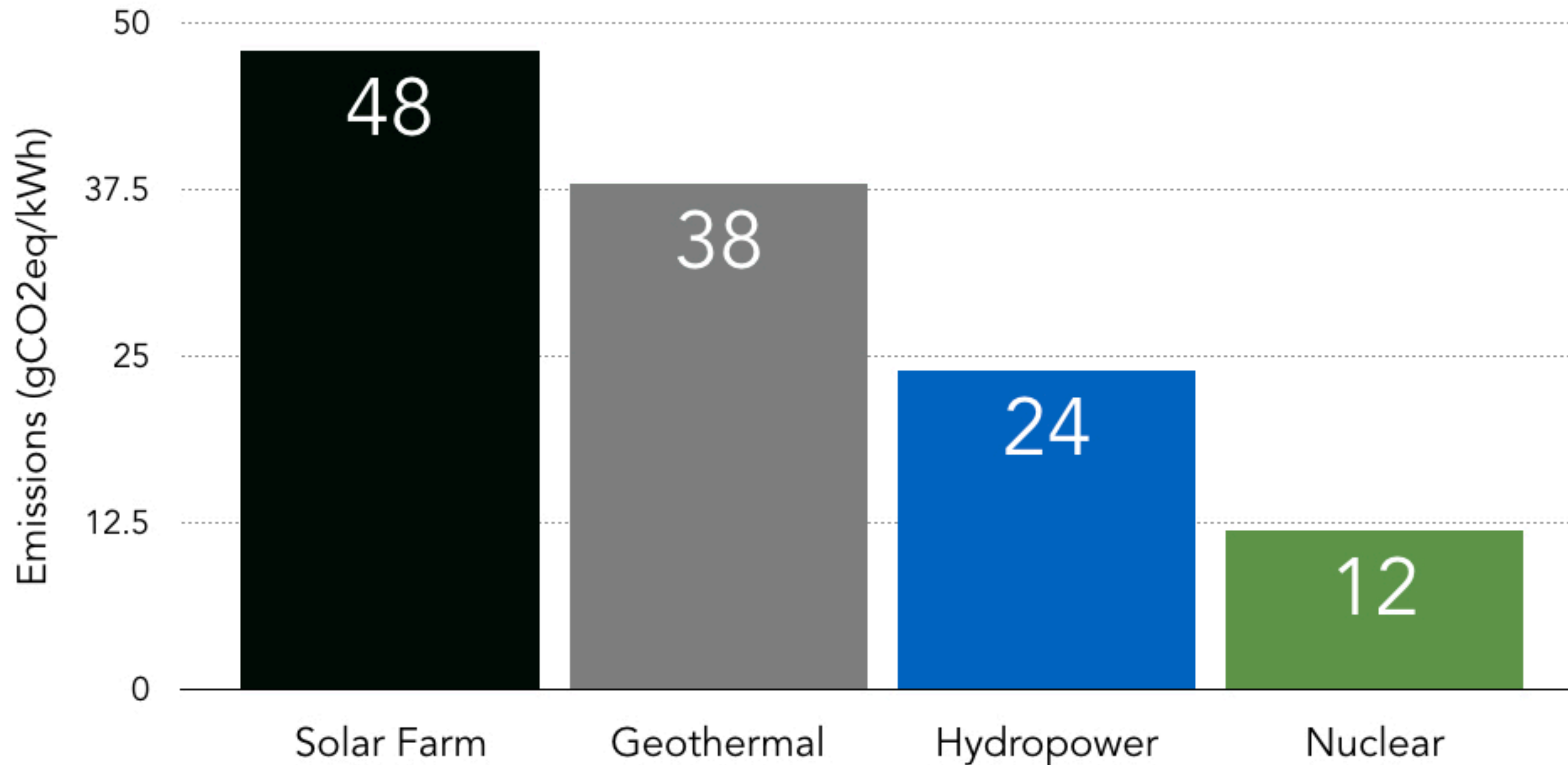


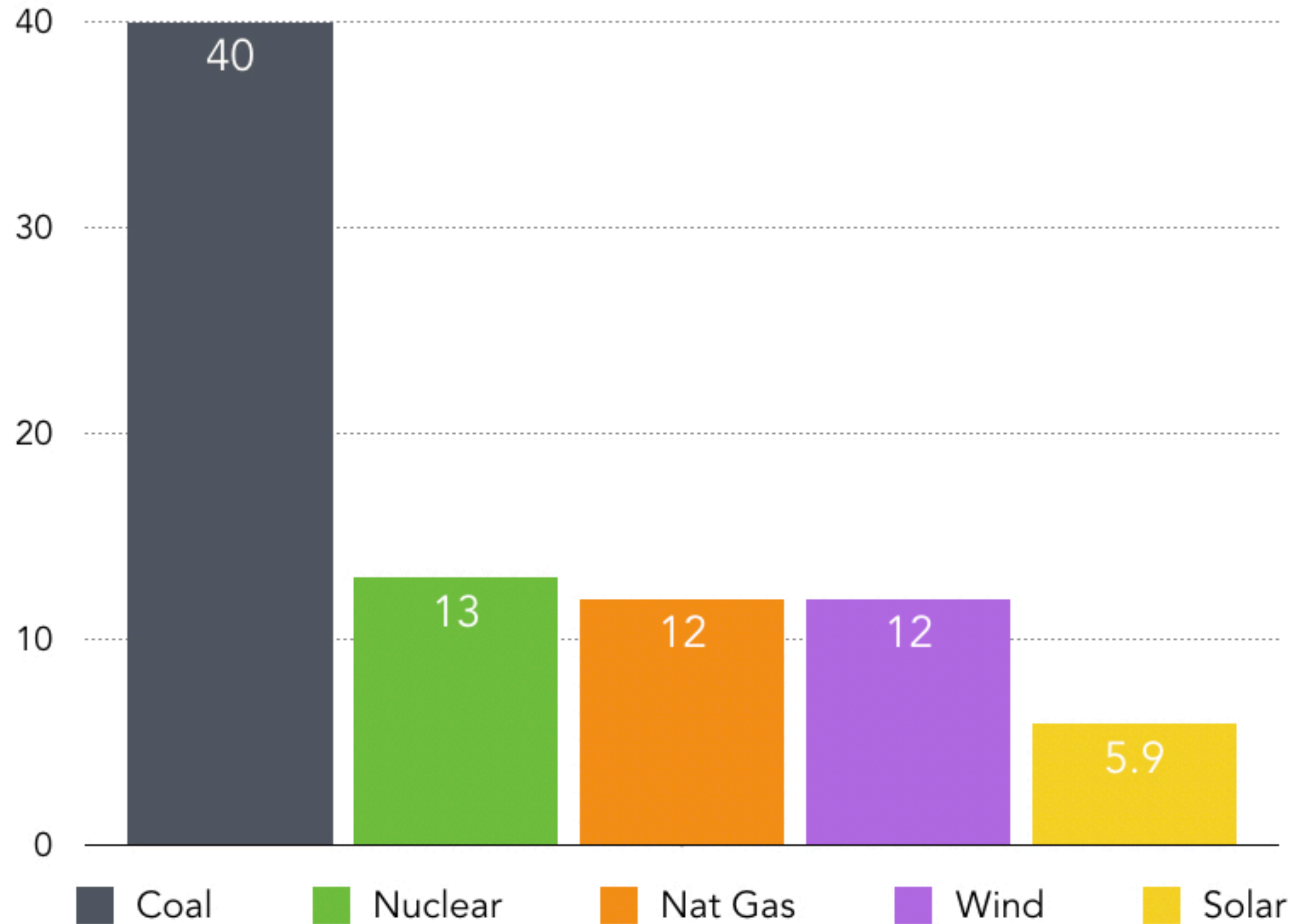
Nuclear produces four times less carbon pollution than solar farms



Source: Intergovernmental Panel on Climate Change (IPCC) 2014

Annex III Table A III.2 :: Schlömer S., T. Bruckner, L. Fulton, E. Hertwich, A. McKinnon, D. Perczyk, J. Roy, R. Schaeffer, R. Sims, P. Smith, and R. Wiser, 2014. "Annex III: Technology-specific cost and performance parameters." In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

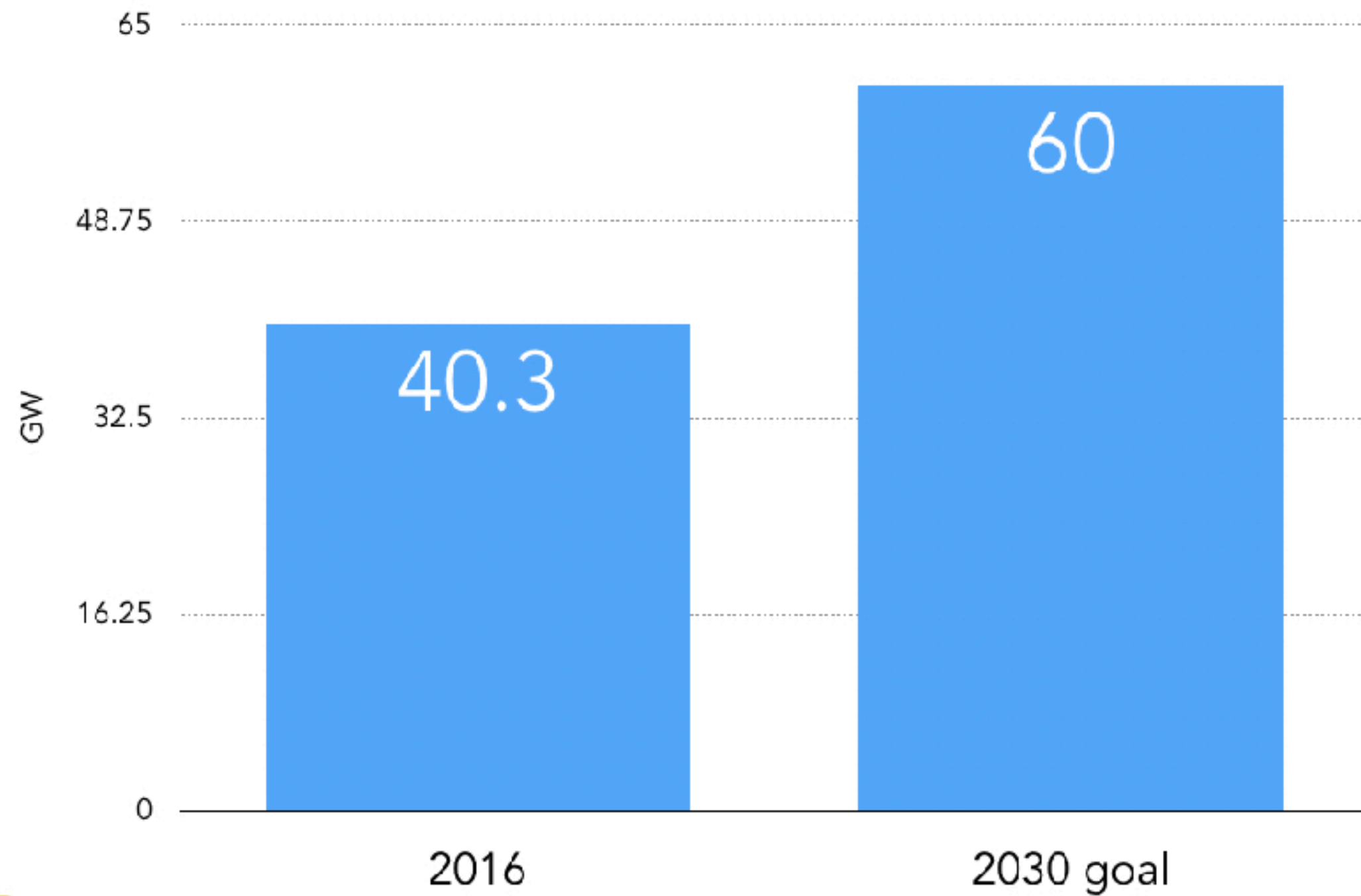
Percent of German electricity in 2016 from coal, nuclear, natural gas, wind and solar



Germany installed 4% *more* solar panels in 2016 – but generated 3% *less* electricity from solar.

