The World Nuclear Industry Status Report 2014

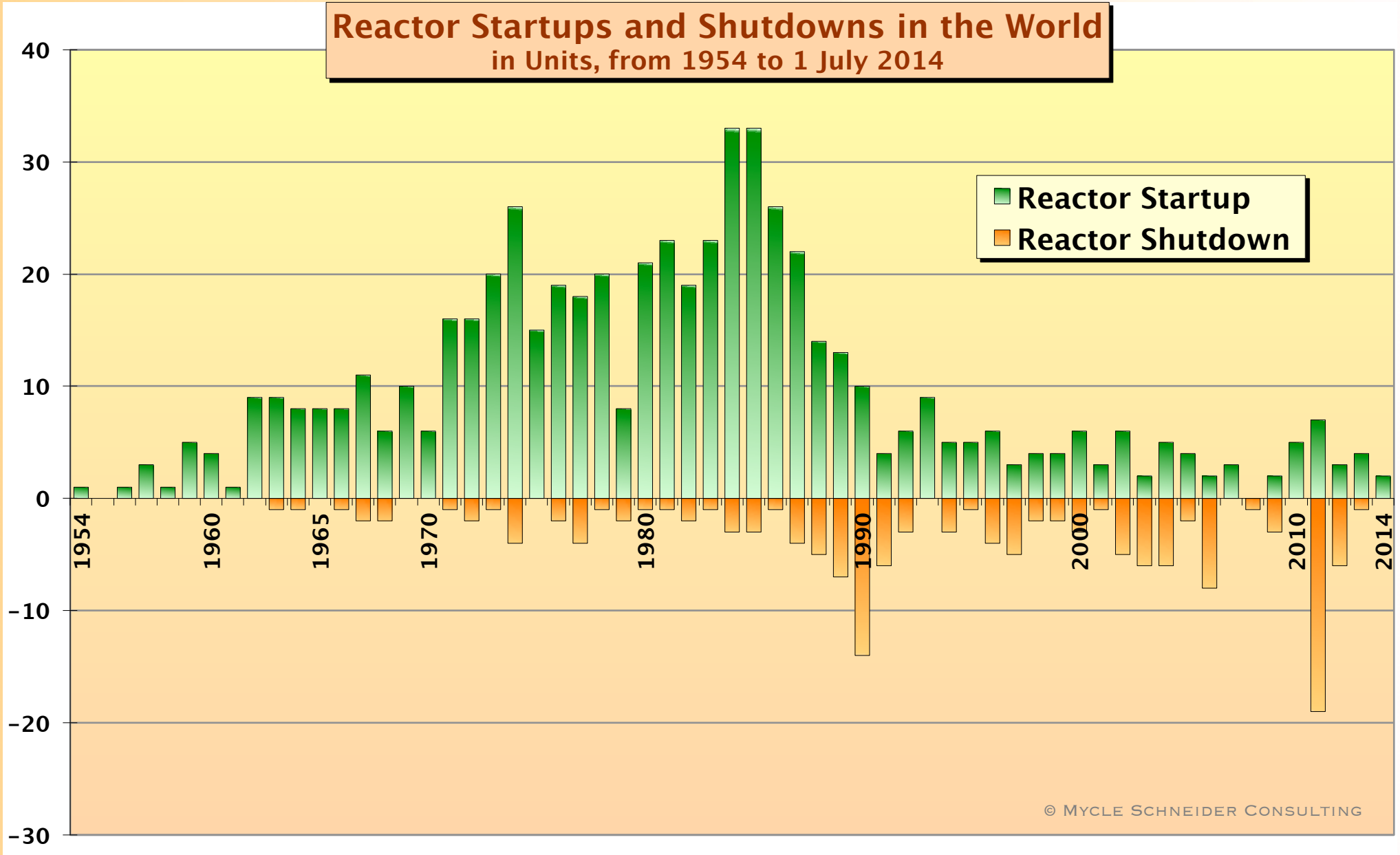
Free download at www.WorldNuclearReport.org

Mycle Schneider

International Consultant on Energy and Nuclear Policy, Paris, France

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

Heinrich Böll Foundation, Budapest, Hungary, 28 October 2014



Source: IAEA-PRIS, MSC, 2014

Nuclear Power Reactors "in Operation" — Really?

IAEA | PRIS Power Reactor Information System

World Statistics | Country Statistics | Publications | Glossary | About PRIS

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

2014 - Nuclear Power Reactors in the...

2014 - Operating Experience with NPP...

PRIS STATISTICS – User's Manual

OVERVIEW

Current Status:

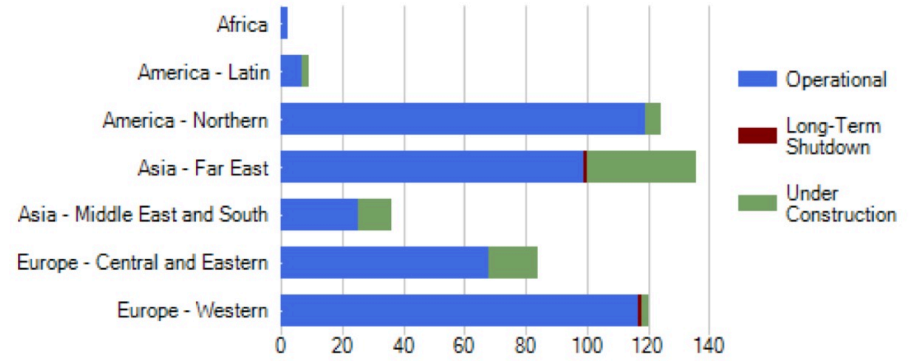
437 NUCLEAR POWER REACTORS IN OPERATION

374 504 MW_e TOTAL NET INSTALLED CAPACITY

2 NUCLEAR POWER REACTORS IN LONG-TERM SHUTDOWN

72 NUCLEAR POWER REACTORS UNDER CONSTRUCTION

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



Source: Screenshot IAEA-website 25 October 2014

Japan's Nuclear Fleet "Operational"?

IAEA | PRIS Power Reactor Information System

World Statistics | Country Statistics | Publications | Glossary | About PRIS

COUNTRIES
Argentina
Armenia
Belarus
Belgium
Brazil
Bulgaria
Canada
China
Czech Republic
Finland
France
Germany
Hungary

Japan

SUMMARY

Nuclear Power Reactors

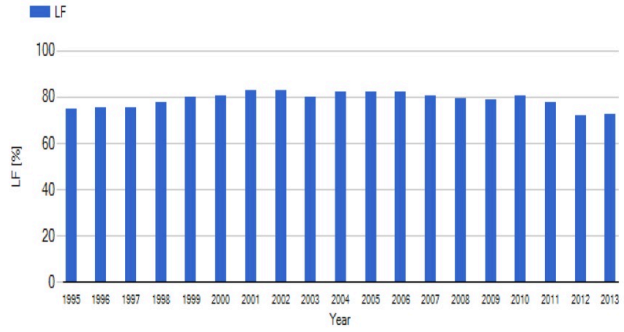
Under Construction	Operational	Long-Term Shutdown	Permanent Shutdown
2	48	1	11

Annual Electrical Power Production

Total Electricity Production (including Nuclear)
812821.00 GW.h
(Net, 2013)

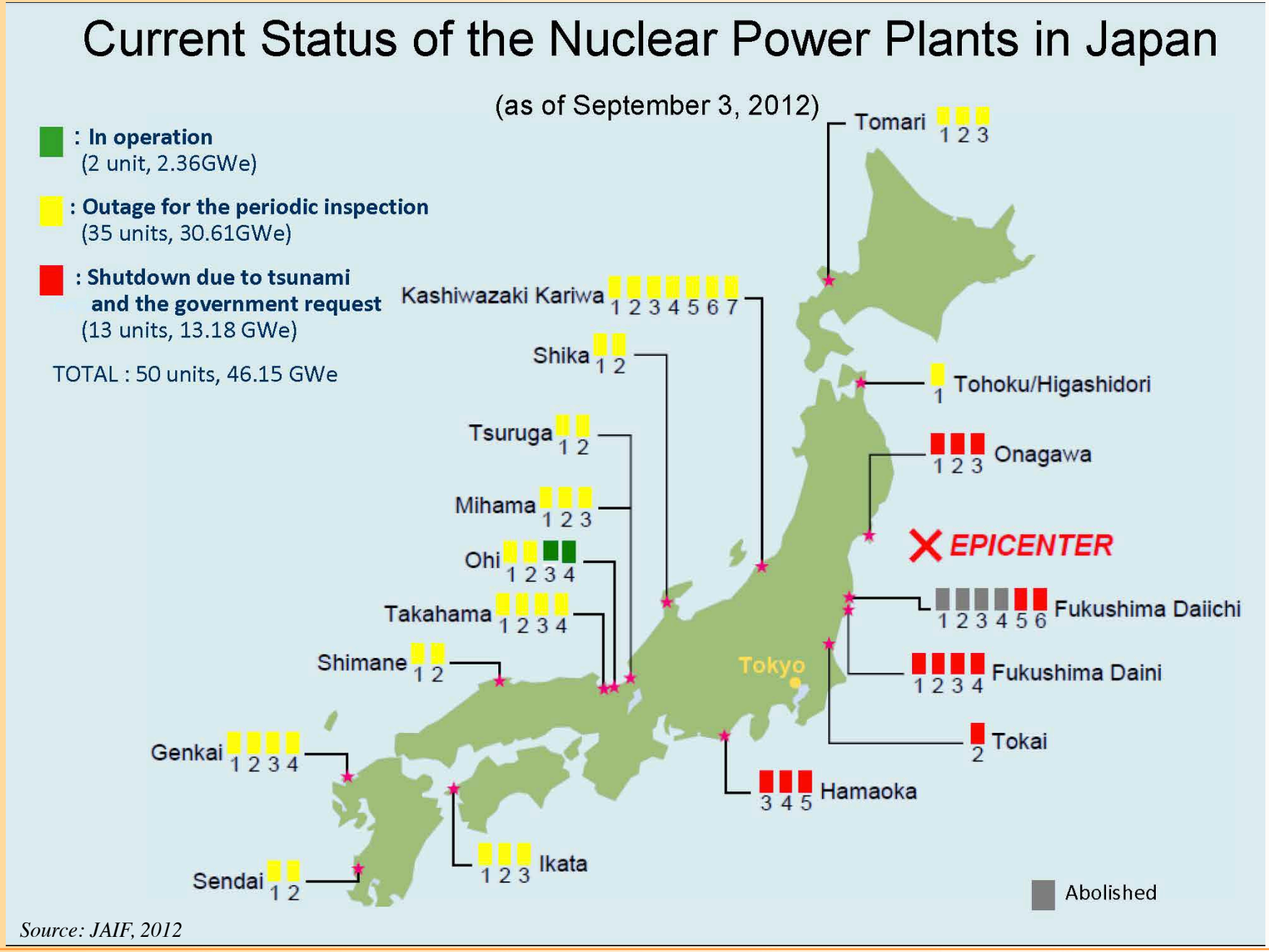
Nuclear Electricity Production
13947.00 GW.h
(Net, 2013)

Electricity Production Share in 2013



Source: Screenshot IAEA-website 25 October 2014

Current Status of the Nuclear Power Plants in Japan



Source: JAIF, 2012

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

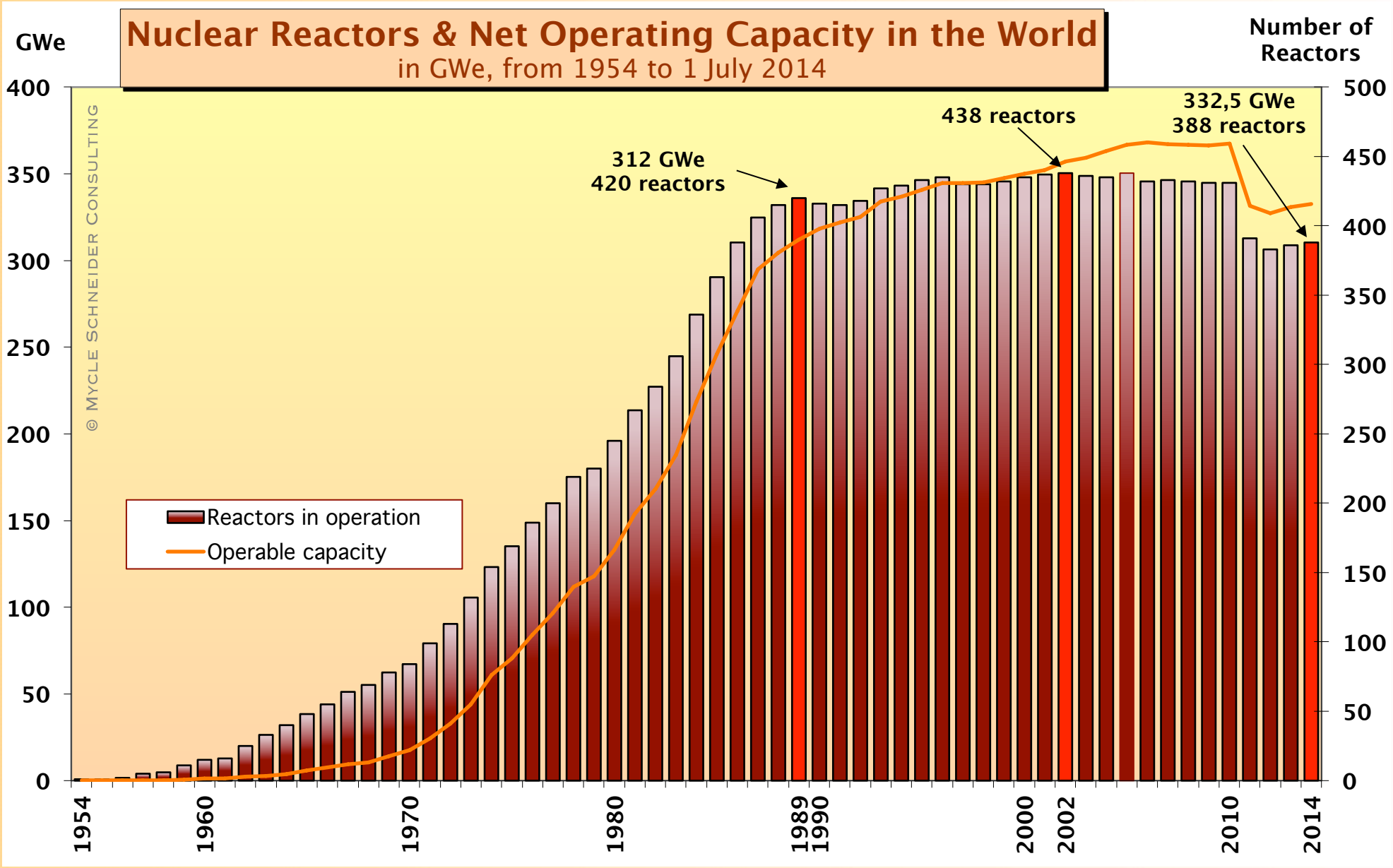
"A nuclear power reactor is considered in Long-Term Outage (LTO) if it has not generated any power in the entire previous calendar year and in the first semester of the current calendar year of the WNISR."

