Nuclear Industry Worldwide: Revival or Technology Geriatrics?

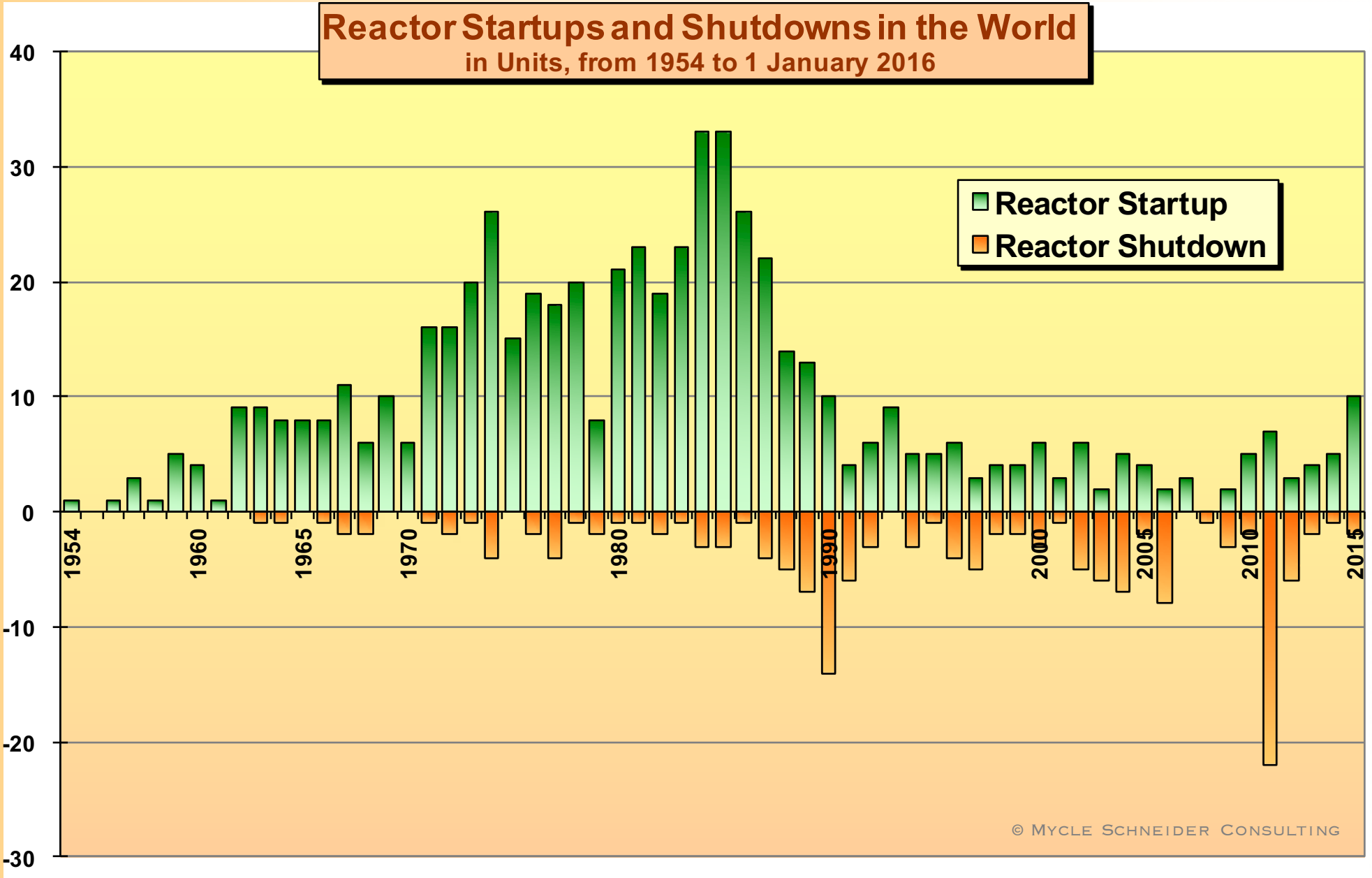
The World Nuclear Industry Status Report 2015 – Free download at www.WorldNuclearReport.org

Mycle Schneider

International Consultant on Energy and Nuclear Policy, Paris, France

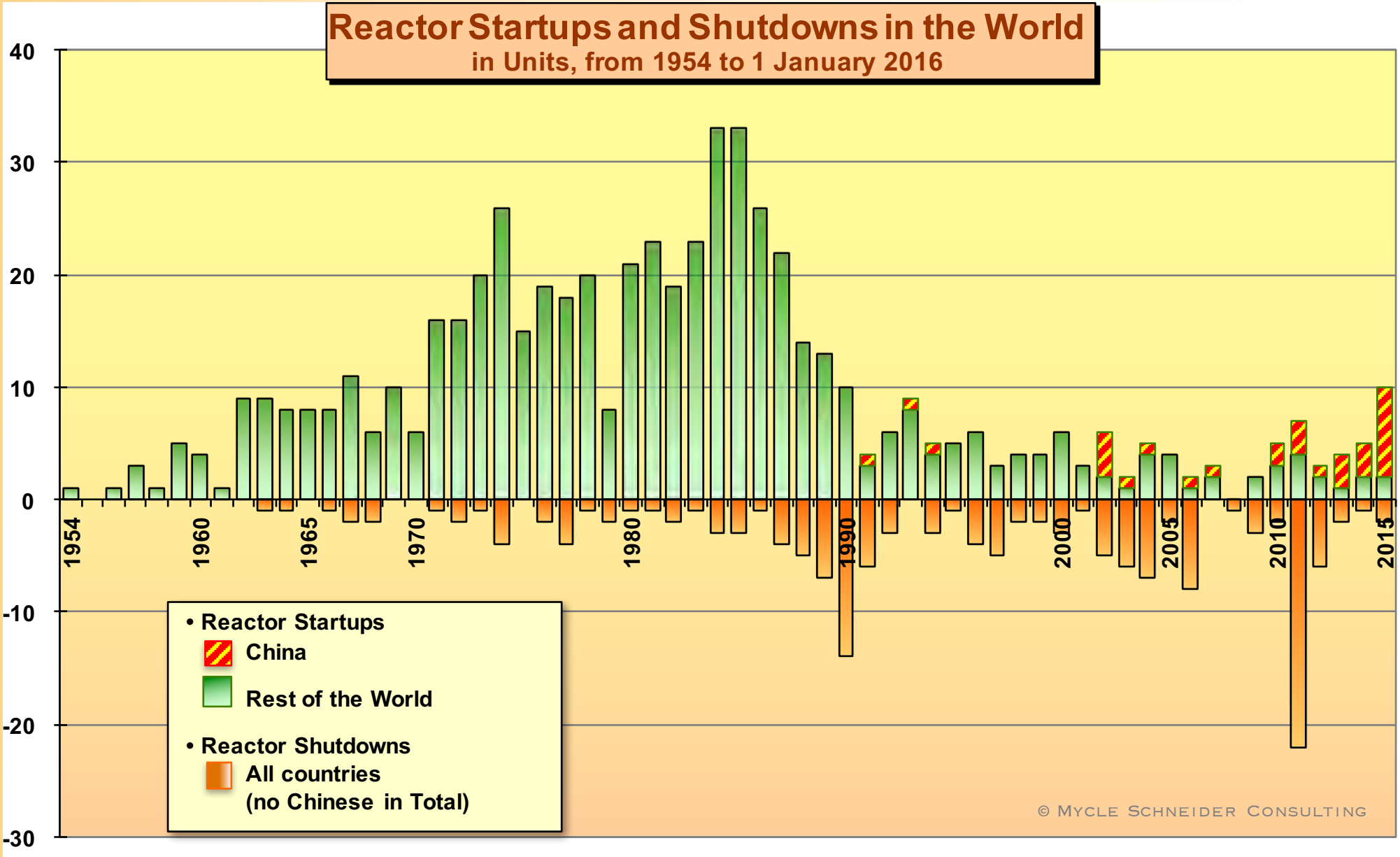
Convening Lead Author of the World Nuclear Industry Status Report (WNISR)