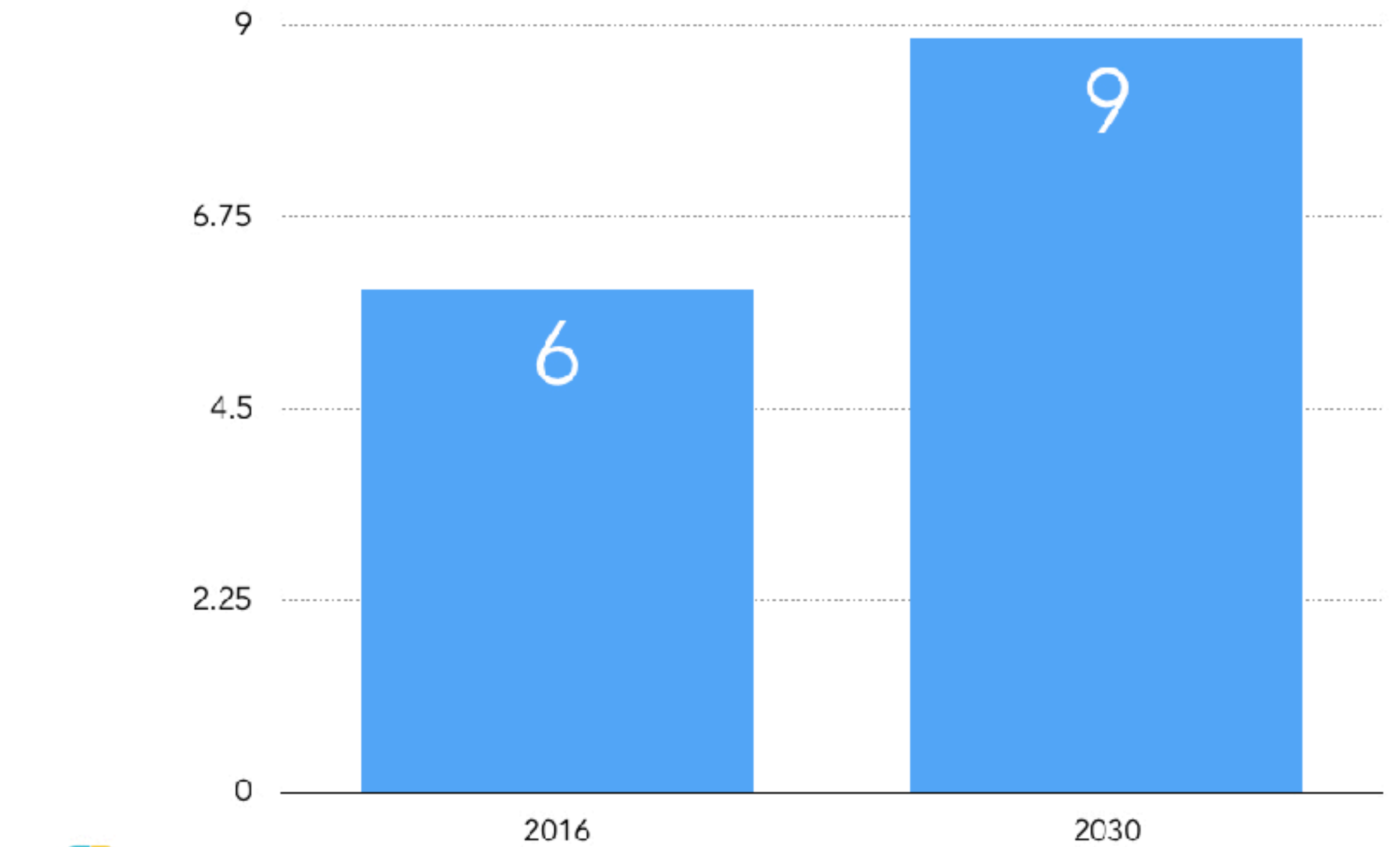
Germany installed 11% *more* wind turbines in 2016 – but generated 2% *less* electricity from wind.

If Germany adds 50% more solar capacity by 2030...



Source: AG Energiebilanzen, 2017

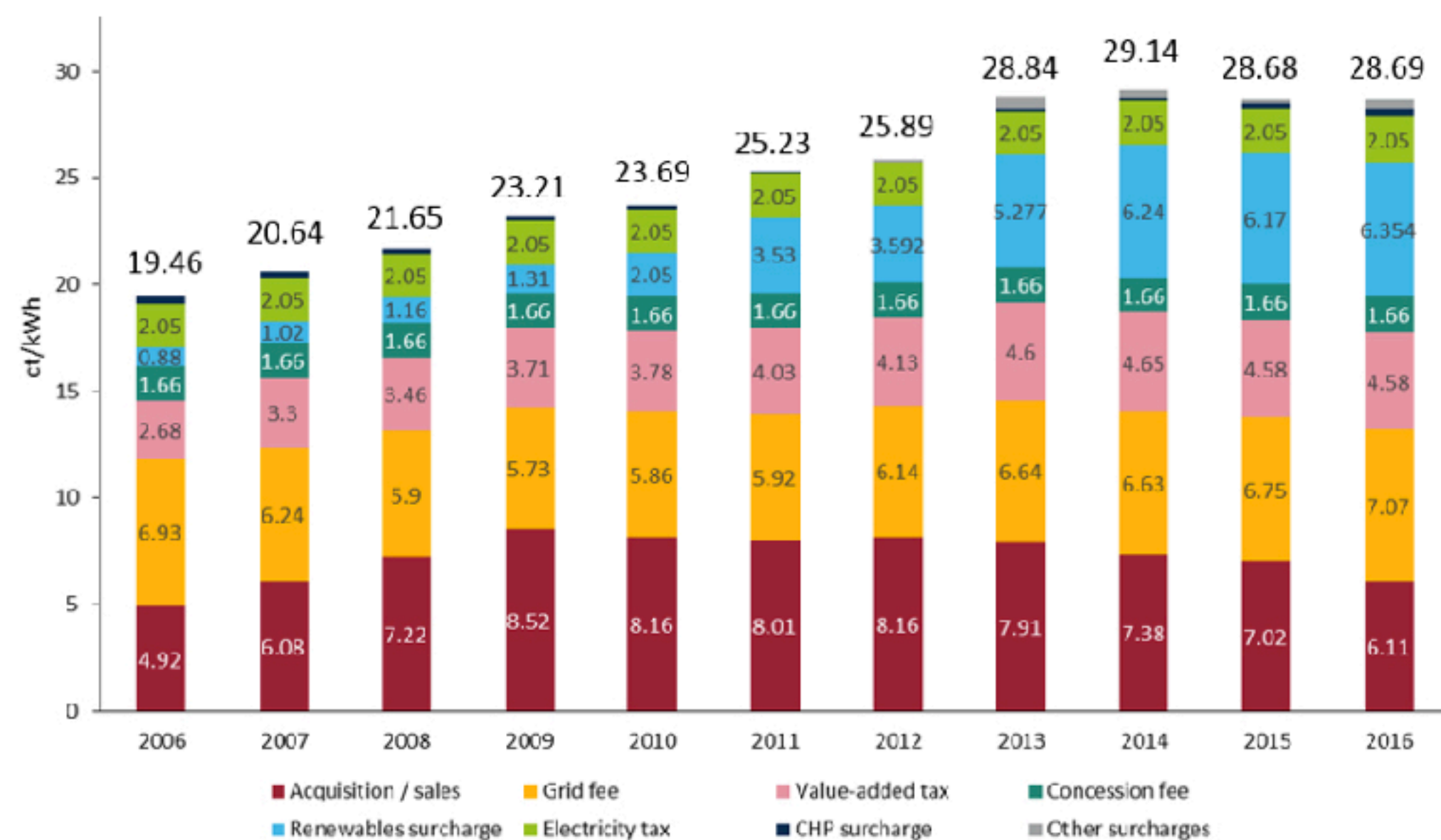
...solar would provide just 9% of electricity during years like 2016



Source: AG Energiebilanzen, 2017

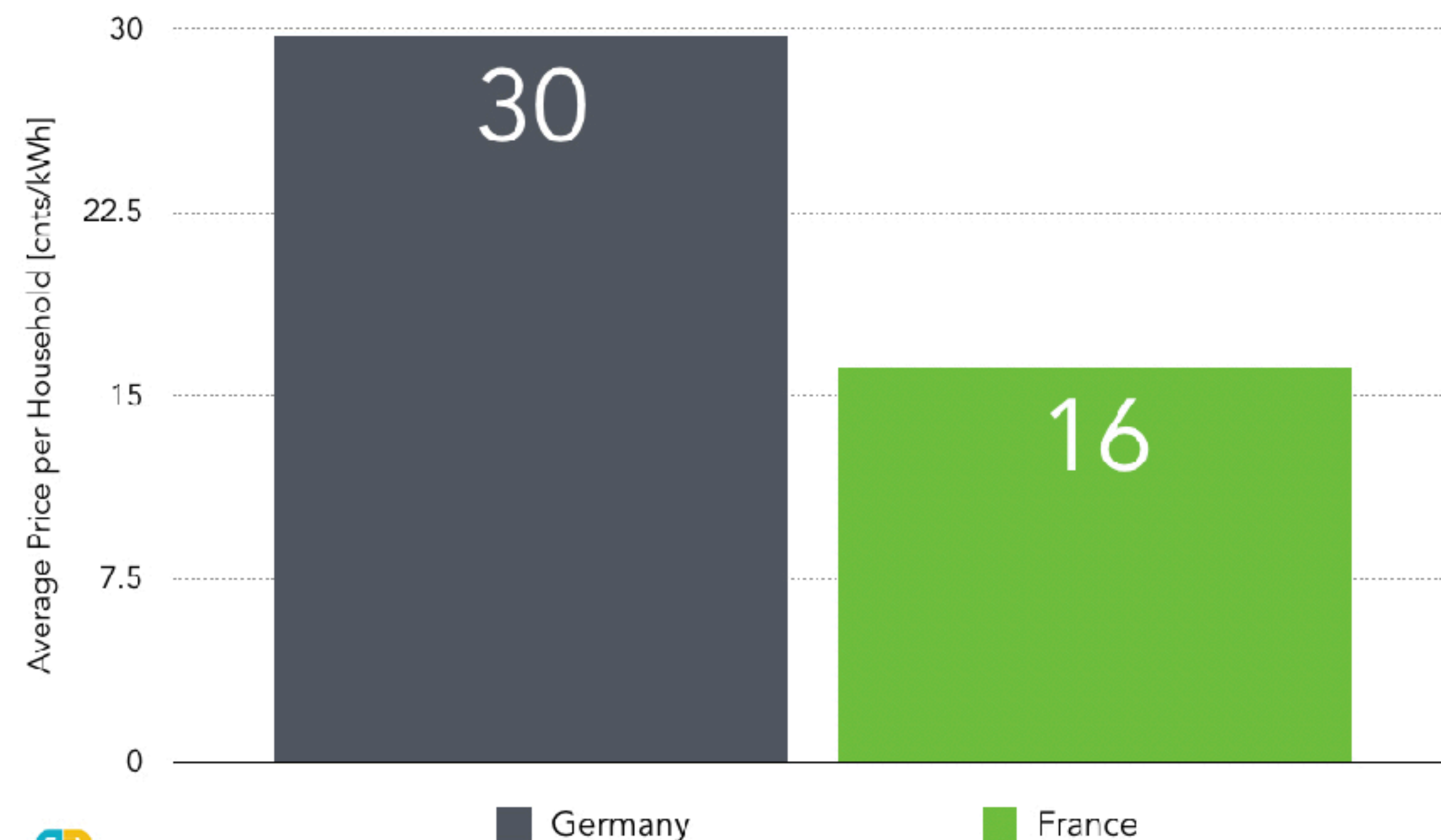
California has 23 minutes of electricity storage — if you used every car and truck in the state along with existing storage.

German electricity prices rose 47 percent from 2006 to 2016.