45 reactors woldwide in LTO

- 43 in Japan, shut down between 1995 and 2012
- 1 in South Korea, Wolsong-1, shut down since 2012
- 1 in India, Rajasthan-1, shut down since 2004

Nuclear Reactors & Net Operating Capacity in the World

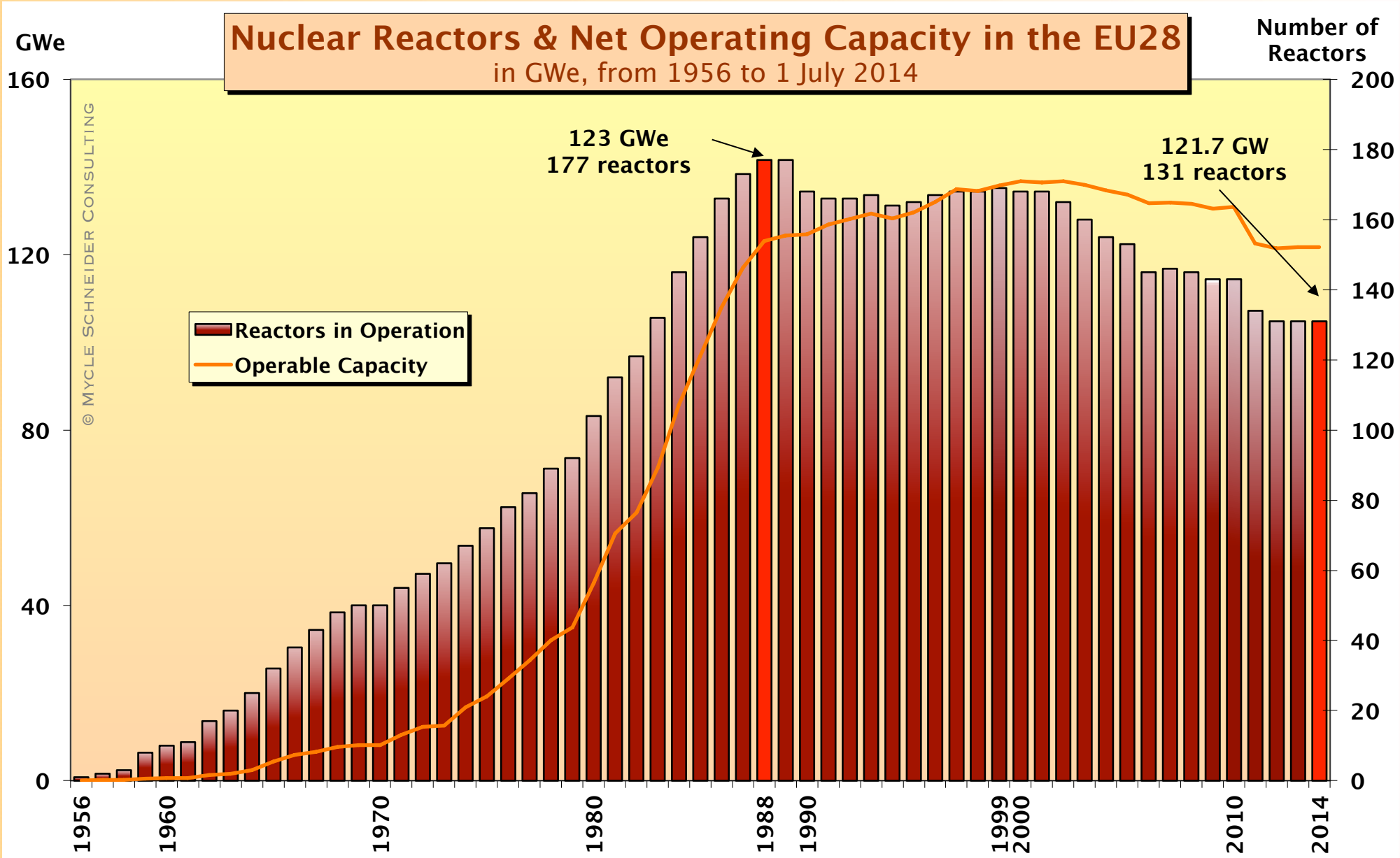
in GWe, from 1954 to 1 July 2014



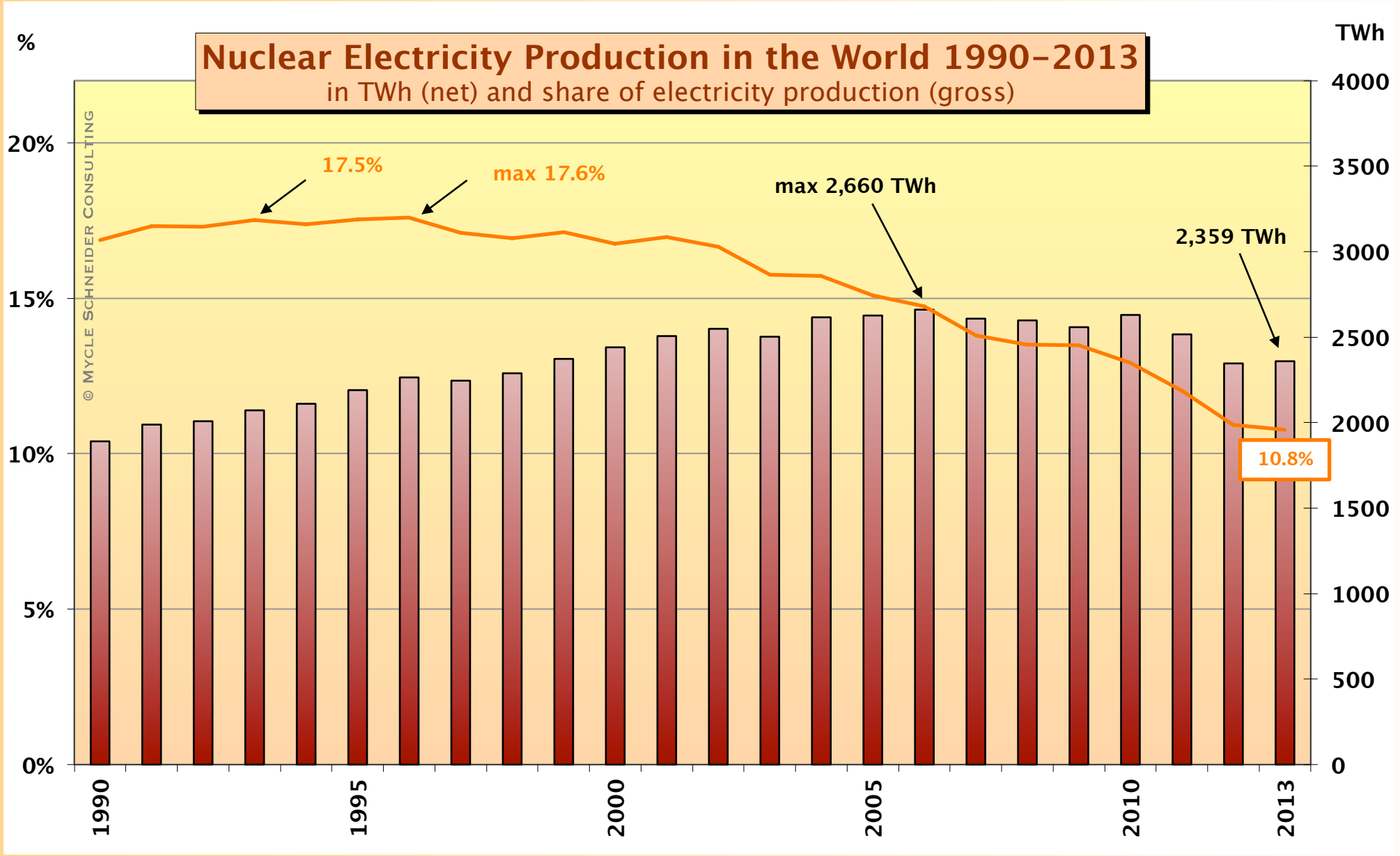
Source: IAEA-PRIS, MSC, 2014

Nuclear Reactors & Net Operating Capacity in the EU28

in GWe, from 1956 to 1 July 2014



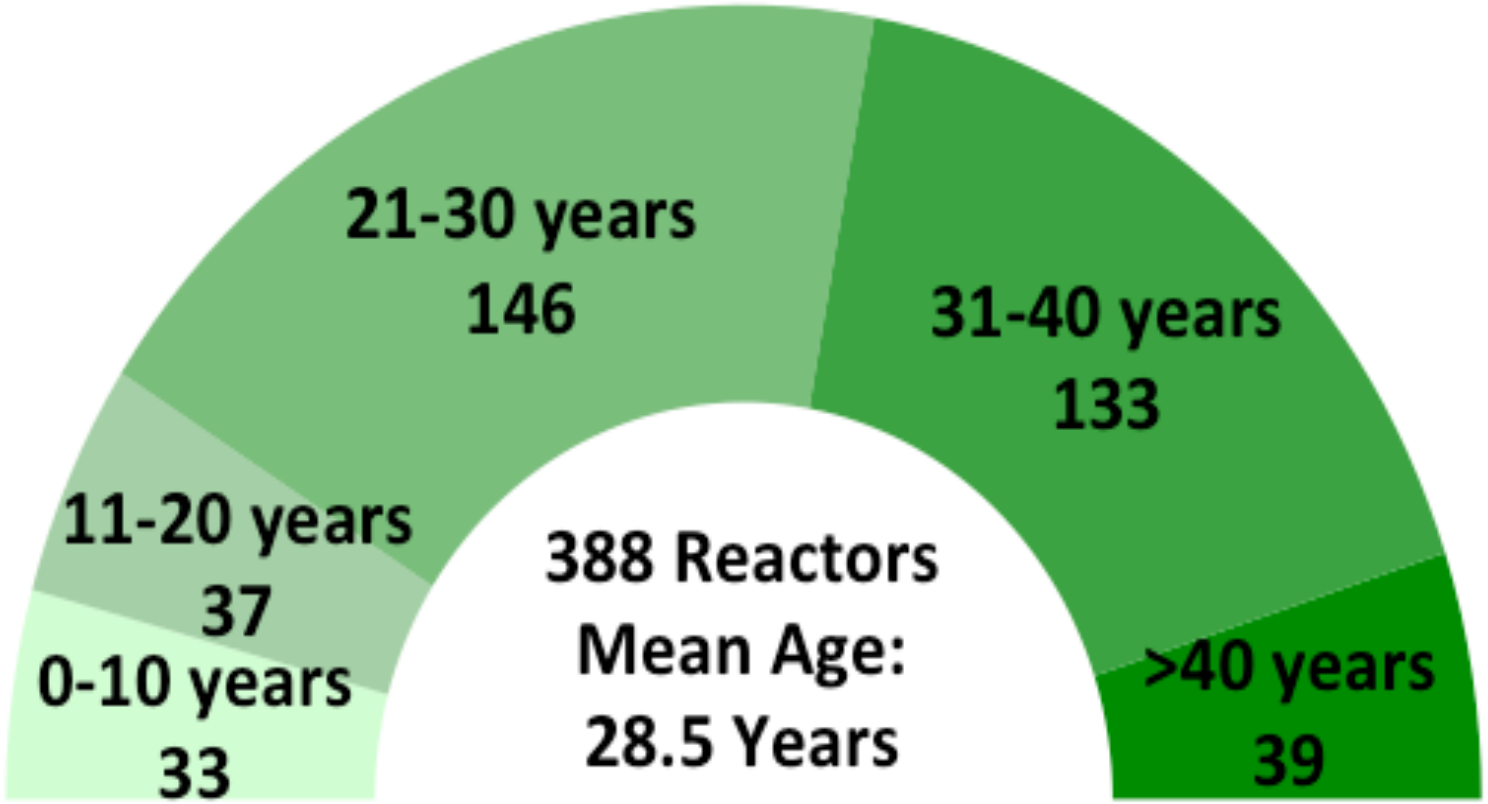
Source: IAEA-PRIS, MSC, 2014



Source: IAEA-PRIS, MSC, 2014

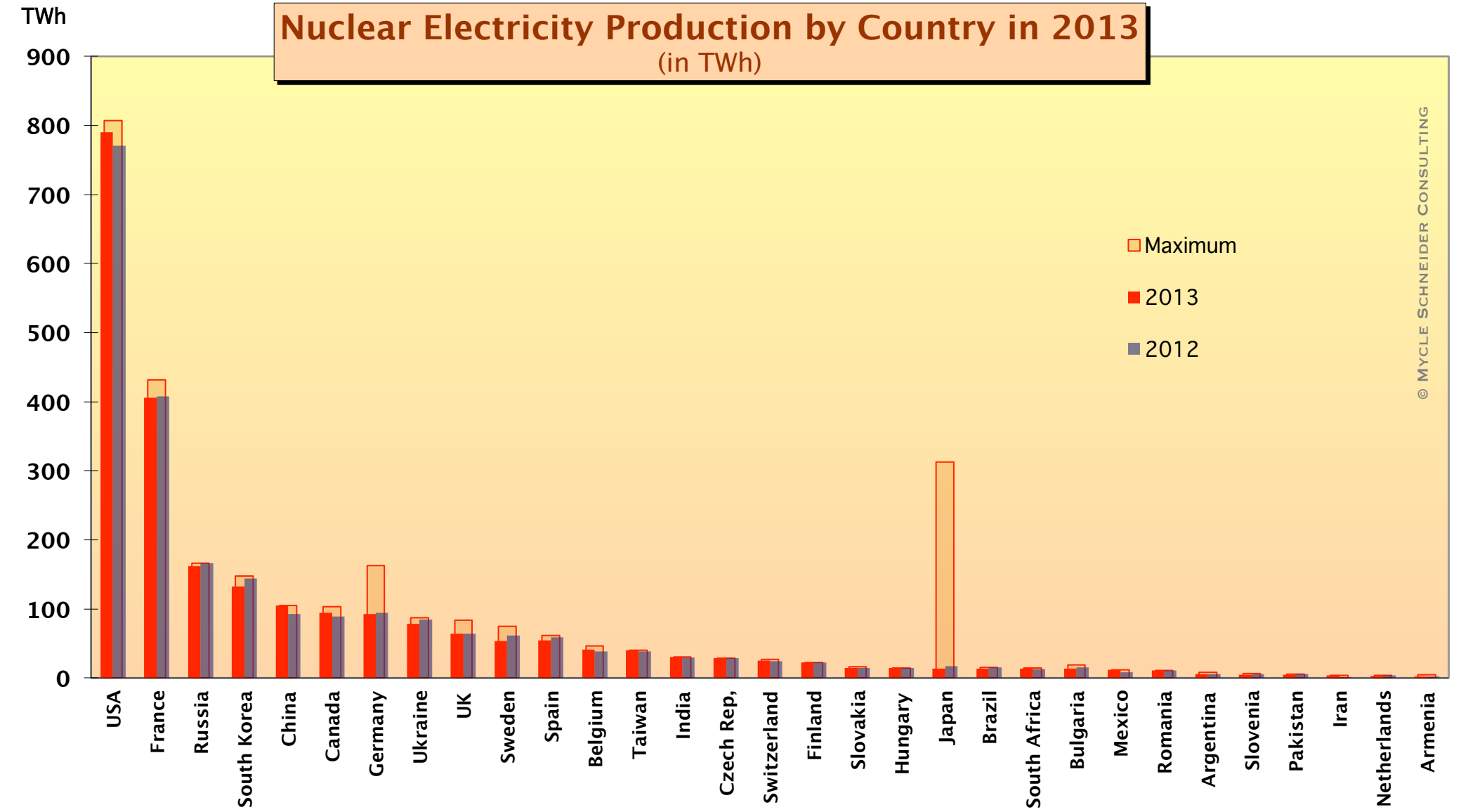
Age of World Nuclear Fleet

as of 1 July 2014



Nuclear Electricity Production by Country in 2013

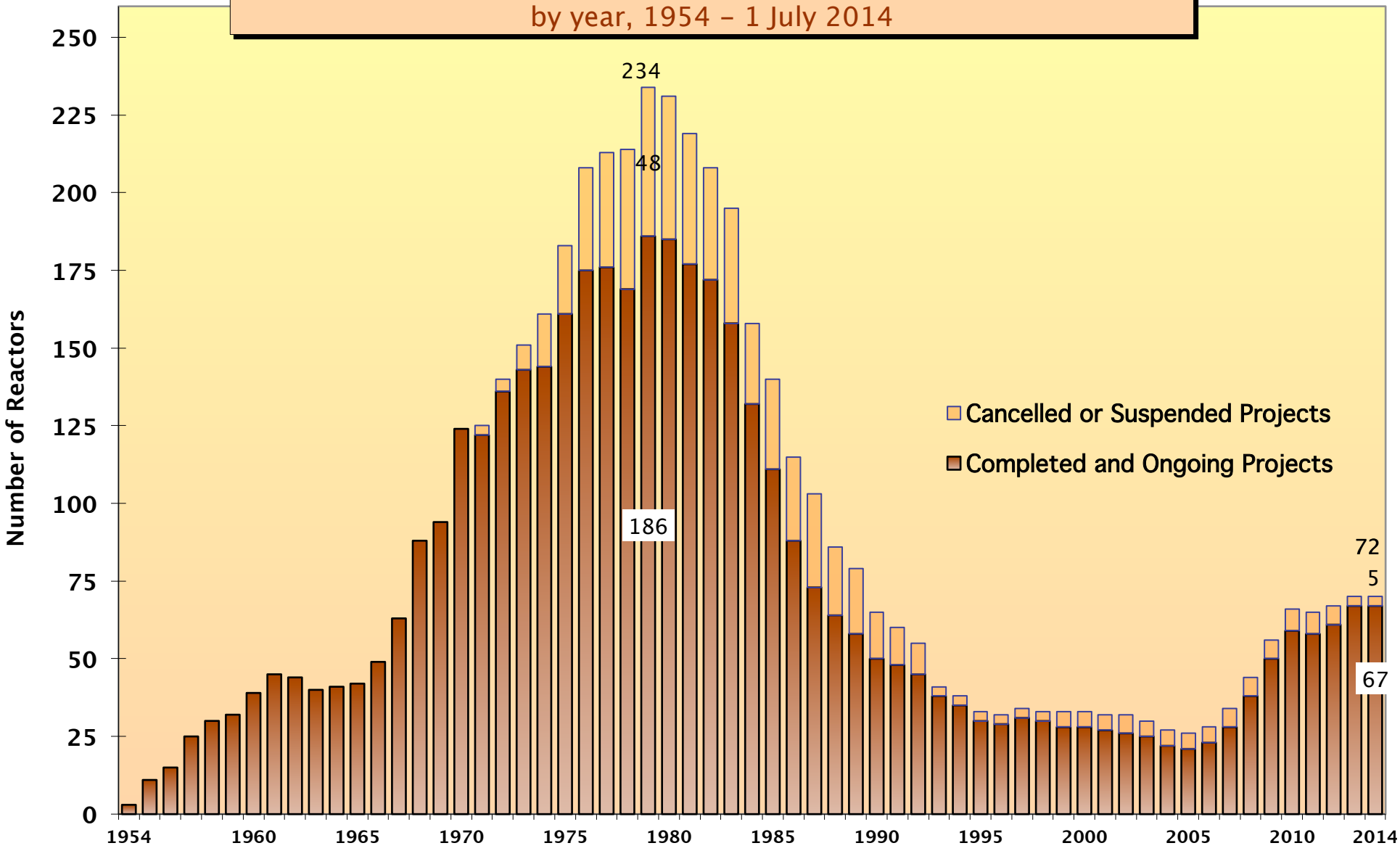
(in TWh)



Source: IAEA-PRIS, MSC, 2013

Number of Nuclear Reactors Listed as "Under Construction"

by year, 1954 – 1 July 2014



Source: IAEA-PRIS, MSC, 2014

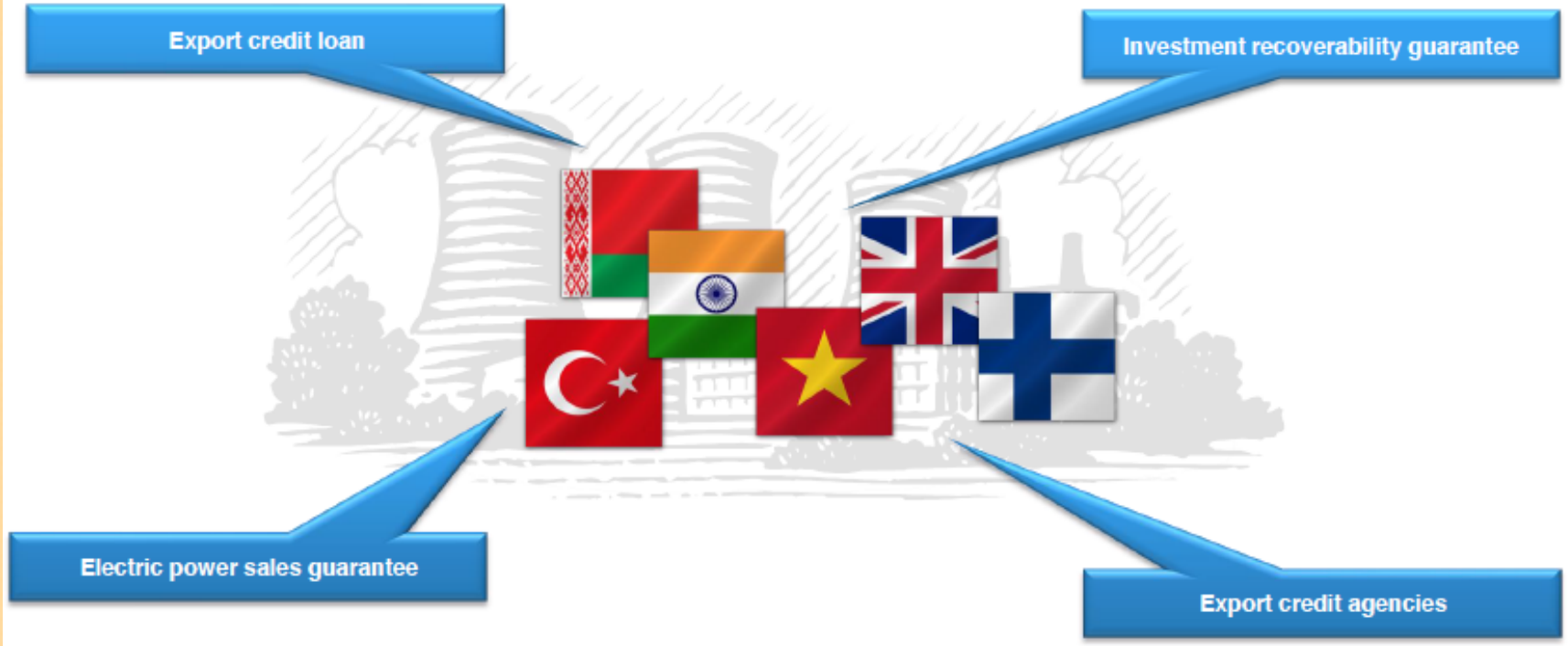
Reactors « Under Construction » in the World (1 October 2014)

Country	Units	MWe (net)	Construction Start	Grid Connection
China	27	26,756	2008-2013	2014-2018
Russia	9	7,273	1983-2019	2014-2019
India	6	3,907	2002-2011	2014-2016
South Korea	5	6,320	2008-2013	2014-2018
USA	5	5,633	1972-2013	2015-2019
UAE	3	4,035	2012-2014	2017-2018
