Japan Launch Event

The World Nuclear Industry Status Report 2021

(*Plus end-of-year-updates!*)

www.WorldNuclearReport.org

Co-Hosted by

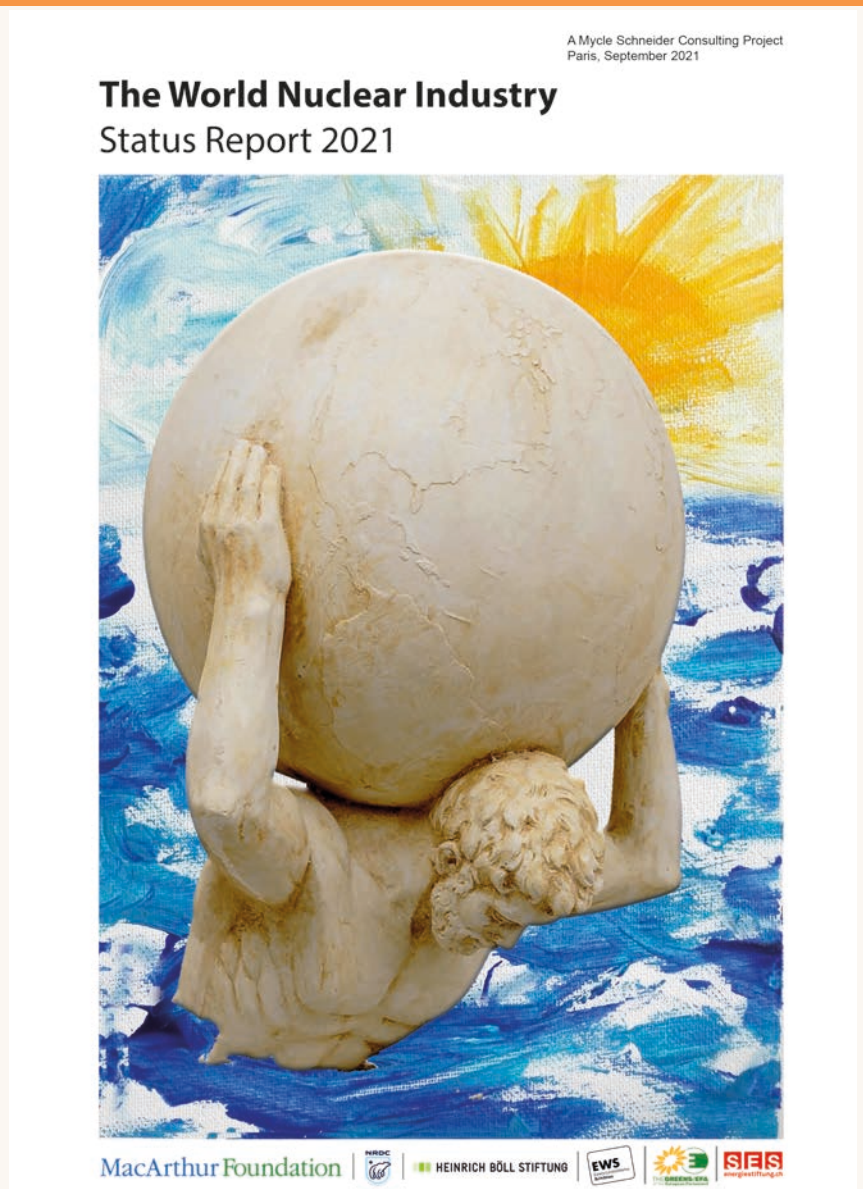
National Graduate Institute for Policy Studies

and

Renewable Energy Institute

Tokyo (Japan), Nagasaki (Japan), Paris (France), London (U.K.), Stockholm (Sweden), 19 January 2022

International, Interdisciplinary Team for a Multi-Indicator Analysis



The World Nuclear Industry
Status Report 2021

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Former Prime Minister of Japan I Member of the House of Representatives, Japan

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Photo: ©Nina Schneider

Mycle Schneider works as independent international consultant on energy and nuclear policy. He is the initiator, Coordinator and Publisher of the World Nuclear Industry Status Reports. He a Founding Board Member and the Spokesperson for the International Energy Advisory Council (IEAC). He is a Founding Member of the International Nuclear Risk Assessment Group (INRAG) and a member of the International Nuclear Security Forum (INSF), based at the Stimson Center, USA. He is a member of the International Panel on Fissile Materials (IPFM), based at Princeton University, USA.

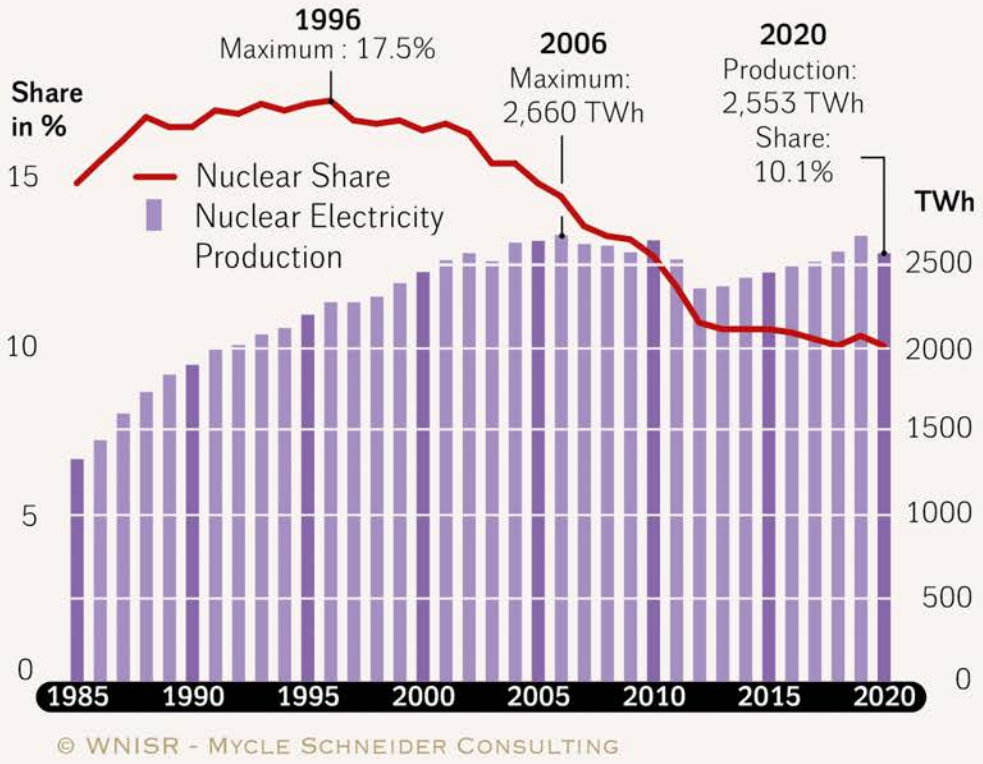
Between 2004 and 2009, he has been in charge of the Environment and Energy Strategies Lecture of the International Master of Science for Project Management for Environmental and Energy Engineering at the *Ecole des Mines* in Nantes, France. From 2000 to 2010, he was an occasional advisor to the German 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 30+ years. He has given lectures or had teaching appointments at over 20 universities and engineering schools in 10 countries.

GLOBAL OVERVIEW – ROLE OF NUCLEAR POWER

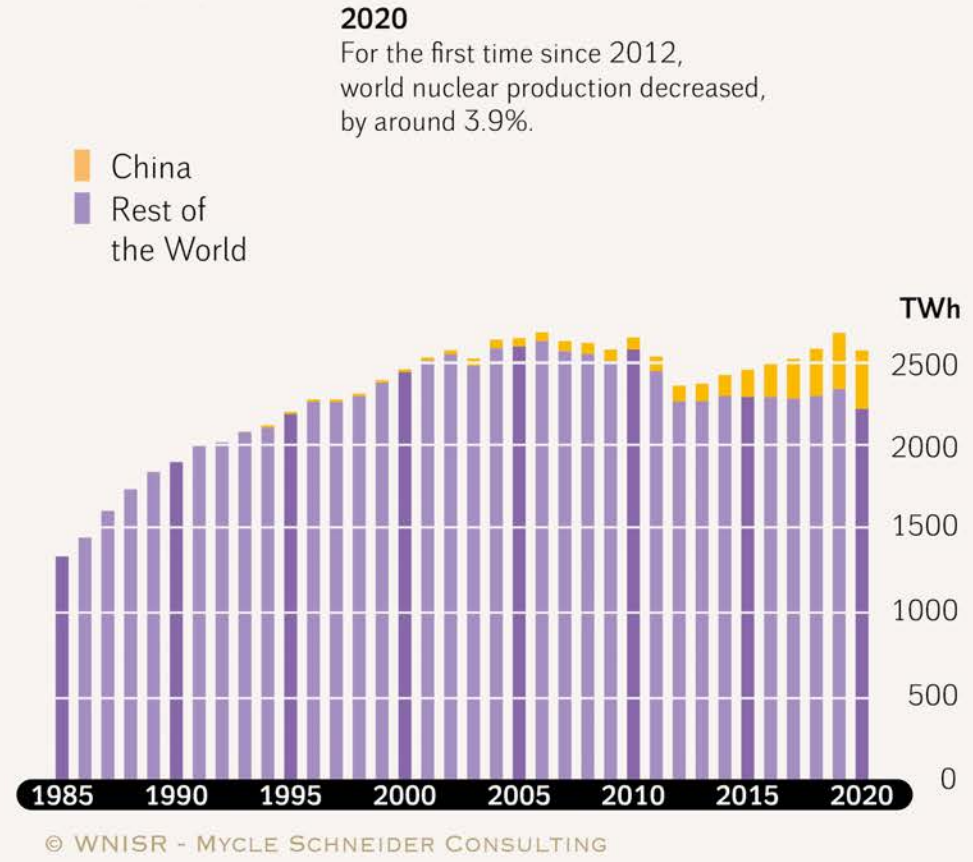
Nuclear Electricity Production 1985–2020 in the World...

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



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

in TWh (net)



Sources: WNISR, with BP, IAEA-PRIS, 2021

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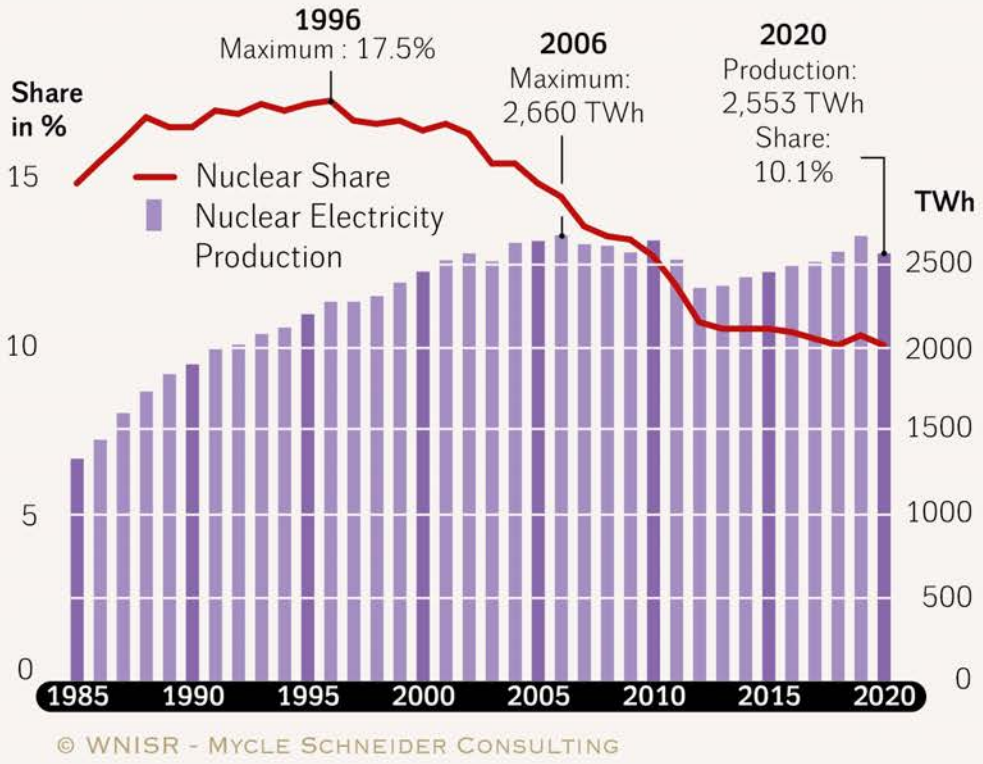

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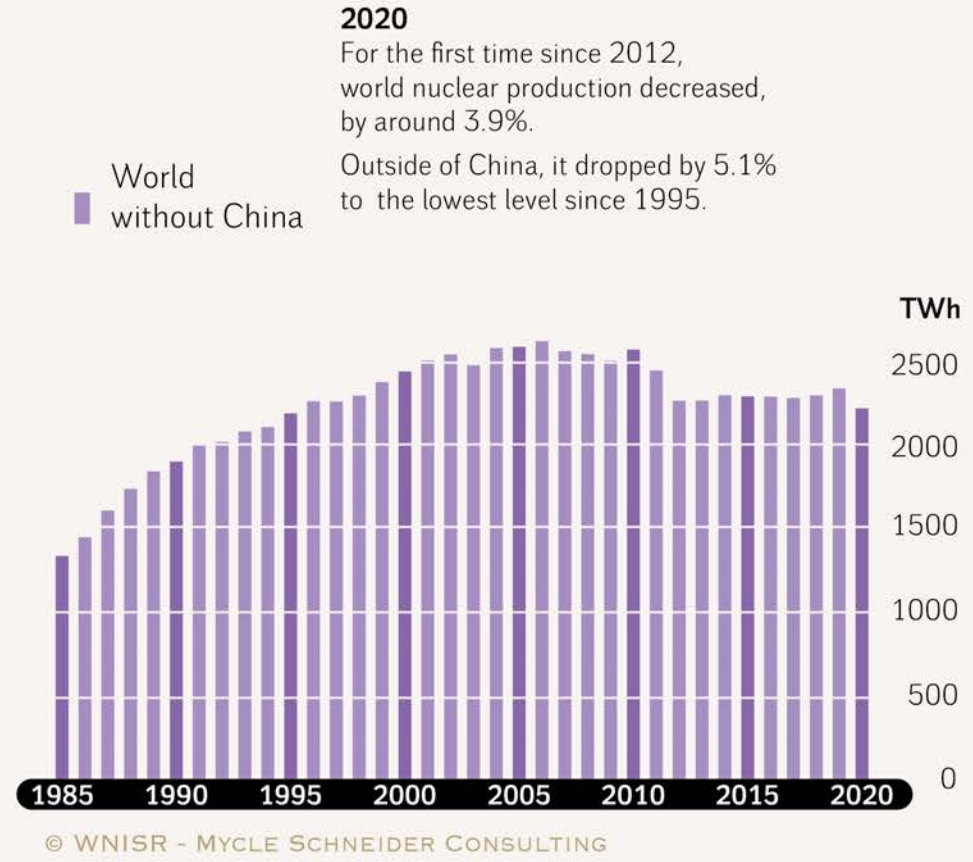
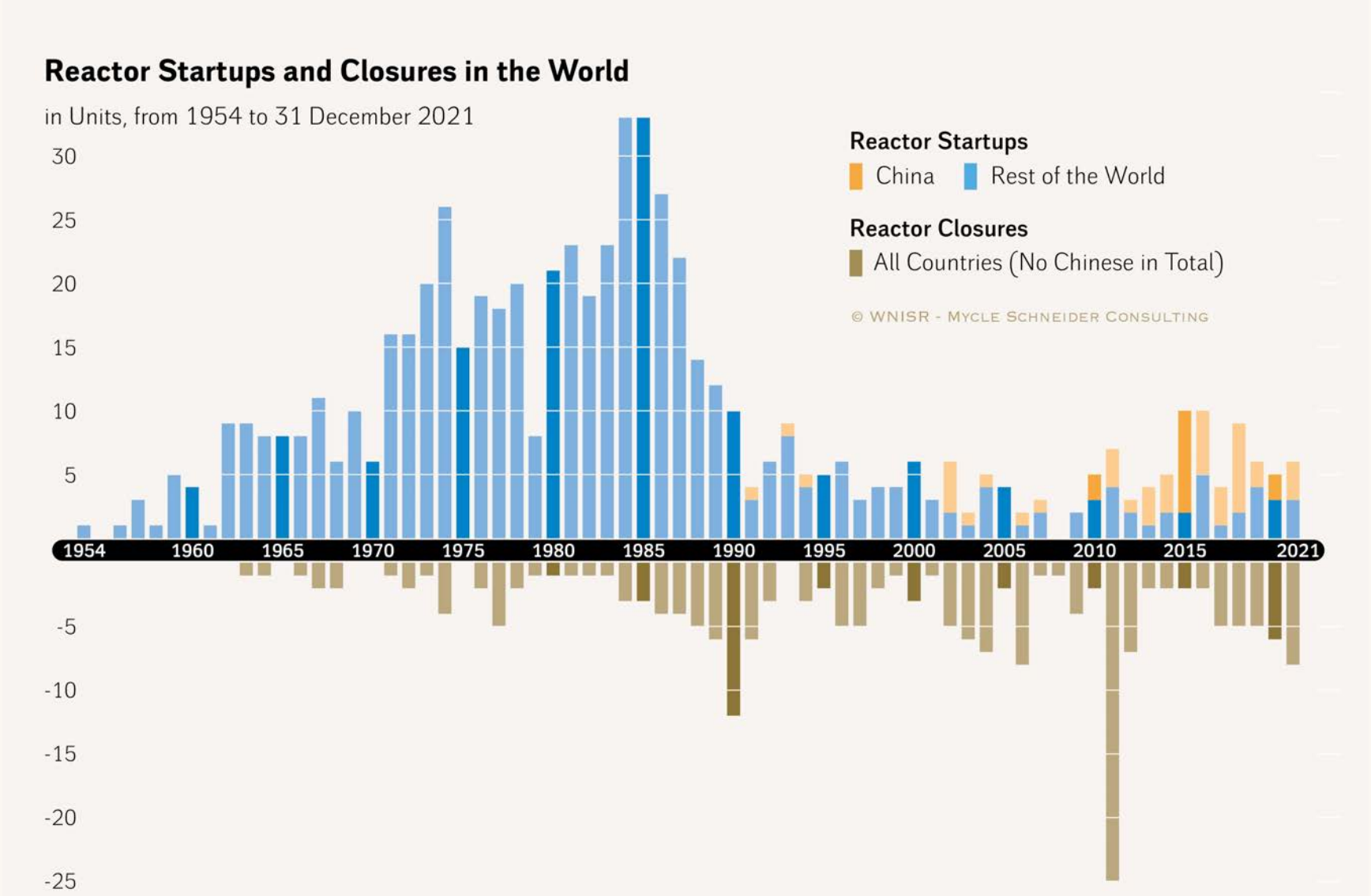