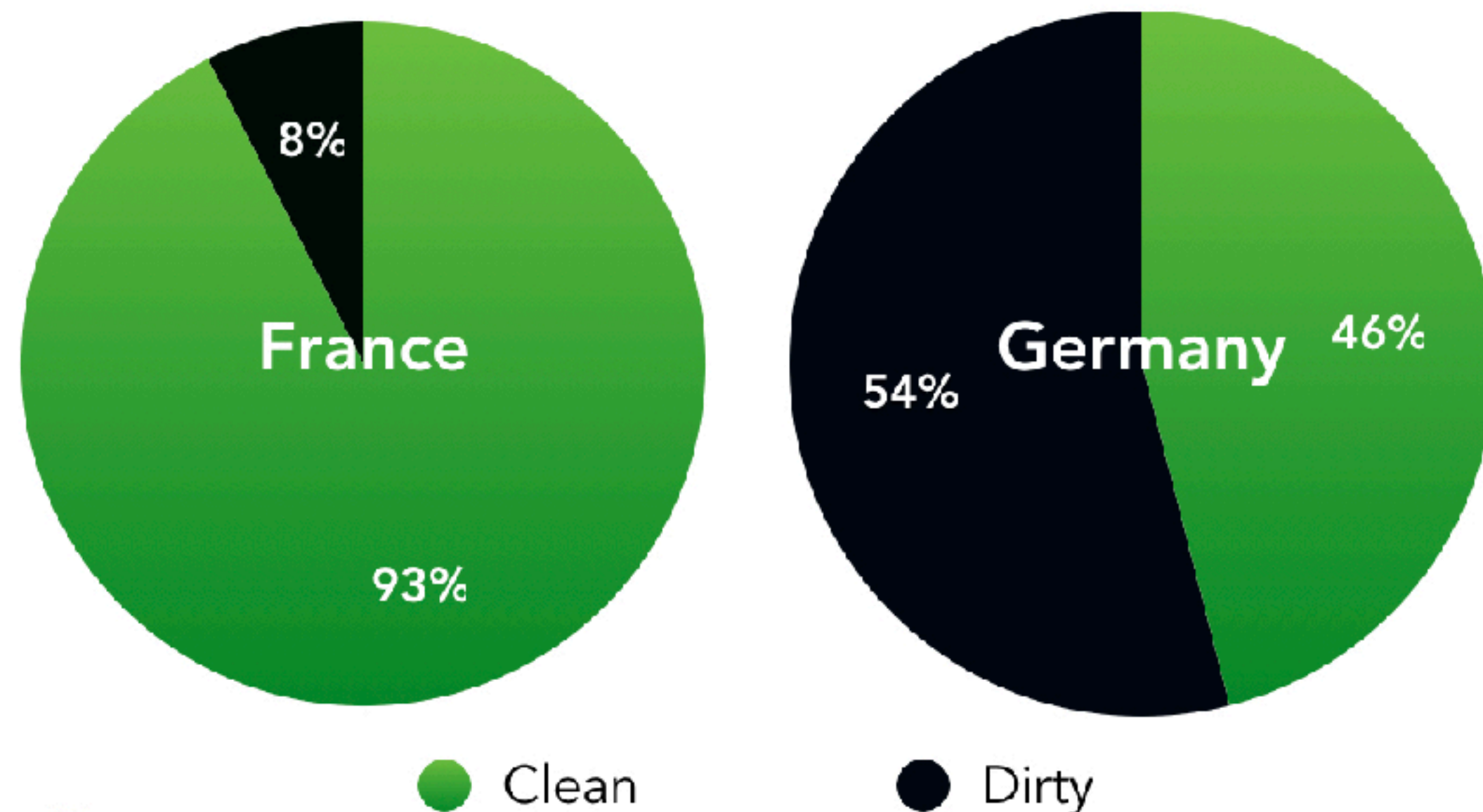


Composition of average power price in ct/kWh for an average household (3,500 kWh per year). Data source: BDEW, 2016.

German electricity is 2x more expensive than French electricity.

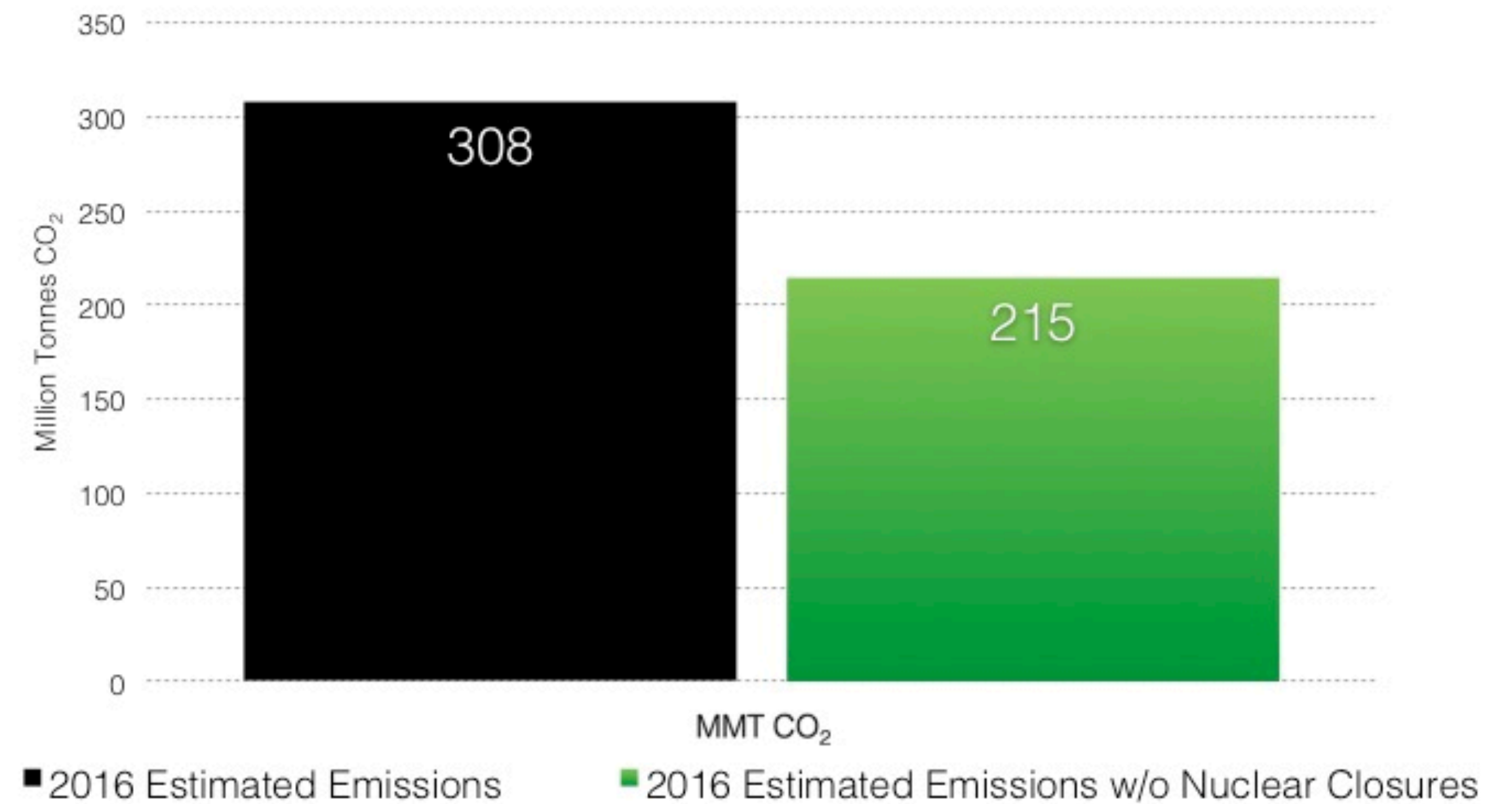


France generates 2x more electricity from clean energy sources than Germany.