Belarus	2	2,218	2013-2014	2019-2020
Pakistan	2	630	2011	2016-2017
Slovakia	2	880	1985	2014-2015
Ukraine	2	1,900	1986-1987	2015-2016
Argentina	1	25	2014	2018
Brazil	1	1,245	2010	2016
Finland	1	1,600	2005	2018
France	1	1,600	2007	2016
Total	**67**	**65,022**	**1972-2014**	**2014-2020**

Source: IAEA-PRIS, MSC, 2014

The role of the state has become a key factor, to which there is no alternative, for the implementation of nuclear power projects

Today there is already a wide selection of mechanisms for state support from state financing to Contract for Difference



The priority is the increase in efficiency and flexibility of implementation of tools of state support and financing in implementation NPP construction projects

The content of this presentation is for discussion purposes only, shall not be considered as an offer and doesn't lead to any obligations to Rosatom and its affiliated companies. Rosatom disclaims all responsibility for any and all mistakes, quality and completeness of the information.

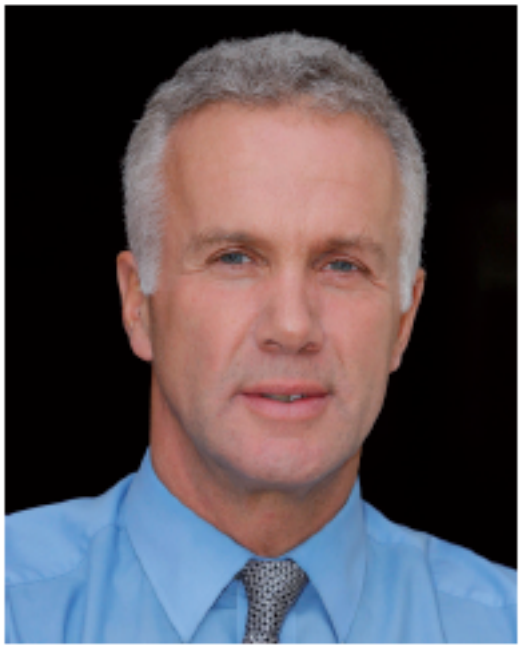
Russian Nuclear Industry Performance

Domestic Projects

- All 9 units under construction delayed; 3 units since 1983-85
- Kursk-5 abandoned in 2012 after 27 years of construction.
- Baltic-1 at Kaliningrad abandoned in 2013 after 1 year.

