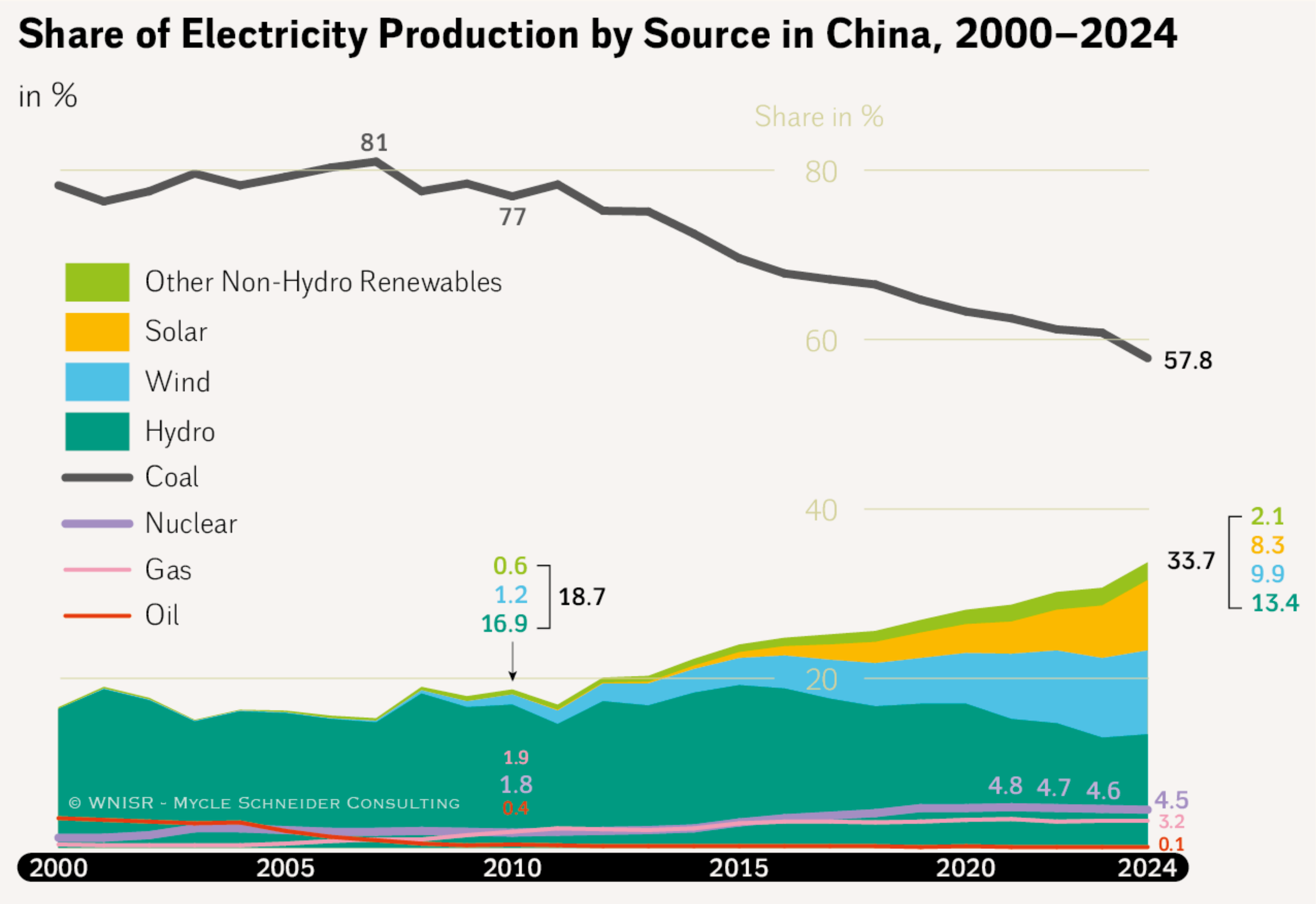
Nuclear power was conceived 60 years ago.
Meanwhile, the context has changed:

- **Climate awareness**
  has increased
- **Electricity markets**
  have been liberalized step by step
- **New energy technologies**
  start to disrupt markets and systems
- **International competition**
  has widened considerably
- **Accelerating change**
  penalizes long lead times