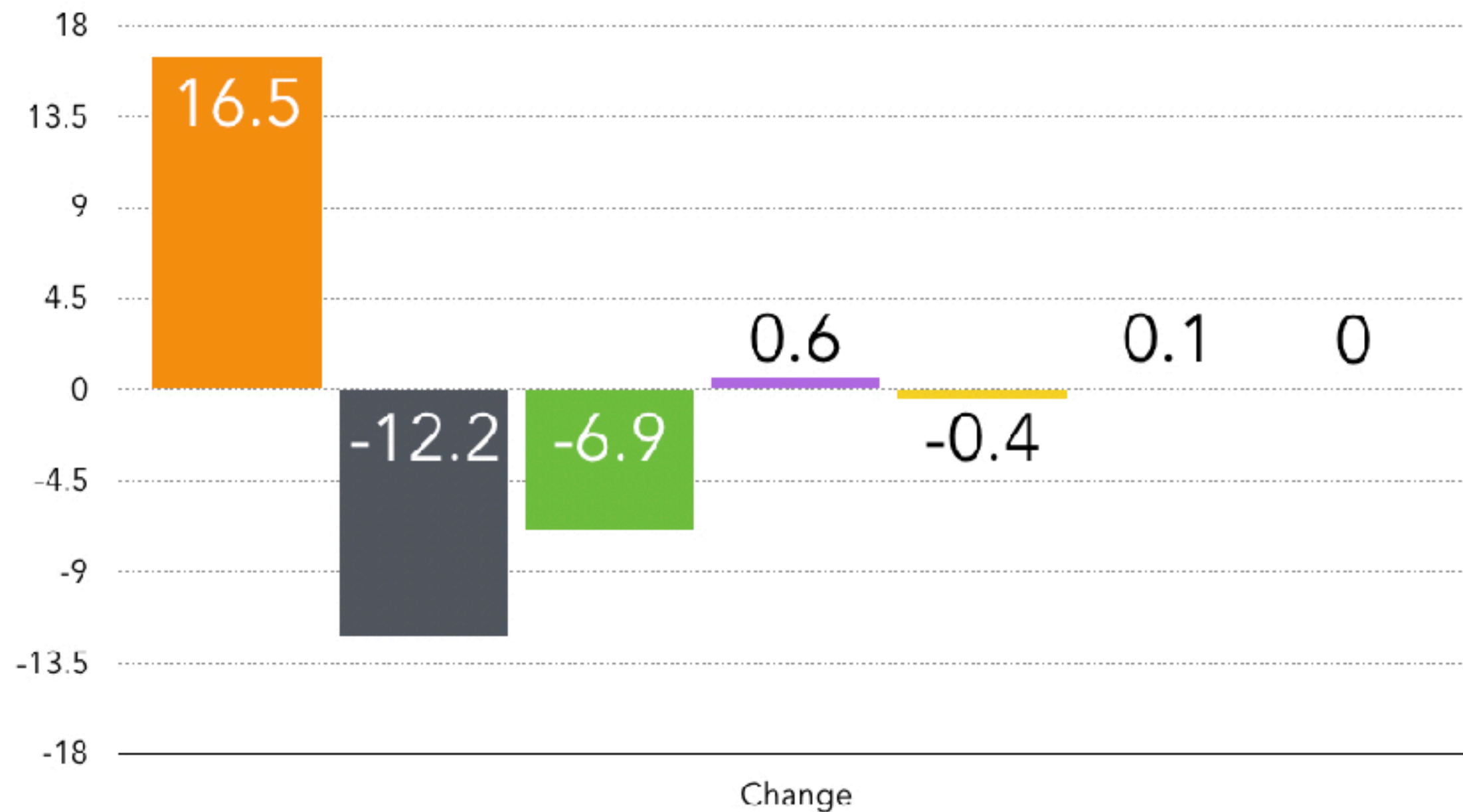
Source: BP Energy Outlook 2016

2016 Germany Electricity Emissions 43% Higher Without Electricity From Closed Nuclear Plants

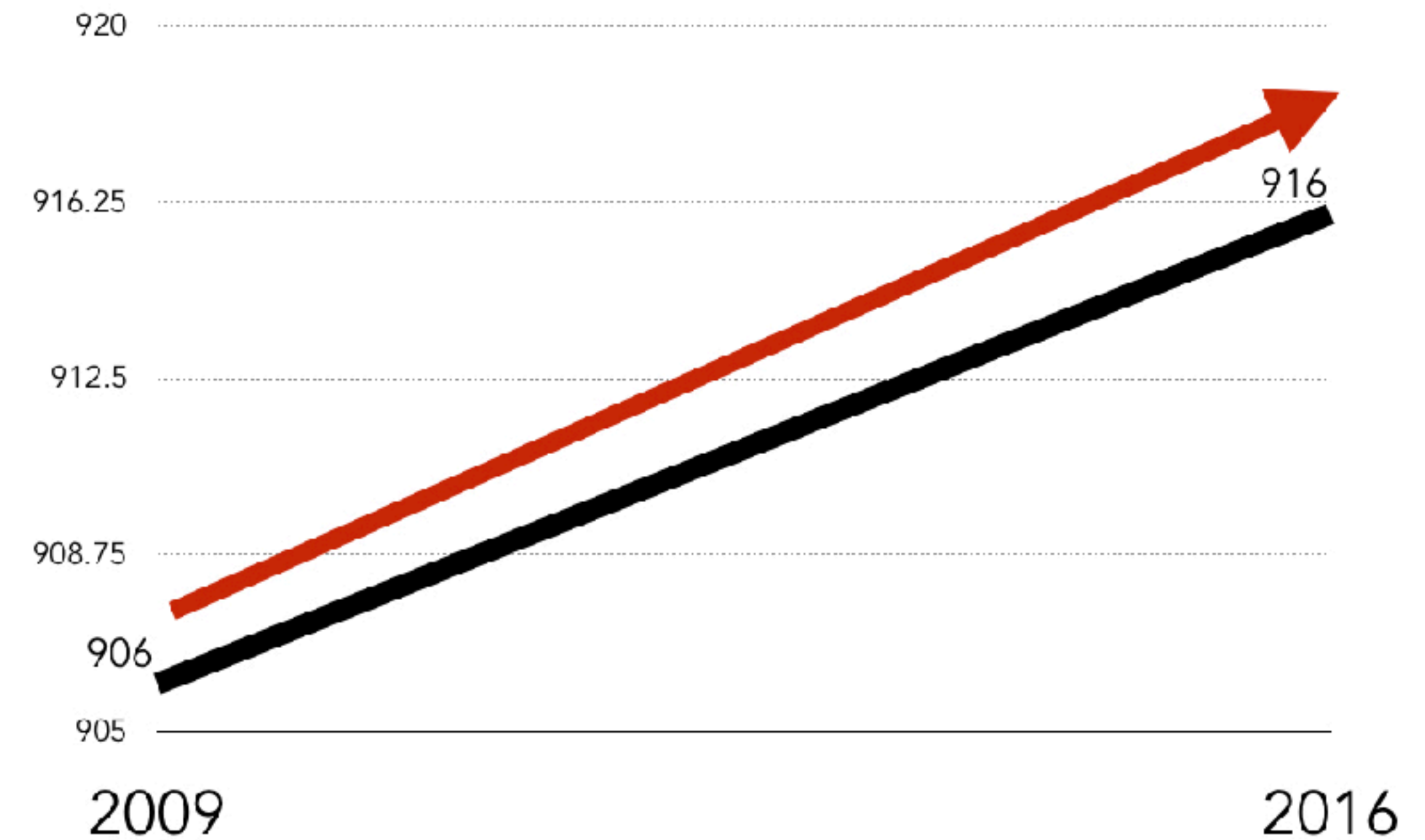


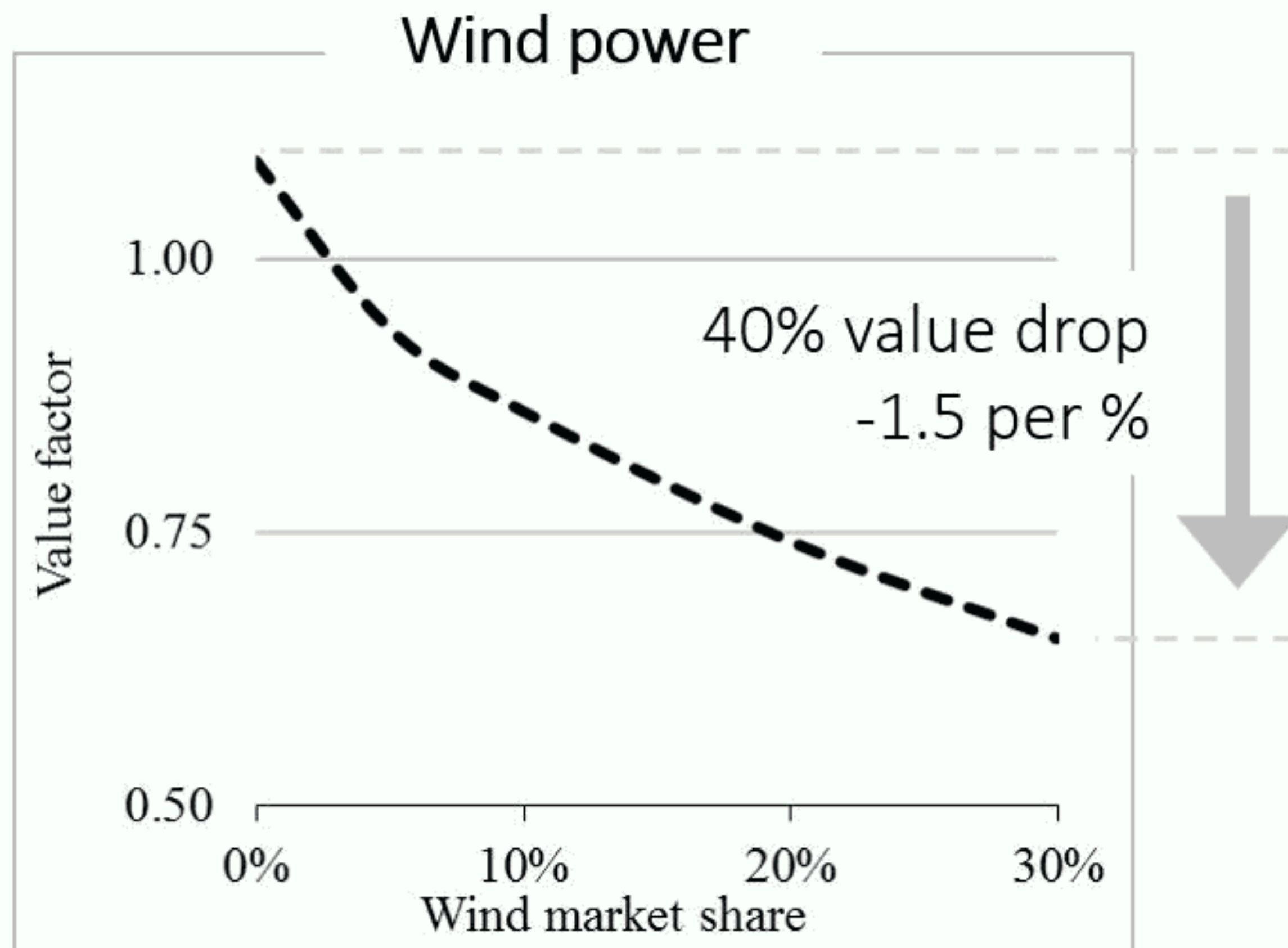
Source: EP analysis using preliminary 2016 electricity production data from Fraunhofer ISE; nuclear production assumed to displace lignite, hard coal, and natural gas production proportionally to the share of each on the grid in 2016