Schweizerische Energie-Stiftung, Zürich, 21 March 2016

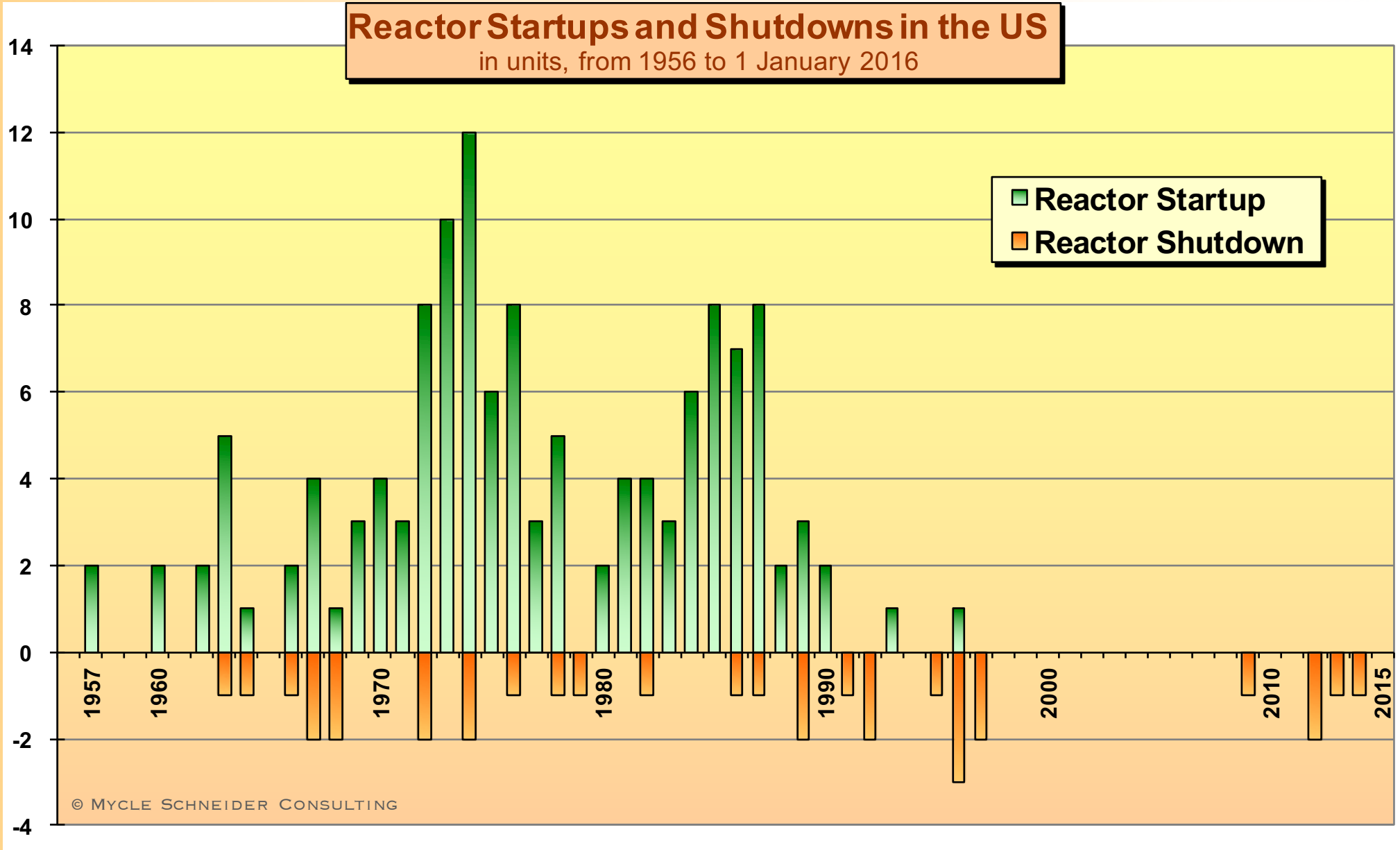


Source: IAEA-PRIS, MSC, 2016

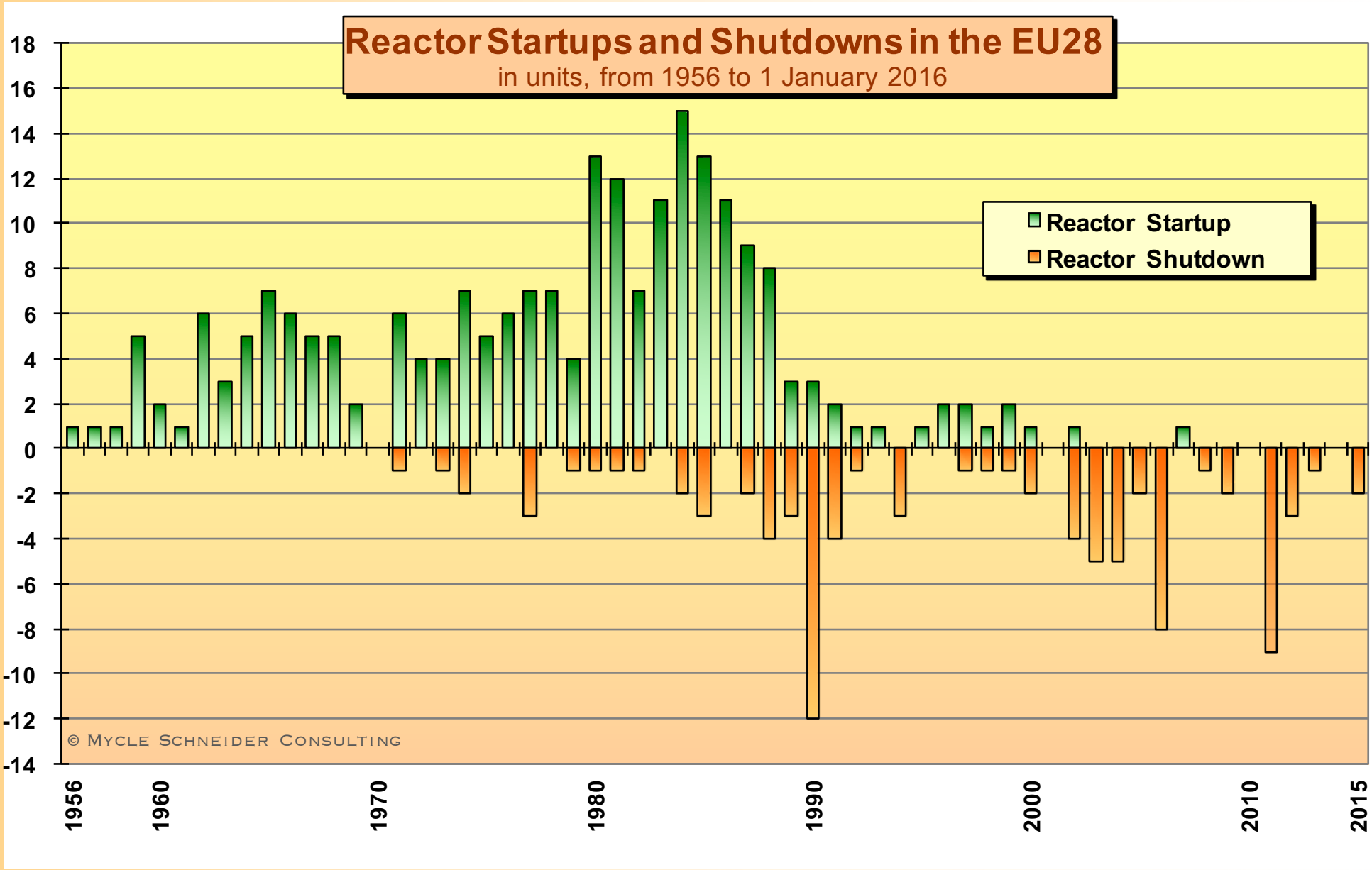
Reactor Startups and Shutdowns in the World
in Units, from 1954 to 1 January 2016



Source: IAEA-PRIS, MSC, 2016



Source: IAEA-PRIS, MSC, 2015



Source: IAEA-PRIS, MSC, 2016

Misleading Official Information on World Reactor Fleet

PRIS

The Database on Nuclear Power Reactors

The Power Reactor Information System (PRIS), developed and maintained by the IAEA for over four decades, is a comprehensive database focusing on nuclear power plants worldwide. PRIS contains information on power reactors in operation, under construction, or those being... READ MORE »

Registered User ENTRY | How to Register

SHORTCUTS

Select Country

Select Reactor

Nuclear Power Reactors in the World...

Operating Experience with NPP (OPEX)

PRIS-WEDAS User's Manual

OVERVIEW

Current Status:

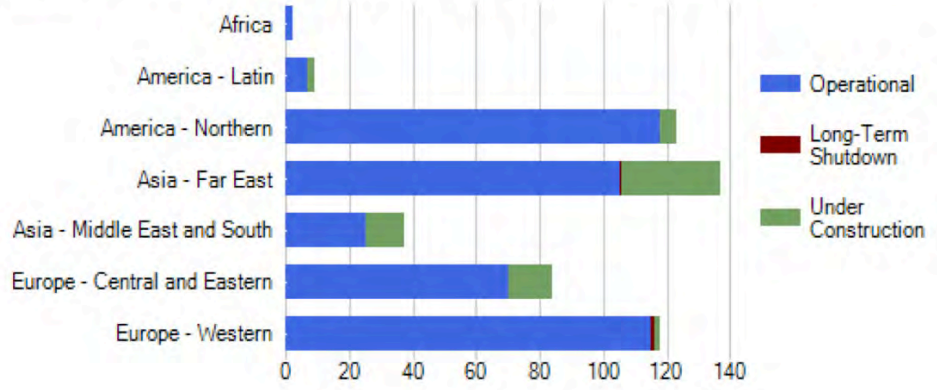
442 NUCLEAR POWER REACTORS IN OPERATION

384 057 MW_e TOTAL NET INSTALLED CAPACITY

2 NUCLEAR POWER REACTORS IN LONG-TERM SHUTDOWN

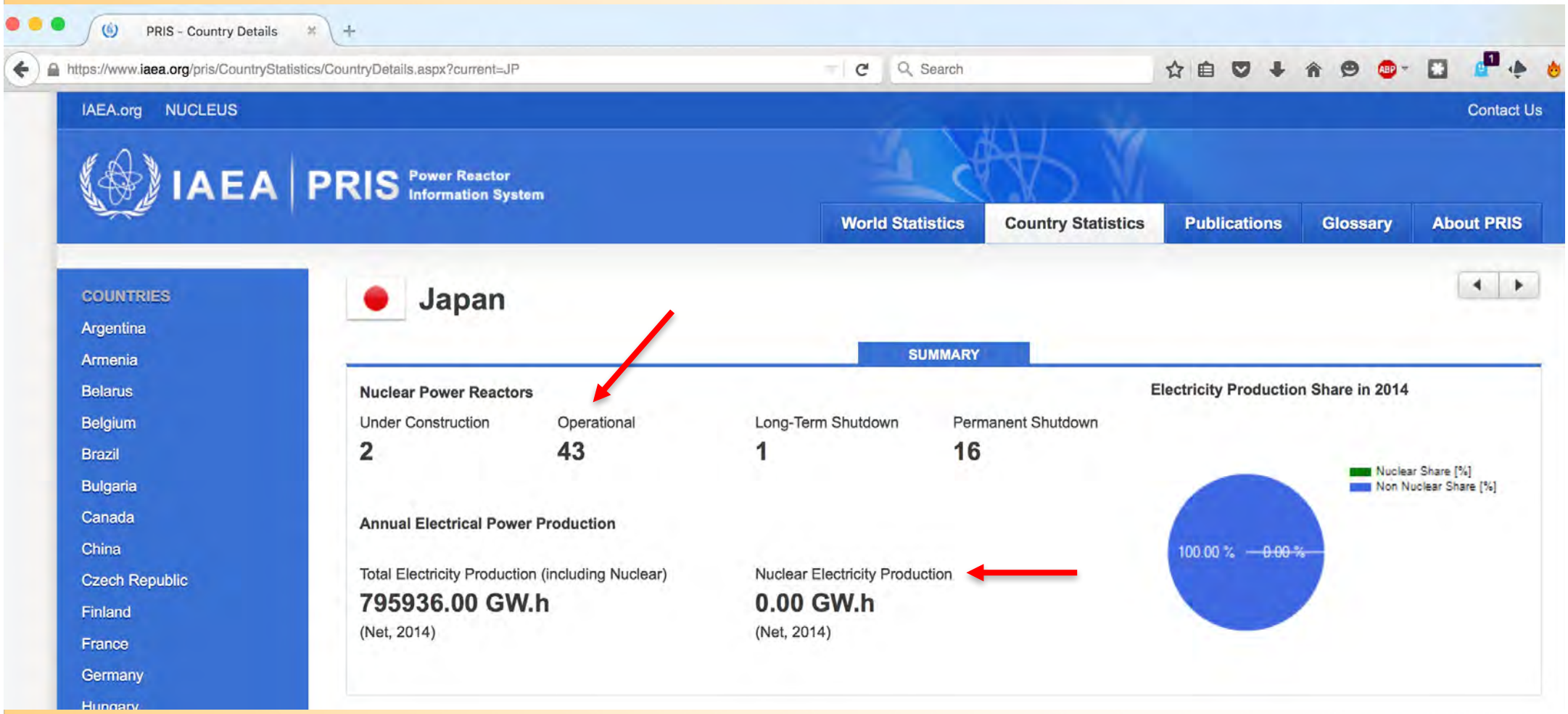
66 NUCLEAR POWER REACTORS UNDER CONSTRUCTION

Regional Distribution of Nuclear Power Plants (Click on the chart for more statistics)



Source: IAEA-PRIS, Screenshot, 27 February 2016

Misleading Official Information on Japan's Reactor Fleet



Source: IAEA-PRIS, Screenshot, 27 February 2016

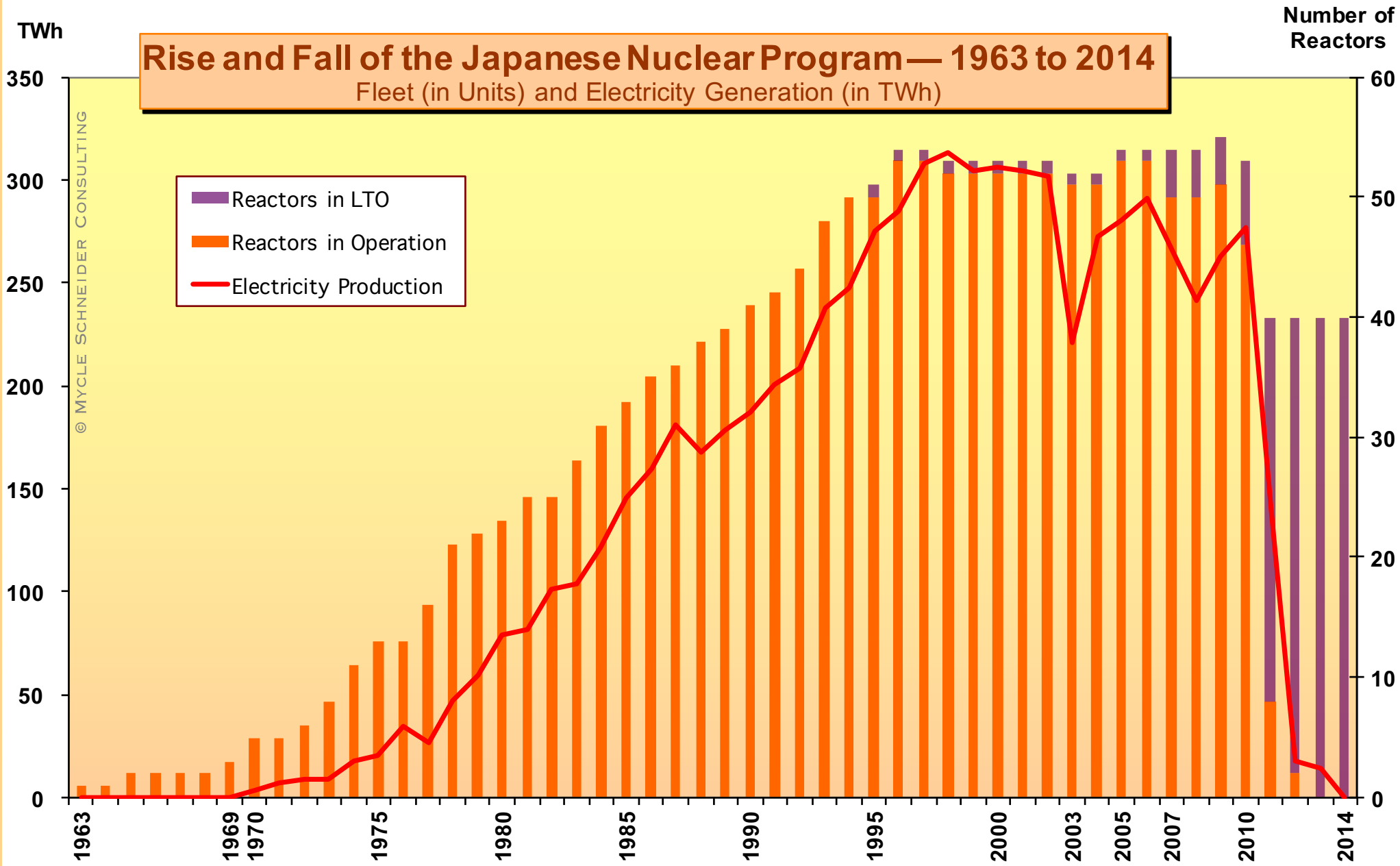
The WNISR2014 Established New Reactor Status Category: Long-Term Outage or LTO

"A nuclear power reactor is considered in Long-Term Outage (LTO) if it has not generated any power in the entire previous calendar year and in the first semester of the current calendar year of the WNISR."

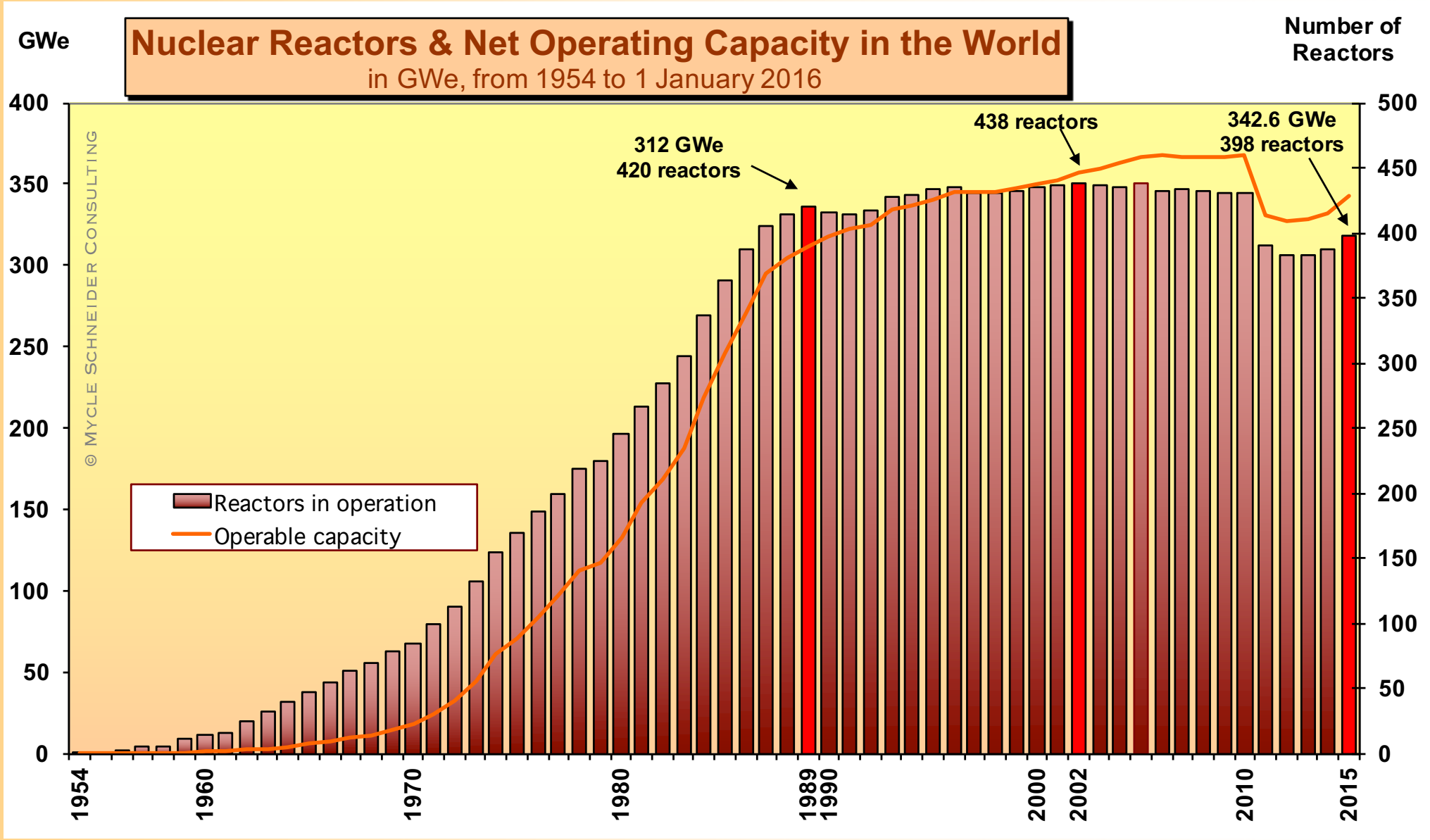
38 reactors in Japan in LTO, shut down between 1995 and 2012.