Foreign Projects

- 2 units at Belene, Bulgaria, first Russian Project in the EU, abandoned in 2012 after 27 years of construction.
- 1 unit at Busheer, Iran started up after 36 years of construction.
- 1 unit at Kudankulam, India started up after 11 years, second unit still under construction after 12 years.
- Projects delayed indefinitely or abandoned in Bangladesh, Czech Republic, Vietnam… to name a few.



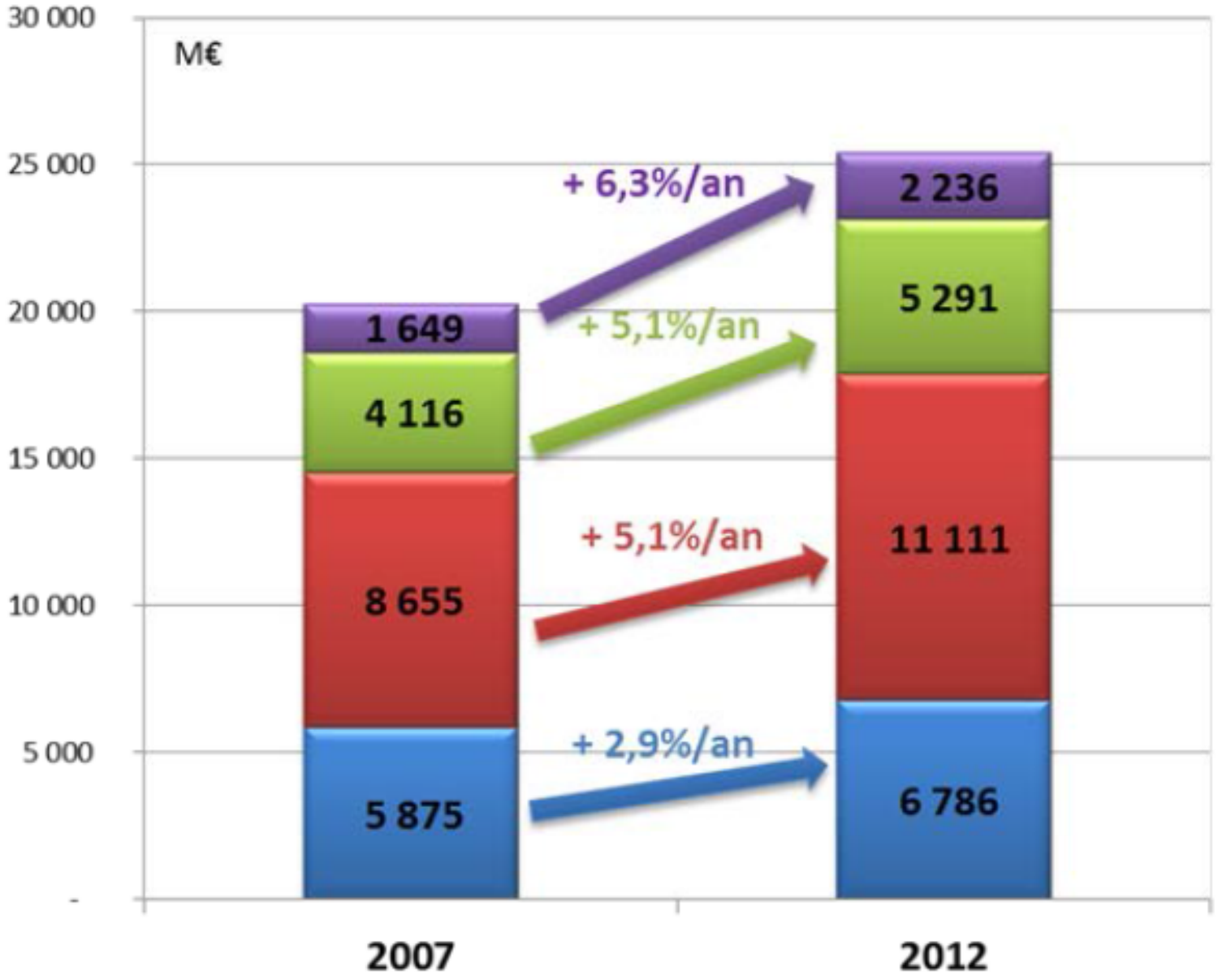
By Steve Kidd

Steve Kidd is an independent nuclear consultant and economist with 17 years of work in senior positions at the World Nuclear Association and its predecessor organisation, the Uranium Institute.

"The sections [in the World Nuclear Industry Status Report] on prospective nuclear countries and the delays to the construction of reactors are also comprehensive and relatively fair. It is reasonable to suggest that it is highly unlikely that Russia will succeed in carrying out even half of the projects in which it claims to be closely involved, while it is true that even the Chinese programme is suffering some delays."

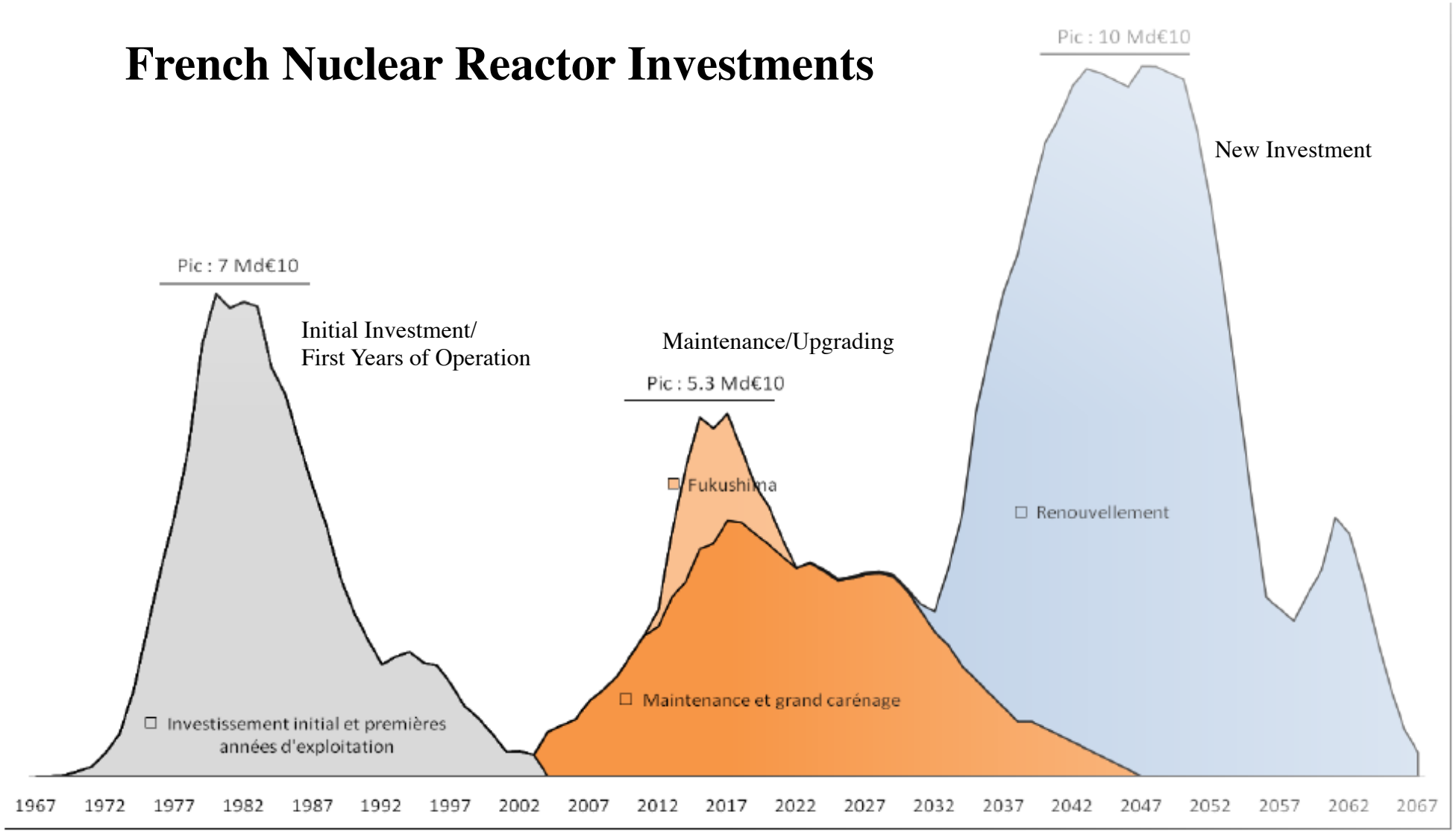
Source: Nuclear Engineering International, September 2014

French Electricity Generating and Marketing Costs 2007-2012: +4.5%/a



Source: Rapport de la Commission de régulation de l'énergie, 4 June 2013

French Nuclear Reactor Investments



Traditional Utilities Under Pressure—UBS: *"Time to Join the Revolution"*

The 20 largest European energy utilities lost over half of the €1 trillion stock market value since 2008, some a lot more (EDF, E.ON over 70%).

Europe's electricity providers face an existential threat.

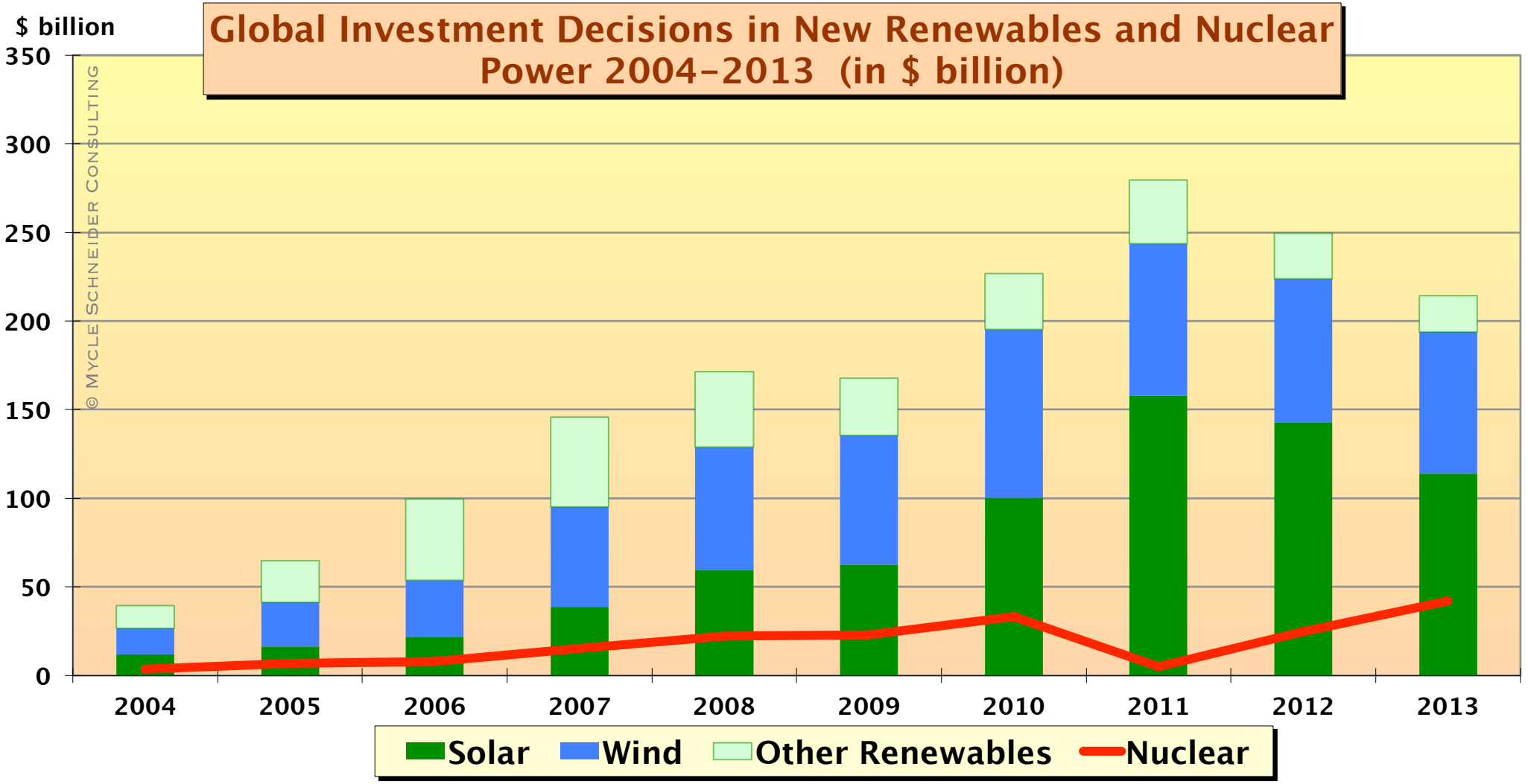
The Economist, London, October 2013

Utility business models are threatened by the dramatic growth in the deployment of technologies that generate electricity onsite or at the distribution grid level.

Navigant Research, Boulder, USA, August 2014

A new technological paradigm in electricity and the end of the reign of the large-scale utilities.