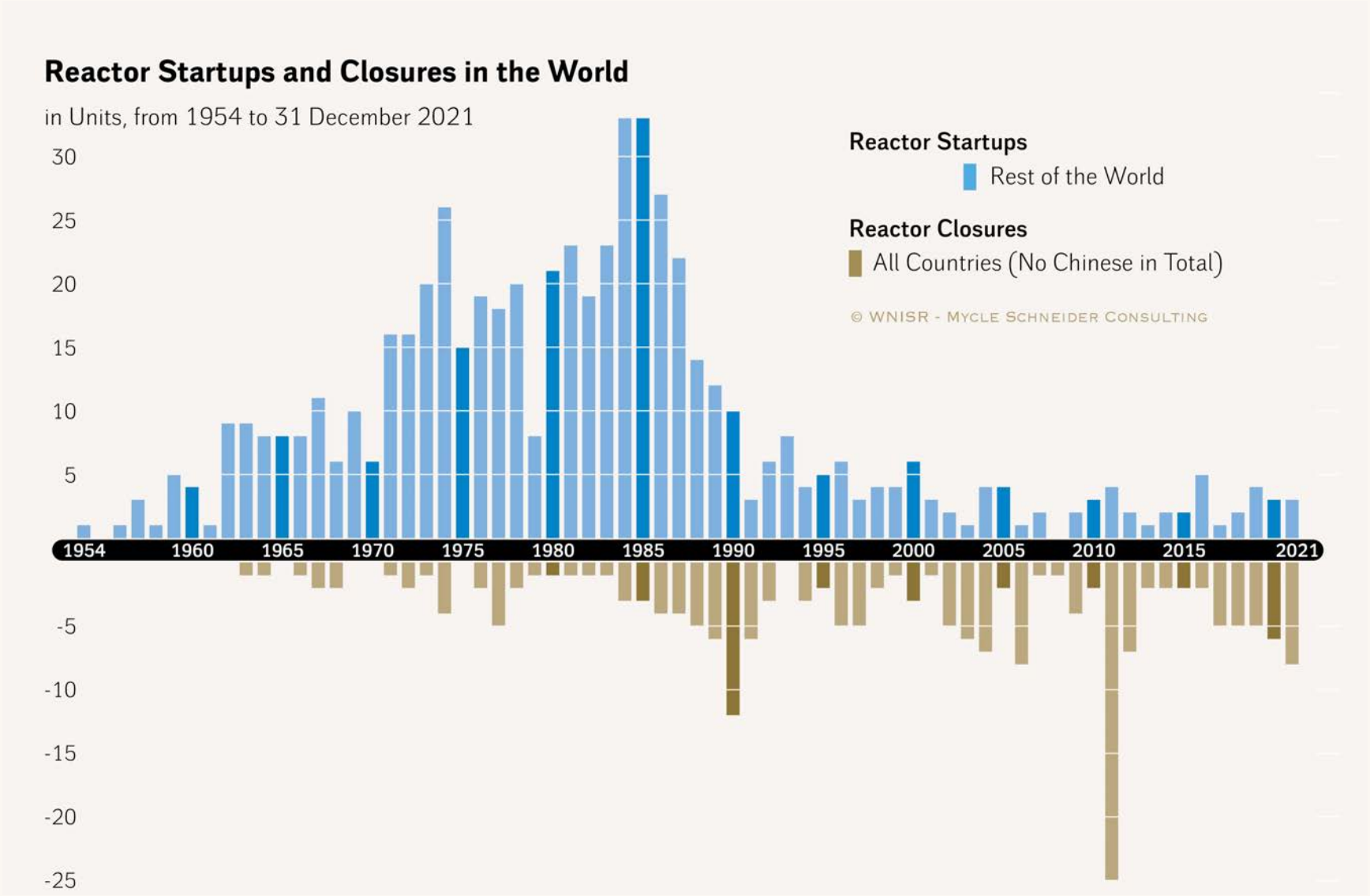
Sources: WNISR, with BP, IAEA-PRIS, 2021

GLOBAL OVERVIEW – STARTUPS AND CLOSURES

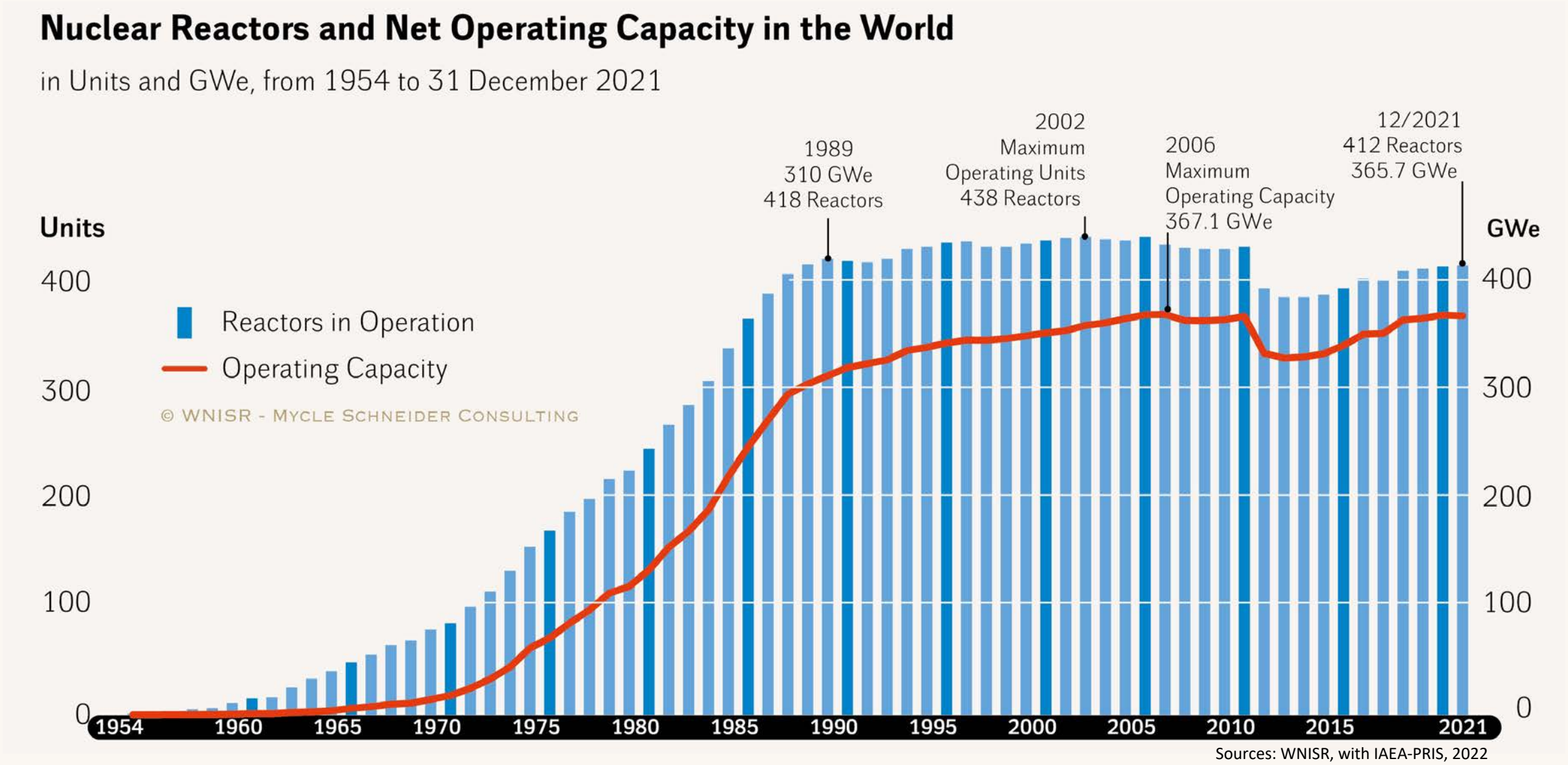


Sources: WNISR, with IAEA-PRIS, 2022

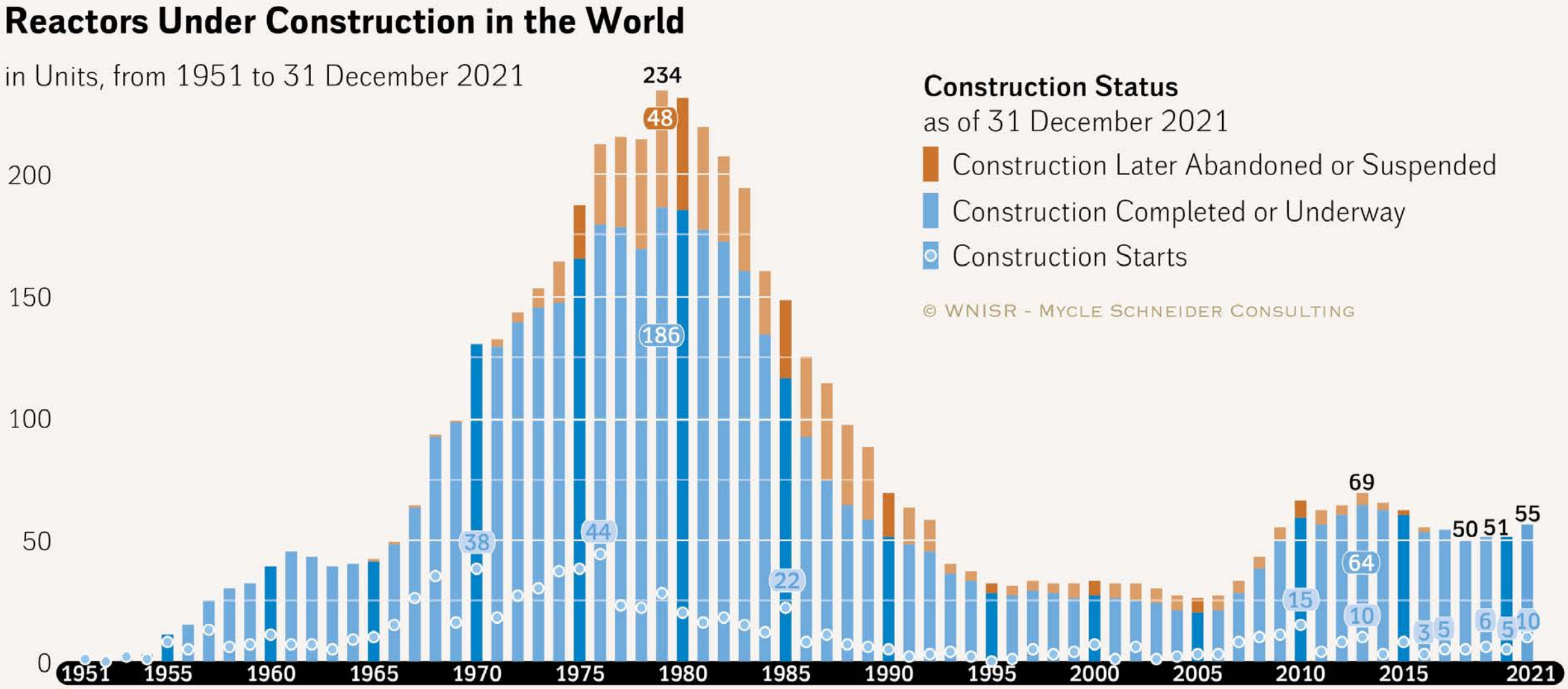
GLOBAL OVERVIEW – STARTUPS AND CLOSURES



Sources: WNISR, with IAEA-PRIS, 2022



Sources: WNISR, with IAEA-PRIS, 2022



Sources: WNISR, with IAEA-PRIS, 2022

GENERAL OVERVIEW — CONSTRUCTIONS

Nuclear Reactors "Under Construction" (as of 31 December 2021)

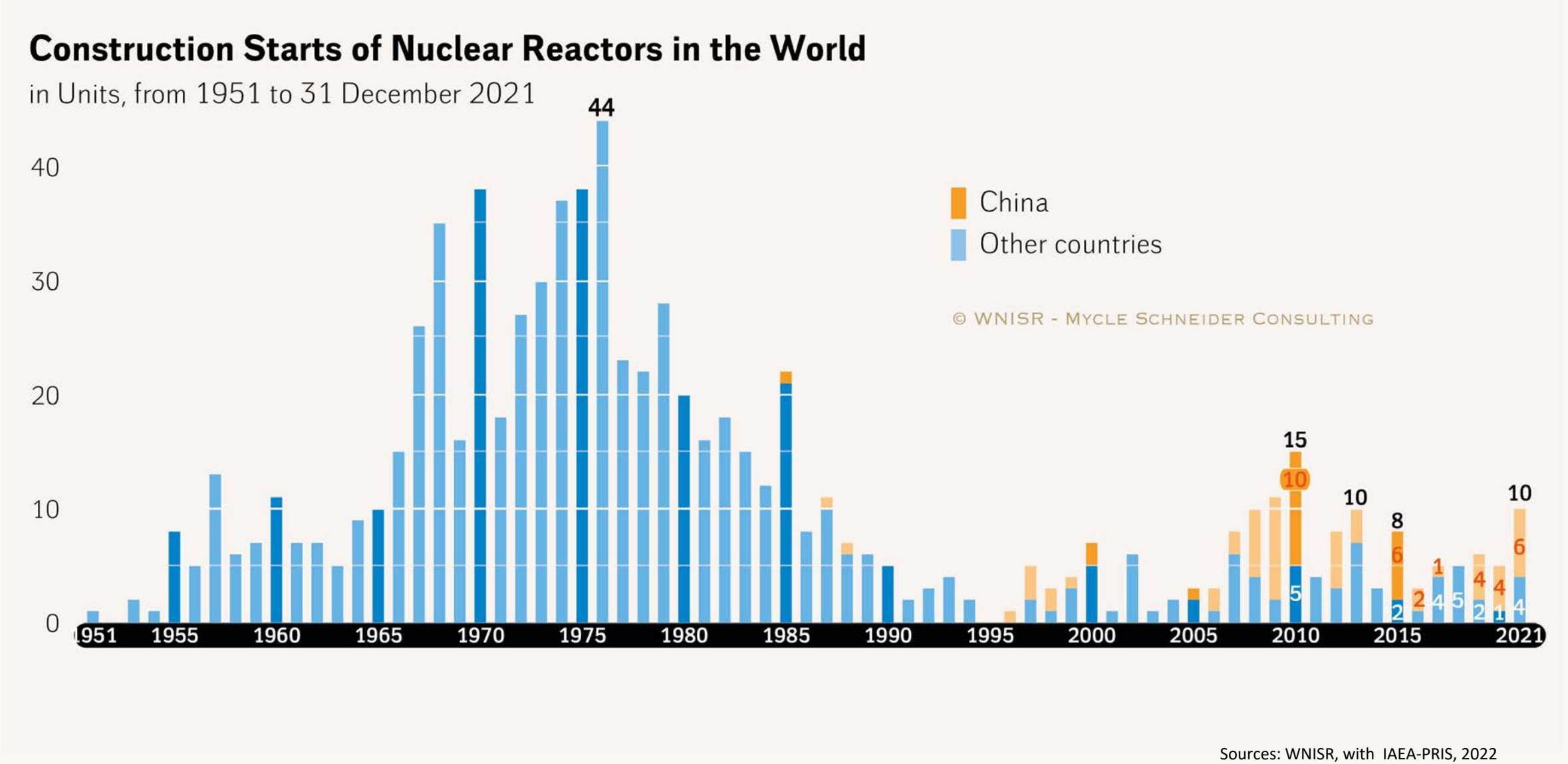
Country	Units	Capacity (MW net)	Construction Start	Grid Connection	Units Behind Schedule
China	20	19 204	2012 – 2021	2022 – 2027	4
India	8	6 194	2004 – 2021	2022 – 2026	6
South Korea	4	5 360	2012 – 2018	2022 – 2025	4
Russia	3	2 650	2018 – 2021	2022 – 2026	0
Turkey	3	3 342	2018 – 2021	2024 – 2026	1
Bangladesh	2	2 160	2017 – 2018	2023 – 2024	0
Slovakia	2	880	1985	2022 – 2023	2
UAE	2	2 690	2014 – 2015	2022 – 2023	2
UK	2	3 260	2018 – 2019	2026 – 2027	2
USA	2	2 234	2013	2022 – 2023	2
Argentina	1	25	2014	2024	1
Belarus	1	1 110	2014	2022	1
Finland	1	1 600	2005	2022	1
France	1	1 600	2007	2023	1
Iran	1	1 196	1976	2024	1
Japan	1	1 325	2007	2025	1
Pakistan	1	1 014	2016	2022	1
Total	**55**	**55 844**	**1976 - 2021**	**2022 – 2027**	**30**