Closure of Nuclear Plant Wiped out Emissions Reductions from Less Coal Power

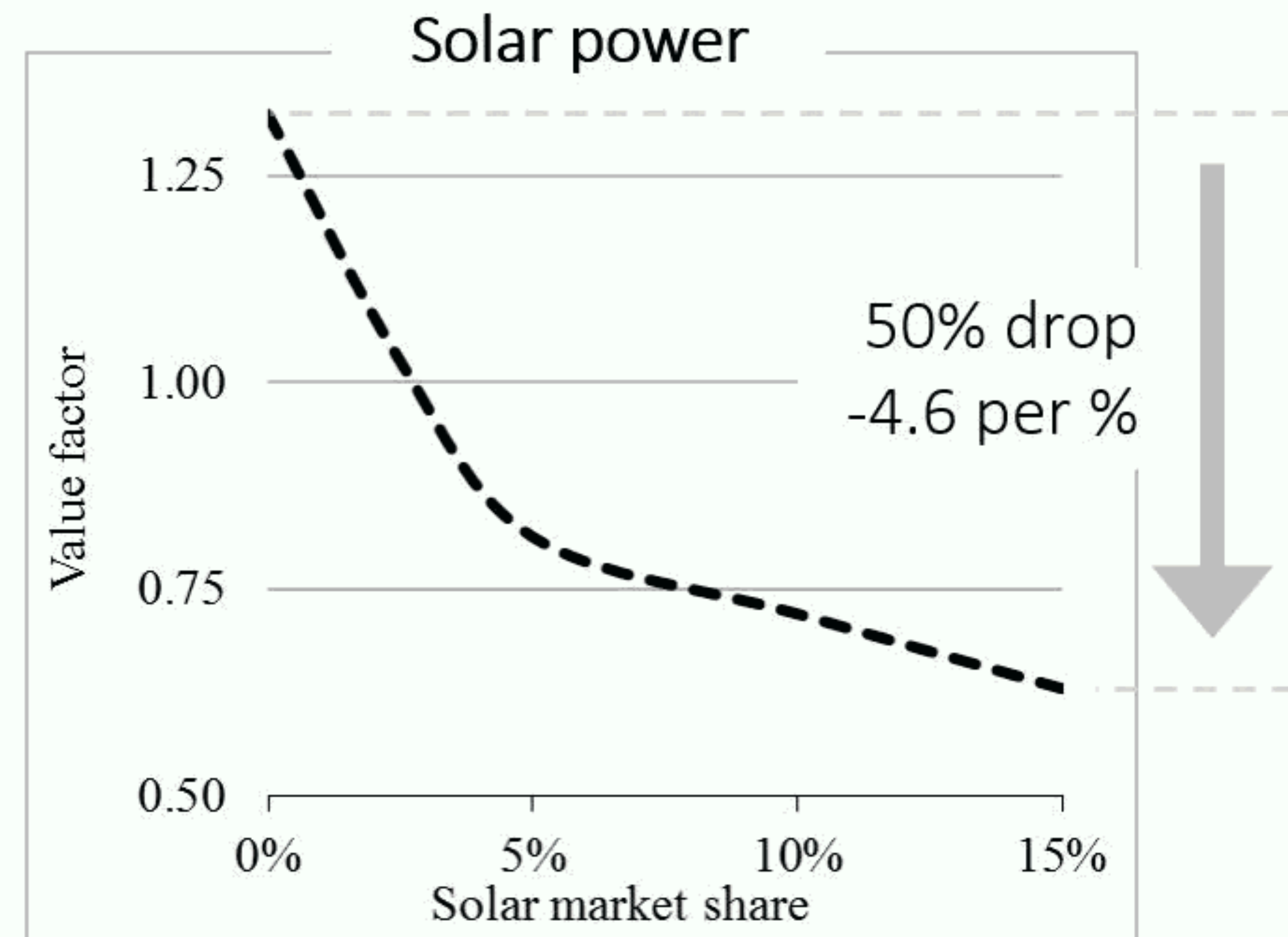


German emissions have been rising since 2009





Source: updated from Hirth (2013): Market value

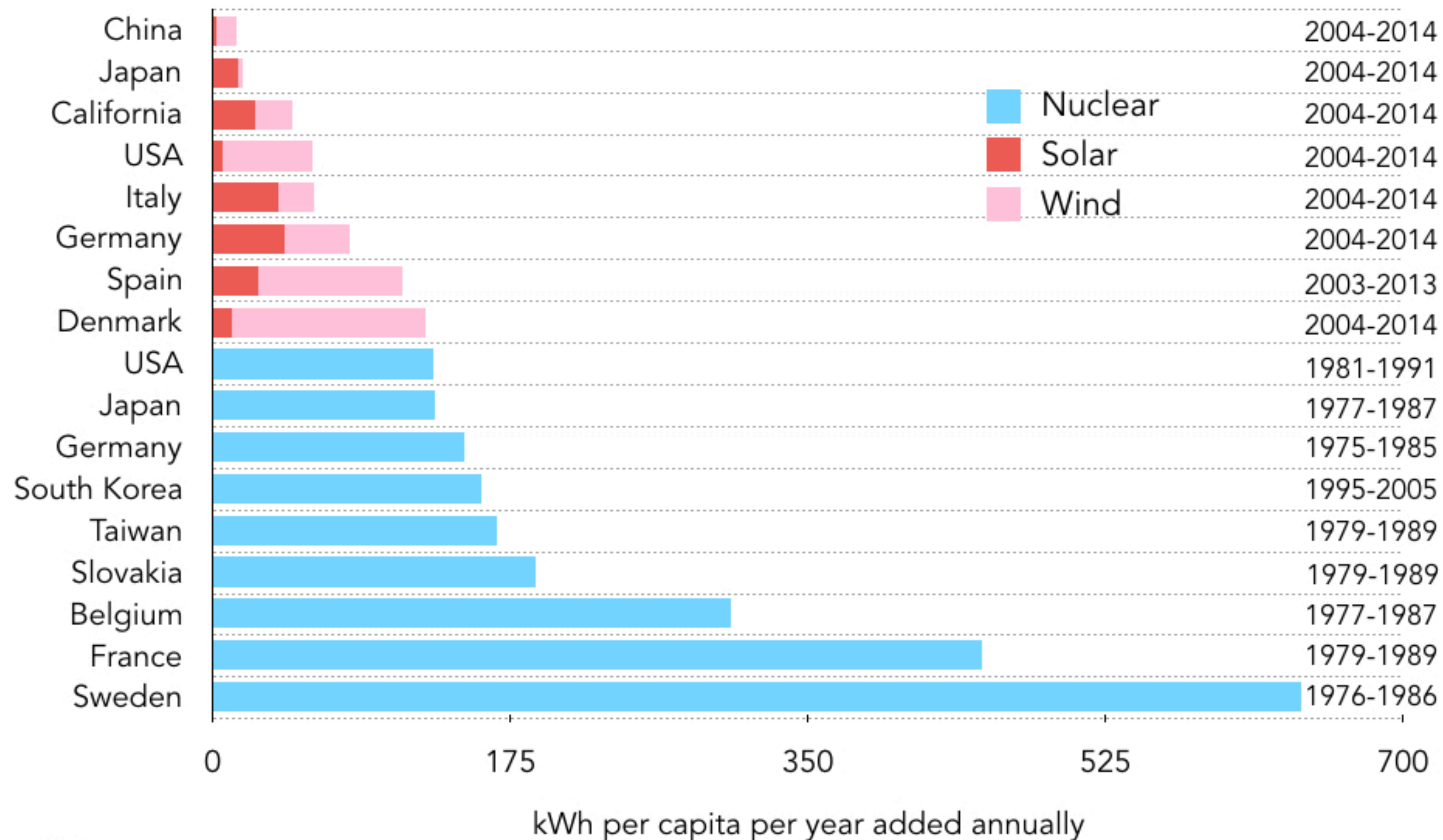


Source: updated from Hirth (2015): Market value of solar



Source: Leon Hirth, "Market Value of Variable Renewables," EUI Working Paper, 2013, http://cadmus.eui.eu/bitstream/handle/1814/27135/RSCAS_2013_36.pdf?sequence

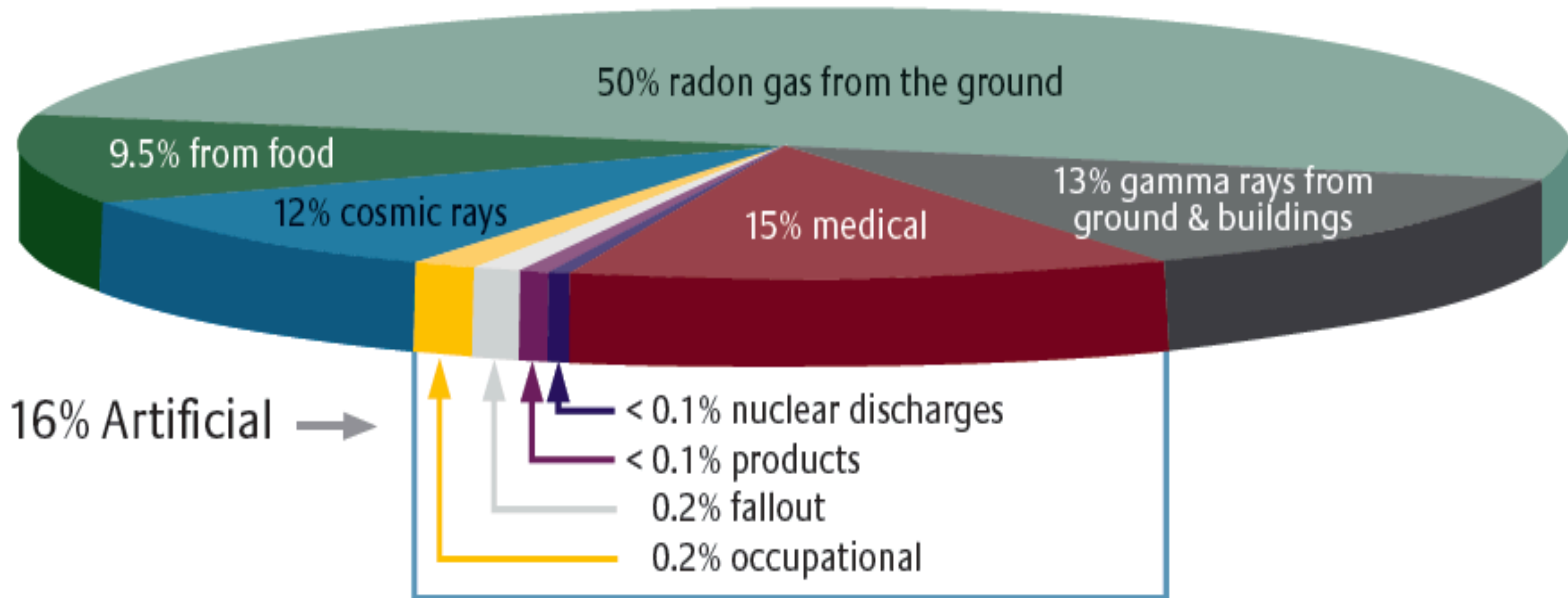
Average annual increase of carbon-free electricity per capita during decade of peak scale-up



Where does ionising radiation come from?



84% Natural



Fallout/nuclear discharges: A-bombs, nuclear accidents
e.g. Chernobyl and Fukushima account for 0.3%

- 28 from ARS
- 15 deaths from thyroid cancer in 25 years
- 1% death rate overall predicted for thyroid cancer. 16,000 excess thyroid cancers in total predicted - therefore 160 deaths
- No (scientific) evidence of increased thyroid cancer outside 3 republics
- No effect on fertility, malformations or infant mortality
- No conclusion on adverse pregnancy outcomes or still births
- Heritable effects not seen and very unlikely at these doses
- No proven increase in any other cancer (including liquidator cohorts)

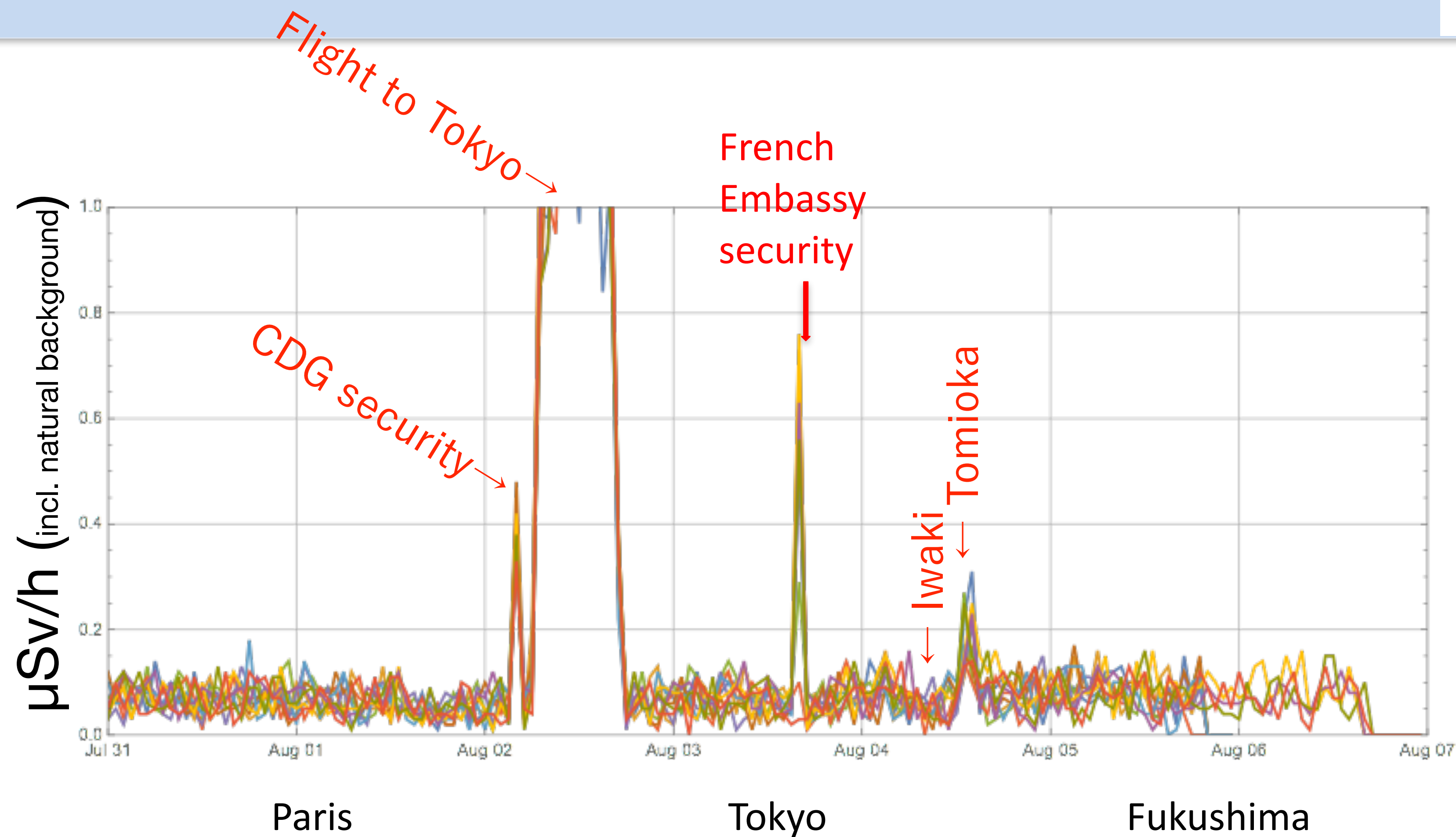


Source: www.unscear.org/docs/reports/2008/11-80076_Report_2008_Annex_D.pdf



- No radiation related deaths compared with >1500 who died as a result of the evacuation or stress related to it, and approx 20,000 in tsunami
- Unlikely to be any increase in thyroid cancer at the doses received
- Psychological harm due to evacuation and radiophobia
- Huge economic effect on local area and Japan as a whole

Source: <http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1710-ReportByTheDG-Web.pdf>

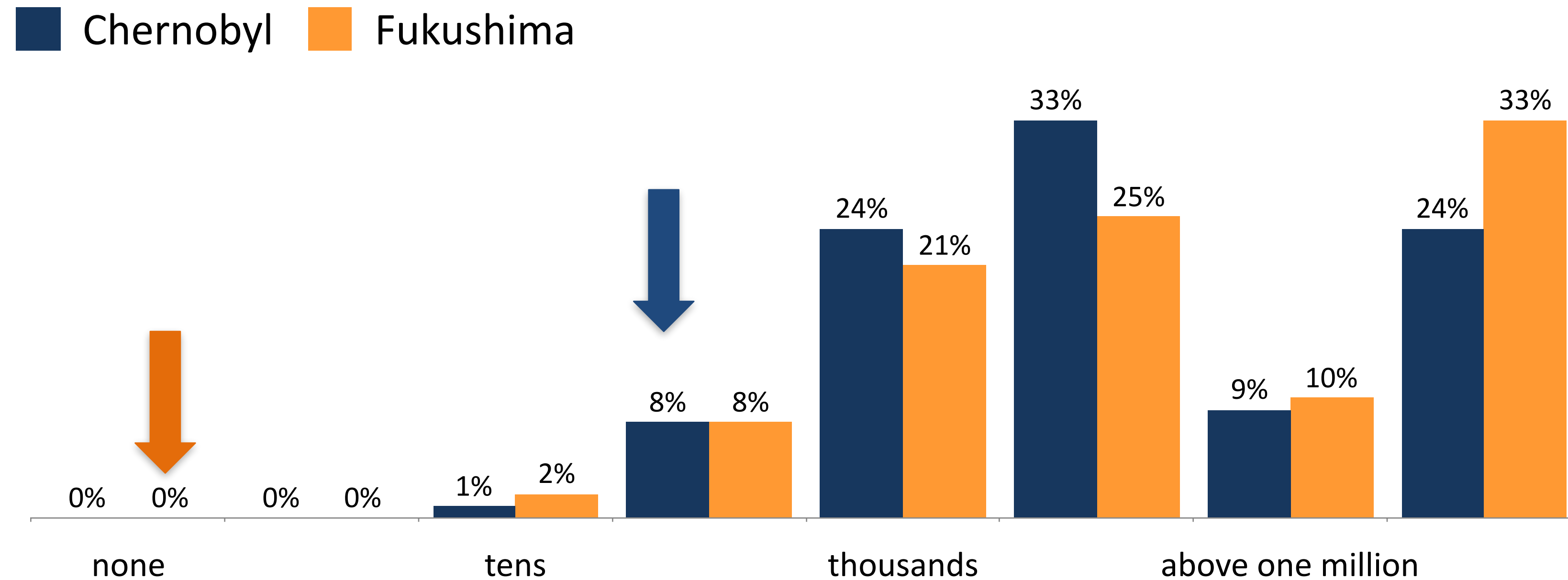


Courtesy Prof Ryogo Hayano and Dr Masaharu Tsubukura

Living in big city increases risk of death more than putting out Chernobyl fire

Megacity versus small town living	2.8%
Passive smoking	1.7%
Exposure of 250mSv (Chernobyl Liquidator)	1.0%
Exposure of 100mSv (Chernobyl Liquidator)	0.4%

Public Perception of Radiation



-Chernobyl accident happened in 1986. In your opinion, how many people died because of the Chernobyl radiation exposure?