Institute for Public Policy Research, London, September 2014

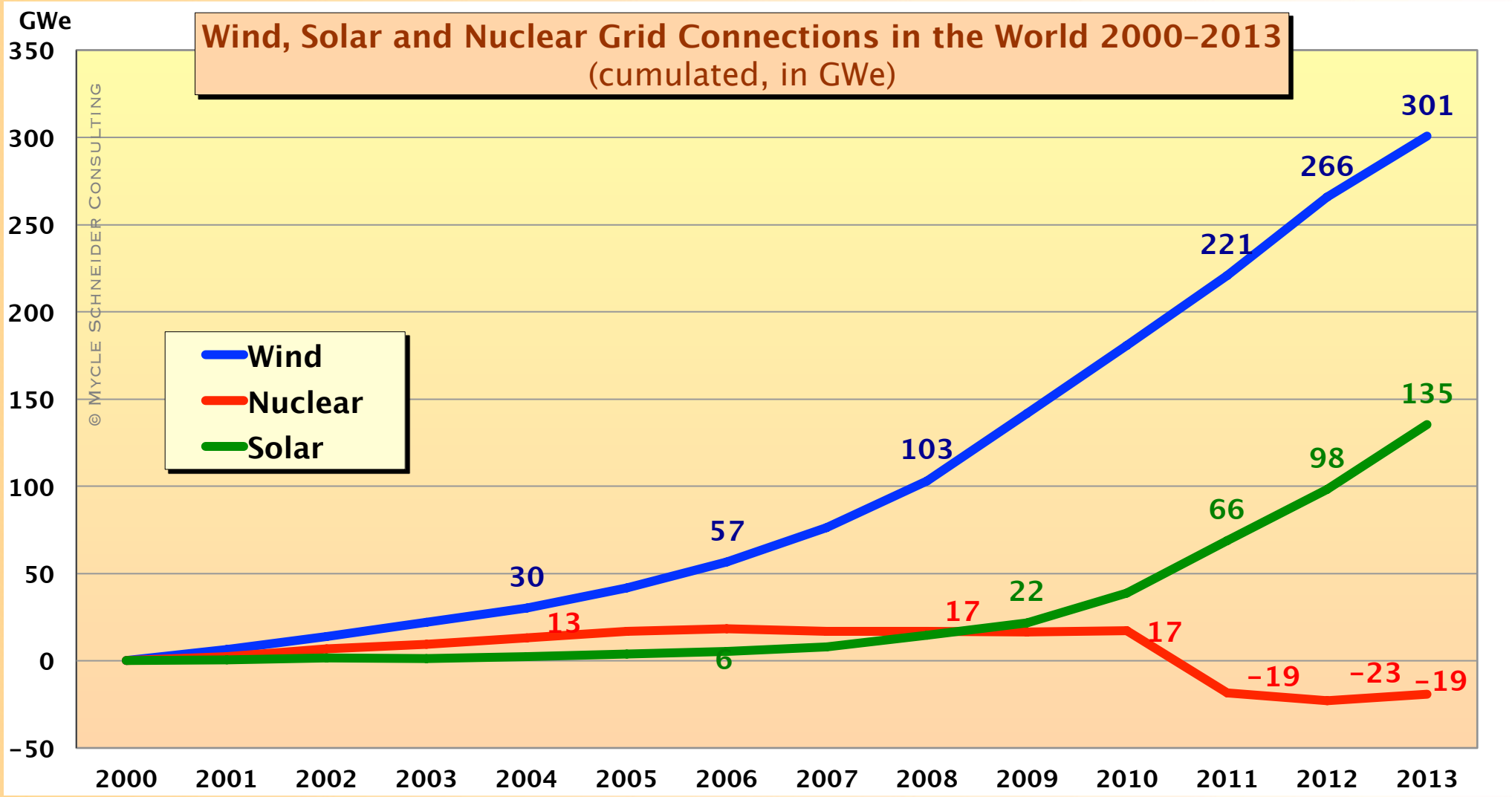


Source: UNEP 2014 and WNISR original research

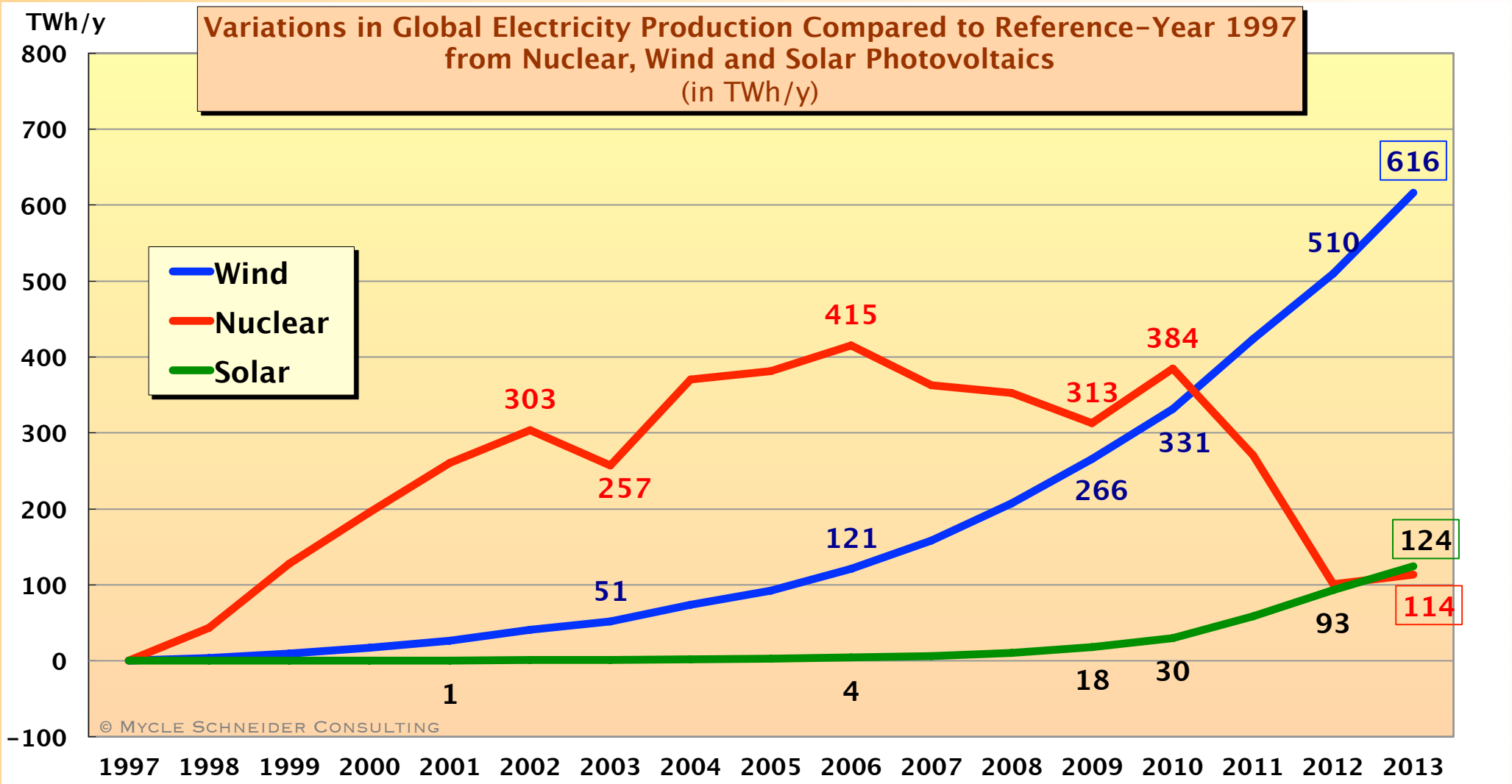
Top 10 Renewable Energy Investment
2011-2013
(in billion US$)

Country	Billion US$		
	2013	2012	2011
1. China	54.2	67.7	45.5
2. United States	33.9	44.2	48.1
3. Japan	28.6	16.3	8.6
4. UK	12.1	8.3	9.4
5. Germany	9.9	22.8	30.6
6. Canada	6.4	N/A	5.5
7. India	6.0	4.5	10.2
8. South Africa	4.9	5.5	0.03
9. Australia	4.4	N/A	N/A
10. Italy	3.6	14.7	28

Source: Bloomberg New Energy Finance, 2013-14

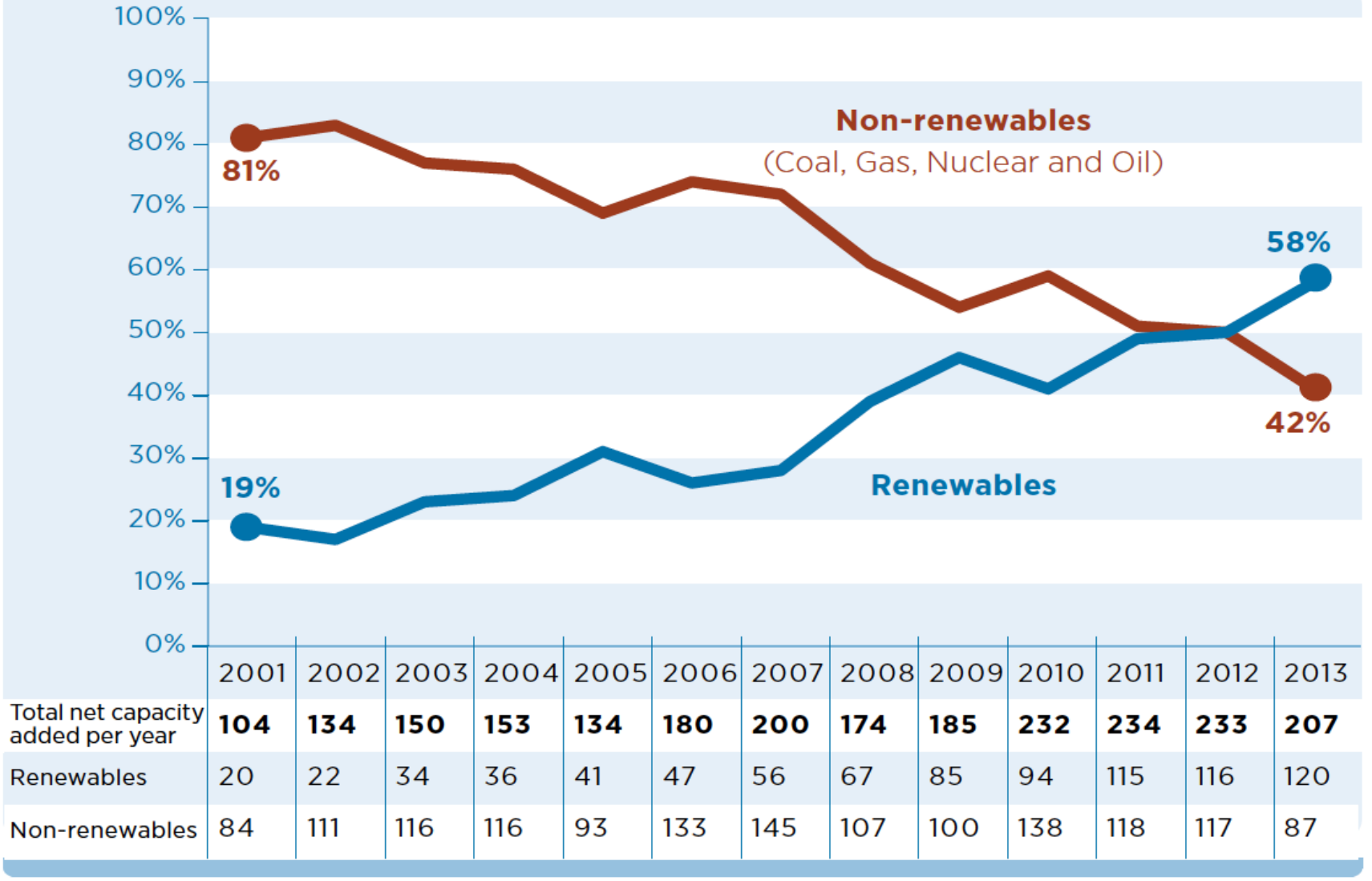


Source: IAEA-PRIS, EPIA, GWEC 2014



Sources: BP, IAEA-PRIS, MSC, 2014

Renewables Share of Global Electricity Generating Capacity Additions



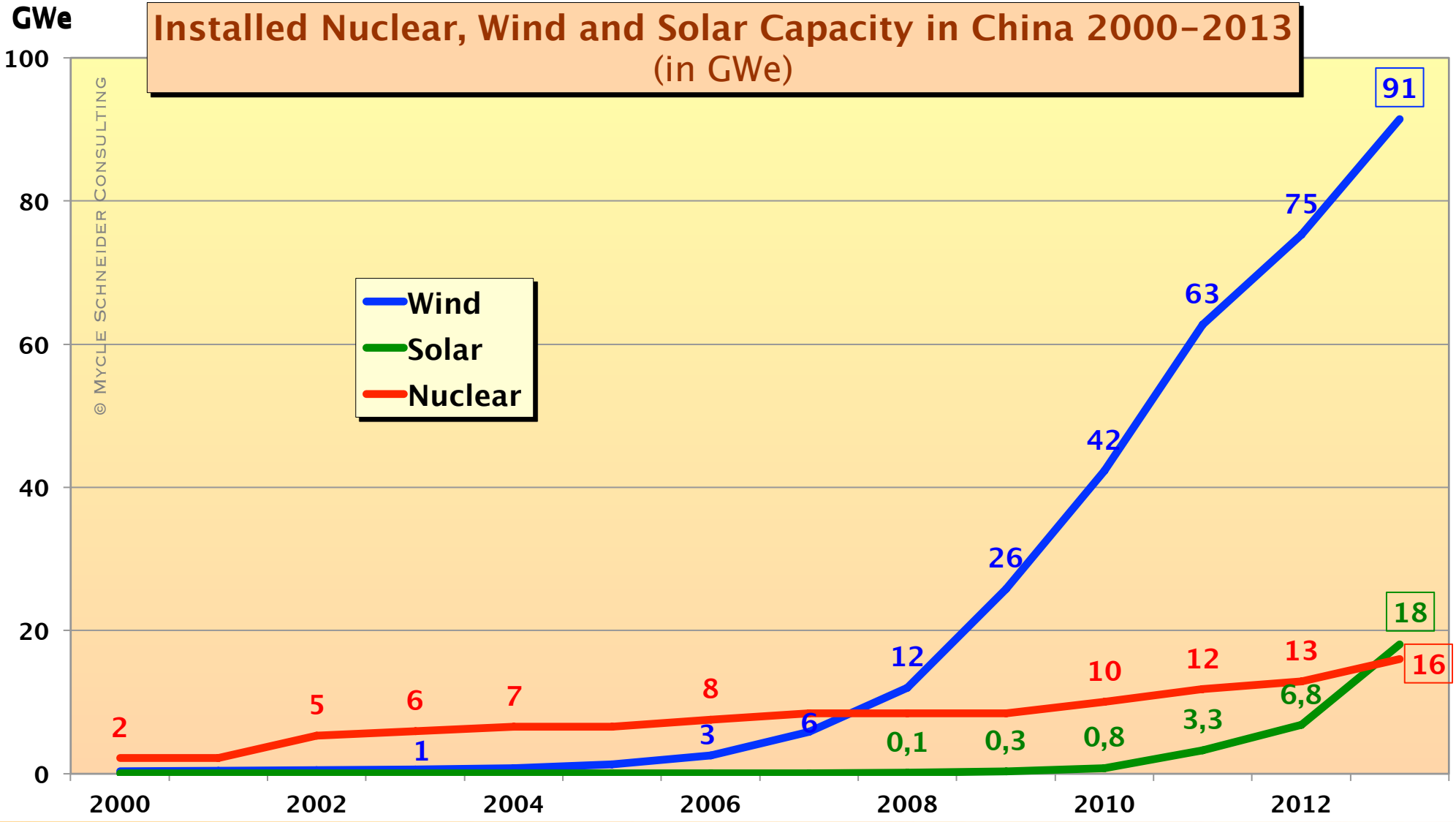
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total net capacity added per year	**104**	**134**	**150**	**153**	**134**	**180**	**200**	**174**	**185**	**232**	**234**	**233**	**207**
Renewables	20	22	34	36	41	47	56	67	85	94	115	116	120
Non-renewables	84	111	116	116	93	133	145	107	100	138	118	117	87