Sources: WNISR, with IAEA-PRIS, 2022

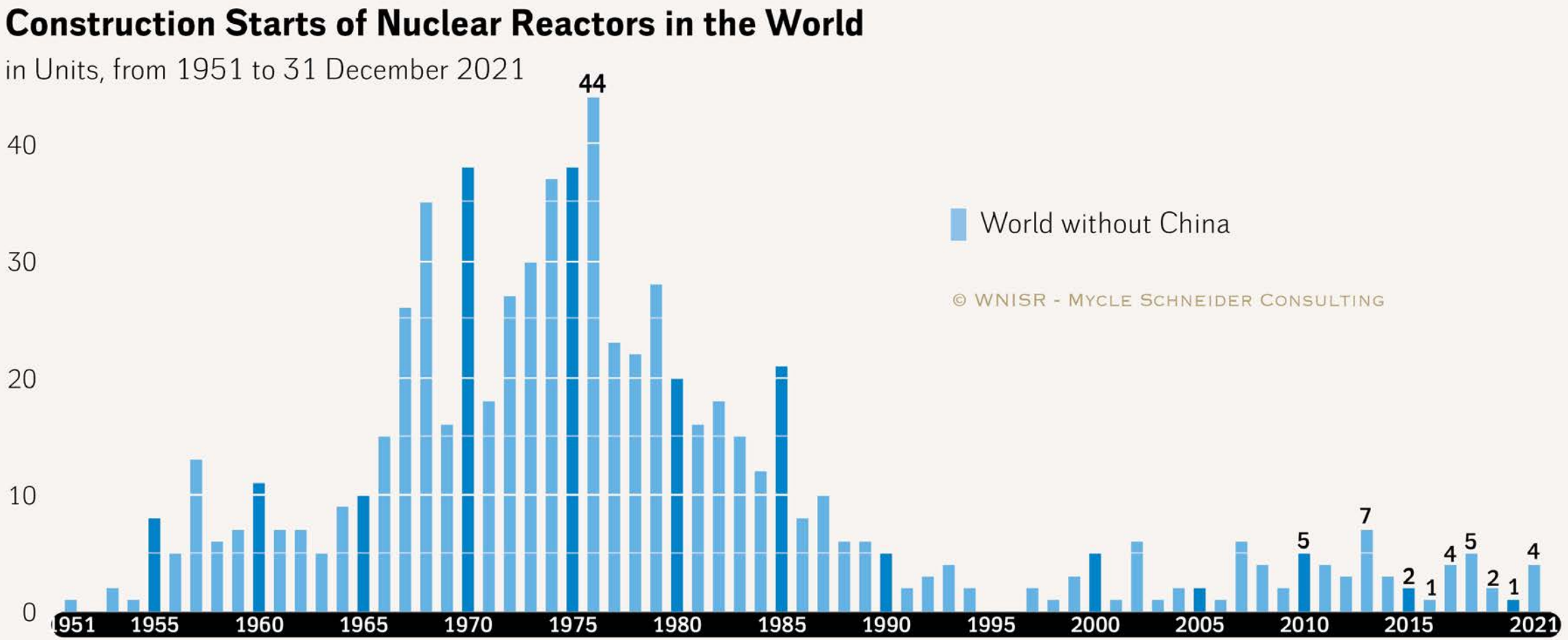
Duration from Construction Start to Grid Connection

Construction Times of 63 Units Started-up 2011–2020				
Country	Units	Construction Time (in Years)		
		Mean Time	Minimum	Maximum
China	37	6.1	4.1	11.2
Russia	10	18.7	8.1	35.1
South Korea	5	6.4	4.2	9.6
India	3	11.5	8.7	14.2
Pakistan	3	5.4	5.2	5.6
Argentina	1	33.0	33.0	
Belarus	1	7.0	7.0	
Iran	1	36.3	36.3	
UAE	1	8.1	8.1	
USA	1	42.8	42.8	
World	63	9.9	4.1	42.8

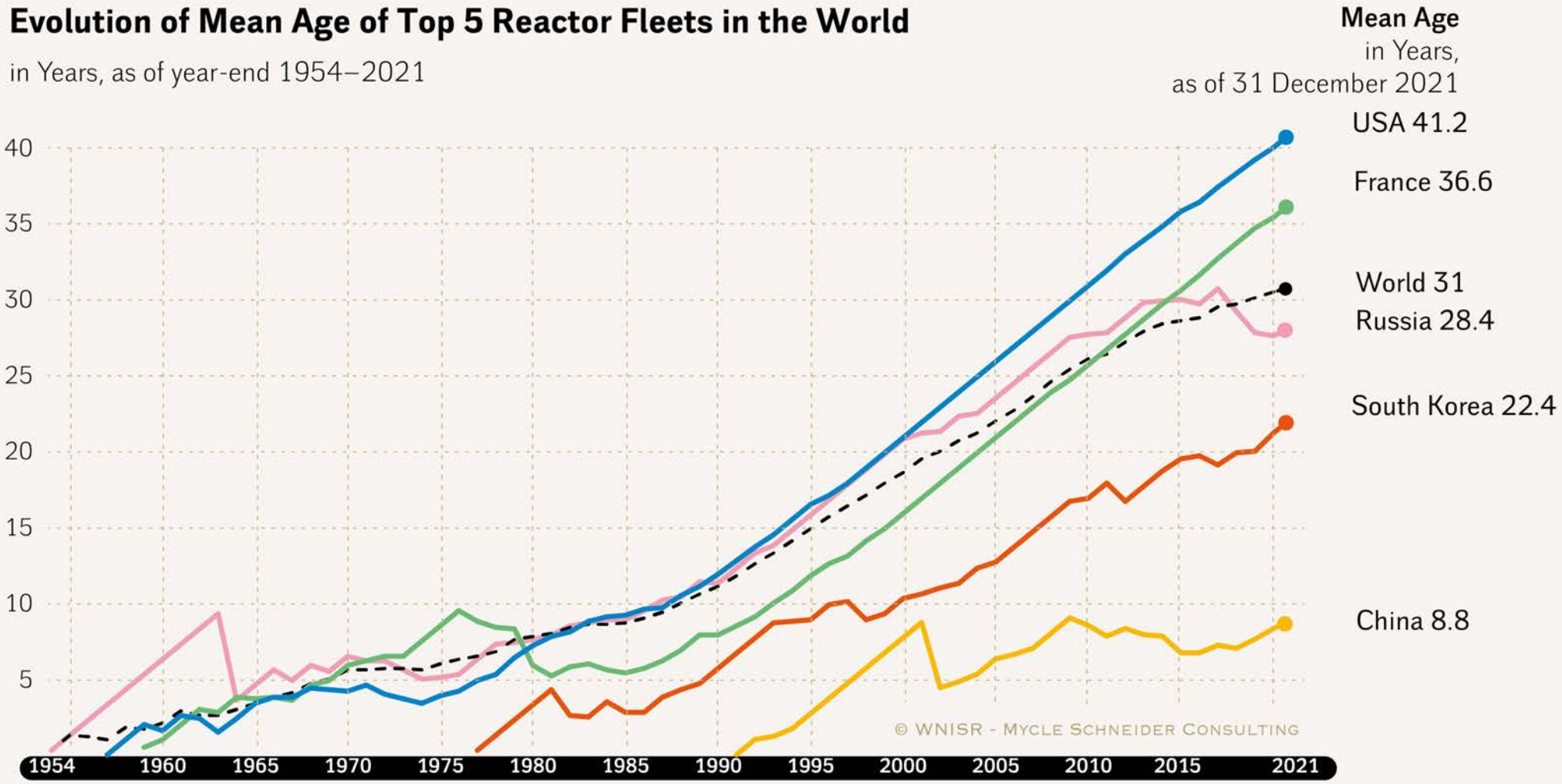
Sources: WNISR, with IAEA-PRIS, 2021



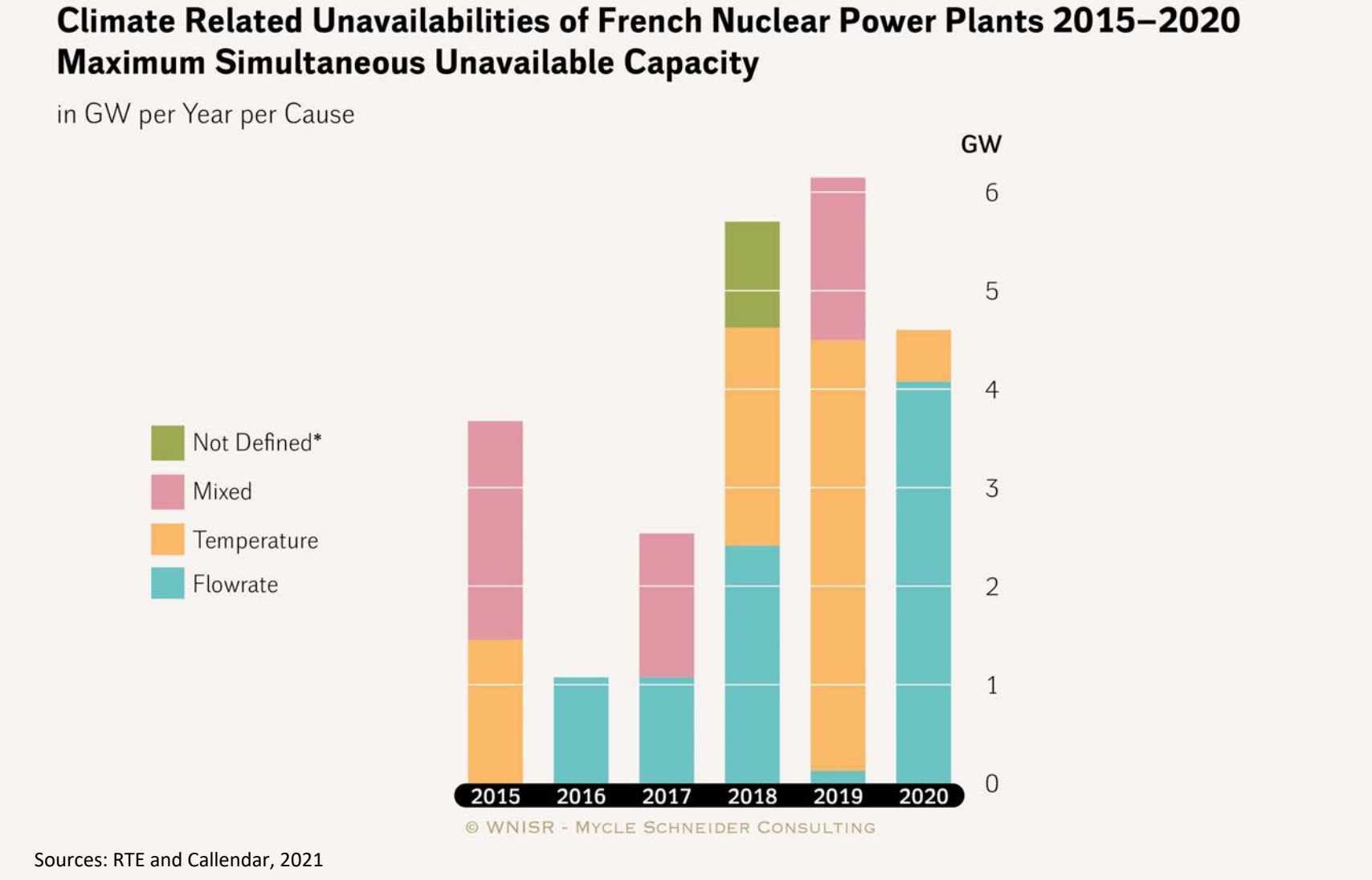
Sources: WNISR, with IAEA-PRIS, 2022



Sources: WNISR, with IAEA-PRIS, 2022



Sources: WNISR, with IAEA-PRIS, 2022



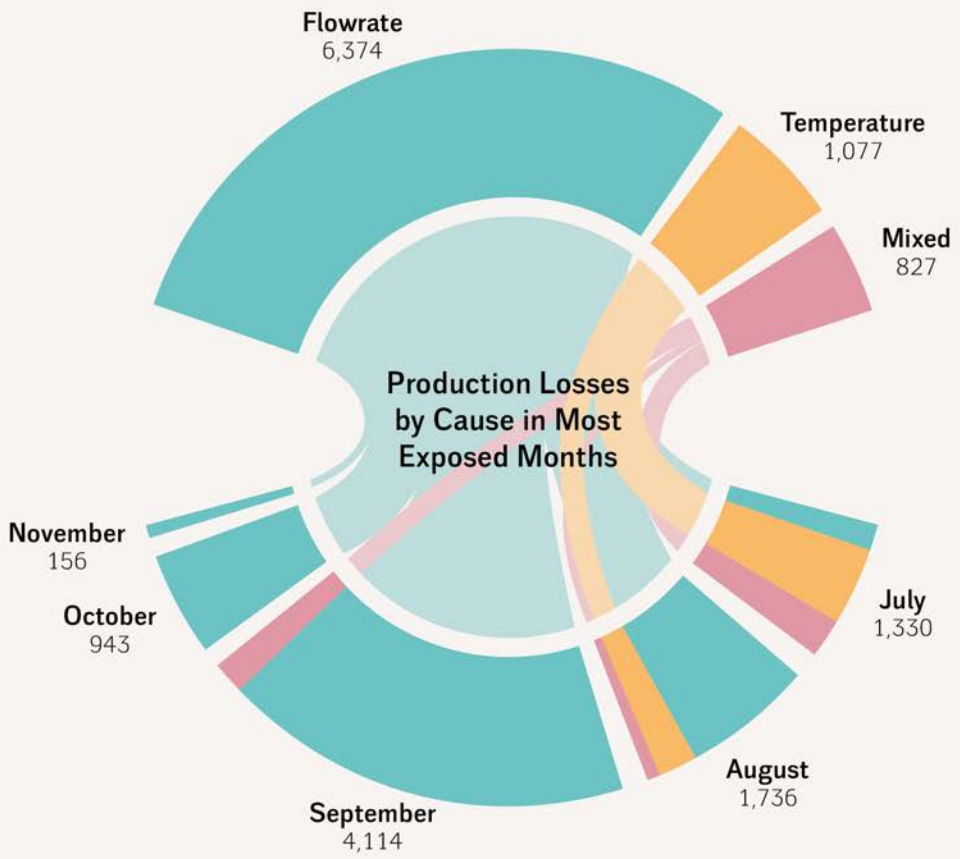
Sources: RTE and Callendar, 2021

Weather-related disruptions of nuclear power production in France since 2015:

- **357 outages** identified
- At least a few dozen disruptions a year
- Up to **2,300 reactor-hours** lost in a year
- Up to **6.2 GW** unavailable

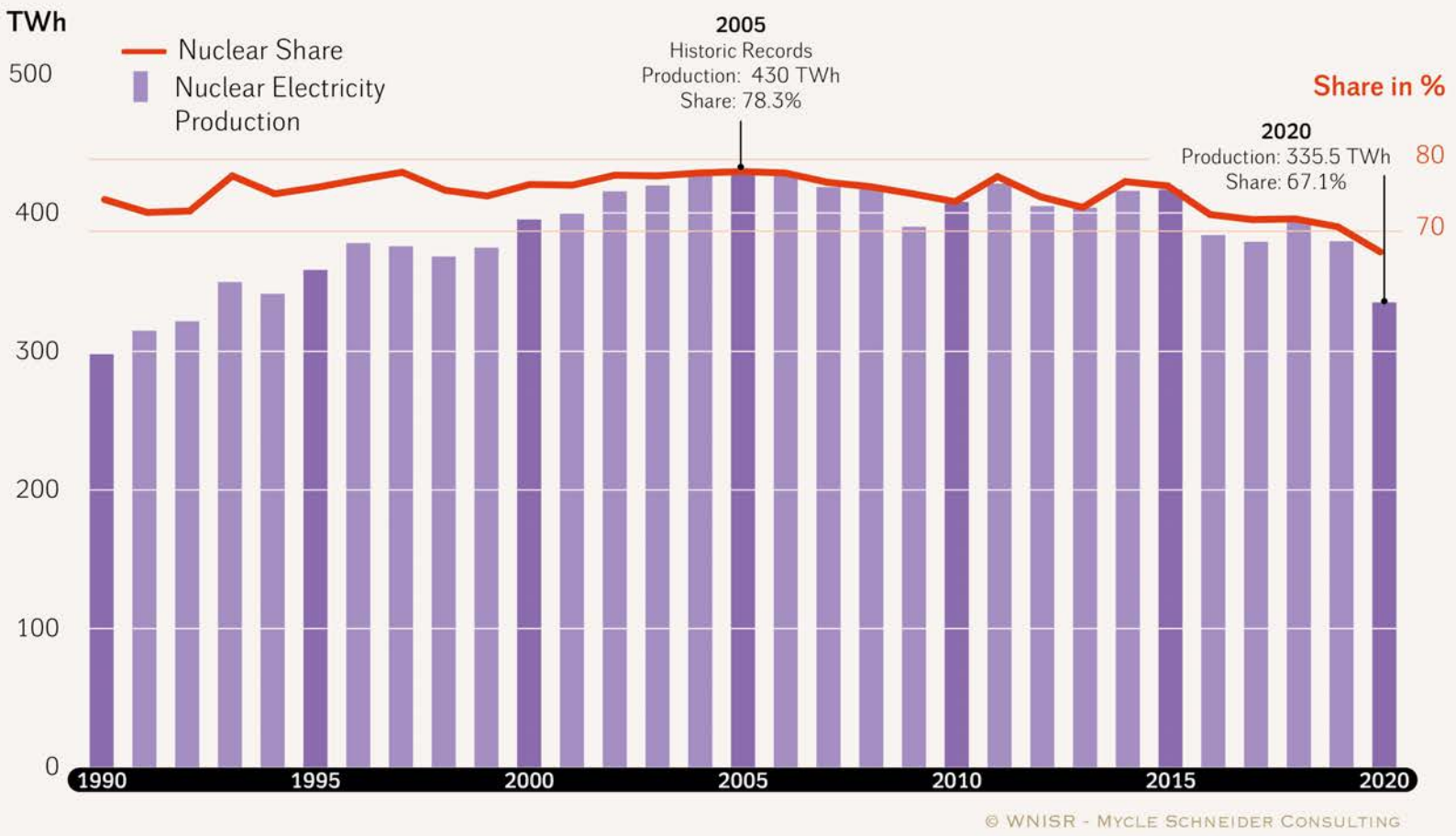
Climate Related Unavailabilities of French Nuclear Power Plants 2015–2020

in GWh by Most Probable Cause and Month



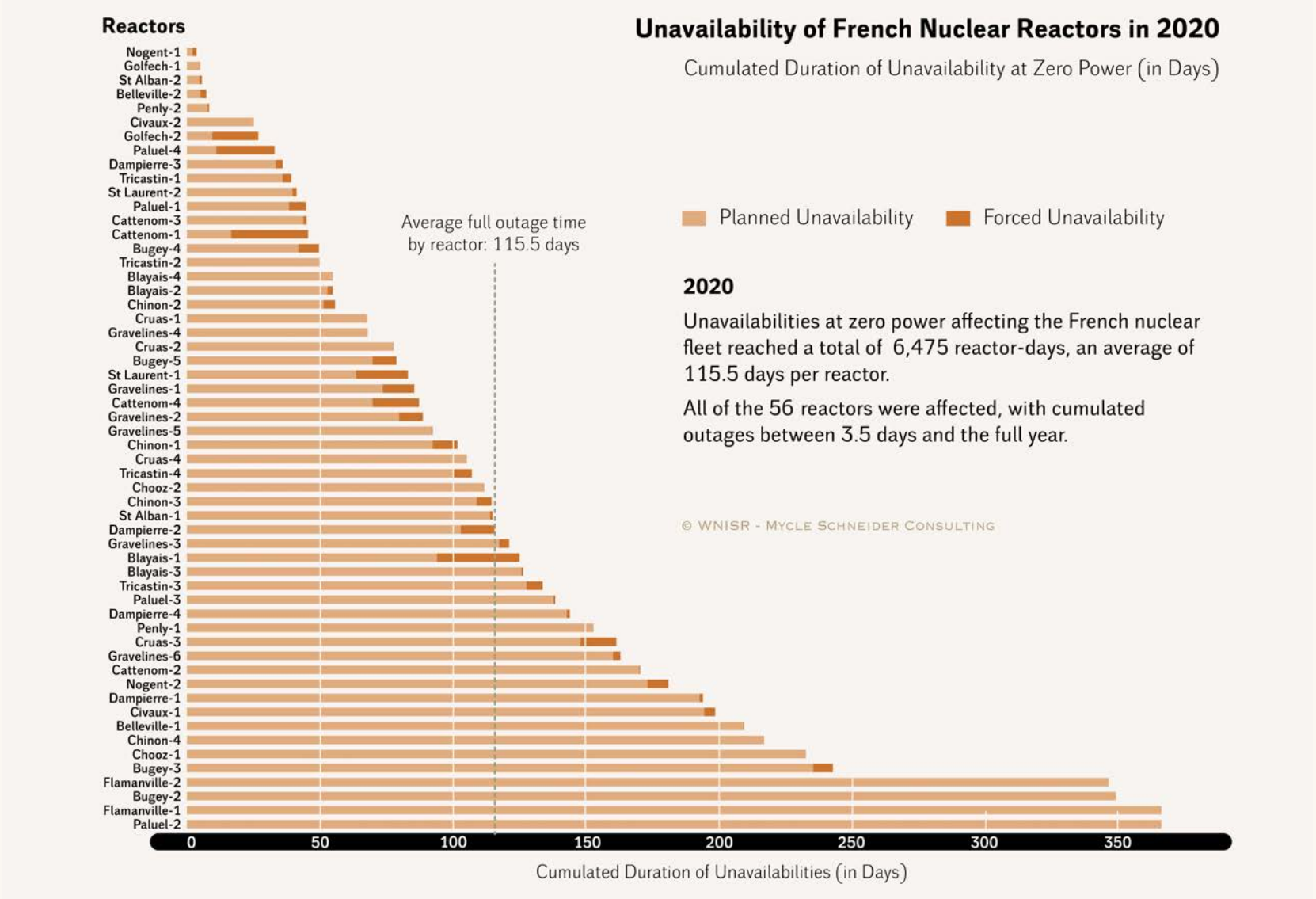
Sources: REMIT, compiled by Callendar 2021