Rise and Fall of the Japanese Nuclear Program — 1963 to 2014

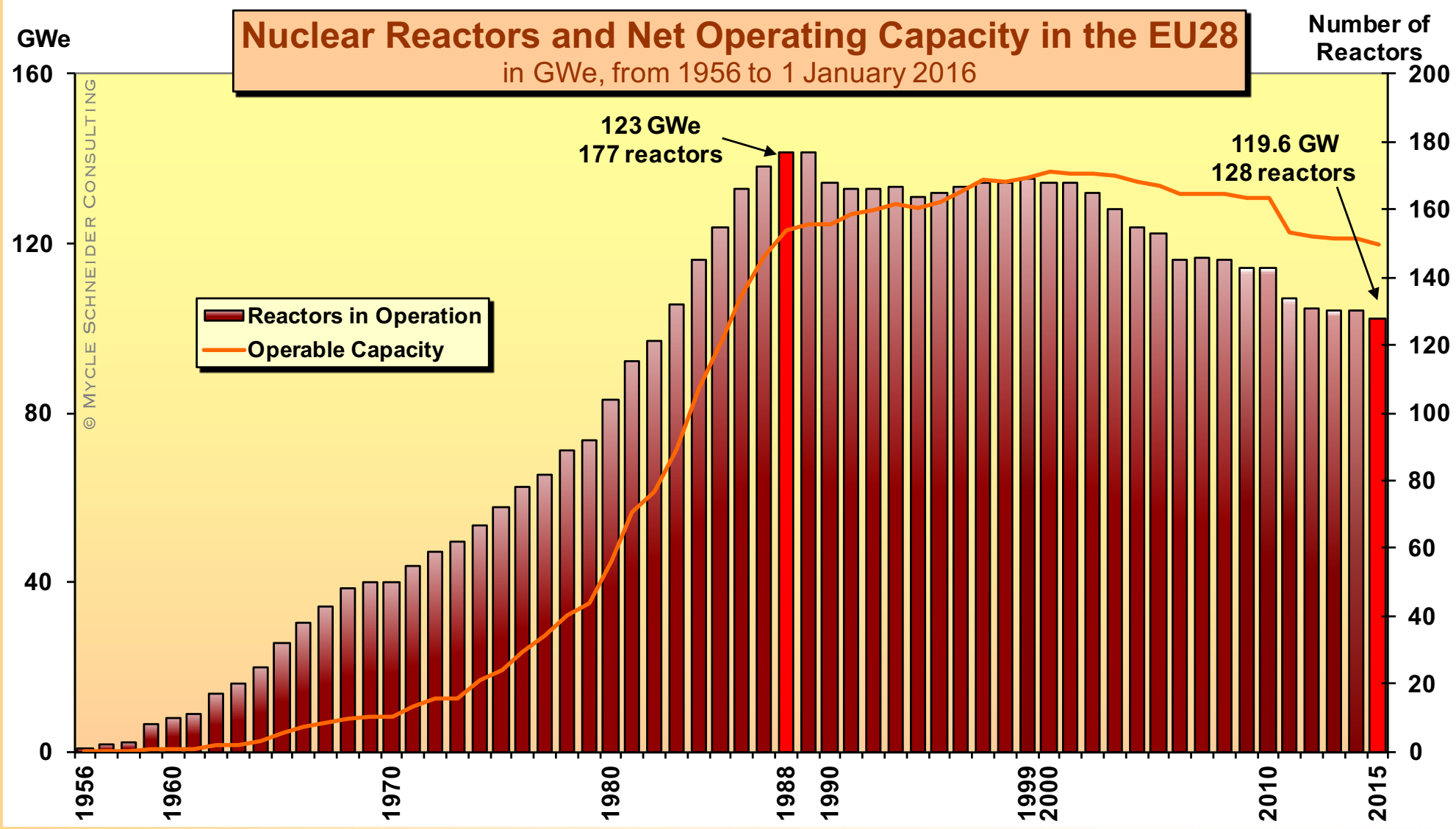
Fleet (in Units) and Electricity Generation (in TWh)