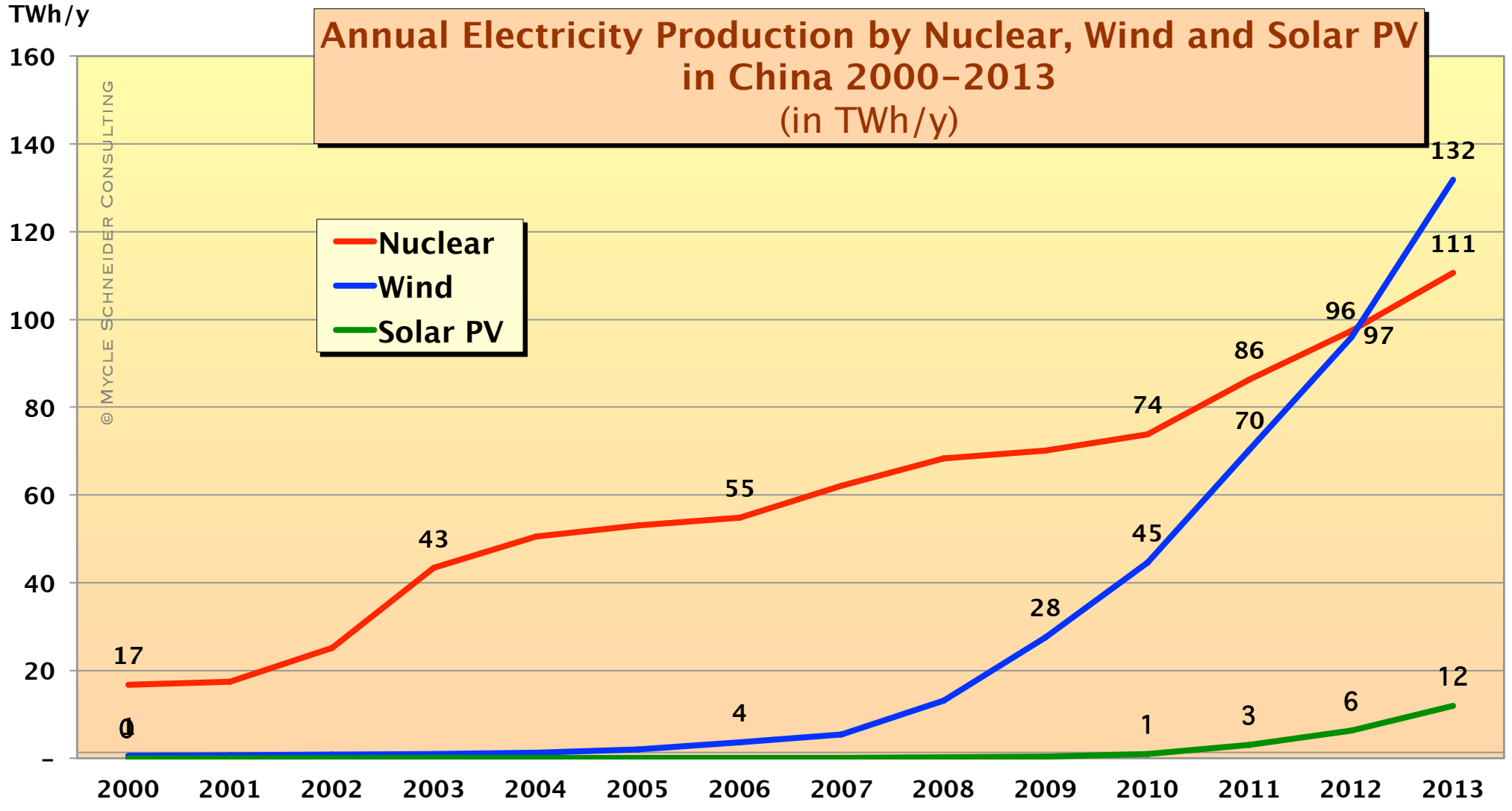
Source: IRENA, Rethinking Energy, 2014

Global

In 2013, Spain generated more power from wind than from any other source, outpacing nuclear for the first time. It is also the first time that wind has become the largest electricity generating source over an entire year in any country.

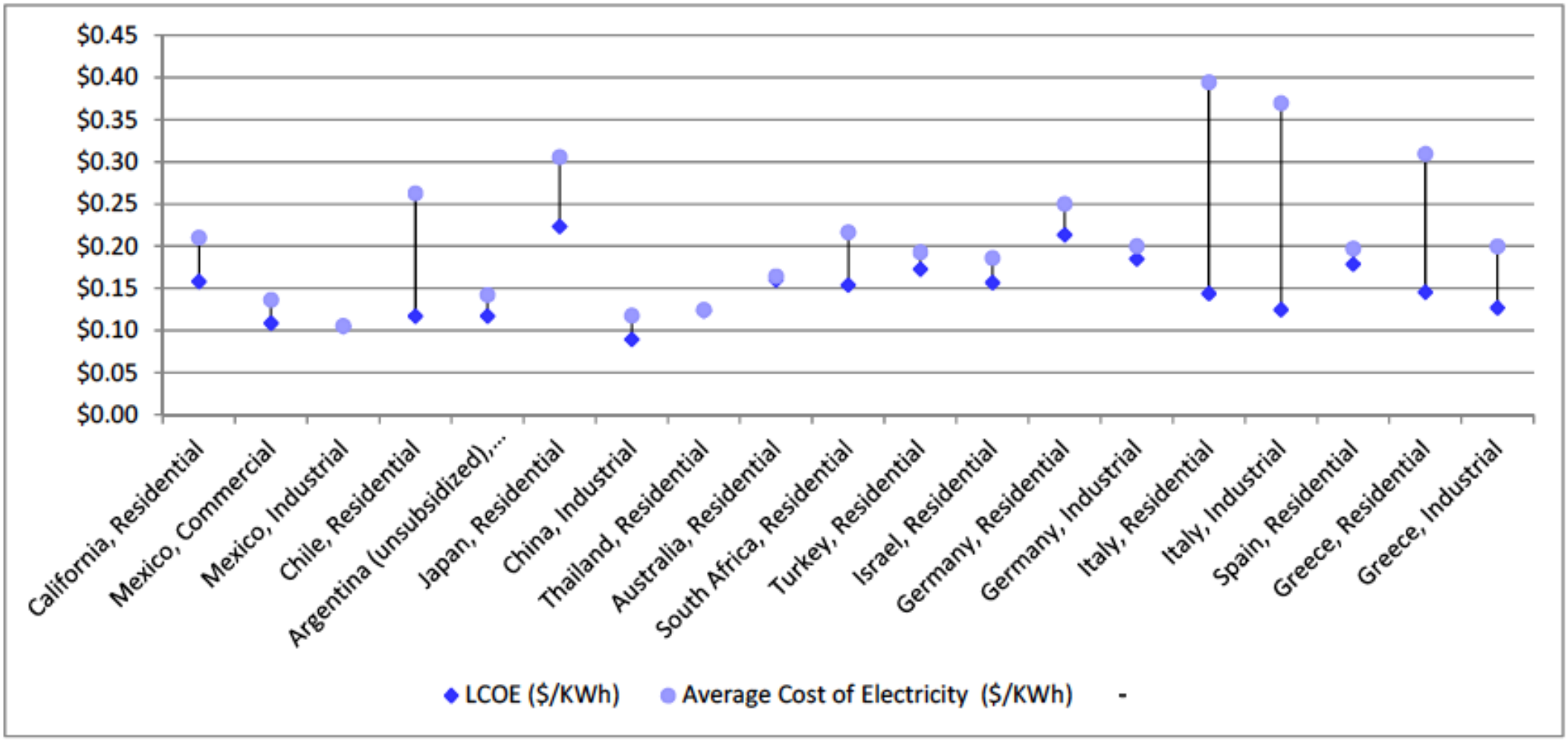
Spain has thus joined the list of nuclear countries that produce more electricity from new renewables—excluding large hydro-power—than from nuclear power that includes Brazil, China, Germany, India and Japan.


GWe
Installed Nuclear, Wind and Solar Capacity in China 2000-2013
(in GWe)
© Mycle Schneider Consulting
Wind
Solar
Nuclear
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
91
75
63
42
26
12
6
3
1
18
16
13
12
10
8
7
6
5
2
6,8
3,3
0,8
0,3
0,1



Source: BP 2014

Markets at Solar Photovoltaics Grid Parity… More to Come



Source: DB, BLS, Ontario Energy Board, Mexican Ministry of Energy, Chile Energy Group, Argentinean Secretary of Energy, NASA, Tepco, Chinese Economic Observer, Beijing International, Indian Central Regulatory Commission, Australia Power and Gas, Saudi Electric Company, Eksom, EuroStat

Source: Deutsche Bank, « 2014 Outlook—Let the Second Gold Rush Begin », 6 January 2014

“Austin’s Super Cheap Solar Agreement (5¢/kWh) Goes To Recurrent Energy”

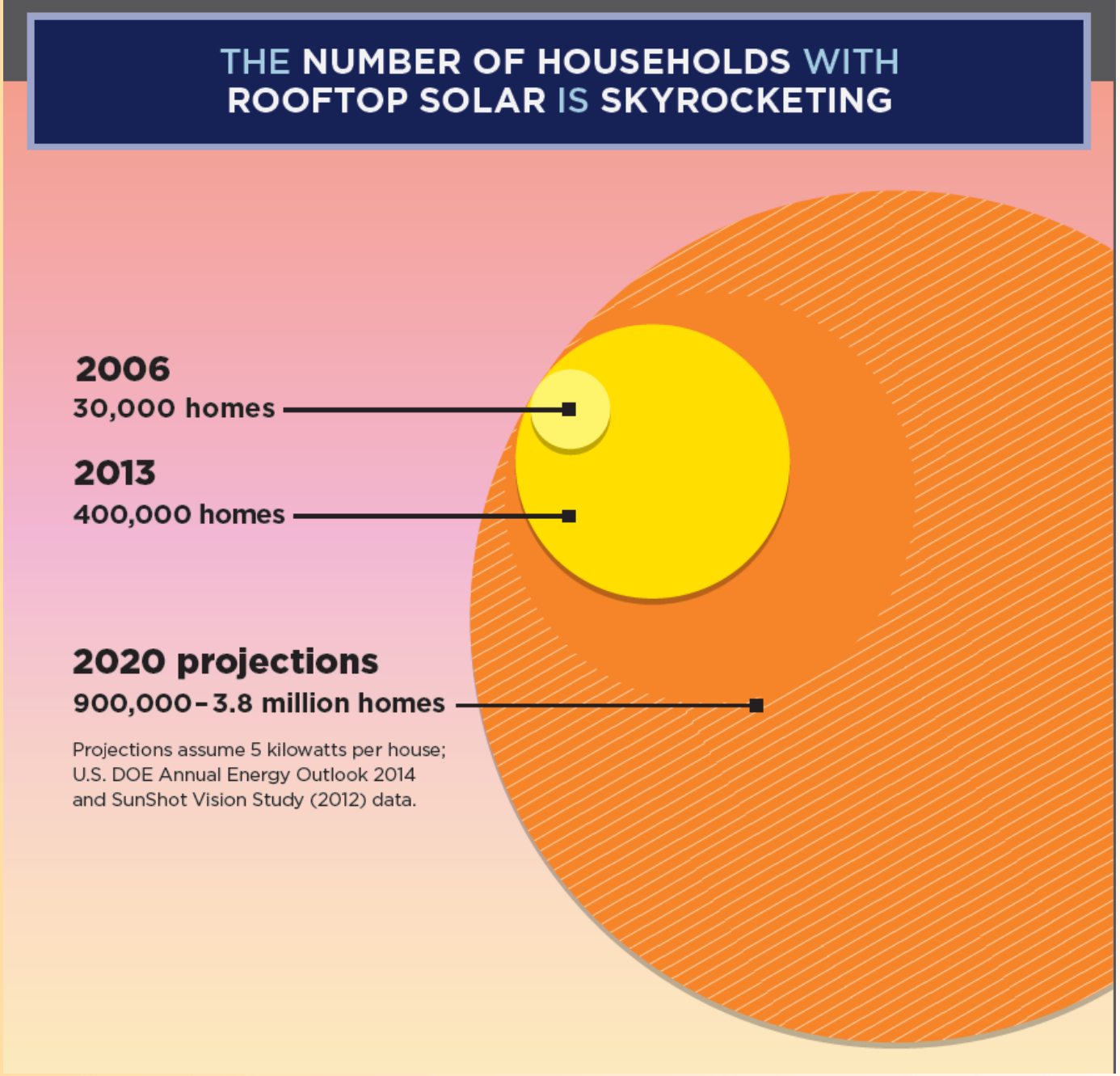
An unprecedentedly low price for a large solar project with 150 MW, 20-year Power Purchase Agreement.