FRANCE FOCUS — UNPRECEDENTED DROP IN NUCLEAR POWER GENERATION



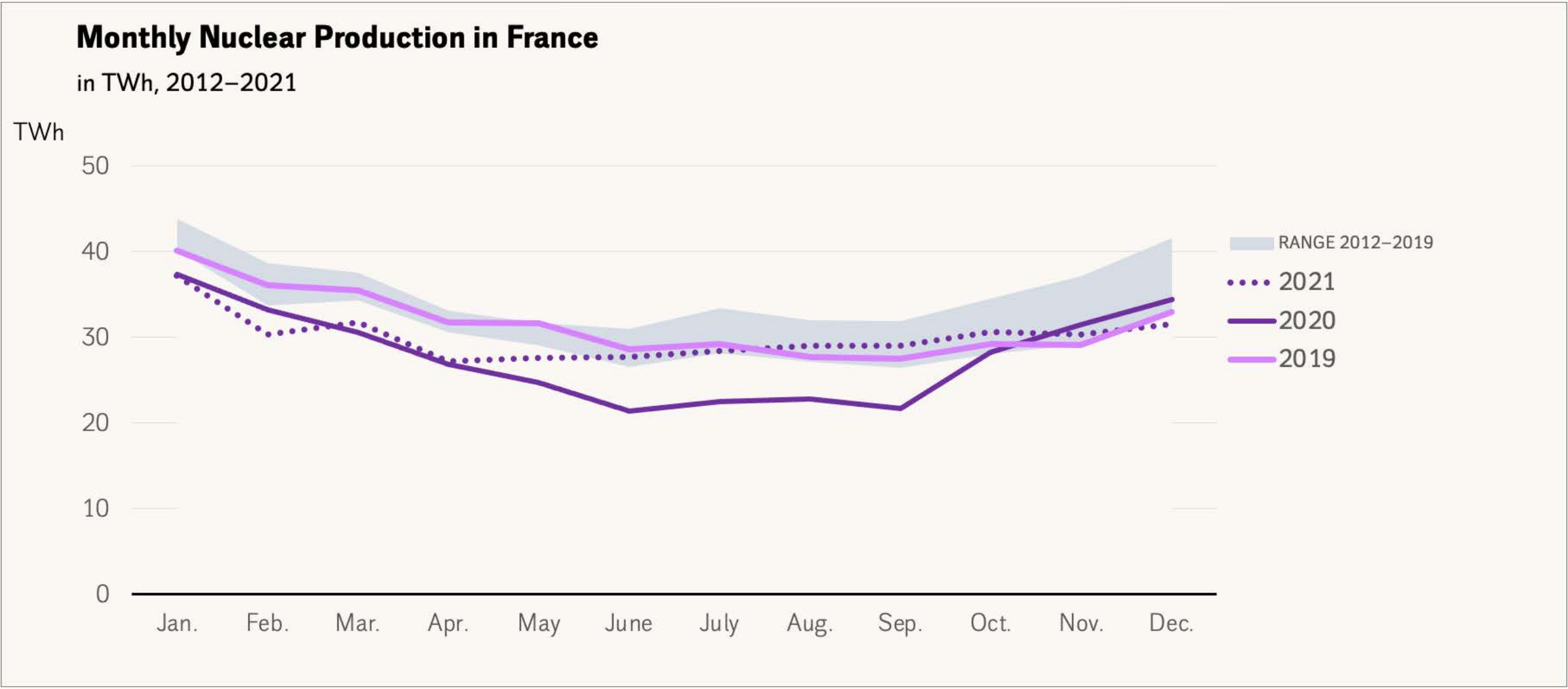
Sources: RTE, 2000–2021

FRANCE FOCUS — NUCLEAR PLANTS INCREASINGLY UNRELIABLE



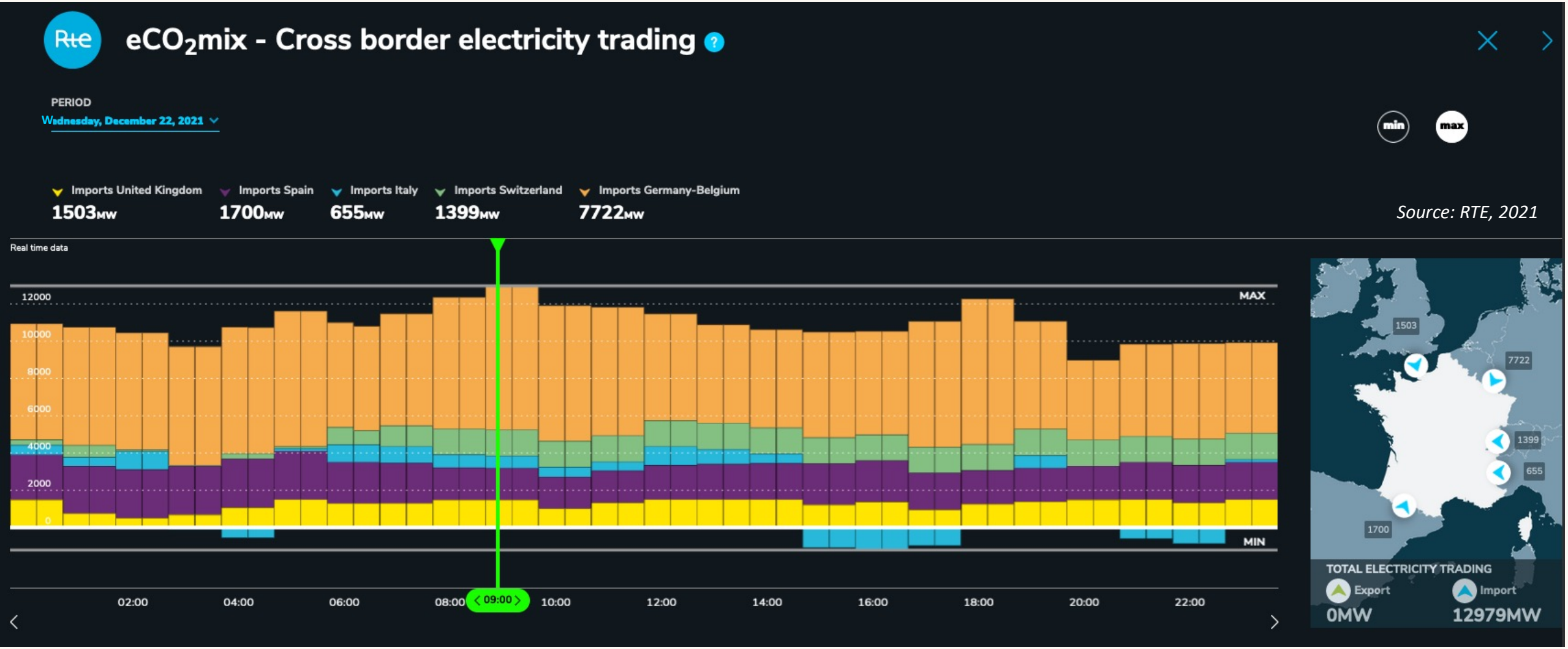
Sources: RTE and EDF, 2021

FRANCE FOCUS — MONTHLY NUCLEAR PRODUCTION IN FRANCE



Source : RTE, EDF, 2021-22

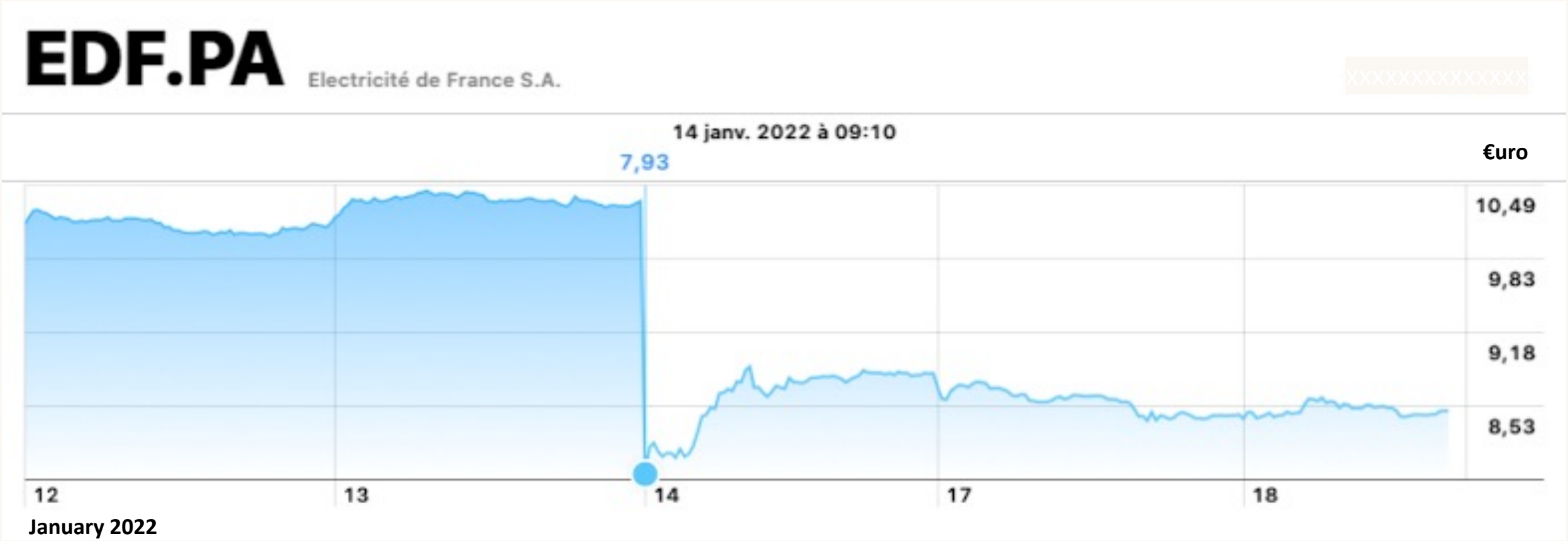
FRANCE FOCUS – POWER EXCHANGE 22 DECEMBER 2021



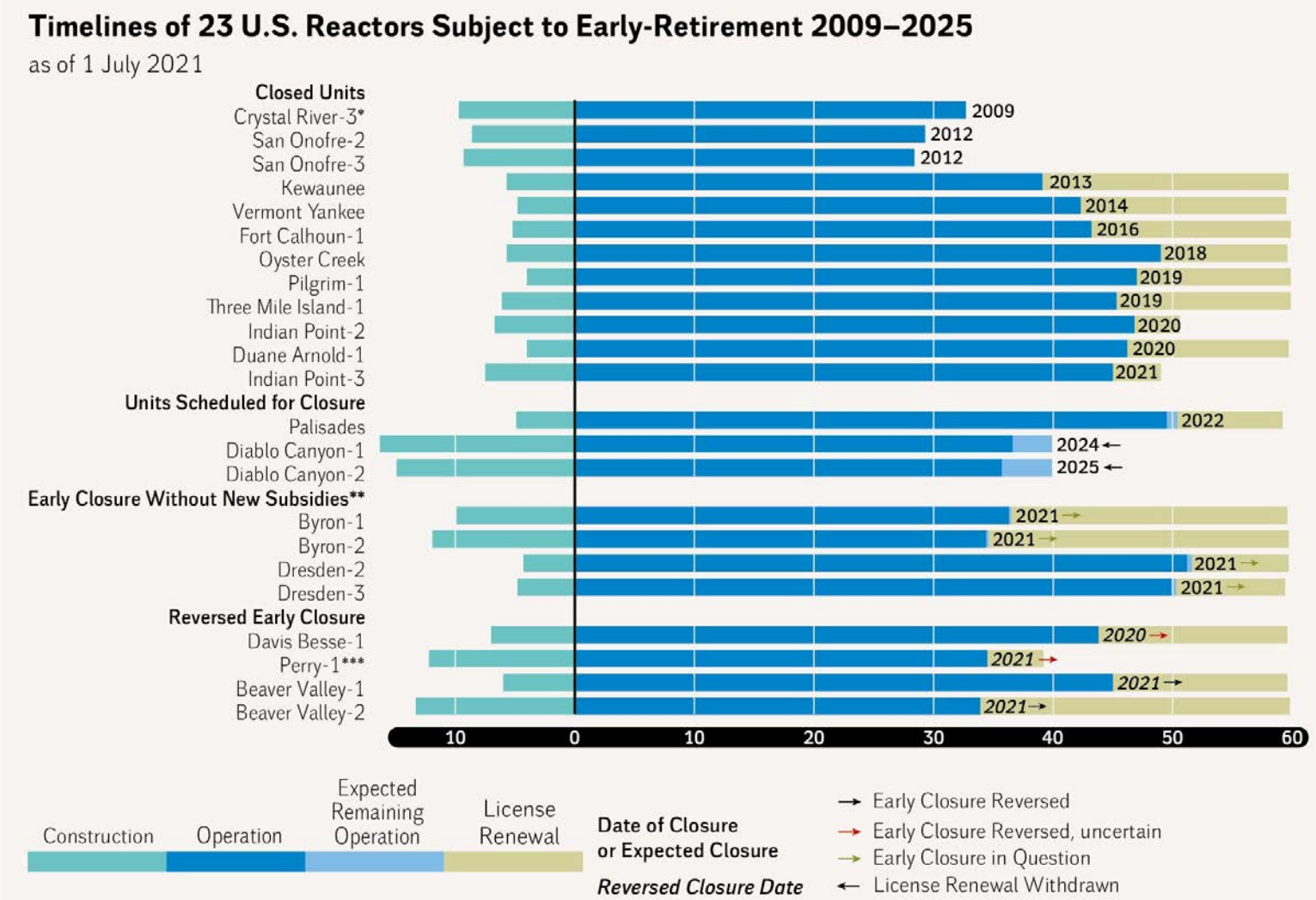
French Power Trade
22 December 2021

- Net import most of the day
- Min. >9 GW net
- Max. 13 GW net *from all neighbouring countries*
- >60% from Germany / Belgium

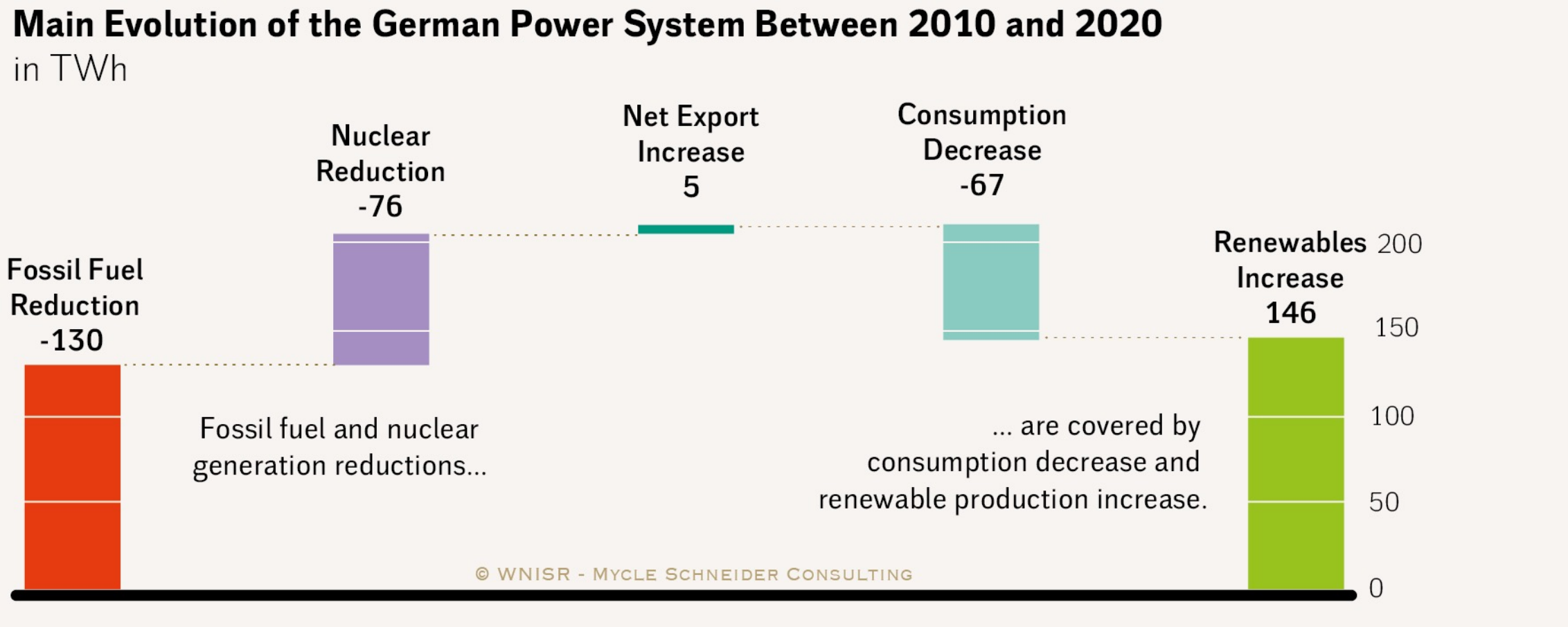
Friday, 14 January 2022: EDF shares plunge by 23% at stock market opening



Source: Yahoo Finance, 18 January 2022



Sources: Various,, compiled by WNISR, 2021



Sources: AG EnergieBilanz, 2021

Tatsujiro Suzuki, Nagasaki — suzukitatsu@nagasaki-u.ac.jp

Tatsujiro SUZUKI is a Vice Director, Professor at the Research Center for Nuclear Weapons Abolition at Nagasaki University (RECNA), Japan. Before joining RECNA, he was a Vice Chairman of the Japan Atomic Energy Commission (JAEC) of the Cabinet Office from January 2010 to March 2014. Until then, he was an Associate Vice President of the Central Research Institute of Electric Power Industry in Japan (1996-2009), an Associate Director of MIT's International Program on Enhanced Nuclear Power Safety from 1988-1993 and a Research Associate at MIT's Center for International Studies (1993-95). He is a member of the Advisory Board of Parliament's Special Committee on Nuclear Energy since June 2017. He is also a Council Member of Pugwash Conferences on Science and World Affairs (2007-09 and from 2014~). Dr. Suzuki has a PhD in nuclear engineering from Tokyo University (1988).