- Fukushima accident happened in Japan in 2011. In your opinion, how many people died because of the Fukushima radiation exposure?

All Russia omnibus 24.10.2012



7 million die annually from air pollution

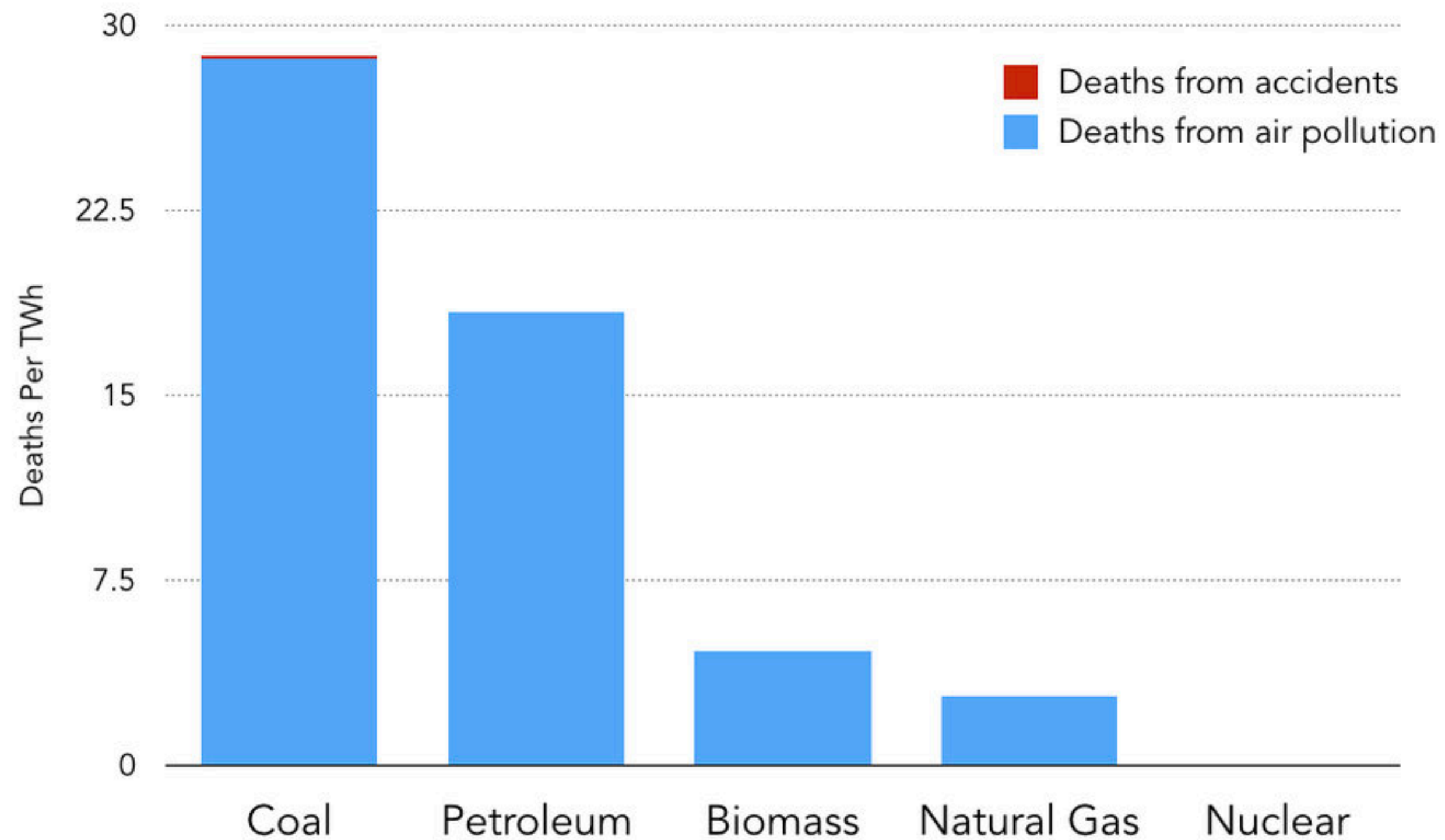
Source: World Health Organization, 2016. <http://www.who.int/mediacentre/news/releases/2016/air-pollution-estimates/en/>



German coal pollution kills 2,490 people/year

Source: WWF, "Lifting Europe's Dark Cloud," October, 2016. <http://croatia.panda.org/en/?280850/Effective-coal-regulation-could-slash-deaths-from-toxic-fumes-by-85>

Nuclear is already the safest way to make reliable electricity.



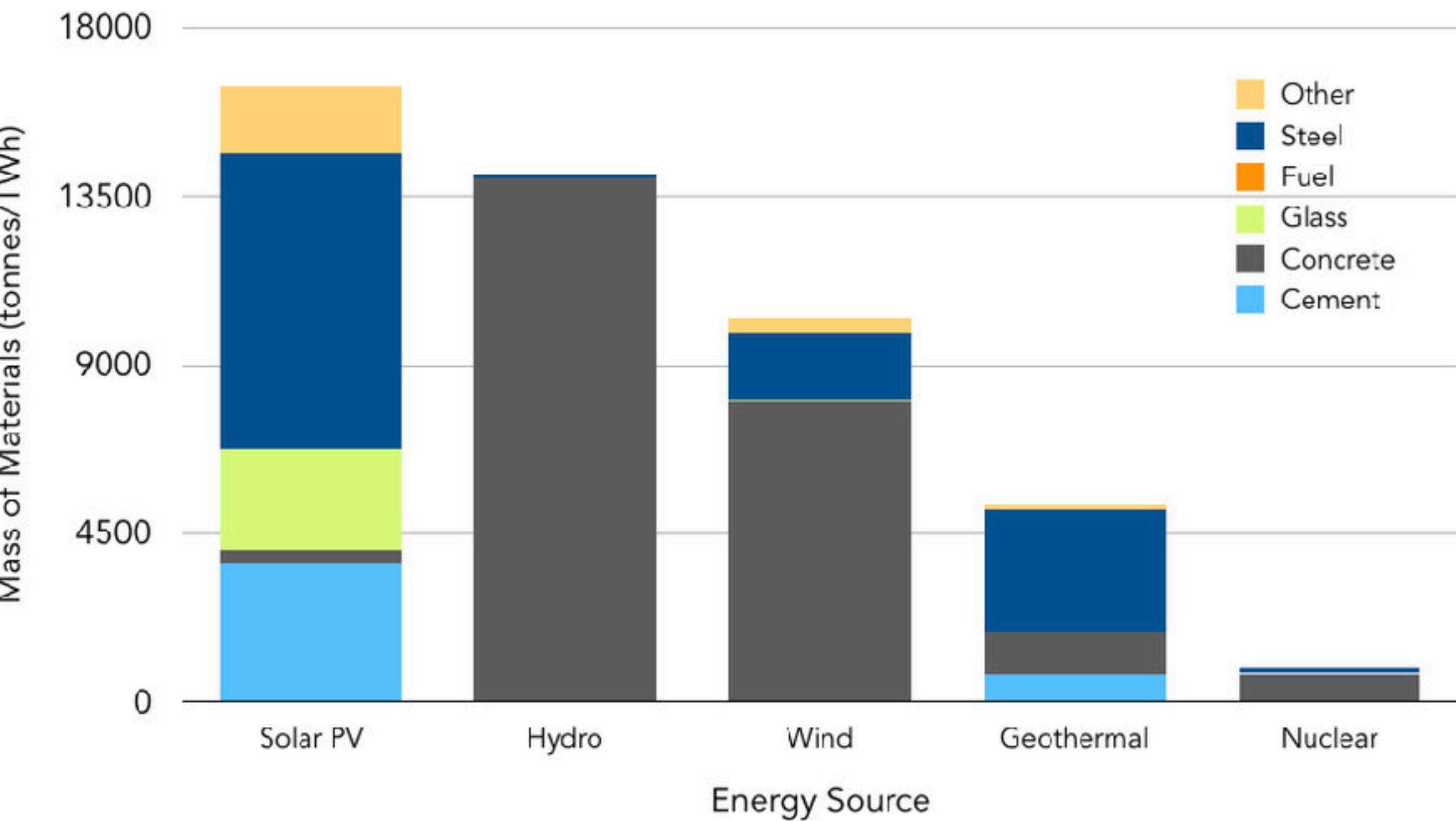
Source: Markandya, A., & Wilkinson, P. 2007. Electricity generation and health. *The Lancet*, 370(9591), 979-990.



Nuclear power has *saved* 1.8 million lives to date by preventing the burning of fossil fuels.

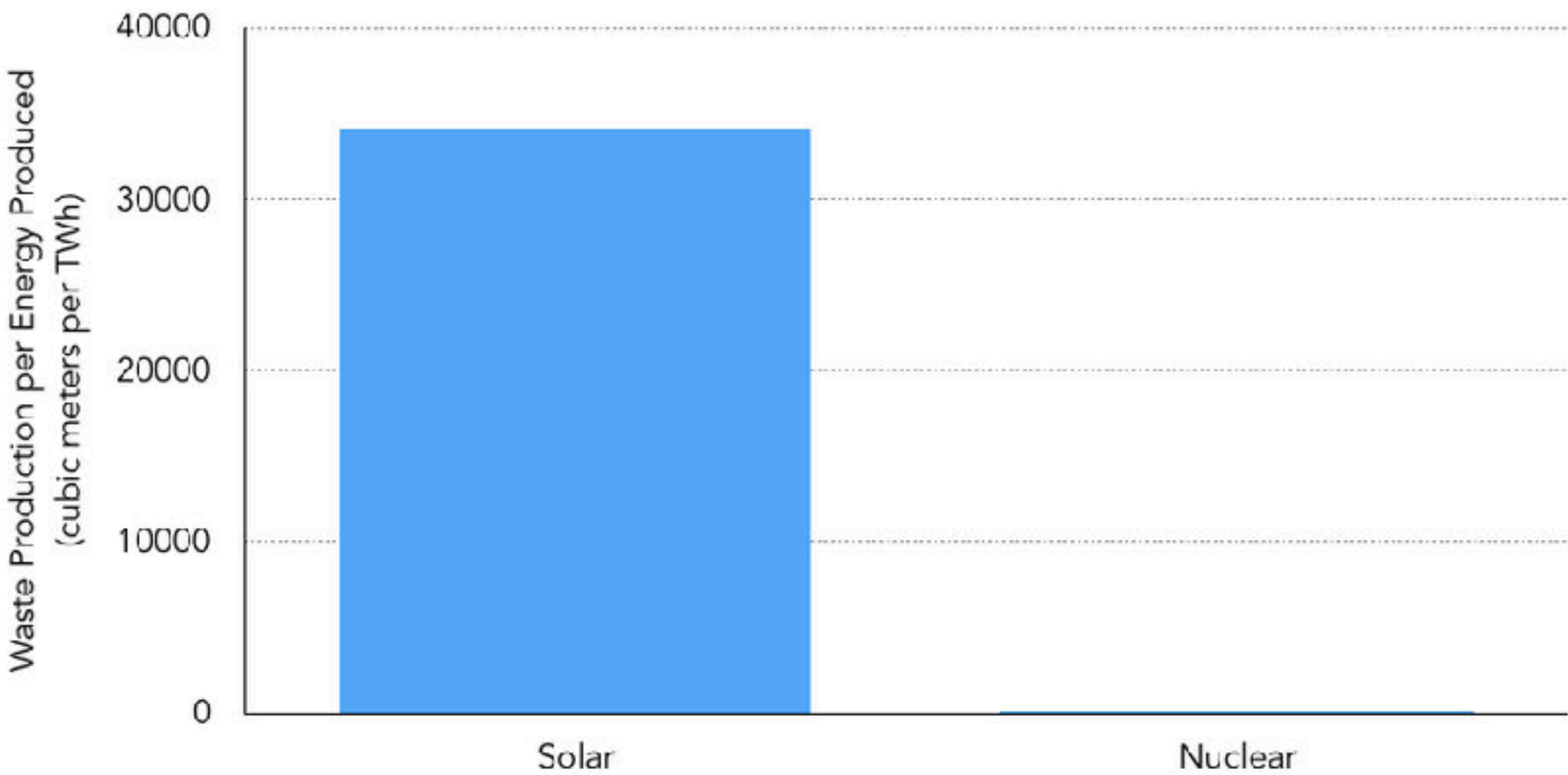
Source: Pushker Kharecha and James Hansen, "Prevented Mortality and Greenhouse Gas Emissions from Historical and projected nuclear power," *Environmental Science and Technology*, 2013