Wind, Solar and Nuclear Capacity and Electricity Production in India 2000–2024
Installed Capacity
in GWe
Solar
Wind
Nuclear
97
73
39
48
45
39
25
13
4
3
5
4
3
5
6
7
2000
2005
2010
2015
2020
2024
© WNISR - Mycle Schneider Consulting
Annual Production
in TWh/year
Solar
Wind
Nuclear
135
115
81
81
60
60
52
46
42
36
32
22
19
0.1
7
15
17
6
2
2000
2005
2010
2015
2020
2024
© WNISR - Mycle Schneider Consulting
Sources: WNISR with IAEA-PRIS, IRENA, Energy Institute, 2025

NUCLEAR vs. RE DEPLOYMENT – China Is Betting on Solar



Source: Energy Institute, 2025

CONCLUSIONS

The slow decline of the nuclear industry continues. Most indicators are on the decline or have reached the historic peak many years ago. Compared to mid-2024:

- The number or countries **operating** power reactors declined from 32 to 31.
- The number or countries **building** new power reactors dropped from 13 to 11.

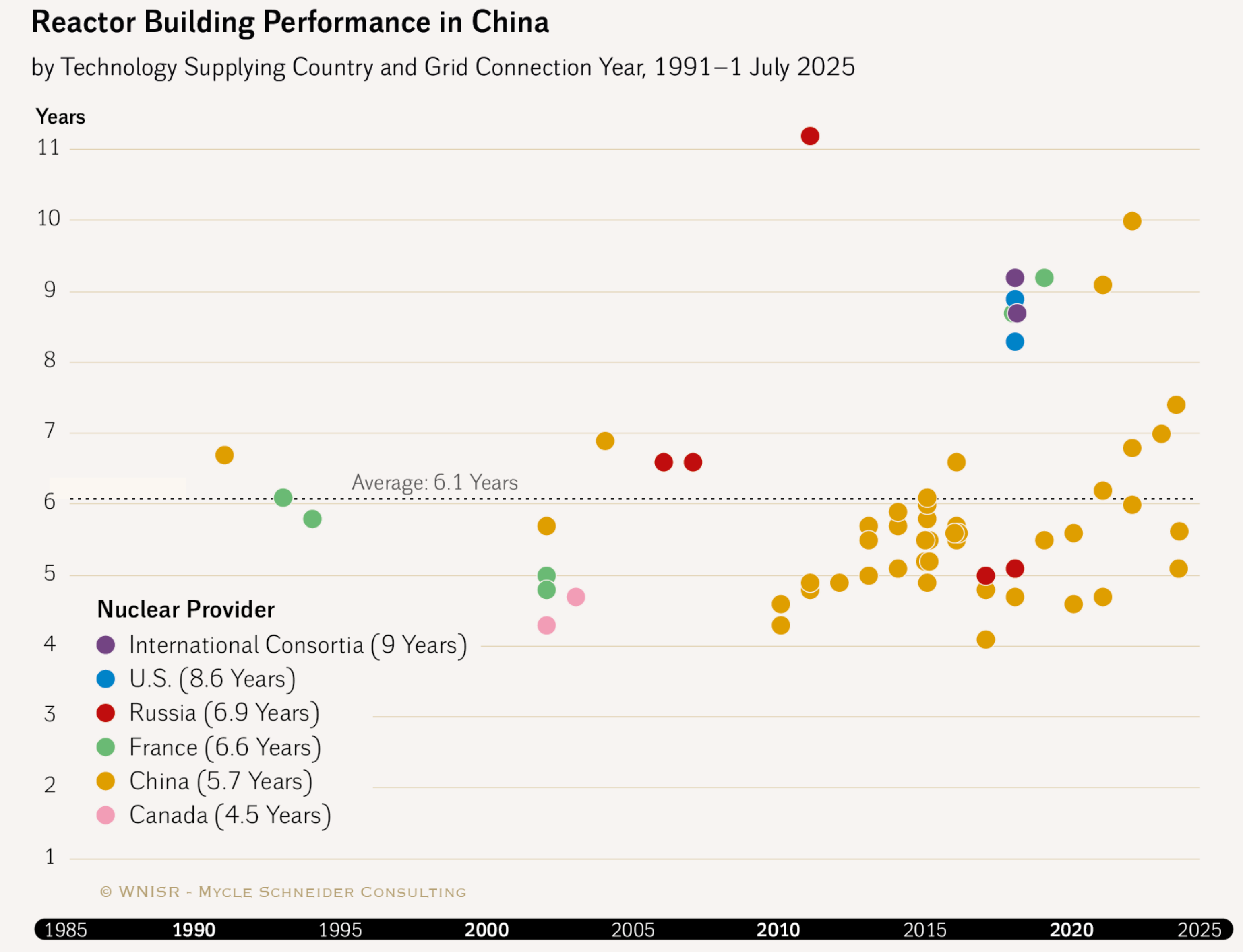
While global nuclear power **generation** reached a new historic maximum in 2024, the result is exclusively due to the buildup in China. Outside China, nuclear production was on the level of the mid-1990s.

