

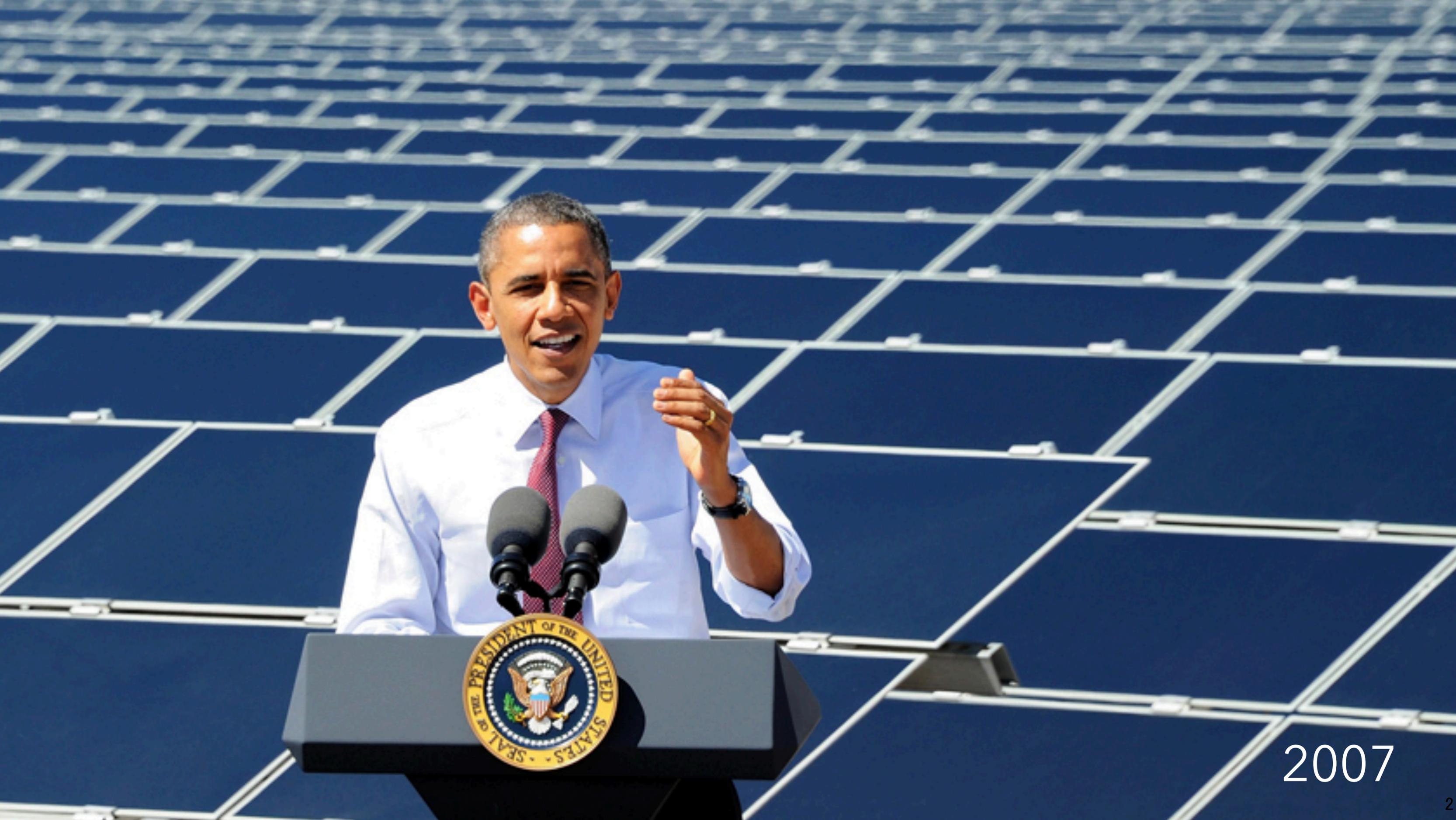
Atomic Humanism for Japan

by Michael Shellenberger