Austin Energy's estimates natural gas at 7 cents, coal at 10 cents and nuclear at 13 cents.

Source: Greentechsolar, 21 May 2014

Solar Photovoltaics in the U.S.

By 2017, more than half of the States could have rooftop solar that is as cheap as local electricity prices.



Source: UCS, http://www.ucsusa.org/, 2014

New Players: Example Seoul

Target Phase 1: Saving or substituting 2 million TOE, achieved in 26 months (by June 2014, 6 months early) through:

- Energy savings: 44.5%
- Energy efficiency: 42.5%
- RE production: 13.0%

Key: Exceptional level of public involvement.

Target Phase 2: Saving or substituting +4 million TOE **by 2020**, reduce CO2e emissions by 20.5% or 10 million tons (compared to 2011). Targets include:

- 100% LED equipment public bldgs.
- RE increase from 2—5%.
- Boost electricity self-reliance from 4—20%

"Large-scale power generation, however, will be the dinosaur of the future energy system: Too big, too inflexible, not even relevant for backup power in the long run."

UBS (largest Swiss bank)
"Will solar, batteries and electric cars re-shape the electricity system?"
20 August 2014

Thank You!

Contact: mycle@orange.fr
Phone: +33-1-69 83 23 79

www.WorldNuclearReport.org - online now!

About the Author

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 and the Coordinator of the Seoul International Energy Advisory Council (SIEAC). 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.

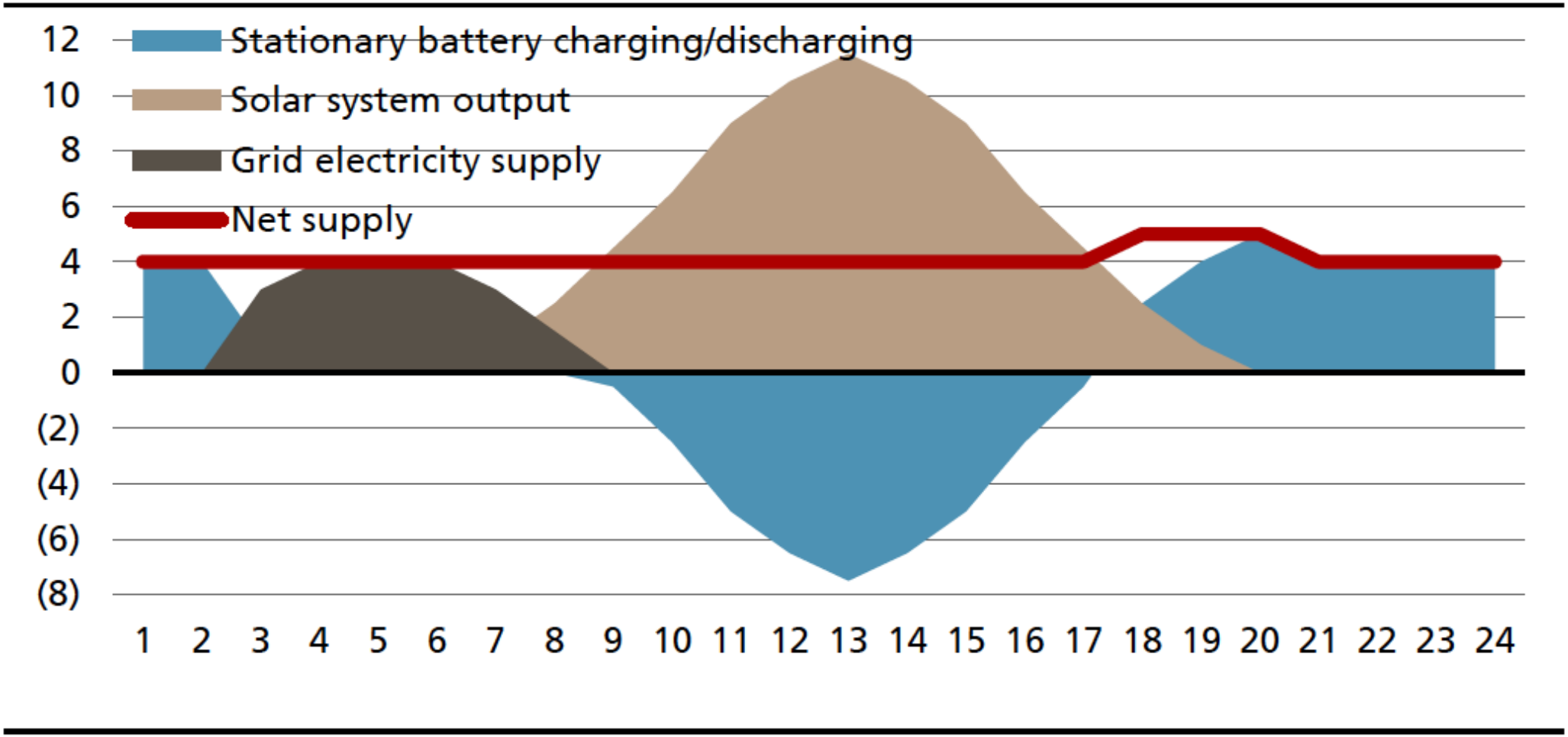
Mycle Schneider has given evidence or held briefings at national Parliaments in 14 countries and at the European Parliament. He has advised Members of the European Parliament from four different groups over the past 26 years. He has given lectures or had teaching appointments at 20 universities and engineering 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").

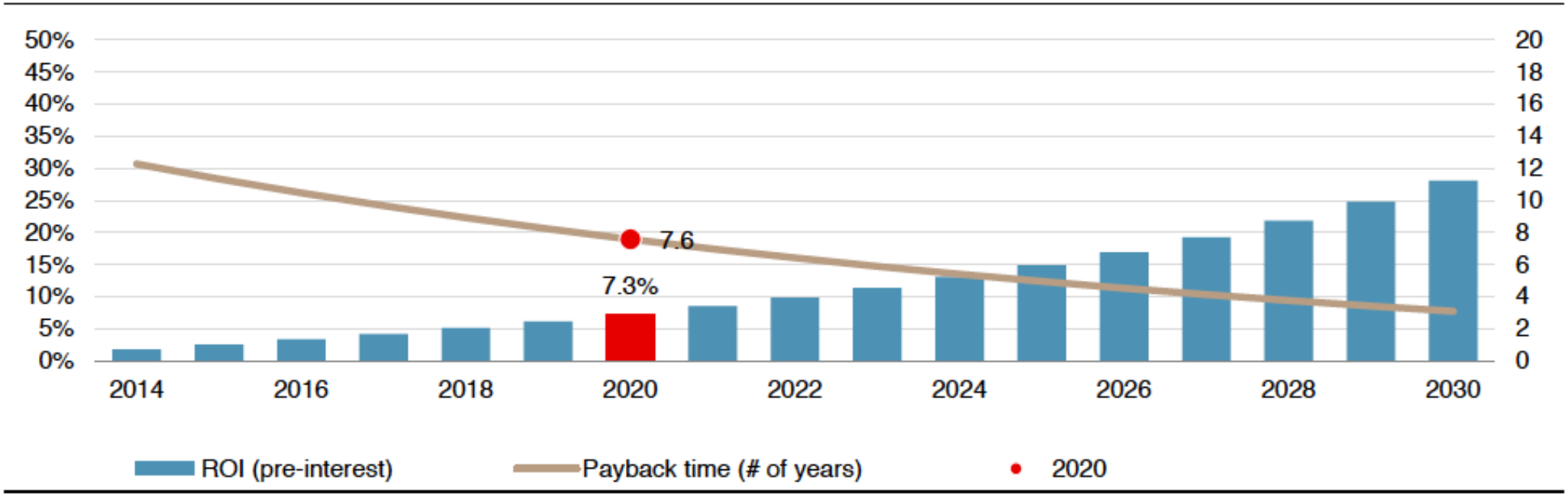
Annexes

UBS: “Daily supply profile can be (almost) perfectly matched”



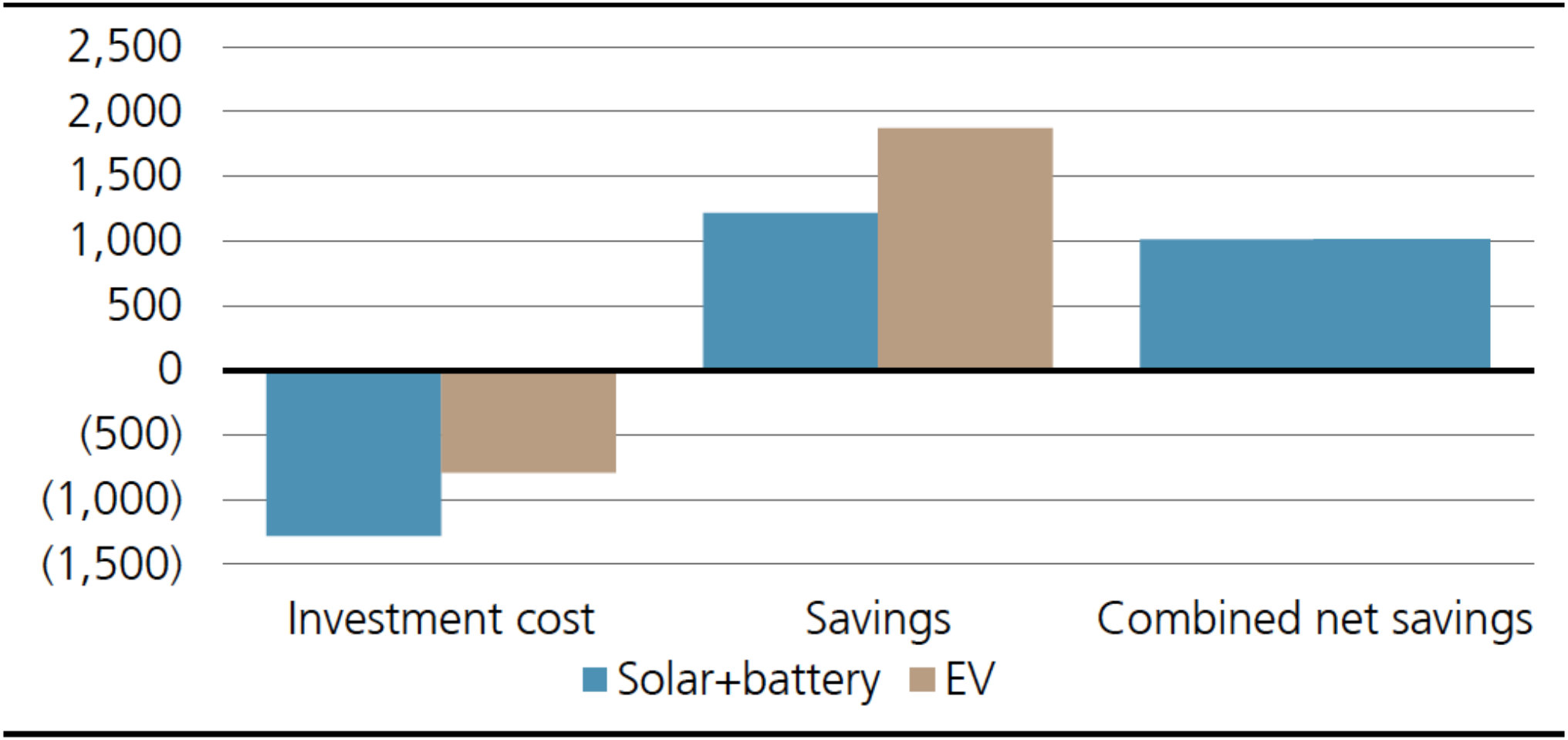
Source: UBS estimates (schematic illustration of a typical working day)

UBS: "Solar + battery + EV already pays off, but economics to further improve dramatically"