- The **share of nuclear power** in the electricity mix has been declining since 1996.
- No Small Modular Reactor (**SMR**) is operating/under construction in the Western world.

Annual global nuclear power capacity additions are in the single-digit gigawatt range while wind, solar, and storage add double- and triple-digit gigawatt capacities to the grid (and behind the meter). Last year's global launch presentation concluded with this sentence: "Especially solar plus storage might rapidly turn into a global changemaker in the energy equation." It appears to have happened already.

ANNEXES

CHINA FOCUS – Building Performance

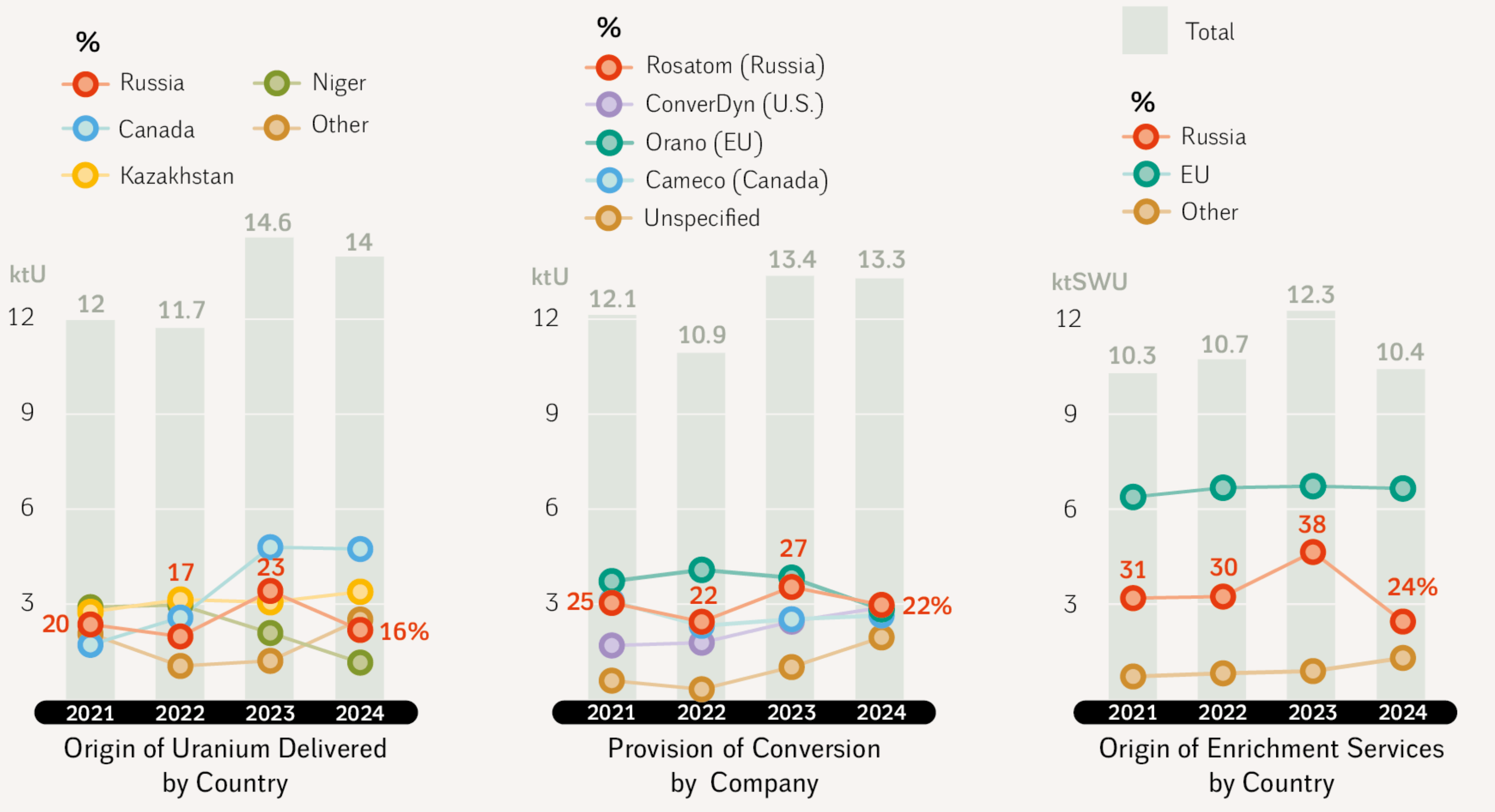


Sources: WNISR with IAEA-PRIS, 2025

RUSSIA DEPENDENCIES – Uranium Services and Supplies

Natural Uranium, Conversion and Enrichment Services to the E.U., by Provider Country 2021–2024

in Thousand Tons of Uranium (ktU) and Thousand Tons of Separative Work Units (ktSWU)