JAPAN FOCUS : 要約「日本の原子力現状」

1. The Fukushima nuclear accidents completely **changed the energy sector** in Japan.
2. Nuclear energy is **no longer most reliable, least expensive, "main" power source** in Japan.
3. Japan's government policy is **self-inconsistent** stating "Japan will reduce its dependence on nuclear power as much as possible" but "maintain it as base load electricity source".
4. There are many **unresolved issues** which **must be addressed regardless of future of nuclear power**, such as nuclear waste disposal.
5. The **lack of independent and reliable information sources**, like the WNISR, is one of the reasons for public mistrust.

Nuclear Power

Operating: **54 units [49 GWe]** (2011/3) → **10 units [10 GWe]** (2021/12)

Share of nuclear power: **26%** (2010) → **4%** (2020)

Coal (29%→31%)—Natural Gas (28% →39%)—Renewables (9% →20%)(2010–2020)

Source : METI, https://www.enecho.meti.go.jp/statistics/total_energy/pdf/gaiyou2020fyr.pdf

Public Opinion

"Nuclear power is necessary": **87.4%** (2010/9) → **24.9%** (2013/12)

"Nuclear power should be maintained **8.0%** or expanded: **2.2%** (2020/10)= **10.2%**

"Nuclear energy should be phased out **48%** or shutdown immediately **8.4%** (2020/10) = **56.4%**

Source : Japan Atomic Energy Relations Organization (JAERO), "Public Opinion on Nuclear Power: 2020 edition", February 2021.
https://www.jaero.or.jp/data/01jigyou/pdf/tyousakenkyu2020/results_2020.pdf

Strategic Energy Plan (2021)

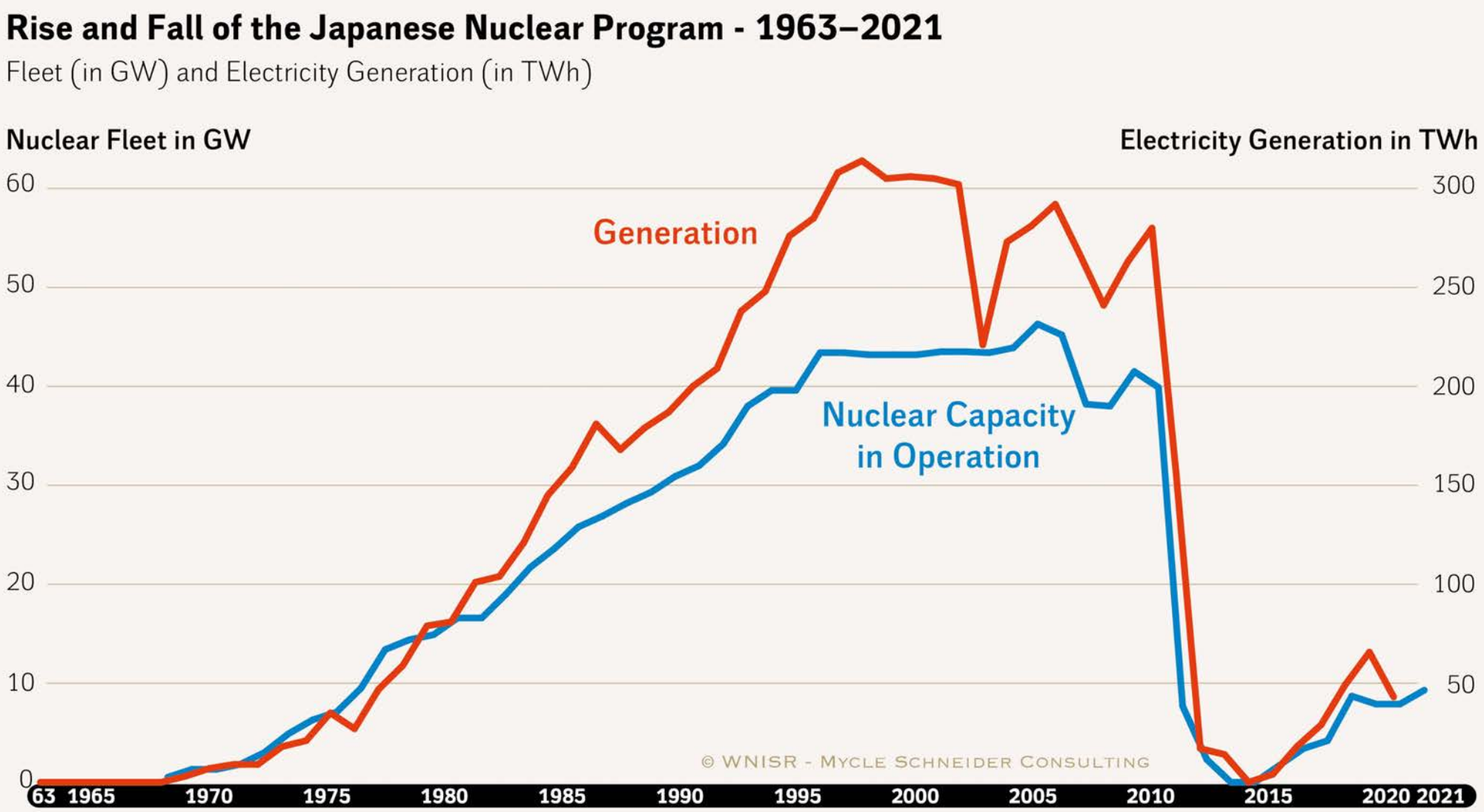
- "Japan, which has experienced the accident at TEPCO's Fukushima Daiichi Nuclear Power Station, is giving the top priority to safety regarding nuclear power when realizing the 2030 energy mix and making its energy choices for 2050 and is reducing its dependency on nuclear power as much as possible as it aims to expand renewable energy. "(p.4)
- "Nuclear power is an important base-load power source as a low carbon and quasi-domestic energy source, contributing to the stability of the energy supply-demand structure in the long term." (p.23)
- "Regarding TEPCO's Fukushima Daiichi Nuclear Power Station accident, the government and nuclear operators must continue their efforts to make sure not to let such accident happen again, not forgetting even for a moment that their falling into the so-called "myth of safety" invited the disastrous situation, sincerely reflecting on that fact."(p.56)

Source: https://www.enecho.meti.go.jp/en/category/others/basic_plan/5th/pdf/strategic_energy_plan.pdf

Still GOJ wants to maintain nuclear power as a base-load electricity source and promote it as a "growth sector" in its "Green Growth Strategy towards 2050 Carbon Neutrality".

Source: METI, "Green Growth Strategy towards 2050 Carbon Neutrality", December 25, 2020, https://www.meti.go.jp/english/press/2020/1225_001.html

JAPAN FOCUS — RISE AND FALL OF THE NUCLEAR PROGRAM

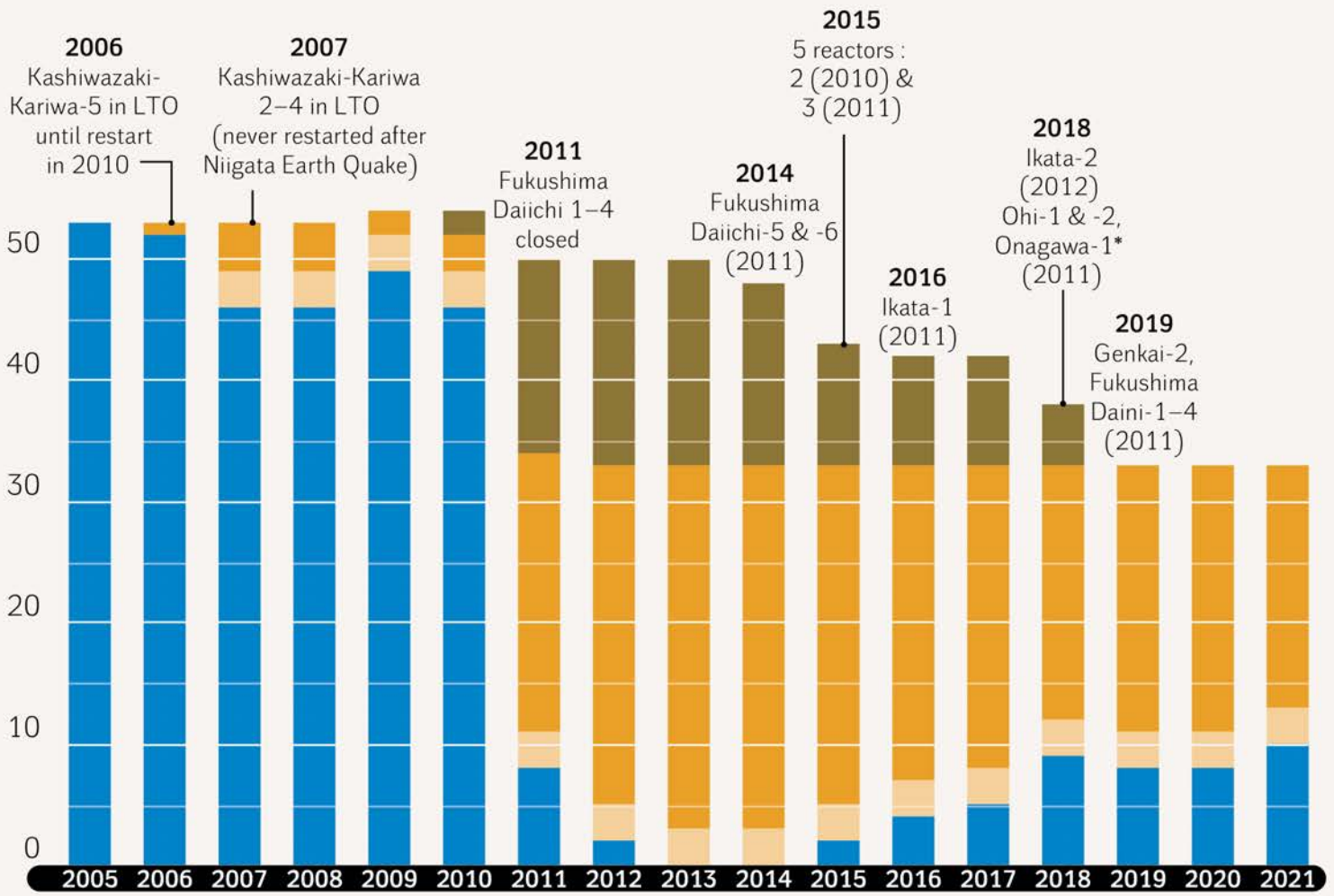


Sources: WNISR with IAEA-PRIS, 2022

JAPAN FOCUS — OFFICIAL VERSUS WNISR ASSESSMENT

Status of Reactors Officially Operational in Japan vs. WNISR Assessment

in Units, as of year end 2005–2021



1 January 2022

Officially Operating
33 Reactors

WNISR Status
10 Operating:
Sendai-1 & -2,
Takahama-3 & -4, Ohi-3 & -4,
Genkai-3 & -4, Mihama-3, Ikata-3.

23 in LTO of which
Kashiwasaki-Kariwa 2–4
since 2007.

YEAR: Officially closed
(YEAR): last production year,
WNISR Closure

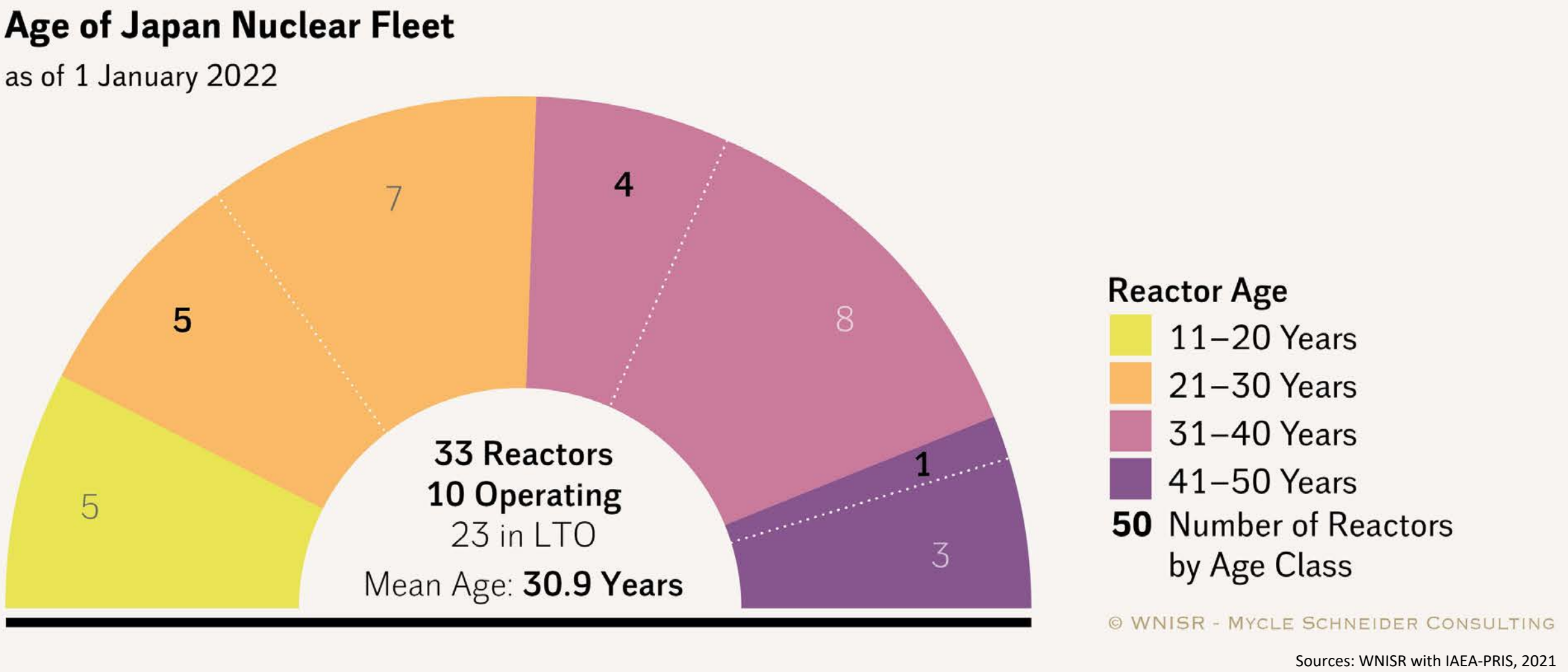
Status

- Operating
- Long Term Outage
- of which since 2007 Earth Quake
- WNISR Closed

* To be decomissioned, but not officially closed yet

Sources: Various, compiled by WNISR

JAPAN FOCUS — AGE OF JAPAN's NUCLEAR FLEET



Sources: WNISR with IAEA-PRIS, 2021

Hisako Sakiyama, Tokyo — sahisako@nifty.com

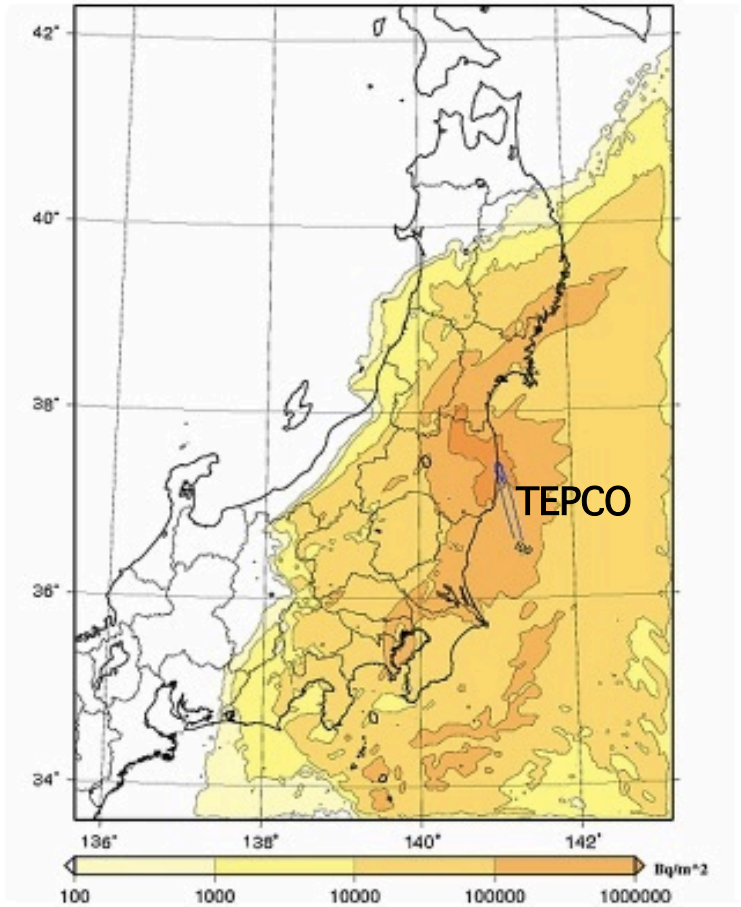
Hisako Sakiyama is the Chair of the Board of Directors of the 3/11 Fund for Children with Thyroid Cancer, which was established in 2016 to provide various forms of support, including financial, for children diagnosed with thyroid cancer following the Fukushima Nuclear Power Plant Disaster. She has also acted as expert witness in a number of lawsuits following the Fukushima disaster. She is a member of Takagi School founded by the late Jinzaburo Takagi in 1999 to train citizen scientists. She and members of the Takagi School are educating the public about the risks of medical exposure in Japan.