Materials throughput by type of energy source



Sources: DOE Quadrennial Technology Review, Table 1C.
Murray, R.L. and Holbert, K.E. 2015. Nuclear energy: an introduction to the concepts, systems, and applications of nuclear processes (7th ed.). Elsevier.

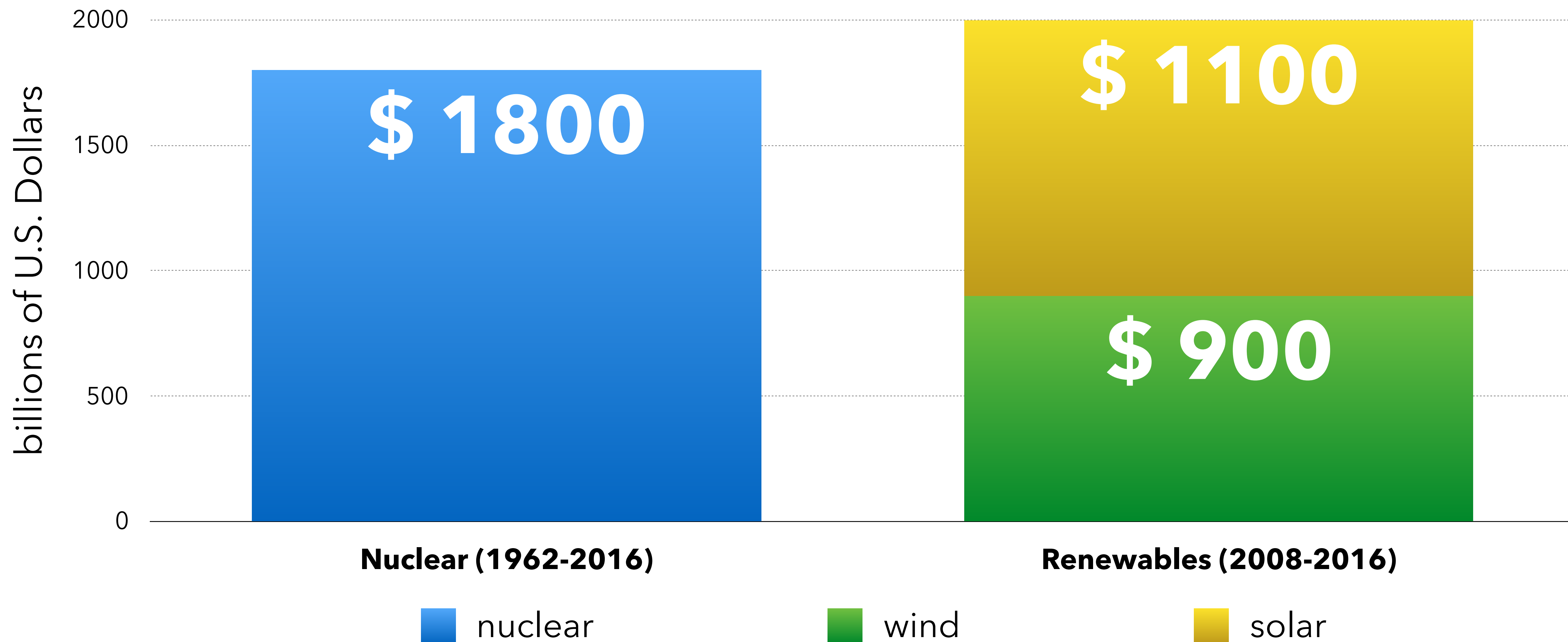
Solar panels produce ~300x more waste than nuclear reactors when providing the same amount of energy.



Sources and Notes:
US GAO, http://www.gao.gov/key_issues/disposal_of_high_level_nuclear_waste/issue_summary
World Nuclear Association, <http://www.world-nuclear.org/information-library/nuclear-fuel-cycle/nuclear-wastes/radioactive-waste-management.aspx>
<http://www.world-nuclear.org/information-library/facts-and-figures/world-nuclear-power-reactors-archive/reactor-archive-december-2015.aspx>
IAEA, <http://www.iaea.org/PRIS/home.aspx>
BP, <http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html>

Solar panels specifications vary. Panel specifications were standardized according to TrinaSolar's Duomax Dual Glass 60-Cell Module: http://static.trinasolar.com/sites/default/files/PS-M-0474%20A%20Datasheet_Duomax_PEG5.XX_US_Feb_2017_A.pdf

Nuclear & solar/wind have each received about \$2 trillion in public/private investment