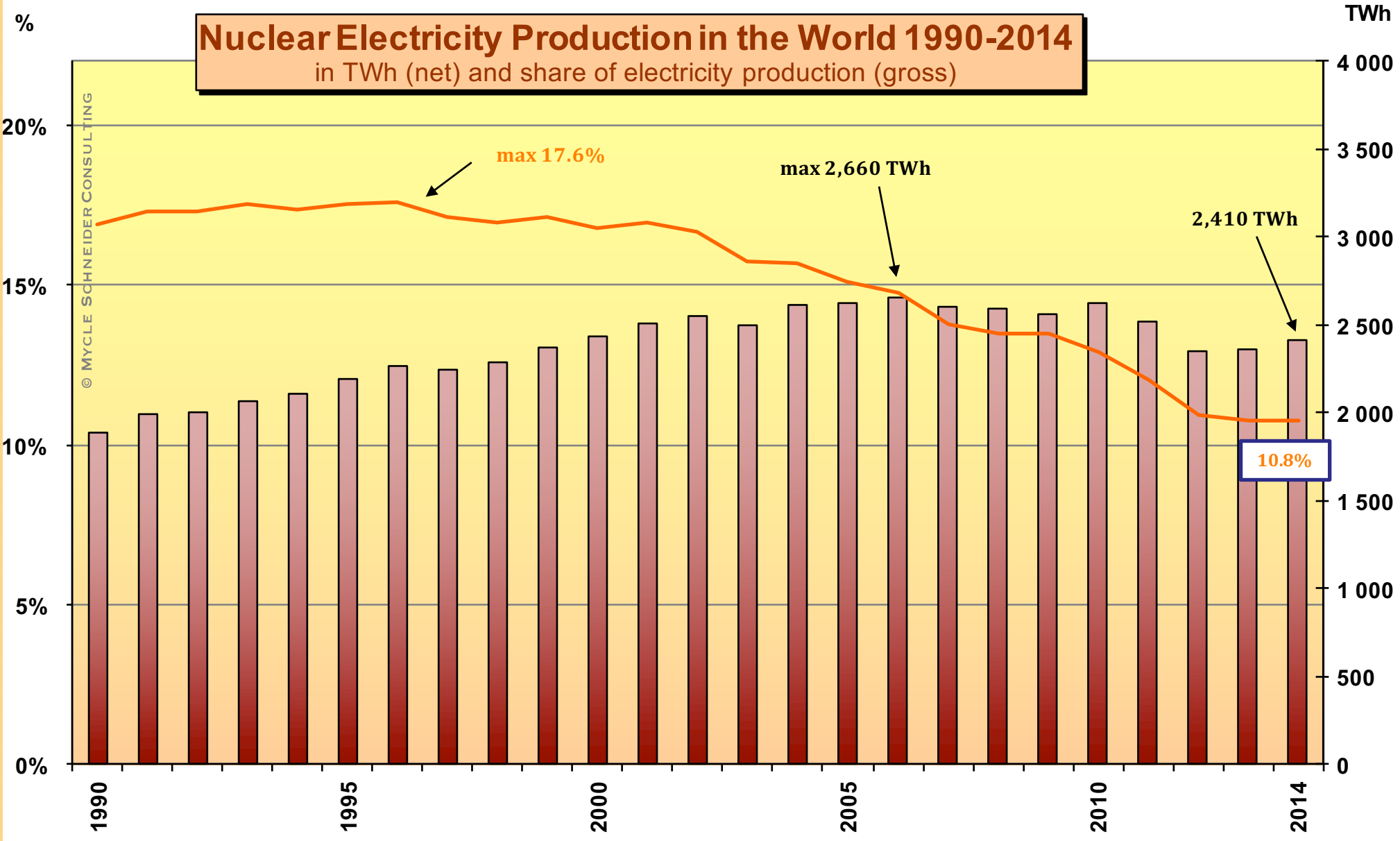
Source: IAEA-PRIS, MSC, 2015



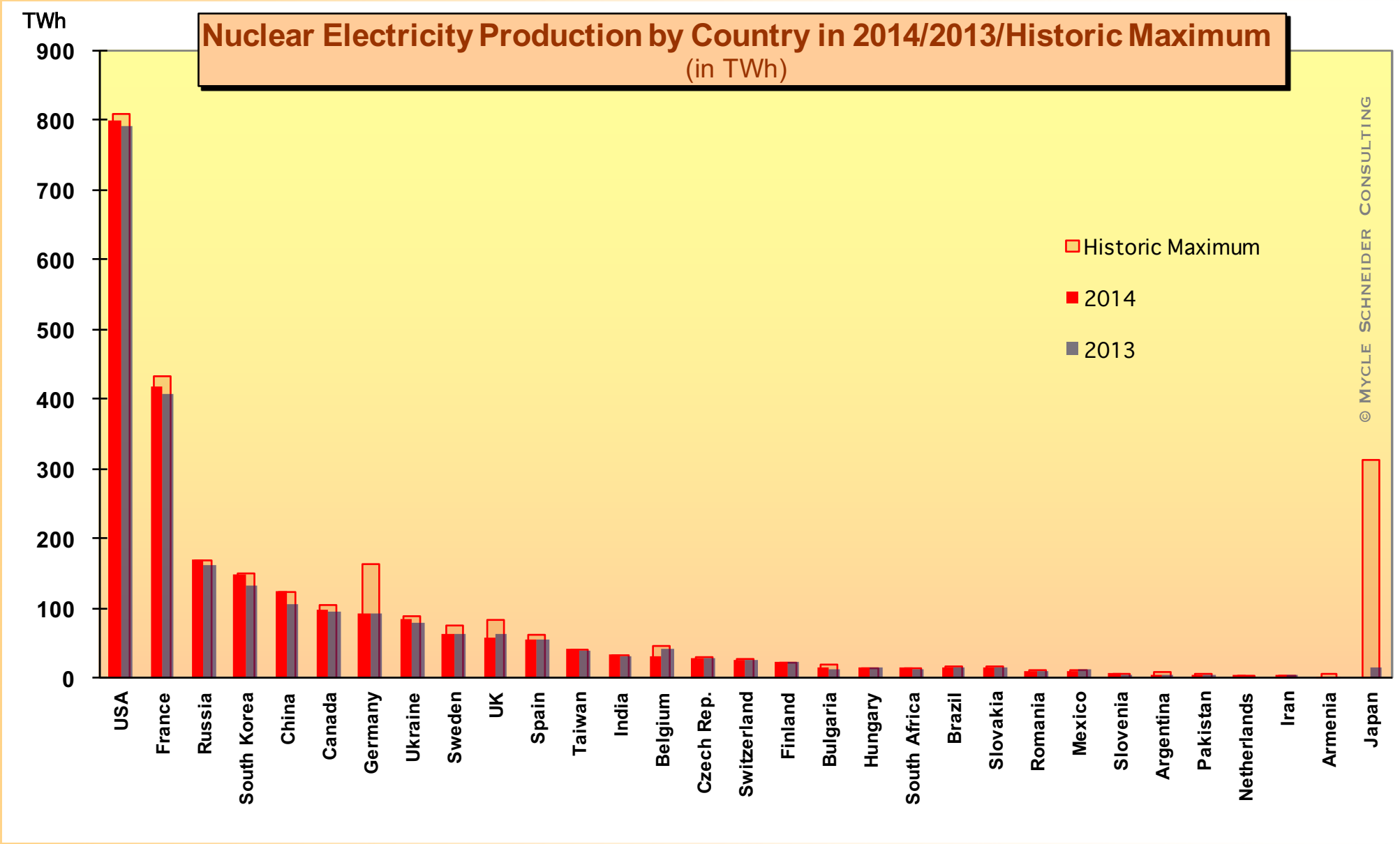
Source: IAEA-PRIS, MSC, 2016



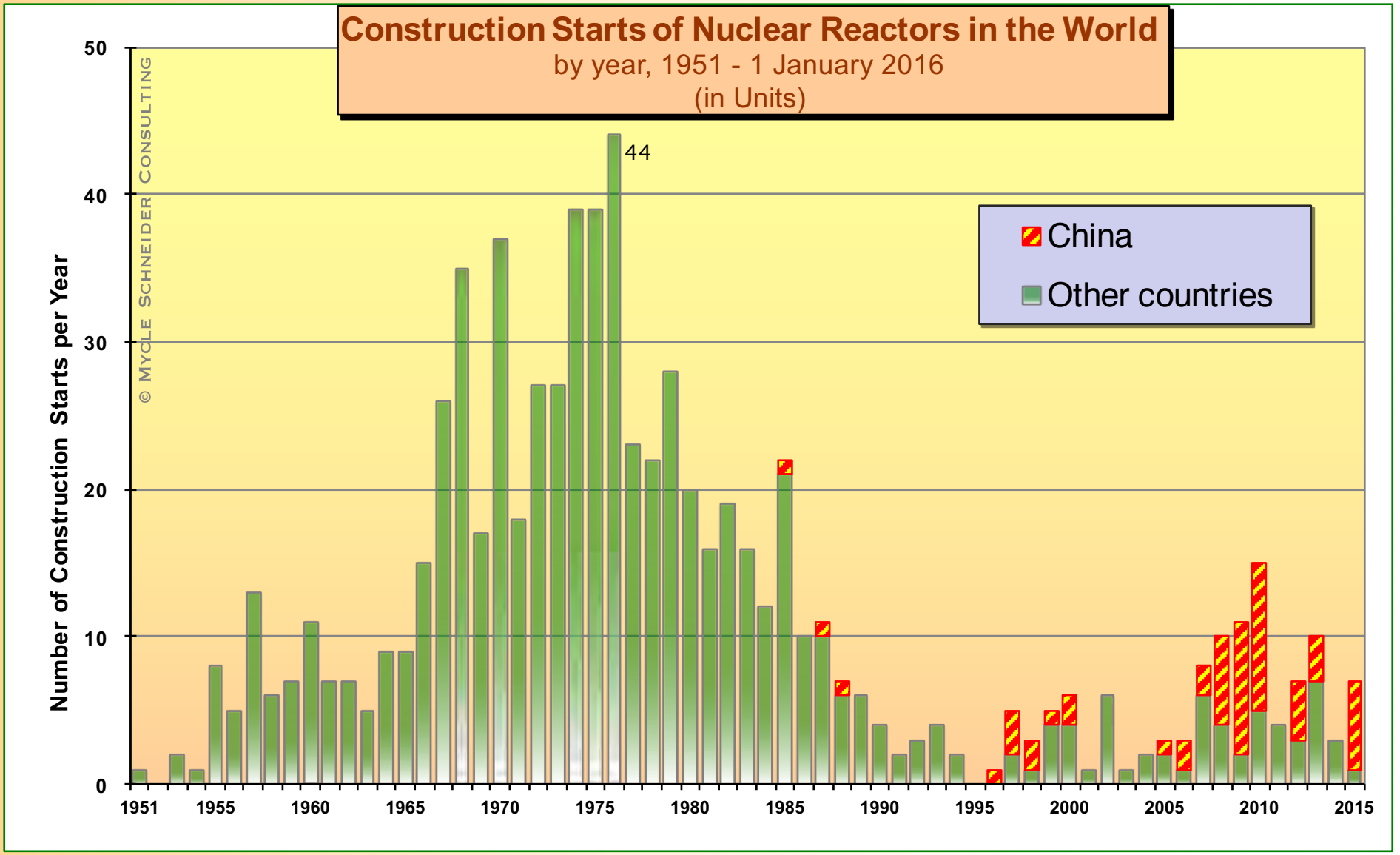
Source: IAEA-PRIS, MSC, 2016



Source: IAEA-PRIS, MSC, 2015



Source: IAEA-PRIS, MSC 2015

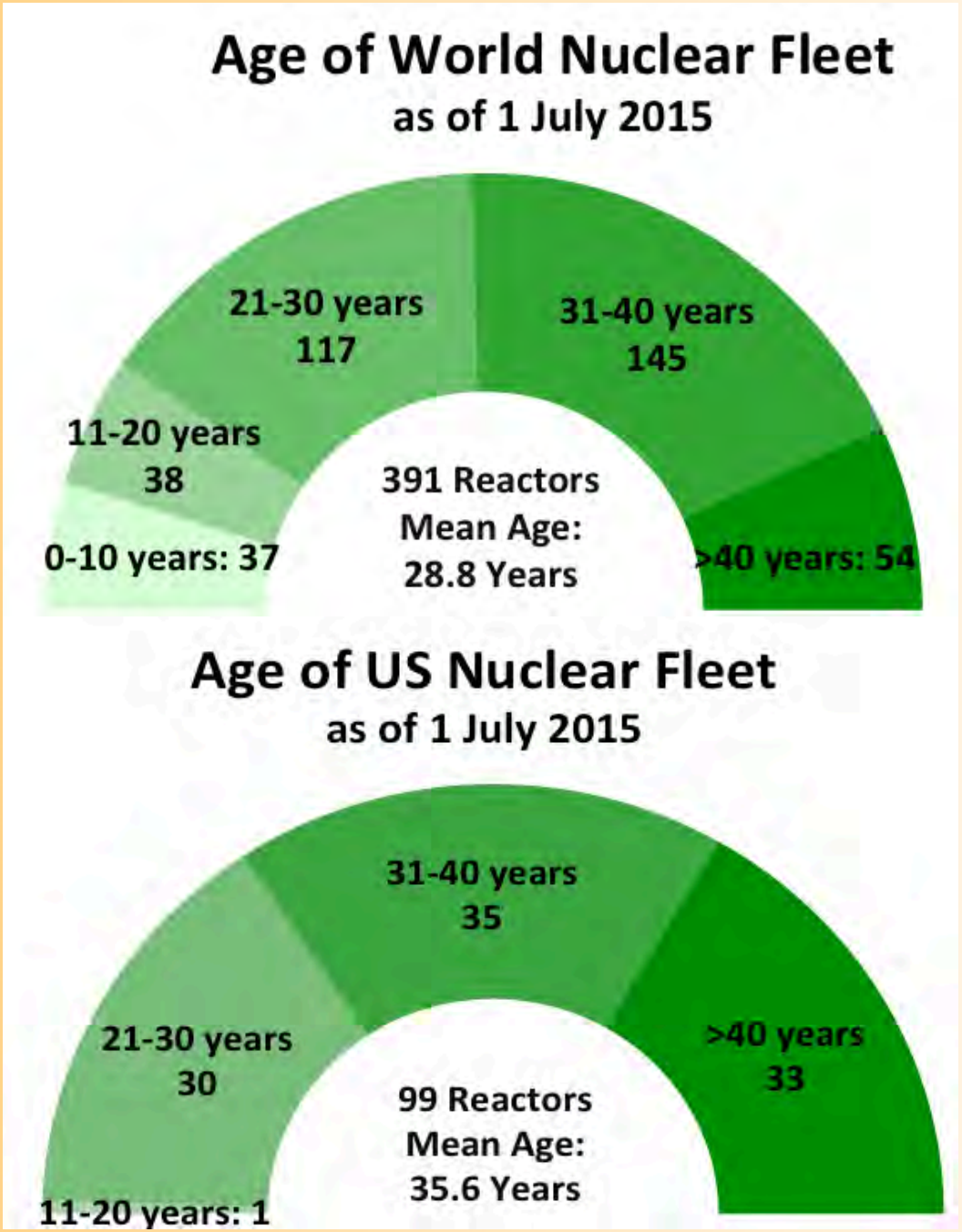


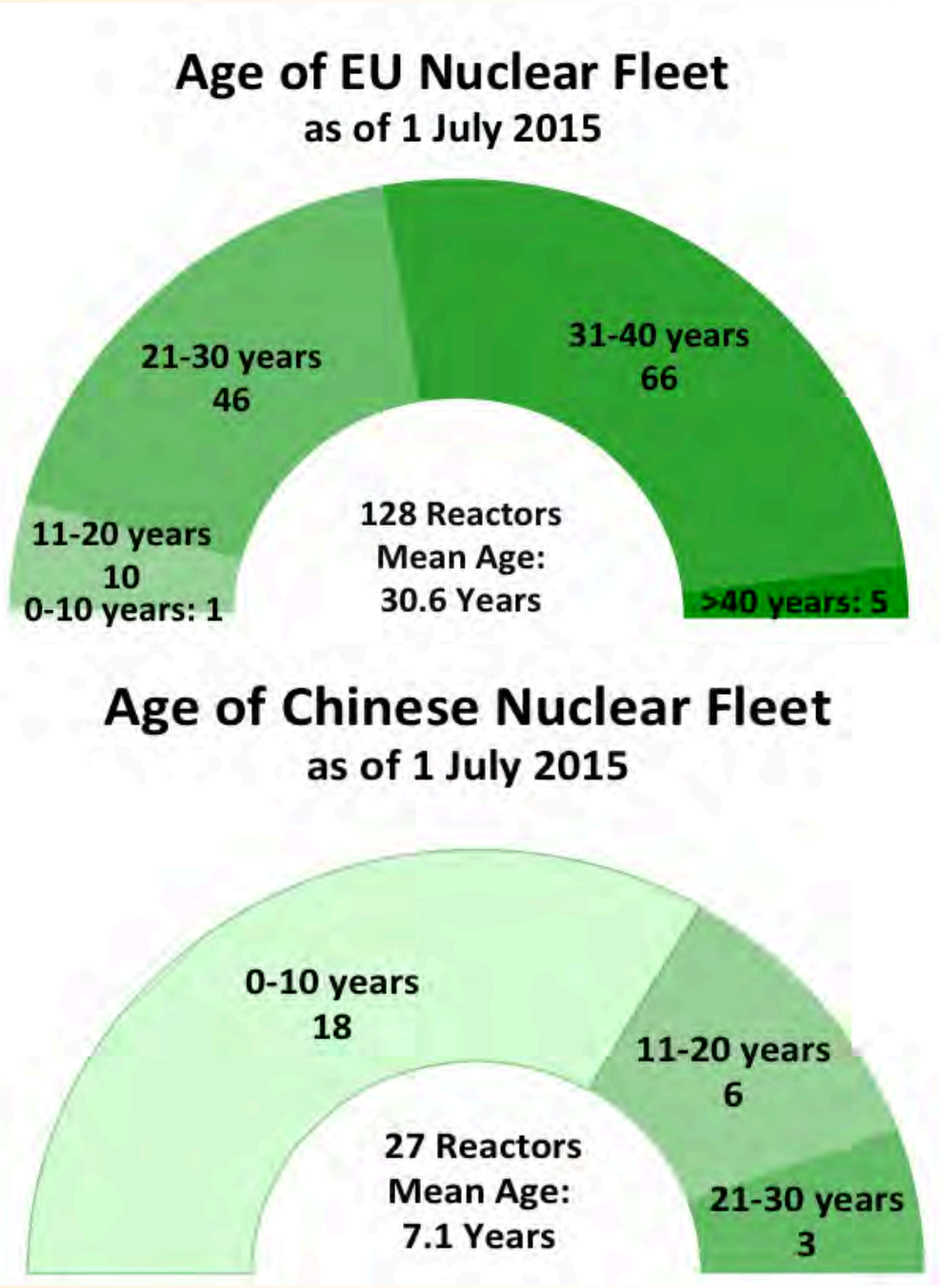
Source: IAEA-PRIS, MSC, 2016

Reactors "Under Construction" in the World (1 July 2015)

Country	Units	MWe (net)	Construction Start	Planned Grid Connection	Delayed Startup (Units)
China	24	23,738	2009-2015	2015-2021	15
Russia	8	6,262	1983-2010	2015-2019	8
India	6	3,907	2002-2011	2015-2019	6
USA	5	5,633	1972-2013	2016-2020	5
South Korea	4	5,360	2008-2013	2016-2018	4
UAE	3	4,035	2012-2014	2017-2019	?
Belarus	2	2,218	2013-2014	2019-2020	?
Pakistan	2	630	2011	2016-2017	2
Slovakia	2	880	1985	2016-2017	2
Ukraine	2	1,900	1986-1987	2019	2
Argentina	1	25	2014	2018	?
Brazil	1	1,245	2010	2018	1
Finland	1	1,600	2005	2018	1
France	1	1,600	2007	2017	1
Total	**62**	**59,033**	**1972-2015**	**2015-2021**	**47**

Source: IAEA-PRIS, MSC, 2015


Age of World Nuclear Fleet
as of 1 July 2015
21-30 years
117
31-40 years
145
11-20 years
38
391 Reactors
Mean Age:
28.8 Years
0-10 years: 37
>40 years: 54


Age of EU Nuclear Fleet
as of 1 July 2015
21-30 years
46
31-40 years
66
11-20 years
10
0-10 years: 1
128 Reactors
Mean Age:
30.6 Years
>40 years: 5

Age of US Nuclear Fleet
as of 1 July 2015
31-40 years
35
21-30 years
30
>40 years
33
99 Reactors
Mean Age:
35.6 Years
11-20 years: 1

Age of Chinese Nuclear Fleet
as of 1 July 2015
0-10 years
18
11-20 years
6
27 Reactors
Mean Age:
7.1 Years
21-30 years
3

"Is Dismantling Reactors the Future of Westinghouse?"*

Early Closures Accelerate – Recent Cases from the US and Sweden

	Shutdown	Relicensed	Reason	Age
U.S.				
Crystal River-3:	2009	Underway	Containment damage	22