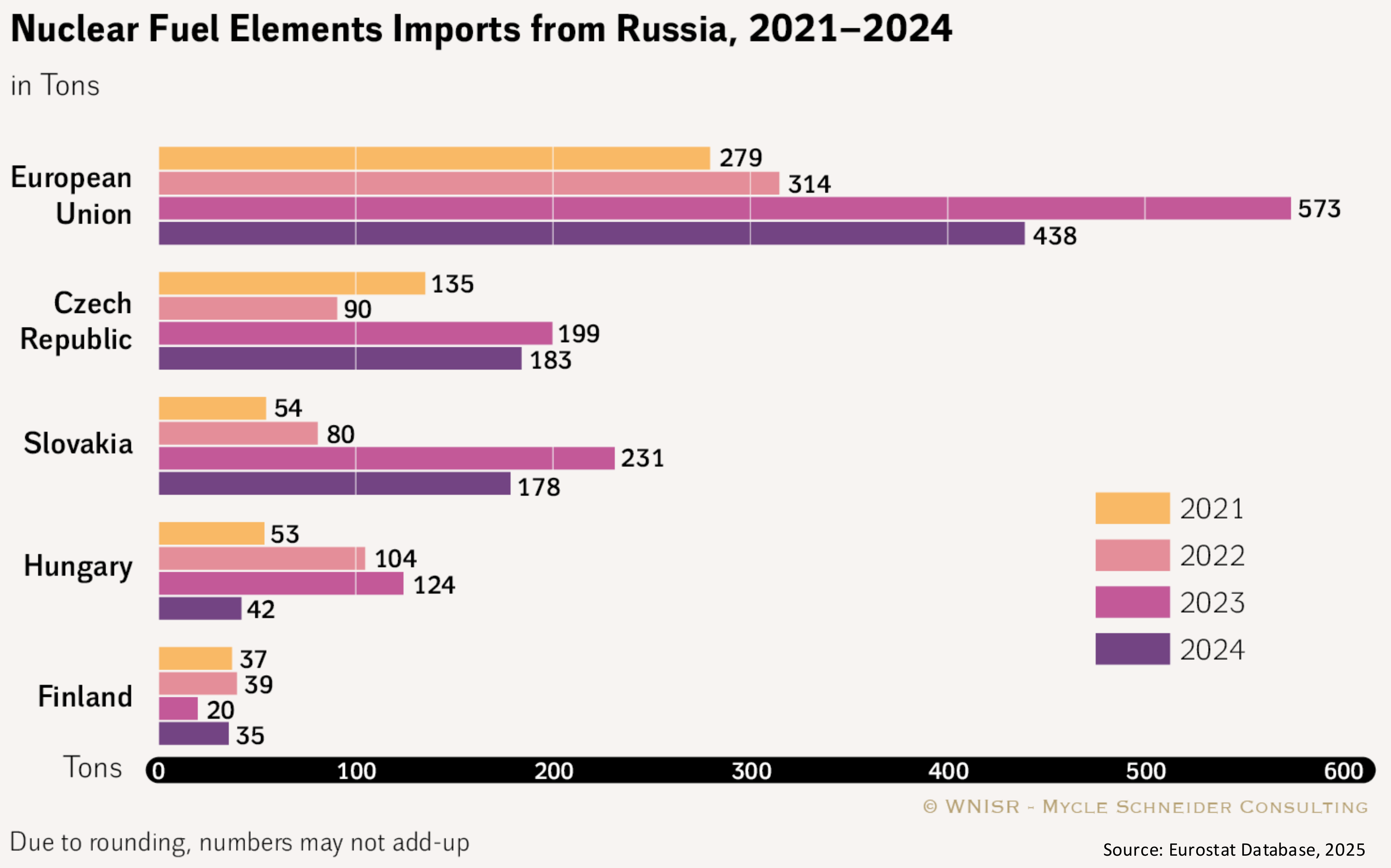


Source: ESA, 2022, 2024 and 2025

Enrichment Uranium supplies to USA from Russia

Source: Bellona report, based on Comtrade data

RUSSIA DEPENDENCIES – E.U. Fuel Assembly Imports



Source: Eurostat Database, 2025

RUSSIA INTERDEPENDENCIES – Rosatom Key Client for Western Technology

Installation of the Arabelle turbine at the first unit of the Akkuyu nuclear power plant, 2024
Photo: Akkuyu Nükleer