She served as a member of the National Diet of Japan Fukushima Nuclear Accident Independent Investigation Commission.

She is the co-author of "Ten Lessons from Fukushima" (Fukushima Booklet Committee), which has been translated into 13 languages.

She received her M.D. and Ph.D. from Chiba University School of Medicine and was a research associate in the department of biochemistry at the Massachusetts Institute of Technology (MIT) (1968-1972). She was a senior researcher at the National Institute of Radiological Sciences (NIRS) working on cancer cell biology (1975-2000).

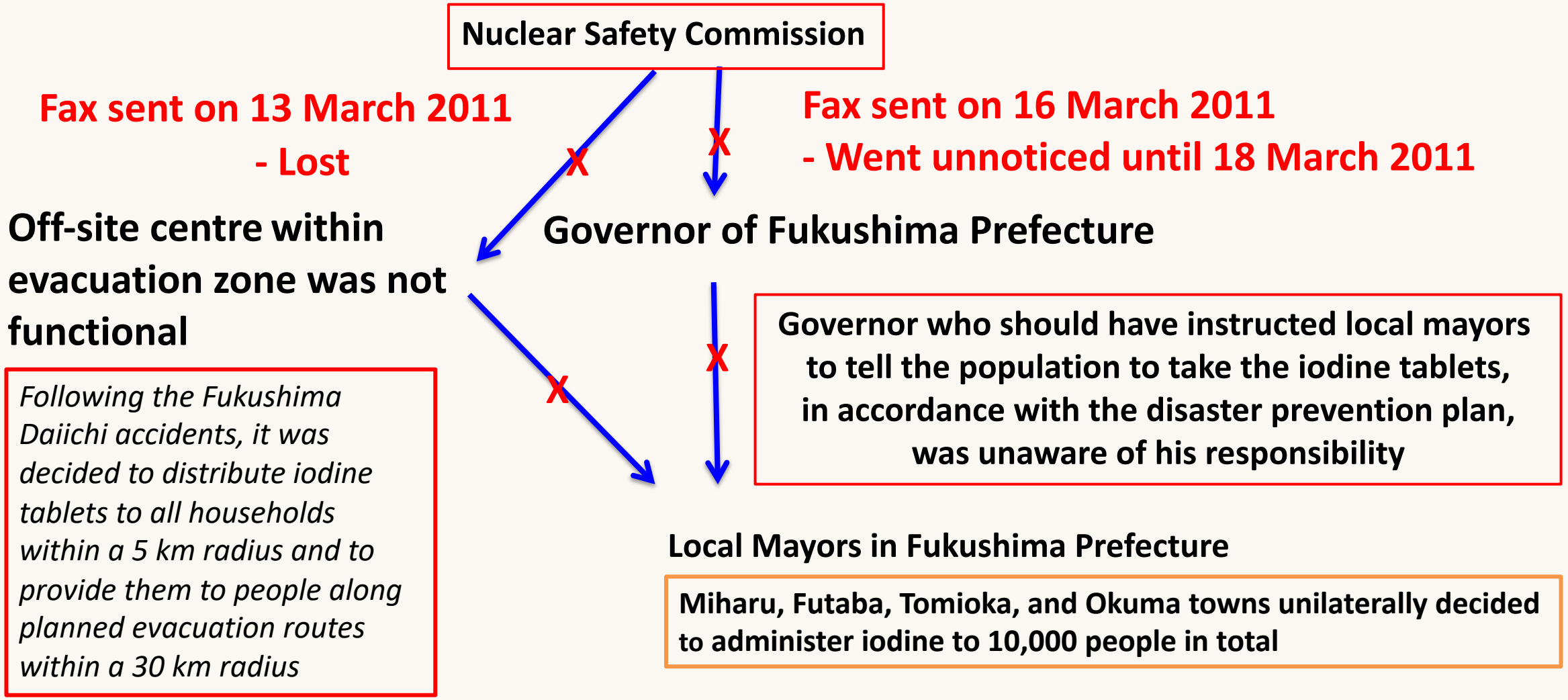
FUKUSHIMA+10 – RADIOACTIVE IODINE DISPERSION



出典：日本原子力研究開発機構「東日本におけるI-131の広域拡散と大気降下量」シミュレーション（2020年3月末頃）

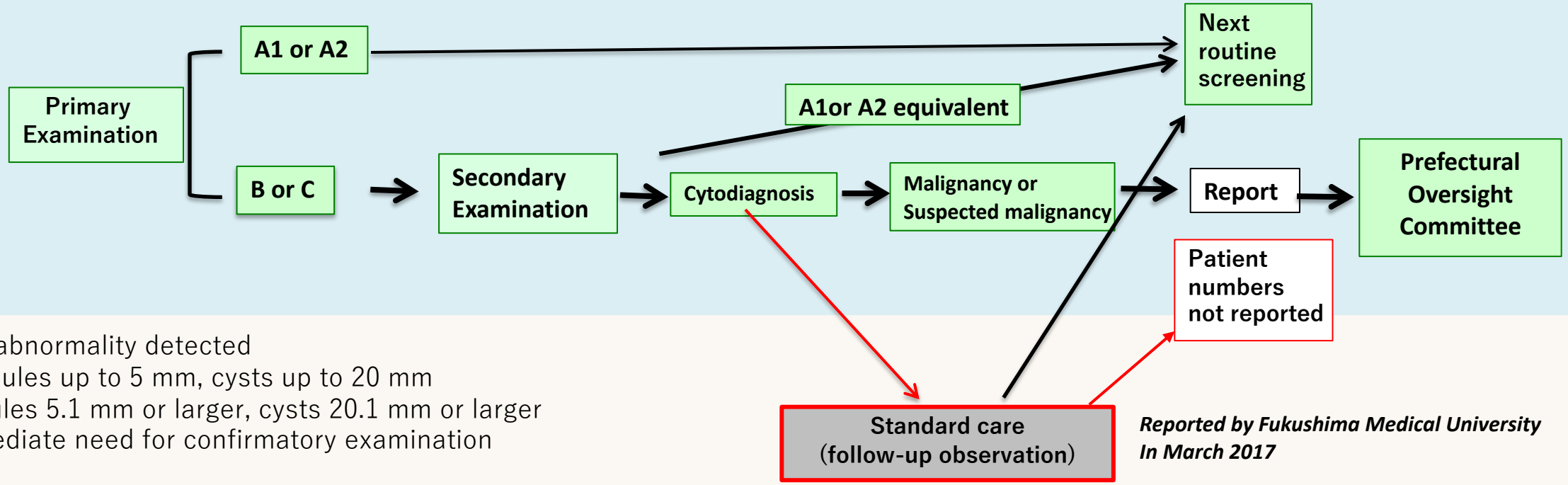
- **Multiple prefectures were contaminated with radioactive iodine (a cause of thyroid cancer).**
- **Thyroid screening carried out in Fukushima Prefecture only.**

Instructions to take iodine tablets as preventative measure were not properly relayed



Thyroid screenings failed to accurately identify thyroid cancer patient numbers

Fukushima Prefectural Health Management Survey Screening Process



A1: No abnormality detected
A2: Nodules up to 5 mm, cysts up to 20 mm
B: Nodules 5.1 mm or larger, cysts 20.1 mm or larger
C: Immediate need for confirmatory examination

Reported by Fukushima Medical University In March 2017

Additional patients identified so far
From 2016-2017 cancer registry: 24 (inc. 19 confirmed cancer cases reported by Shinichi Suzuki）
3.11 thyroid cancer children's fund/surgery performed outside Fukushima: 9

Source: Documents from FHMOC (compiled by 3.11 Fund)

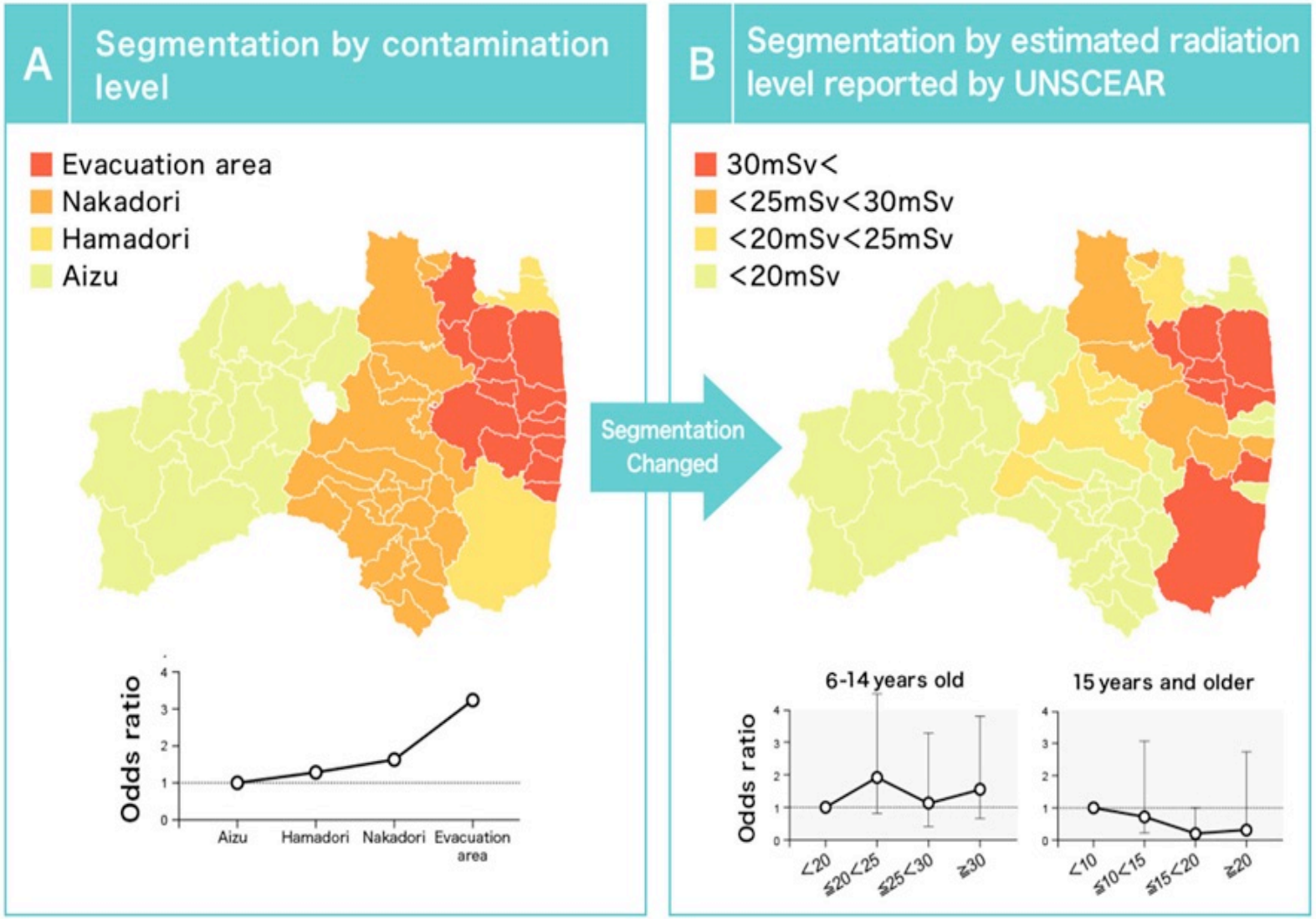
Thyroid Cancers Identified in the Fukushima Prefectural Health Management Survey

	Round 1 (FY2011–2013)	Round 2 (FY2014–2015)	Round 3 (FY2016–2017)	Round 4 (FY2018–2019)	Round 5	For age 25 (FY2017–2021)	Total
Malignant or suspected	116	71	31	36	3	9	266
Previous Round Results		Round 1 results: A1: 33 A2: 32 B: 5 Not examined: 1	Round 2 results: A1: 7 A2: 14 B: 7 Not examined: 3	Round 3 results: A1: 6 A2: 19 B: 8 Not Examined: 3	Round 4 results: Not reported	Round 4 results: A2:2 B:2 Not Examined: 5	
Confirmed	101 Benign:1	55	29	29	1	6	221 Benign:1
Participants (Participation rate)	300,472 (81.7%)	270,540 (71.0%)	217,922 (64.7%)	183,352 (62.3%)	32,404 (12.8%)	7,621 (8.7%)	

Number of people initially rated A1 but developing 5.1 mm+ nodules in 2 years: 46

Sources: FHMSOC, October 2021

FUKUSHIMA+10 – SEGMENTATION ISSUES



Exposure levels were estimated and segmented by the Oversight Committee on the basis of aircraft measurements in the evacuation zone and three regions outside. The causal relationship that is clearly visible when the exposure doses are segmented by contaminated area (A) incorrectly seems to disappear when the doses were segmented according to the UNSCEAR estimate based on the calculated sum of external and internal exposure for two different age groups (B).

Sources: Fund for Children with Thyroid Cancer, FHMSOC, 2021

Comparison of earthquake and tsunami deaths with disaster-related deaths in Fukushima, Miyagi, and Iwate Prefectures

Definition of disaster-related deaths: deaths resulting from conditions exacerbated by the earthquake or illnesses from evacuation stress, legally recognised as being a result of the disaster for the purposes of condolence money payments etc.

Total disaster-related deaths in Japan: 3,784
Disaster-related deaths in Fukushima Prefecture: 2,329 (~2/3 of total)

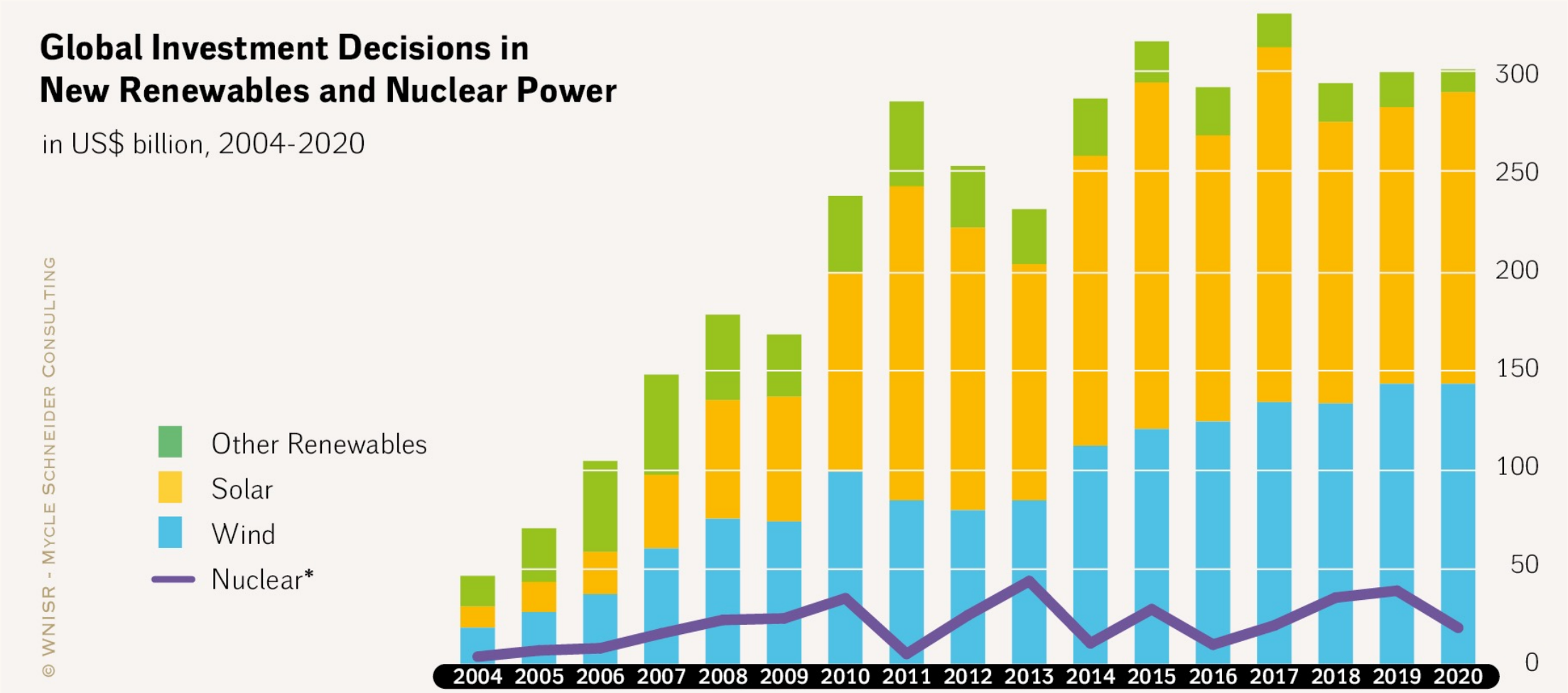
Prefecture	Earthquake Deaths	Tsunami Deaths	Earthquake + Tsunami Deaths	Disaster-related Deaths
Fukushima	1,466	1,275	2,741 (10.6%)	2,329 (62.5%)
Miyagi	8,745	6,674	15,419 (59.6%)	929 (24.9%)
Iwate	4,243	3,479	7,722 (48.6%)	470 (12.6%)

Although direct deaths from the earthquake and tsunami in Fukushima were 1/5 and 1/6 of those in Iwate and Miyagi respectively, disaster-related deaths are 2.5 and 5 times higher in Fukushima.