San Onofre-2 and -3:	2012	Yes	Steam gen. damage	28/29
Kewaunee	2013	Yes	Economics	39
Vermont Yankee	2014	Yes	Economics	42
Pilgrim	2017?	Yes	Economics	(45)
Fitzpatrick	2016/17	Yes	Economics	(41/42)
Prairie Island next?	*?*	*Yes*	*Economics*	*(42)*
Sweden				
Oskarshamn-1	2015?	Upgraded	Economics	(44)
Oskarshamn-2	2013	Upgrade halted	Economics	39
Ringhals-1	2020	Upgraded	Economics	(46)
Ringhals-2	2019	Upgraded	Economics	(45)

India next? *Tarapur-1 and -2 face early closure*

*Sources: Various, compiled by MSC; *bizjournals.com, 2 Nov. 2015*

French Nuclear Companies in Trouble

EDF — World's Largest Nuclear Power Operator

- +4.5%/a operating cost increase 2007-2012
  - → Deficit (production cost vs. income from kWh sales) €1.5bn in 2012
  - → Need for significant tariff increases to cover cost increases
- Stock value plunged 89% since 2007
- High debt €37.4bn for turnover of €75bn

AREVA — "Global Leader in Nuclear Energy"

- Technically bankrupt
- Loss of €2bn in 2015 (€10bn in 5 years)
- High debt €6.3bn for revenues of €4.2bn
- Stock value plunged by 95% since 2007
- Standard & Poor's downgraded AREVA shares to BB+ ("junk") in November 2014 and again to BB- in March 2015

Sources: Company websites; Standard & Poor's

Hinkley Point C: EDF's Waterloo in the Making?

Investment bank Investec has advised clients to sell shares in French energy group EDF amid fears that its connection with the nuclear plant at Hinkley Point C could put payouts to shareholders under threat.
This is Money, 25 October 2015

EDF Actionnariat salarié (EAS) said in a statement that the interests of EDF are gravely threatened by the Hinkley Point project, which it calls "a financial catastrophy foretold" (…). EAS asks the management of EDF to stop this risky project, whose financial risks are to big for our company and which could put EDF's very survival at risk."
Reuters, 12 November 2015