- Western companies have provided I&C technology („The brain of a power plant“) to Russian reactor projects
- Rosatom has become a global player for building new reactors and a client for Western equipment
- Rosatom projects in Türkiye, Egypt, Hungary heavily involve Western technology, for example:
  - I&C technology from Framatome and Siemens
  - The French Arabelle turbine

➢ **Strong mutual dependencies between Rosatom and Western companies in their reactor business**

SYSTEMIC CHALLENGES – Fundamentally Different Physical Principles

Nuclear Power

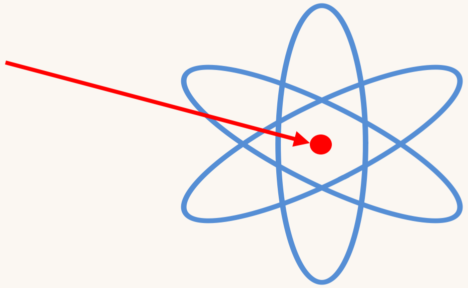


Image: Areva

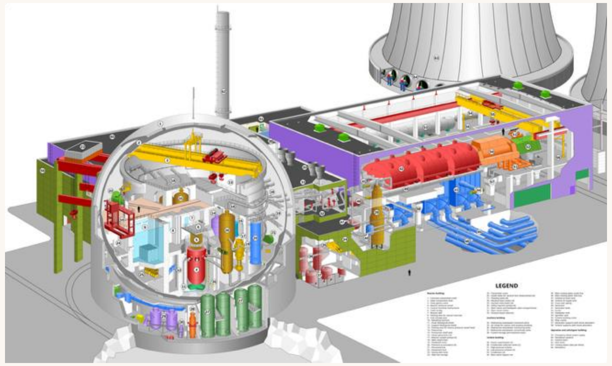
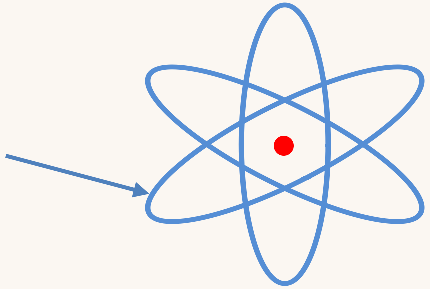


Image: CC Wikimedia

Image: CC Wikimedia

Chain reaction splits atomic nuclei	Reactor pressure vessel (Olkiluoto): 425 tons → heat	• control of **chain reaction** • protection against **radiation, theft, terrorism, war** • radioactive **waste**	• Construction time 5-10 years • Onsite construction • Series size 1-10

Photovoltaics



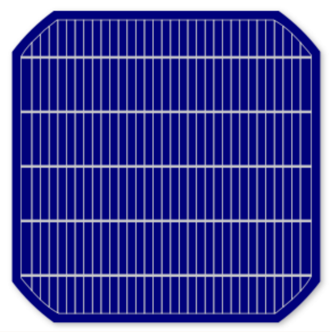


Image: CC Wikimedia

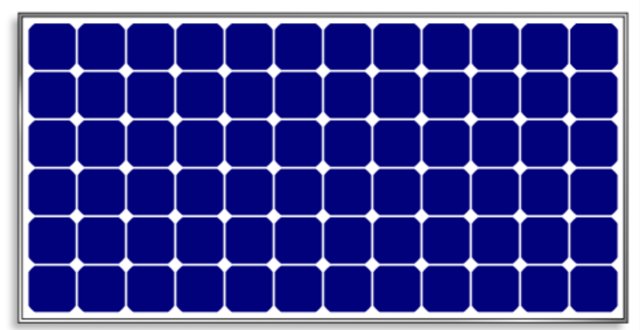


Image: CC Wikimedia

Image: CC Solarspace

Solar radiation moves electrons in the atomic electron shell	Photovoltaic cell: 3 g → electricity	• Protection against external **dirt**, **humidity, hail** • no moving parts	One factory can produce up to 2 billion PV cells / year