Source: Reconstruction Agency, as of Sept 2021

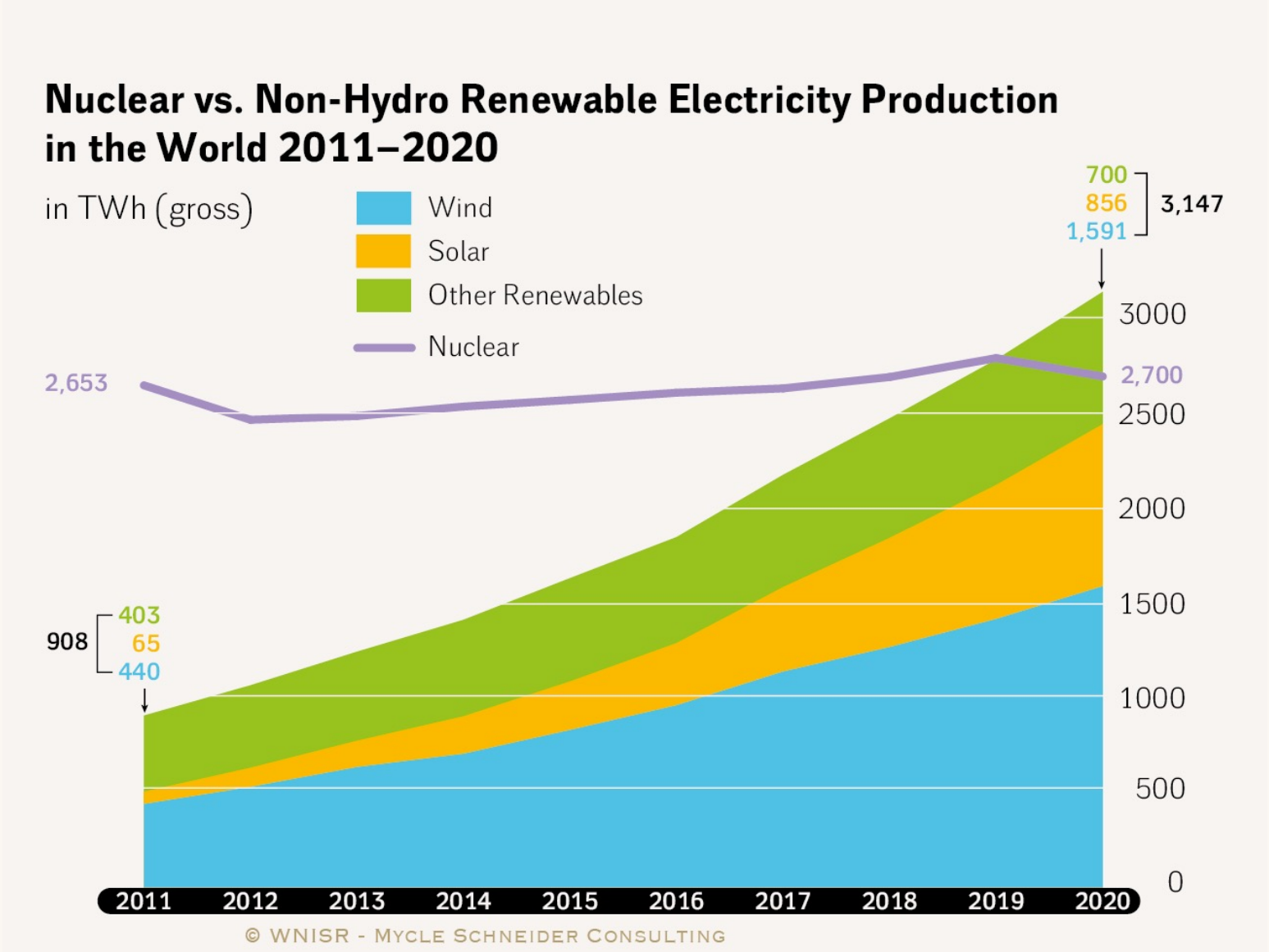
Antony Froggatt joined Chatham House in 2007 and is Deputy Director and a Senior Research Fellow in the Energy, Environment and Resources Department. He has worked as an independent consultant for 20 years with environmental groups, academics and public bodies in Europe and Asia. His most recent research projects are understanding the energy and climate policy implications of Brexit, climate risk (particularly in China) and on the technological and policy transformation of the energy sector. Since 1992 he has been the co-author of the World Nuclear Industry Status Report, a now annual independent review of the nuclear sector.

NUCLEAR POWER VS. RENEWABLES DEPLOYMENT



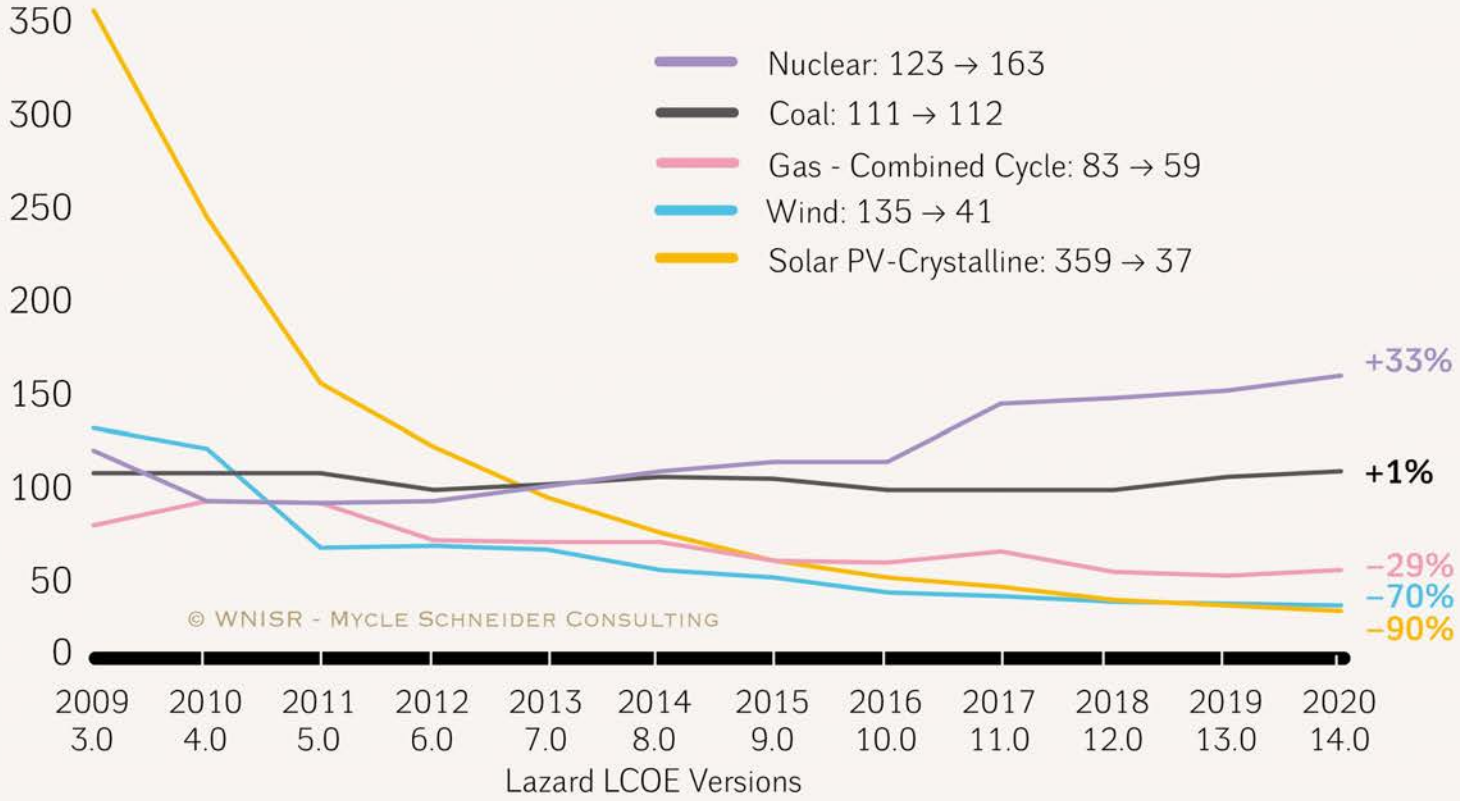
Sources: FS-UNEP/BNEF 2018, 2020, REN21 2019, BNEF 2021 and WNISR Original Research, 2021

NUCLEAR POWER VS. RENEWABLES DEPLOYMENT



Sources: BP Statistical Review, 2021

NUCLEAR POWER VS. RENEWABLES DEPLOYMENT



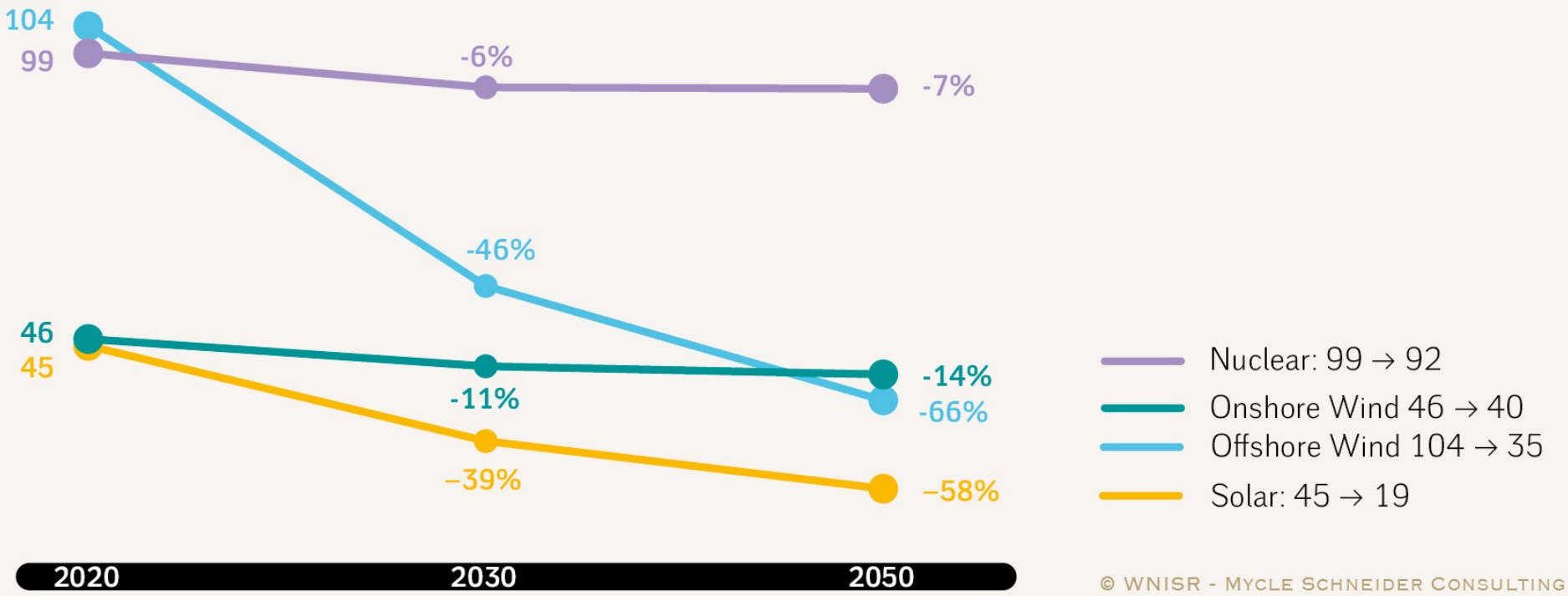
* Reflects total decrease in mean LCOE since Lazard's LCOE VERSION 3.0 in 2009.

Source: Lazard Estimates, 2020

NUCLEAR POWER VS. RENEWABLES DEPLOYMENT

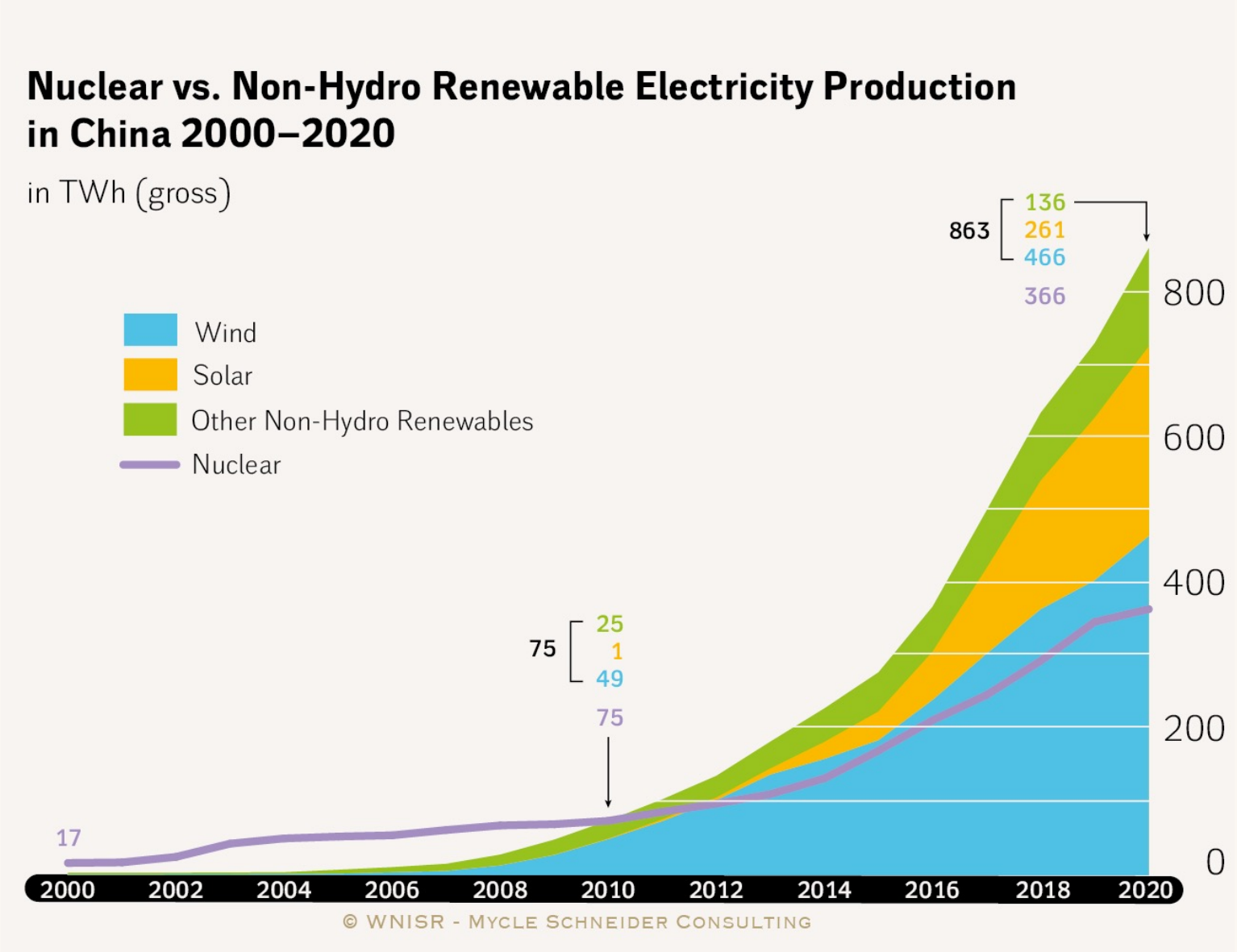
2050 Forecasted Average Cost of Electricity from Nuclear and Renewables