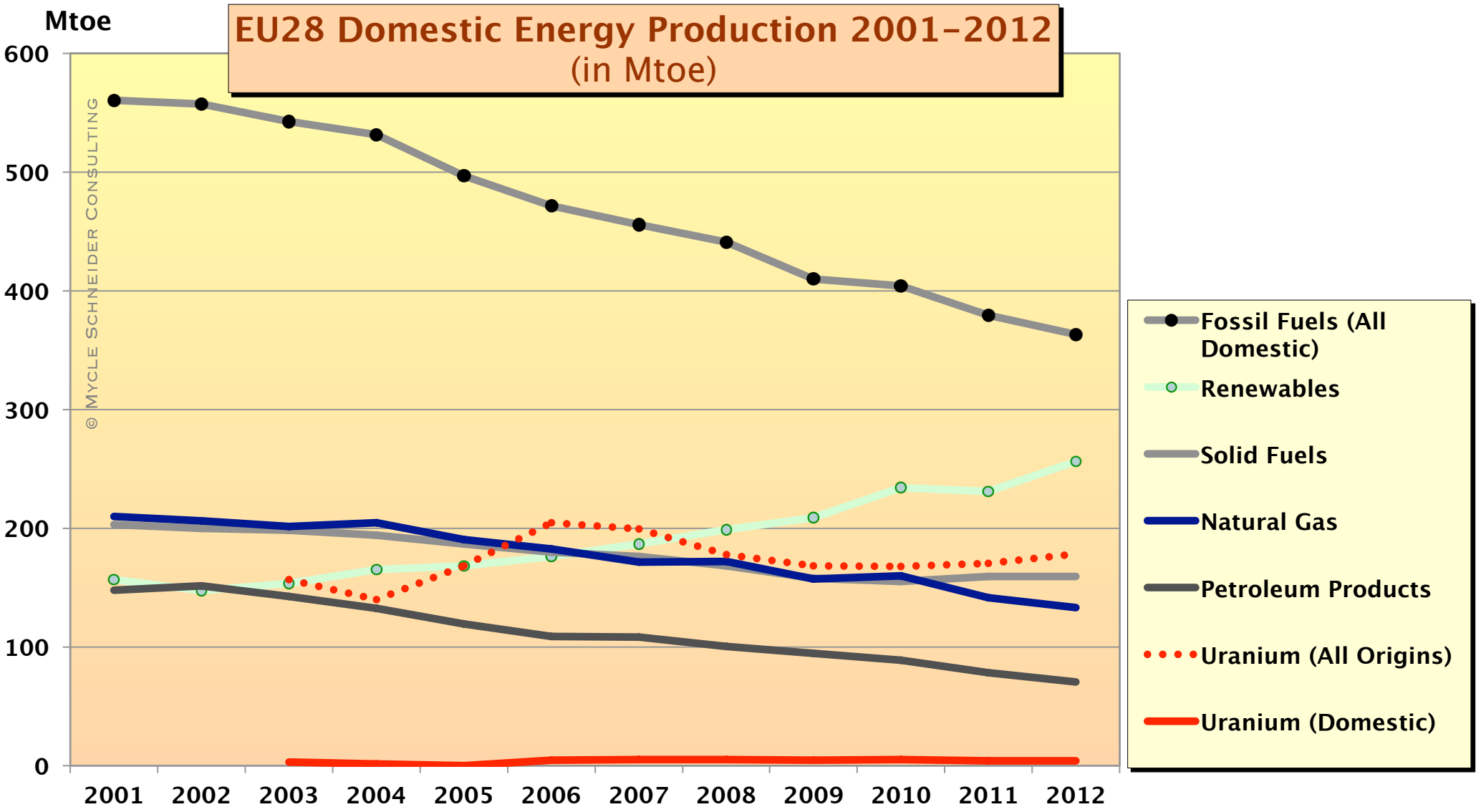
Source: UBS estimates
Note: Chart shows economics in Germany.

Annual Balance of EV + Solar + Battery = €1,000 Savings Per Year

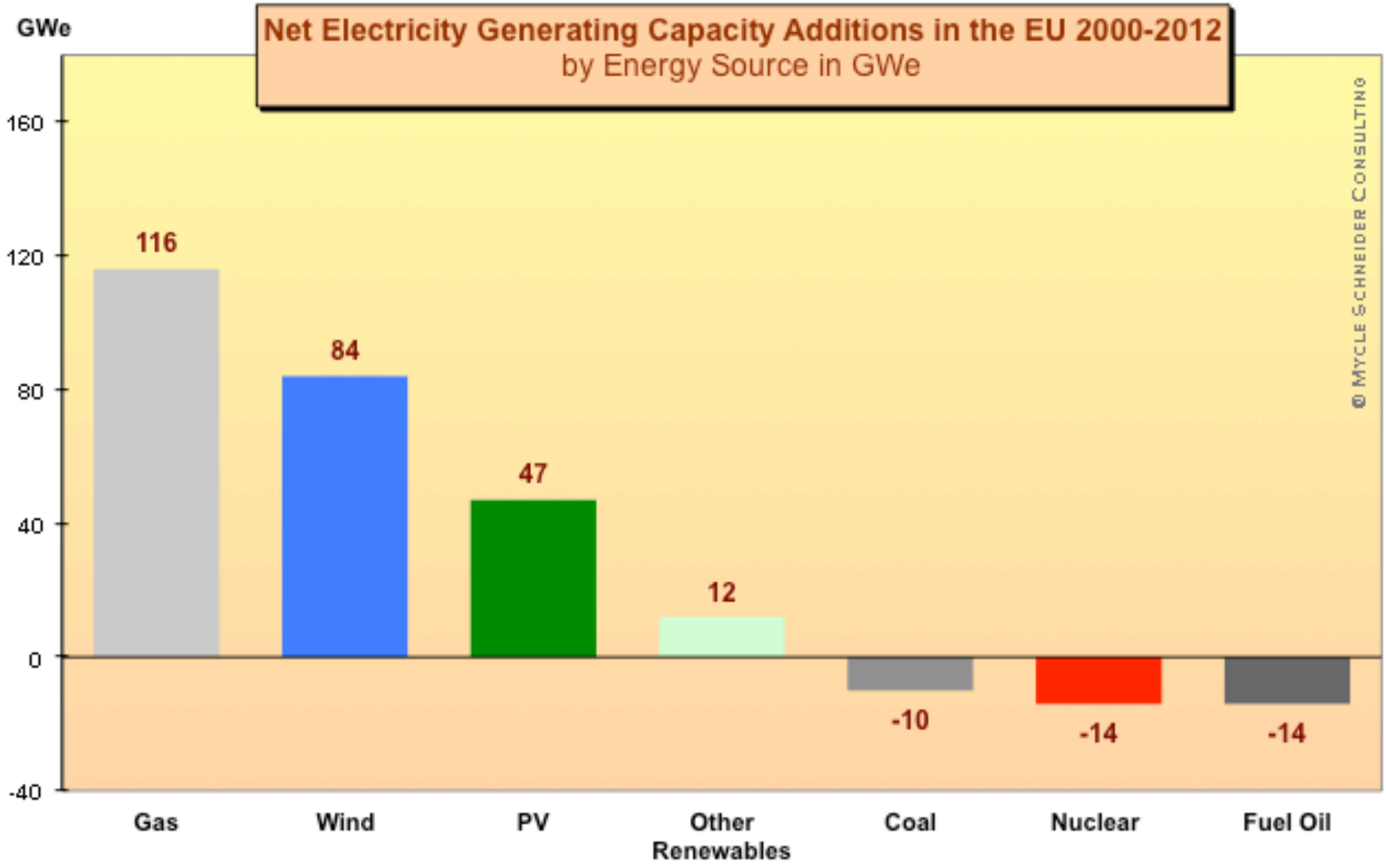


Source: UBS estimates
Note: Based on purchase in Germany in 2017; assumes EV is charged with self-generated solar power.

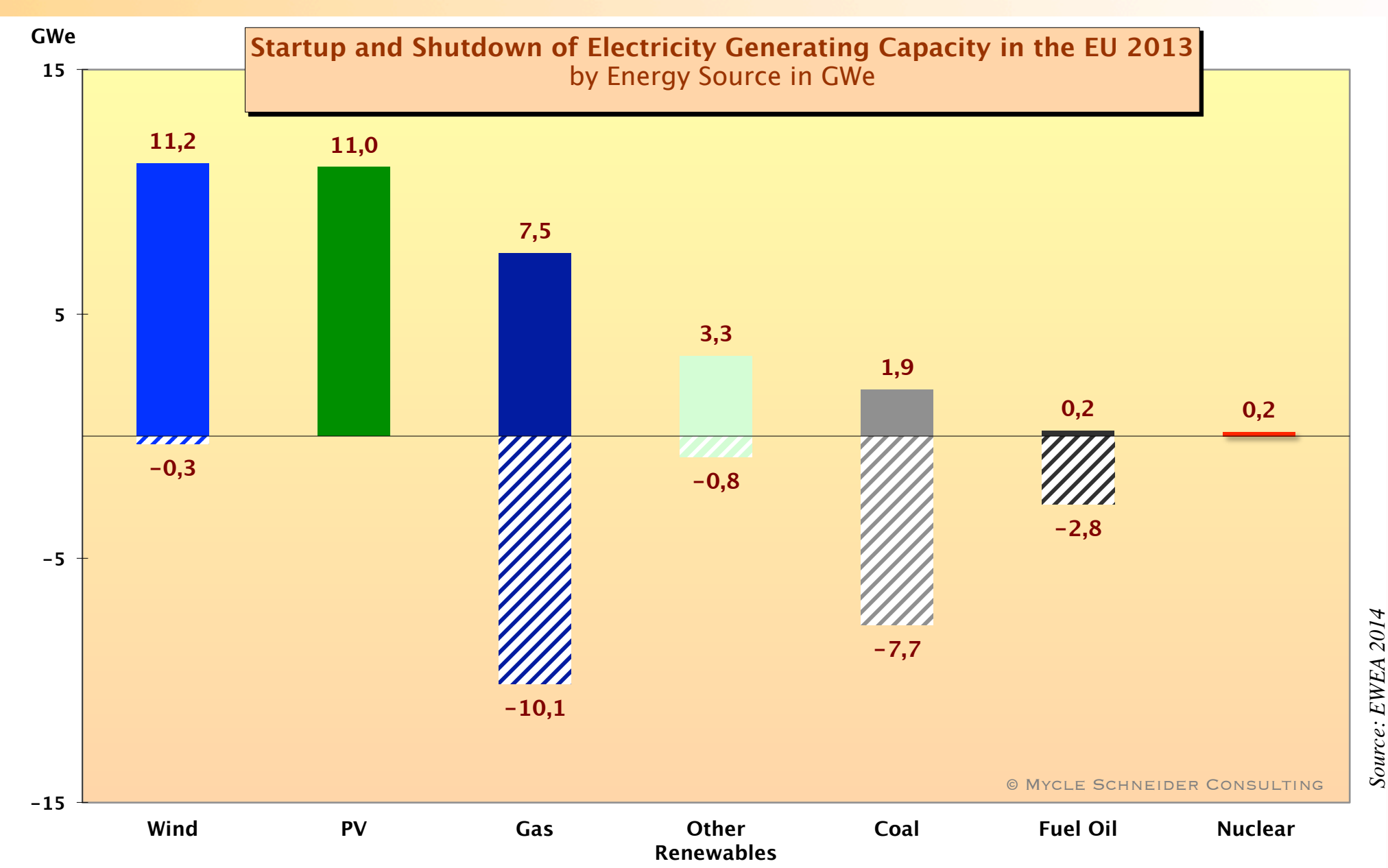
EU28 Domestic Energy Production 2001-2012
(in Mtoe)



Source: Sources: Eurostat, Euratom Supply Agency, BEE/Raffaele Piria, 2014



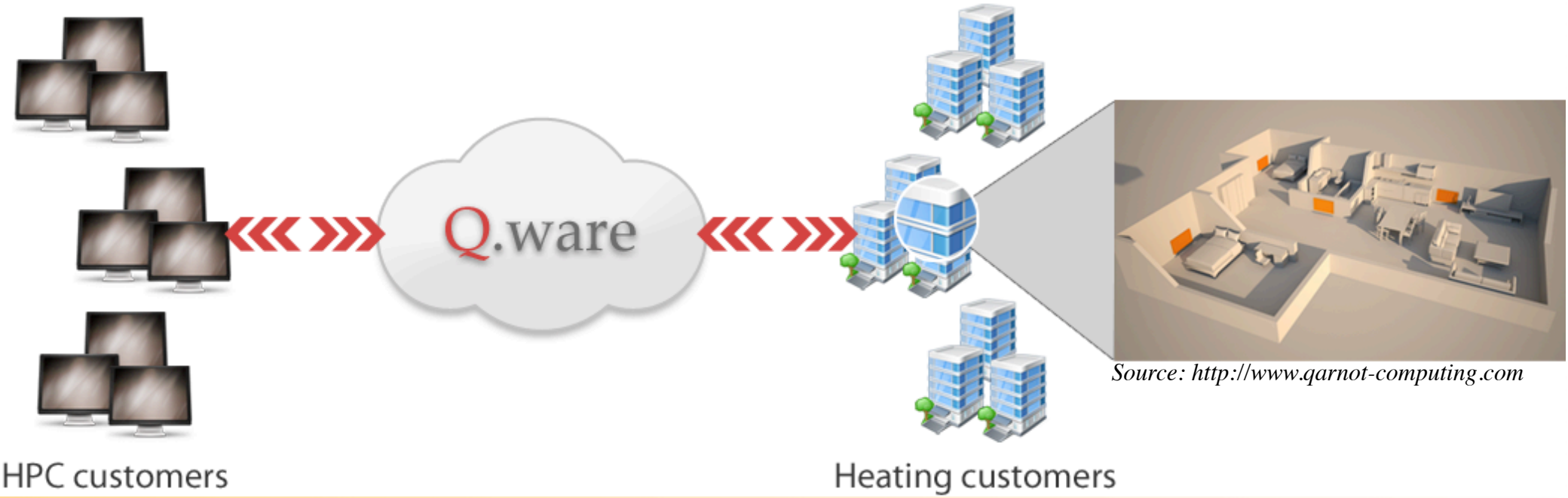
Source: EWEA 2013


GWe
Startup and Shutdown of Electricity Generating Capacity in the EU 2013
by Energy Source in GWe
15
5
-5
-15
11,2
-0,3
11,0
7,5
-10,1
3,3
-0,8
1,9
-7,7
0,2
-2,8
0,2
Wind
PV
Gas
Other Renewables
Coal
Fuel Oil
Nuclear
© Mycle Schneider Consulting
Source: EWEA 2014

Example 3: Heat/Cold + Communication

New Competitive Concepts: Example Qarnot Computing

Heating with waste heat from processors placed in peoples' homes, rather than implementing expensive cooling for digital servers in huge data centers.



Source: http://www.qarnot-computing.com

Within two years, Qarnot Computing has built up a network of thousands of processors that are heating several hundred homes and offices in Paris for free and is providing commercial computing services far below market price.