FINANCIAL TIMES

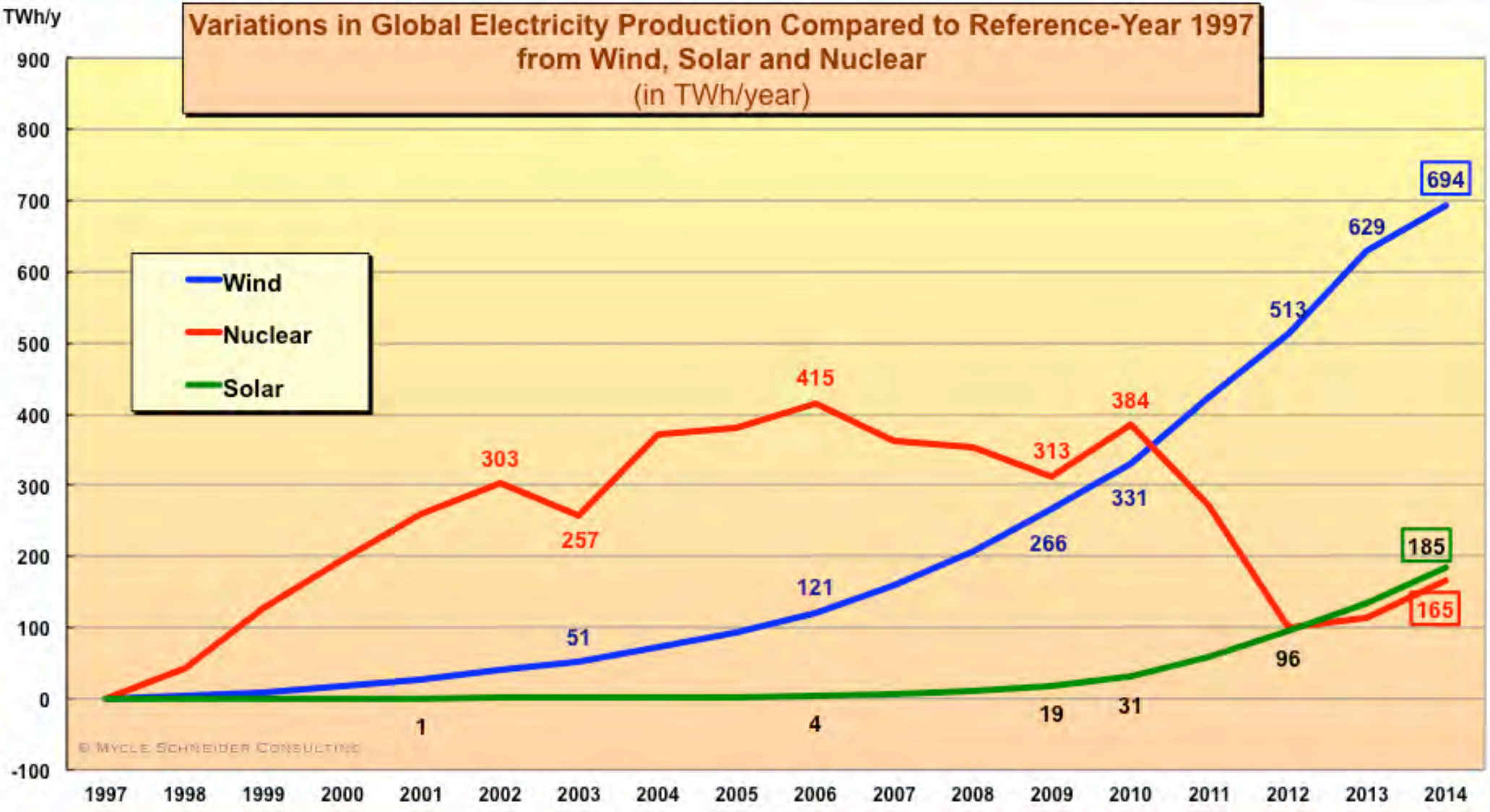
March 7, 2016 7:12 pm

A blow to Britain's plan for nuclear renaissance

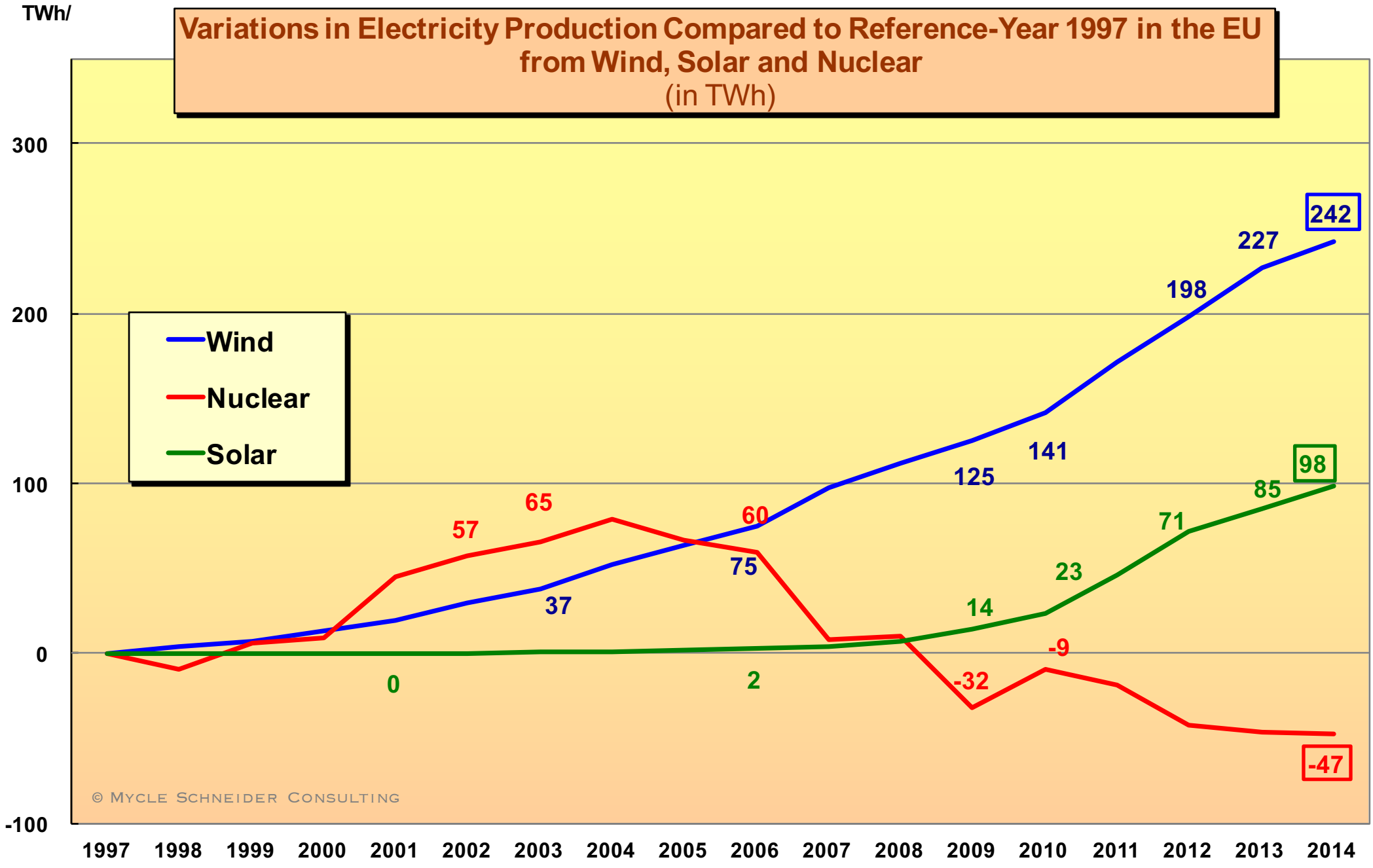
Print Clip

A shock resignation makes it harder to defend the Hinkley Point project

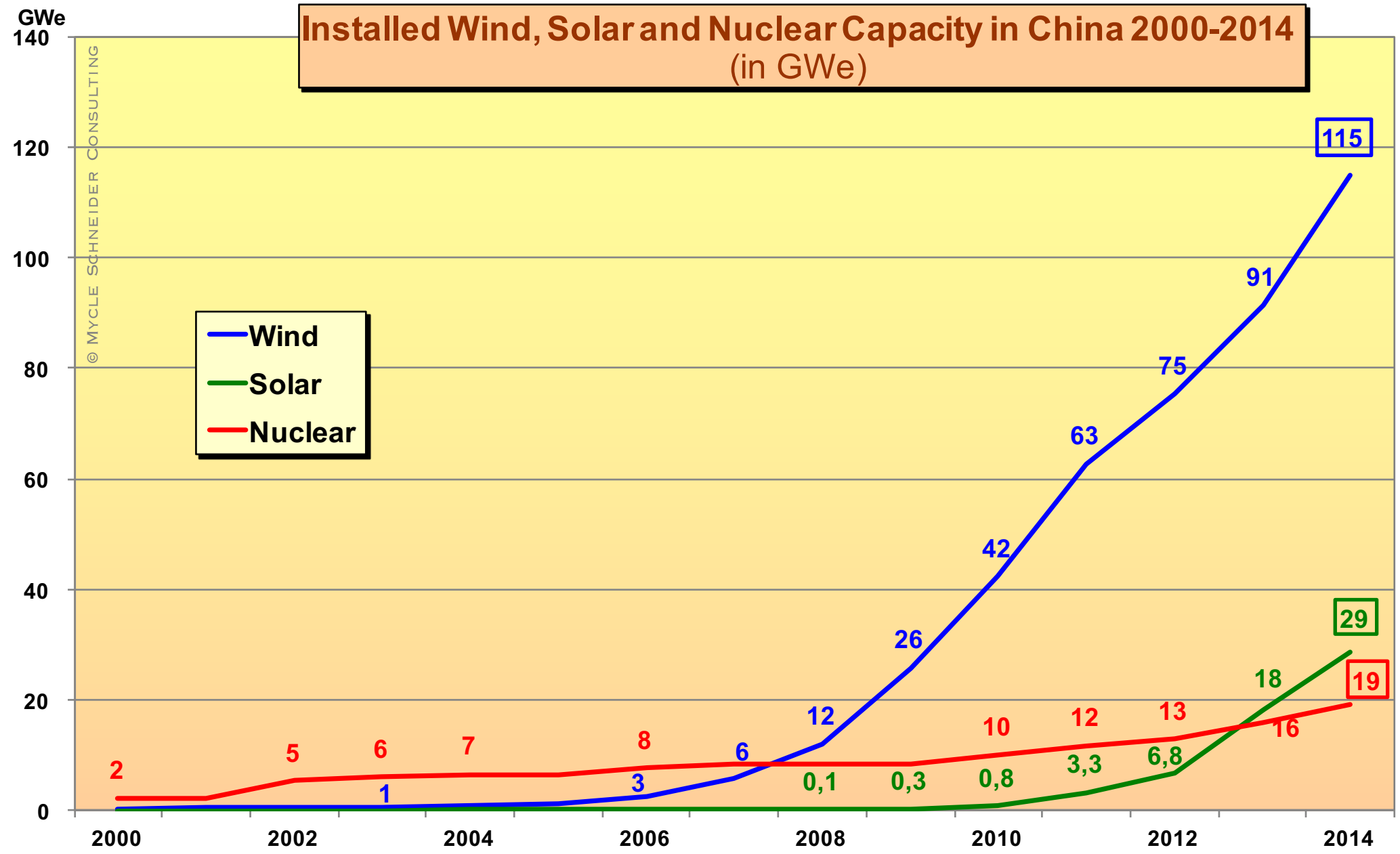
EDF's response to these concerns, and that of the governments backing the projects, has essentially been: "Trust us". But it is no longer enough simply to assert confidence in the project's merits. It is time for both EDF and the British government to face up to the difficulties besetting Hinkley Point and to outline alternatives. (…)
Mr Piquemal's resignation makes it ever harder to defend a deal whose flaws have become increasingly apparent. It is time to move on.