in US$/MWh



Source: IEA, 2021

NUCLEAR POWER VS. RENEWABLES DEPLOYMENT

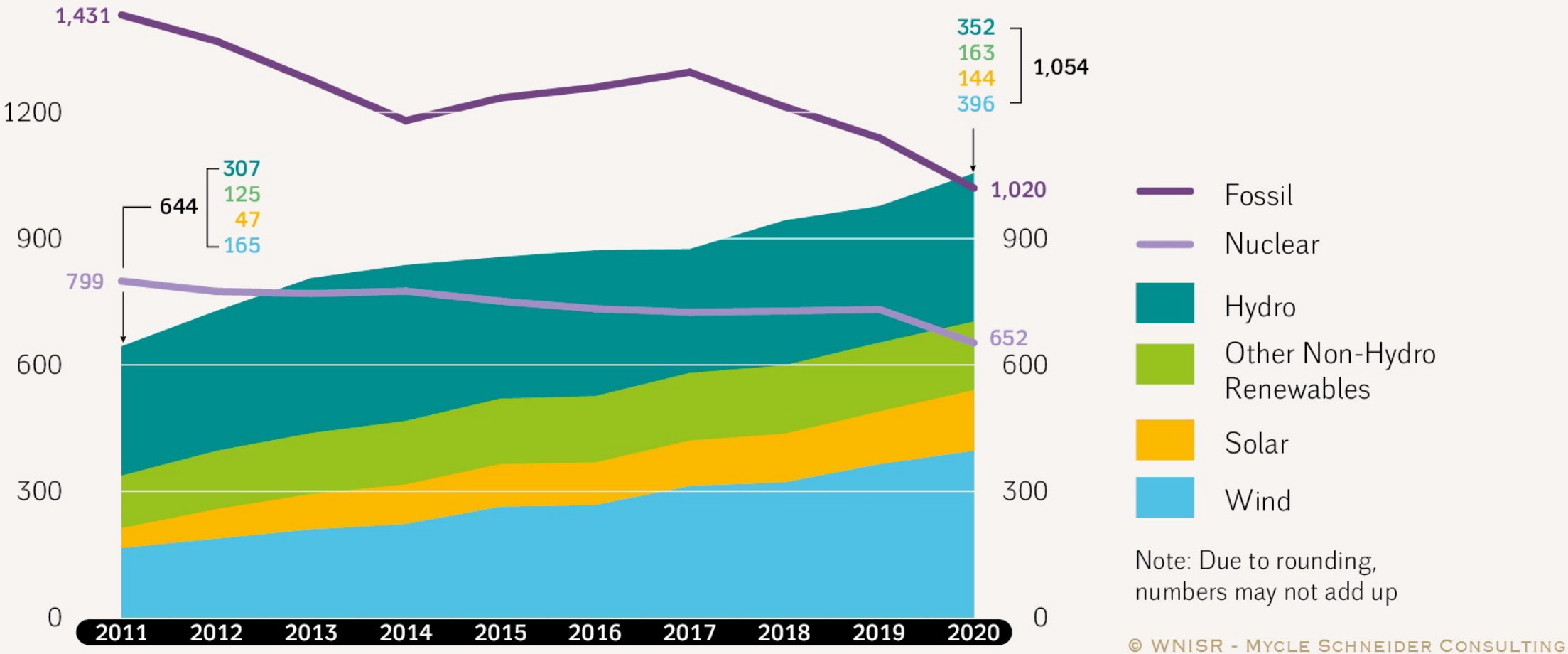


Sources: BP Statistical Review, 2021

NUCLEAR POWER VS. RENEWABLES DEPLOYMENT

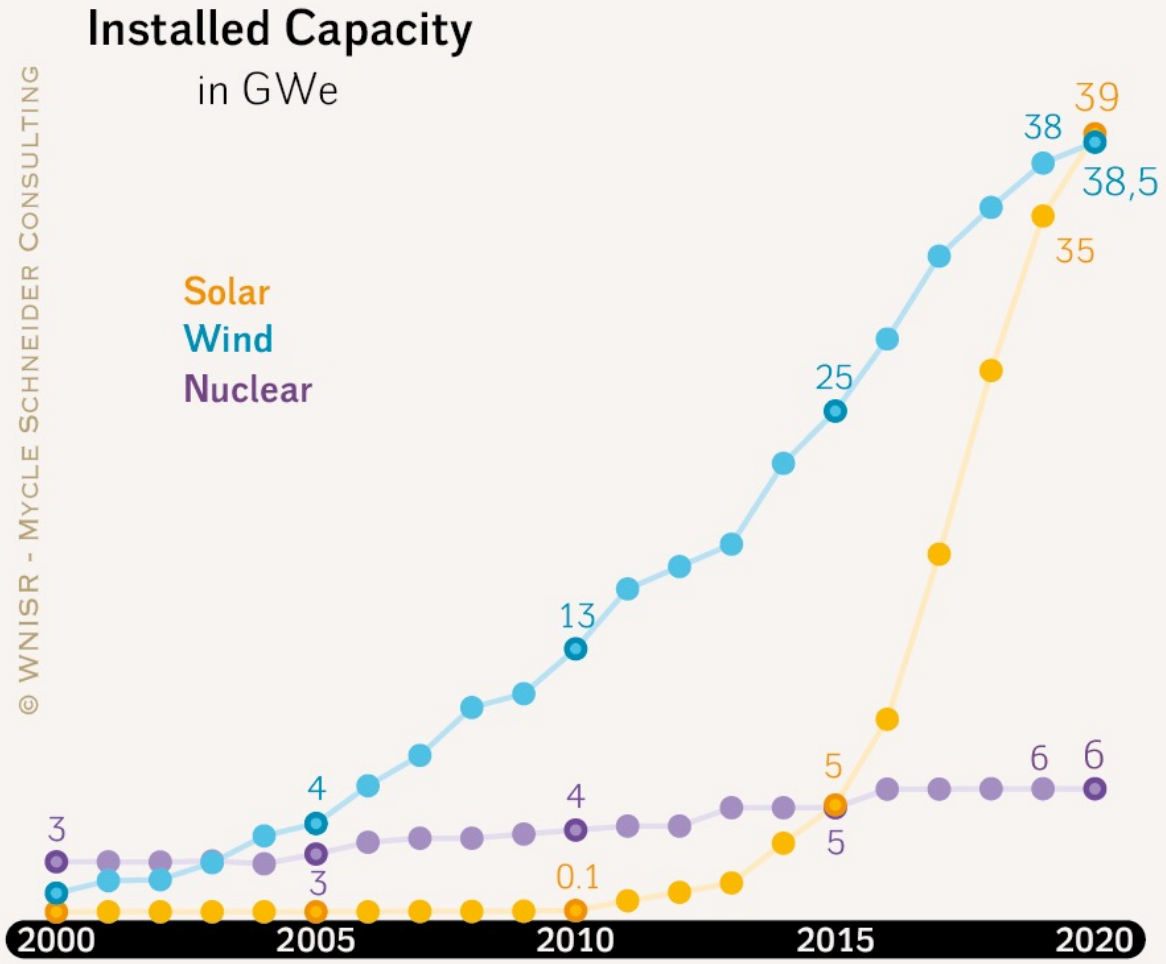
Electricity Production in the EU27 2011–2020

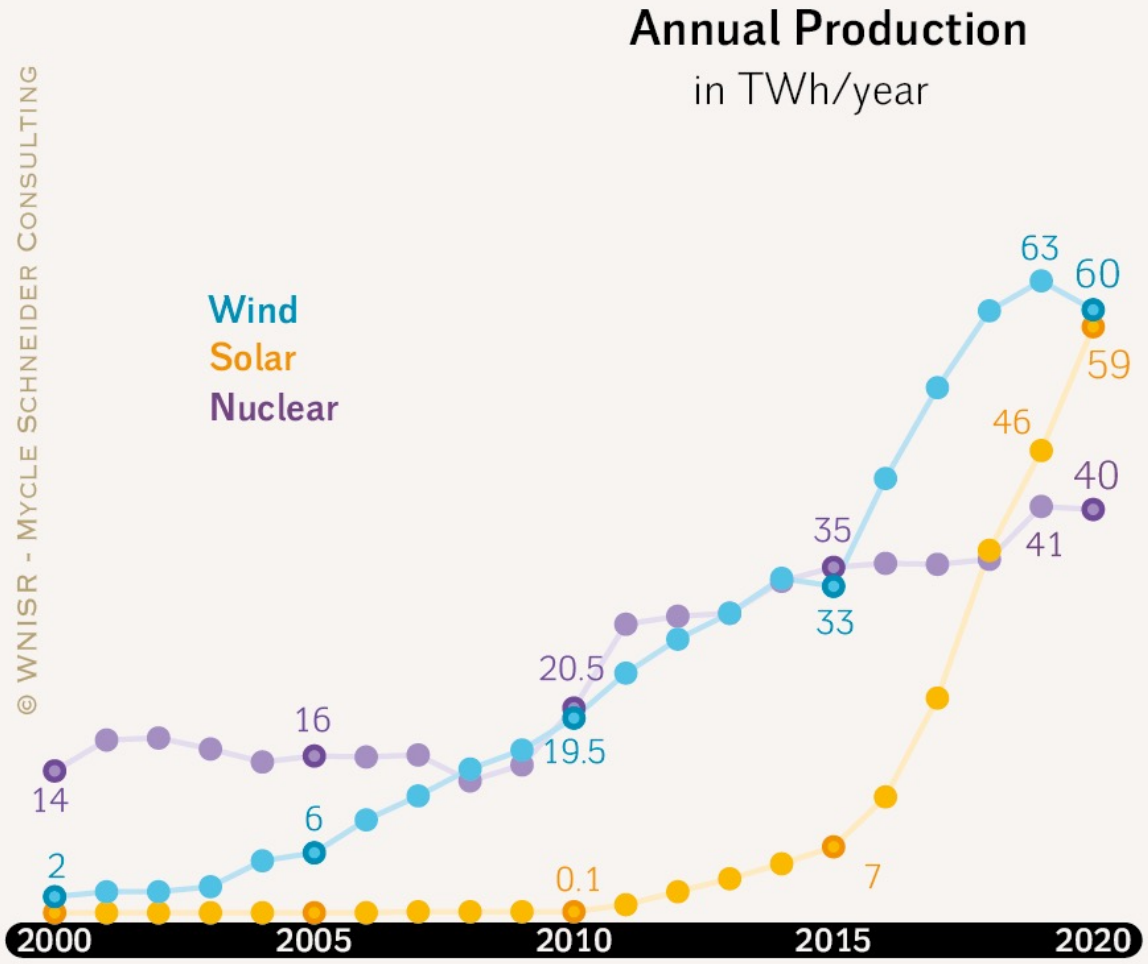
in TWh/year



Note: Due to rounding, numbers may not add up

Wind, Solar and Nuclear Capacity and Electricity Production in India 2000–2020





Sources: WNISR with IAEA-PRIS, IRENA, BP Statistical Review, 2021

CONCLUSIONS

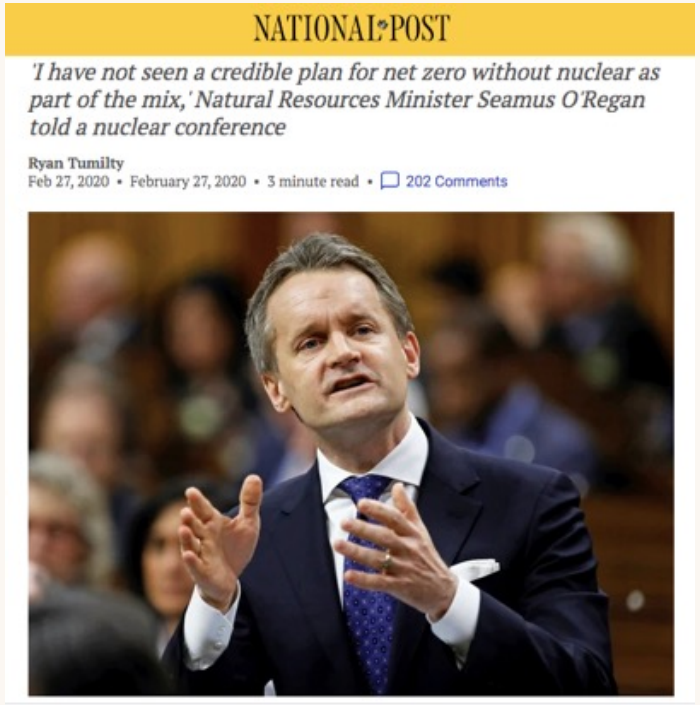
- In 2020, nuclear power generation plunged by un an unprecedented margin except for the aftermath of 3/11 (2011–12).
- The French case illustrates increasing difficulties with ageing reactors, the nuclear share dropped to 35-year low in 2020.
- Non-hydro renewables—mainly wind, solar and biomass—have out-performed nuclear power on a global scale. Hydro alone has been generating more power than nuclear for most of the past three decades.
- For the first time, *non-hydro* renewables generated more power in the European Union than nuclear, and renewables *including hydro* generated more power than all fossil fuels combined.
- Net nuclear capacity addition—new startups minus closure decisions—declined to 0.4 GW in 2020 and turned negative in 2021 compared to +290 GW for renewables alone. Nuclear is irrelevant in today's electricity capacity newbuild market.
- Small Modular Reactors (SMRs) get a lot of media coverage, some public money, but are so far unavailable commercially and will not be—if ever—for another 10–15 years. Pilot projects in Argentina, China, and Russia have been disappointing.
- The situation at Fukushima, onsite/offsite, remains unstable. Effects on health and well-being are significant. Cost estimates have risen, currently range from US$223.1 billion (Gov.) to US$322–758 billion (independent). Japanese courts have acquitted Government/TEPCO officials over disaster responsibility but ruled against reactor operation in some cases.
- Nuclear power demonstrated a high sensibility to the COVID-19 pandemic. A first analysis shows that it has a low resilience against the most common climate change effects. Nuclear's resilience will likely further decline.
- There is a real question about the exposure of the nuclear power sector to criminal activities including bribery and corruption, counterfeiting and other falsification, as well as infiltration by organized crime.

Annexes

- Small Modular Reactors
- European Union Taxonomy
- Newbuild Program in France?

Small Modular Reactors (SMRs) – Public Attention

- **Lots of media coverage**
- **Some public funding**
- **Favourable regulation**



NATIONAL POST

'I have not seen a credible plan for net zero without nuclear as part of the mix,' Natural Resources Minister Seamus O'Regan told a nuclear conference

Ryan Tumilty
Feb 27, 2020 • February 27, 2020 • 3 minute read • 202 Comments

Example Canada

- 2018: Federal funding for SMR roadmap
- 2020: Federal government released action plan
- October 2020: CAD20 million (US$16 million) in federal funding to Terrestrial Energy
- March 2021: CAD50 million (US$40 million) in federal funding to Moltex
- October 2020: Ontario Power Generation announced agreements with GE Hitachi, Terrestrial Energy and X-energy

SMRs – Project Delays and Poor Performance

- **Argentina**

  Carem-25 construction start 2014; November 2020 report: “physical completion of Carem 25 is at 70%”; No completion date.

- **China**

  HTR-PM (2 x 100 MW) construction start 2012; projected to generate electricity in 2017; only one module grid-connected so far (four years late).

- **Russia**

  KLT-40S (2 x 30 MW) construction start 2007; projected to start operations in October 2010; commissioned in May 2020; load factors in 2020 just 29 and 16 percent.

SMRs – Reactor Design Delays

India

AHWR 2000 projection: operating by 2011; no current construction plans.

USA

NuScale 2008 projection: electricity generation by 2015-16; current: 2029-30?

Russia

"Federal Program for Advanced Nuclear Technologies" in 2012: three commercial fast neutron reactors by 2020, including the BREST-300, as well as the lead-bismuth cooled SVBR-100, and the sodium-cooled BN-1200; BREST construction start in June 2021.

SMRs – Smaller Size, New Challenges

- **Loss of economies of scale**

  - Nuclear power is already costly

$$\frac{K_1}{K_2} = \left(\frac{S_1}{S_2}\right)^{0.6}$$

- **More spent fuel/proliferation potential**

  - Accentuates problems

EUROPEAN UNION TAXONOMY — What is it?

- The EU Taxonomy is a classification system for sustainable economic activities.
- Overall goal is to create transparency and disclose the impact of investments. It is part of the EU Action Plan Financing Sustainable Growth (European Commission).
- Aims to enable the financial system to guide investment decisions into a more sustainable direction and thus accelerate the transition to a circular economy in Europe and beyond.

Sources: Various, compiled by Antony Froggatt

EUROPEAN UNION TAXONOMY — Timeline

- Taxonomy Regulation published 22 June 2020, entered into force 12 July 2020.
- Draft delegated act for first two environmental objectives (climate change mitigation and adaptation) approved 21 April 2021.
- Delegated Act supplementing Article 8 of the Taxonomy Regulation adopted 6 July 2021 (specifies the content, methodology and presentation of information to be disclosed by financial and non-financial undertakings). Taxonomy compass launched.
- The draft delegated acts for the remaining four environmental objectives are expected to be published by the end of 2021.
- The Taxonomy is expected to go into force for the first two environmental objectives by the end of 2021, and for the remaining four objectives by the end of 2022. The Taxonomy will be fully operational by 2023.
- 1 January 2022, European Commission announced consultation on Complementary Delegated Act covering certain nuclear and natural gas activities.
- Disclosure requirements apply on 1 January 2022 in relation to the climate objectives, and on 1 January 2023 in relation to the other four environmental objectives.

Sources: Various, compiled by Antony Froggatt

EUROPEAN UNION TAXONOMY — Who will be impacted?

- **Companies**
  - ...already required to provide non-financial information under the Corporate Sustainability Reporting Directive will have to disclose the share of their Taxonomy-aligned activities.
  - ...will benefit from a tool to measure the sustainability level of a particular investment and gradually increase the share of a company's sustainable economic activities.
- **Financial Market Participants**
  - ...offering sustainable finance products.
  - ...will benefit helping them to avoid investments in green-washing and support institutional investors (such as insurance companies or pension funds) to invest their long-term capital in sustainable economic activities.
- **Public Sector**
  - ...used to define green financial products via the EU Ecolabel/EU green bond standards.

Sources: Various, compiled by Antony Froggatt

EUROPEAN UNION TAXONOMY — Nuclear Power

The European Commission considers there is a role for natural gas and nuclear power as means to facilitate the transition towards a predominantly renewables-based future.

- Public consultation launched on 1 January and closed on 12 January 2022...
- European Parliament and European Council have four months. Majority of 20 Member States and majority of European Parliament can overturn proposal (highly unlikely).

Leaked Draft Delegated Regulation — Nuclear Power

- Nuclear power plant investments designated as sustainable under certain conditions, incl. the project "has a plan with detailed steps to have in operation, by 2050, a disposal facility for high-level radioactive waste".
- Nuclear supporting renewables? "Finally, by providing a stable baseload energy supply, nuclear energy facilitates the deployment of intermittent renewable sources and does not hamper their development" as required by the Taxonomy Regulation. Hard to demonstrate.
- Lifetime extensions also sustainable? "In view of the long lead times for investments in new nuclear generation capacity, extending the service time of selected existing nuclear installations can support the decarbonisation of the energy system in the near to medium term. The technical screening criteria for such extensions should, however, include modifications and safety upgrades..."

Sources: Various, compiled by Antony Froggatt

Leaked Draft Delegated Regulation — Natural Gas

- Natural gas plants are considered sustainable if they produce emissions below 270 g of CO_2 equivalent per kilowatt-hour, replace more polluting fossil fuel plants, receive a construction permit by 31 December 2030, and the power generated by the activity may not yet efficiently be replaced by power generated from renewable energy sources.

- Also, “the facility demonstrates compatibility with co-firing of low carbon gaseous fuels and there are effective plans or commitments, approved by the management body, to use at least 30% of renewable or low-carbon gases as of 1 January 2026, and at least 55% of renewable or low- carbon gases as of 1 January 2030, and to switch to renewable or low-carbon gases and the switch takes place by 31 December 2035”.

Macron Announcement 9 November 2021

- "For the first time in decades, we will relaunch the construction of nuclear reactors in our country". No date, no site, no numbers. ("*Nous allons, pour la première fois depuis des décennies, relancer la construction de réacteurs nucléaires dans notre pays").*

Leaked October 2021 Government Paper on "New Nuclear"

- Design choices "to be confirmed et uncertainties to be lifted to guarantee the constructibility of the EPR2".
- EDF estimates that "more than 20 million engineering hours" are necessary to get from the "basic design" to "detailed design".
- EDF cost estimate increased by 13% between early 2020 and mid-2021.
- Grid connection of first reactor between 2039 and 2043, sixth reactor 2047–2051.
- Document renders obsolete timeline and nuclear economics of grid operator RTE major study "Future énergétique 2050" released also in October 2021.

Source: Gouvernement France, "Travaux relatifs au nouveau nucléaire — PPE 2019-2028", Octobre 2021