The New York Times

Wind and Solar Power Advance, but Carbon Refuses to Retreat

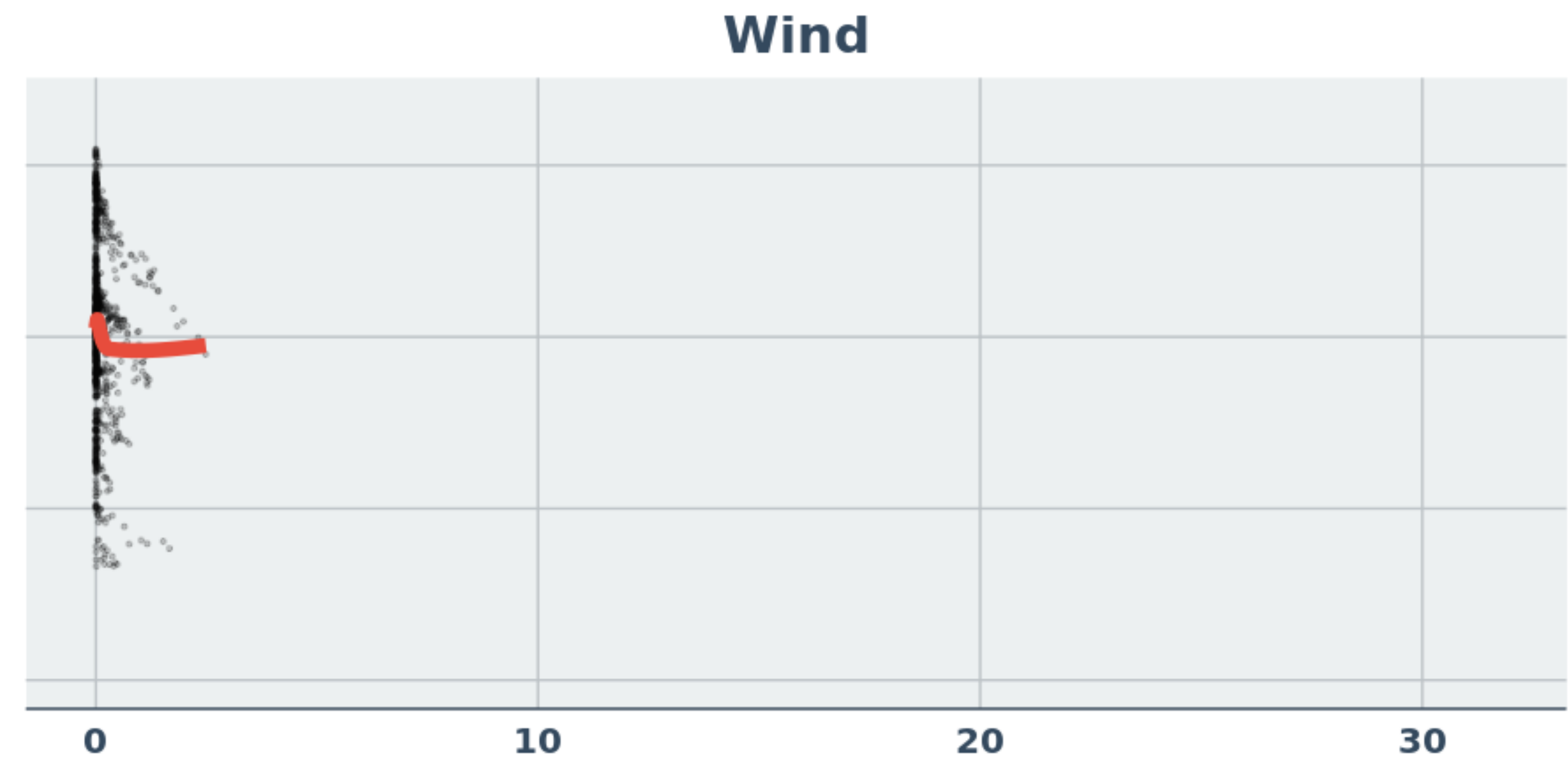
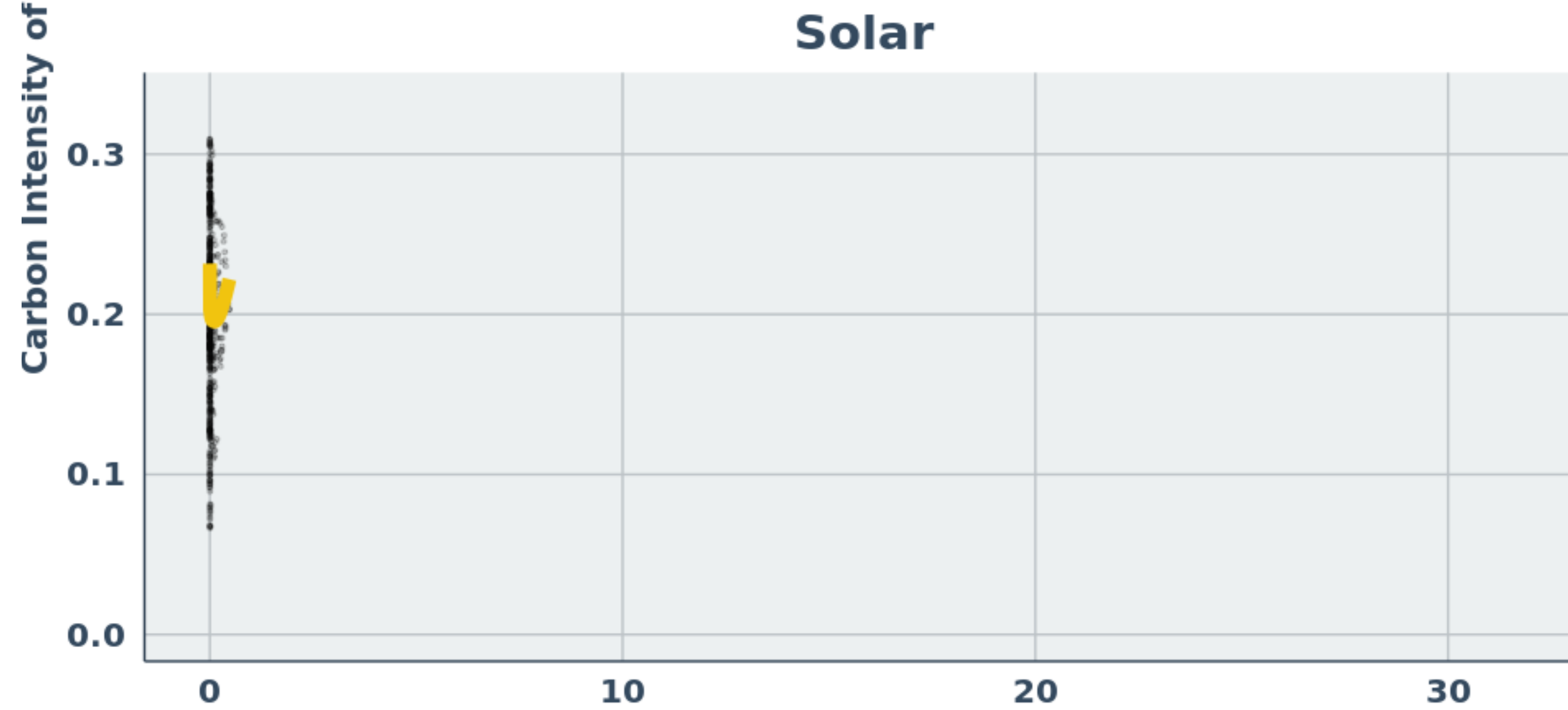
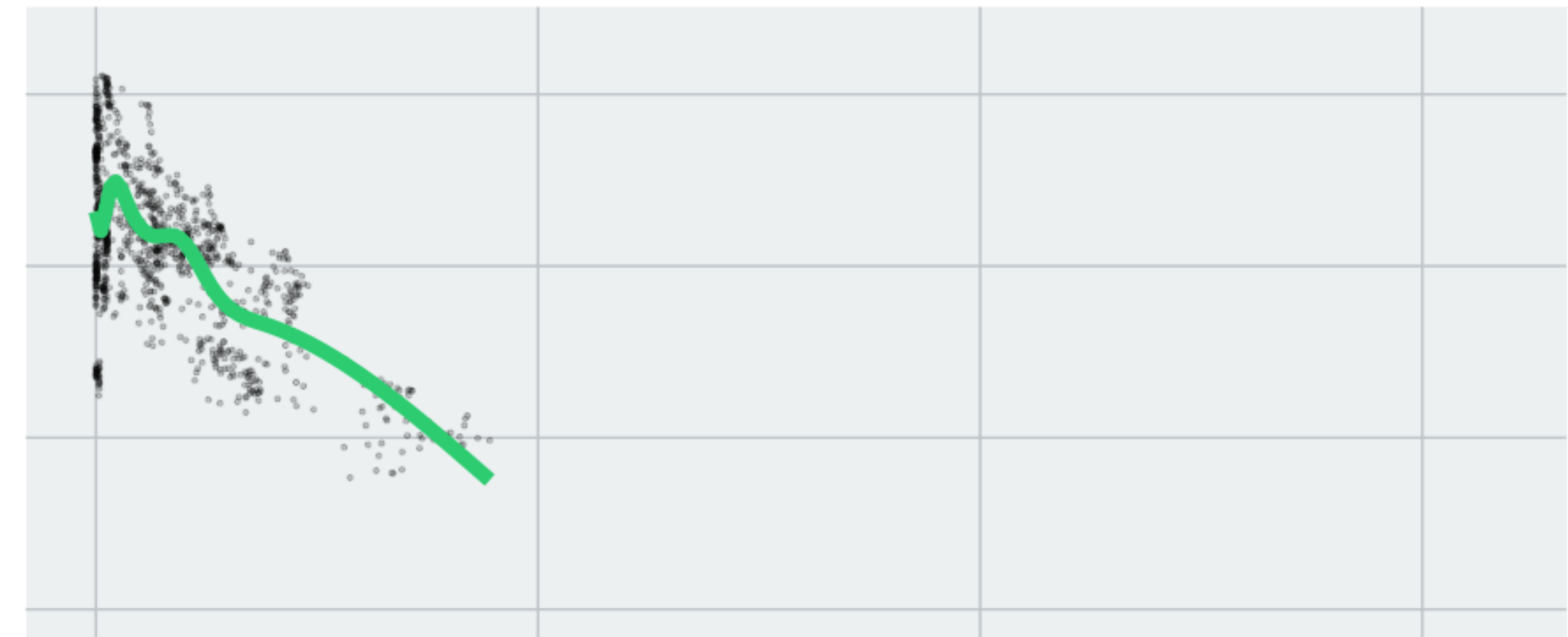
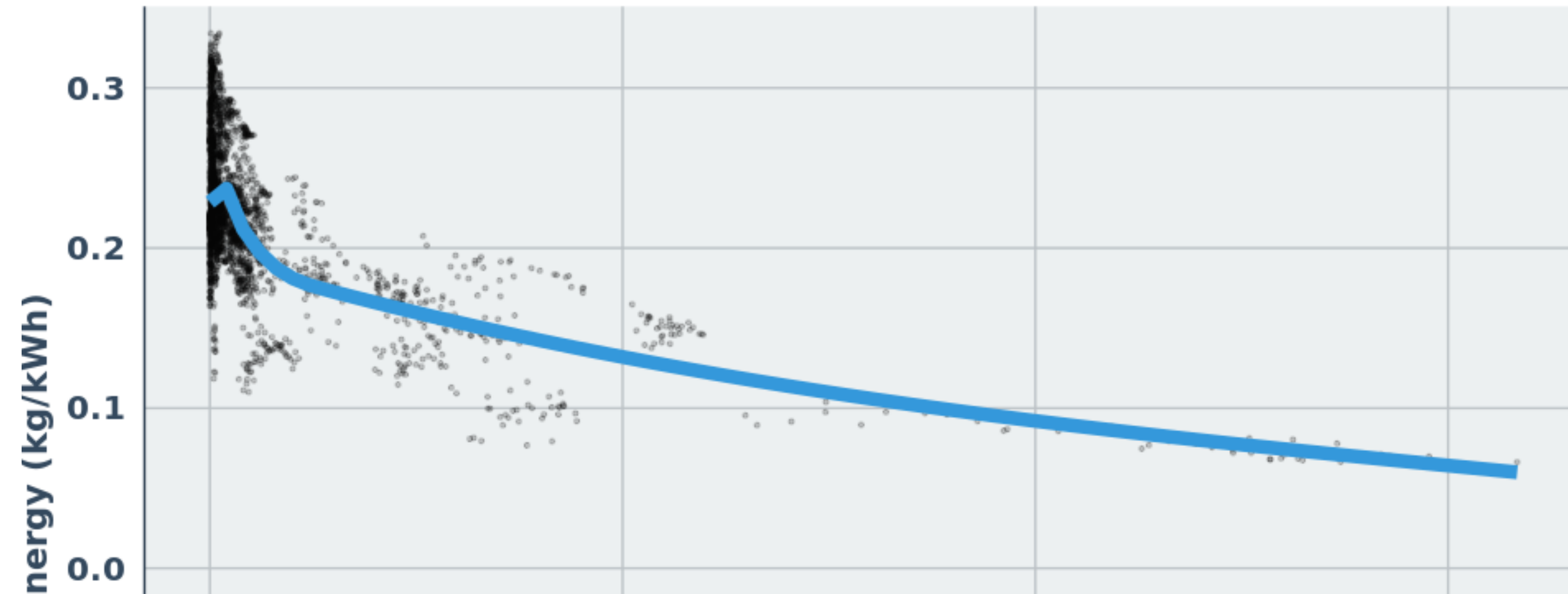
By EDUARDO PORTER NOV. 7, 2017

Environmental Progress [performed an analysis](#) of the evolution of the carbon intensity of energy in 68 countries since 1965. It found no correlation between the additions of solar and wind power and the carbon intensity of energy: Despite additions of renewable capacity, carbon intensity remained flat.

Correlation between Low-Carbon Electricity Generation and Carbon Intensity of Energy

Hydro

Nuclear



Annual Electricity Generation from Solar, Wind, Nuclear, or Hydro (MWh per Capita)

■ Hvdro ■ Nuclear ■ Solar ■ Wind

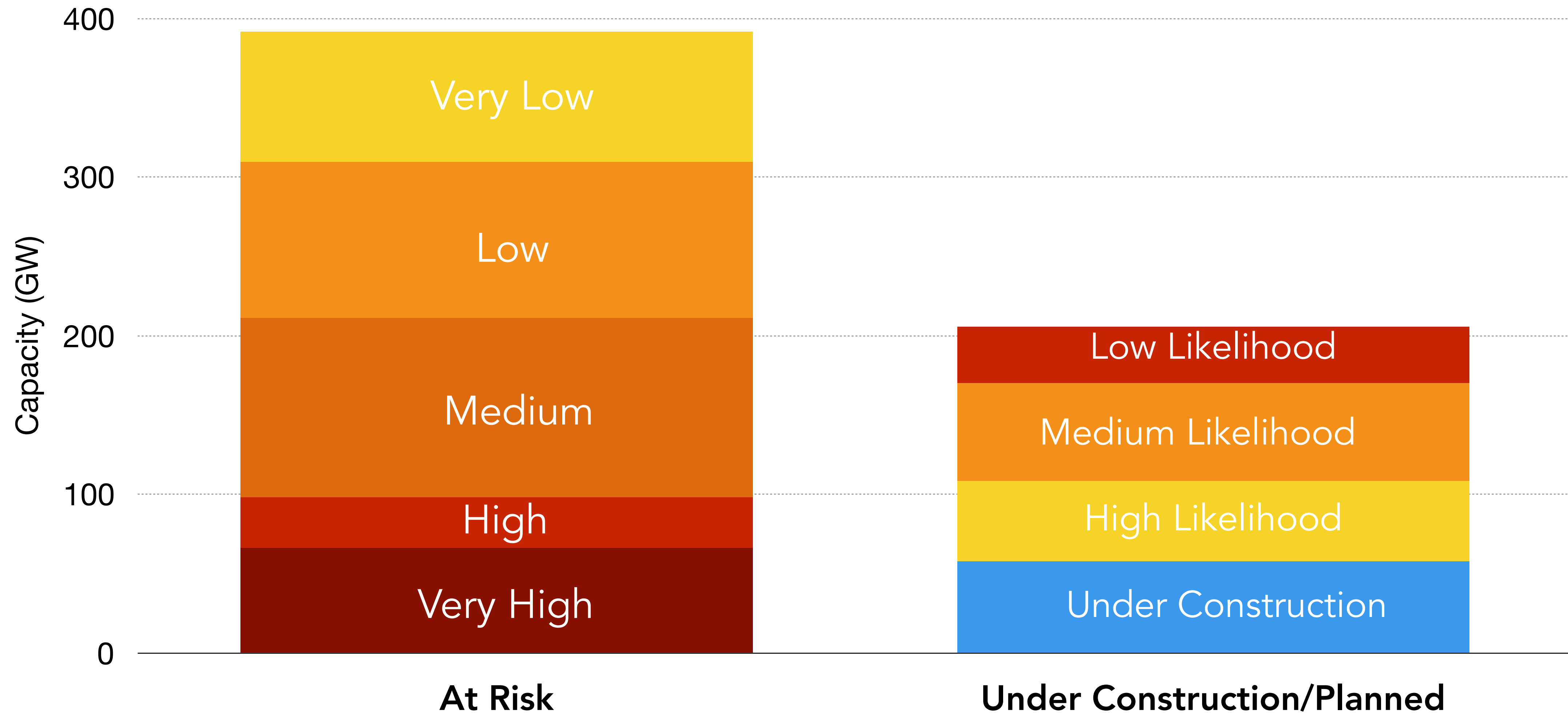




South Korea *wanted* nuclear energy
& agreed to *not* get a weapon

North Korea was denied
nuclear energy & got itself
a weapon

World could lose up to 2x more nuclear than it gains by 2030



Source & Methods: EP Energy Progress Assessment, 2017. Plant-specific rankings based on economic and energy trend analysis, political and societal assessment, and expert elicitations. Longer methodology discussion can be found at environmentalprogress.org/research Last updated March 2, 2017. Email info@environmentalprogress.org for more information.