Sources: BP, IAEA-PRIS, MSC, 2015

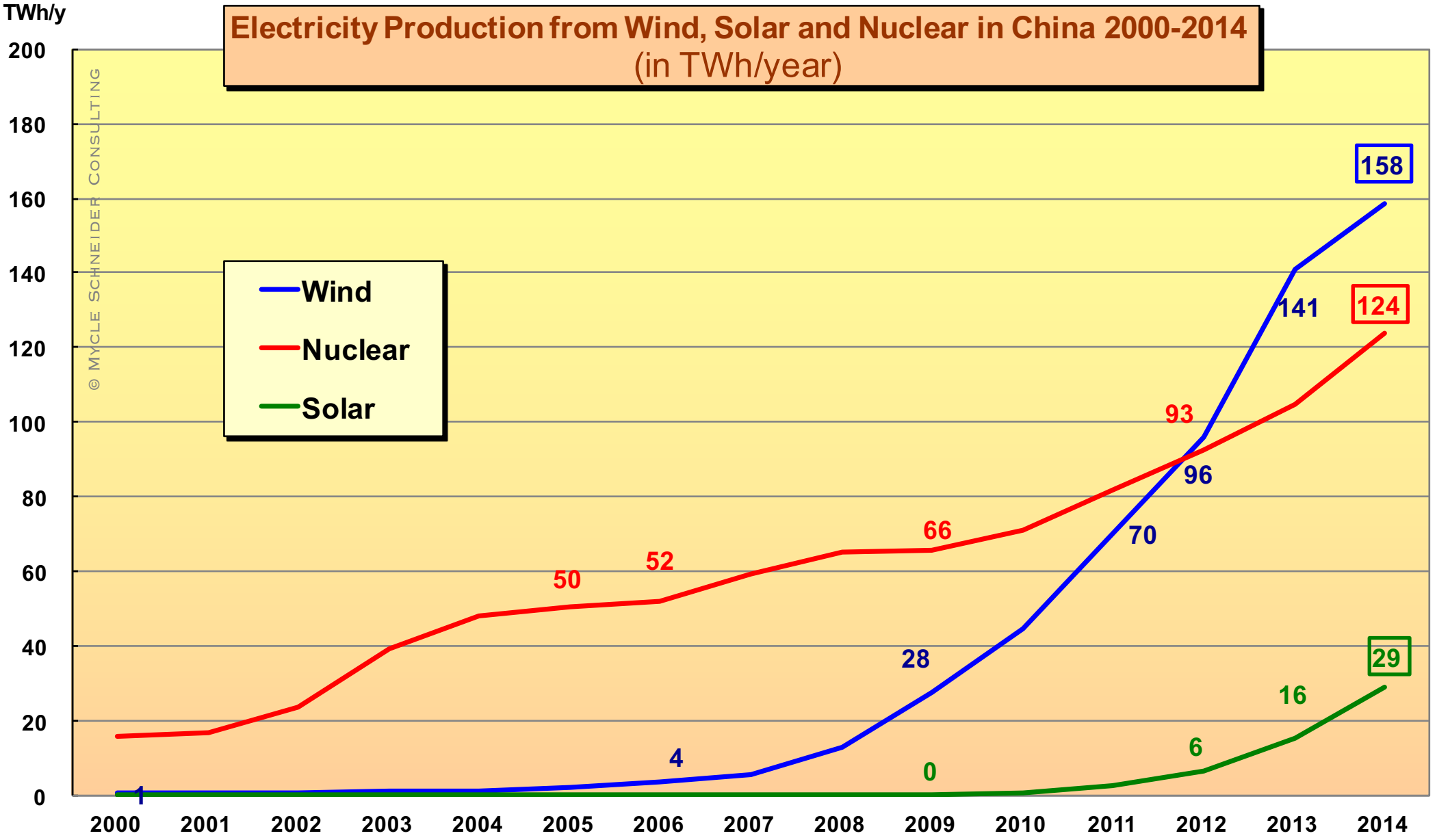


Source: IAEA-PRIS, BP, MSC 2015



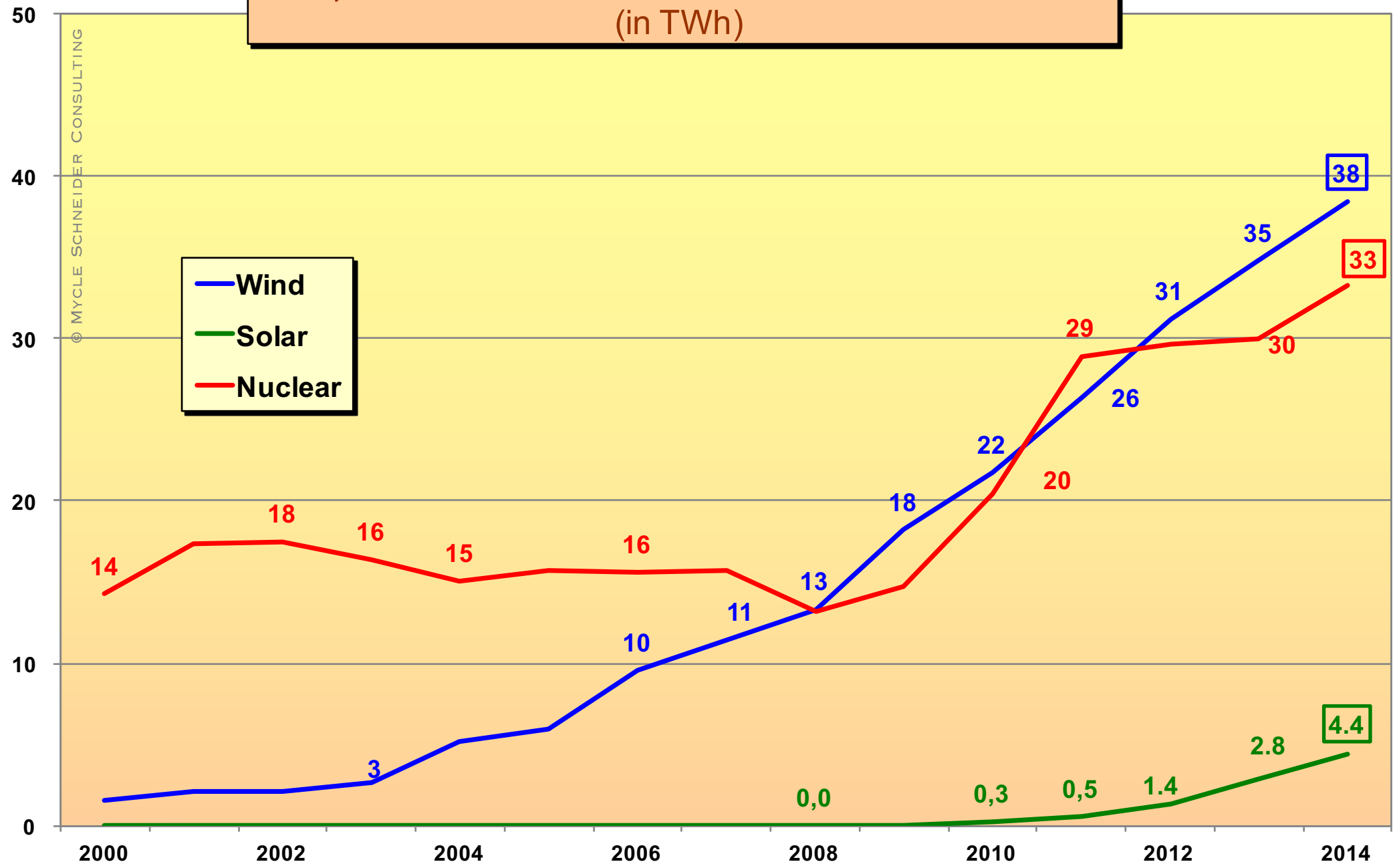
Source: EPIC, IAEA-PRIS, GWEC 2015

Electricity Production from Wind, Solar and Nuclear in China 2000-2014
(in TWh/year)



Source: BP 2015, IAEA-PRIS 2015

Wind, Solar and Nuclear Production in India 2000-2014
(in TWh)



Concluding Remarks

• Nuclear power has passed its historic maximum for most of the indicators: operating reactors, electricity generation, reactors under construction, new construction sites, etc.

• Nuclear's position in the power market is increasingly threatened by a shrinking client base, increasing production costs, stagnating electricity consumption, and ferocious competitors, especially from the renewable energy sector.

• Nuclear industry companies and utilities are struggling with high debt loads, shrinking profit margins and decreasing prices on the wholesale power market.

Thank You! Contact: mycle@orange.fr **www.WorldNuclearReport.org**

Mycle Schneider works as independent international consultant on energy and nuclear policy. He is the initiator and Convening Lead Author of the World Nuclear Industry Status Reports. He is the Coordinator of the Seoul International Energy Advisory Council (SIEAC) and the Spokesperson for IEAC. He is a member of the International Panel on Fissile Materials (IPFM), based at Princeton University, USA.
In 2010-2011, he acted as Lead Consultant for the Asia Clean Energy Policy Exchange, implemented by IRG, funded by USAID, with the focus of developing a policy framework to boost energy efficiency and renewable energies. 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 14 countries and at the European Parliament. He has advised Members of the European Parliament from four different groups over the past 26 years. He has given lectures or had teaching appointments at 20 universities and engineering schools in 10 countries.
Mycle Schneider has provided information and consulting services to a large variety of clients including international institutions and organizations, think tanks and NGOs.
In 1997 he was honoured with the *Right Livelihood Award* ("Alternative Nobel Prize").