Tokyo, Japan :: November 13, 2017



2003

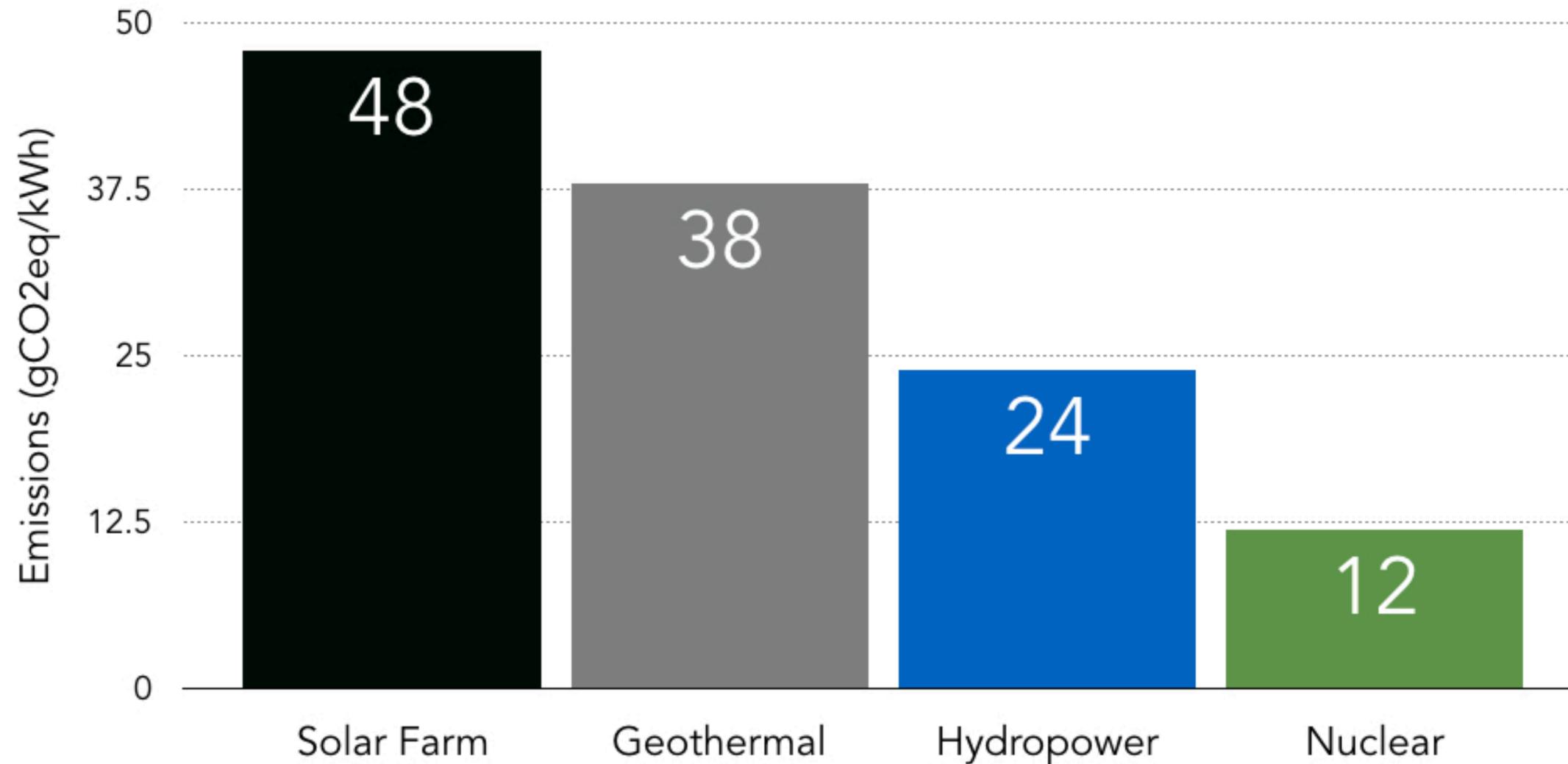


2007



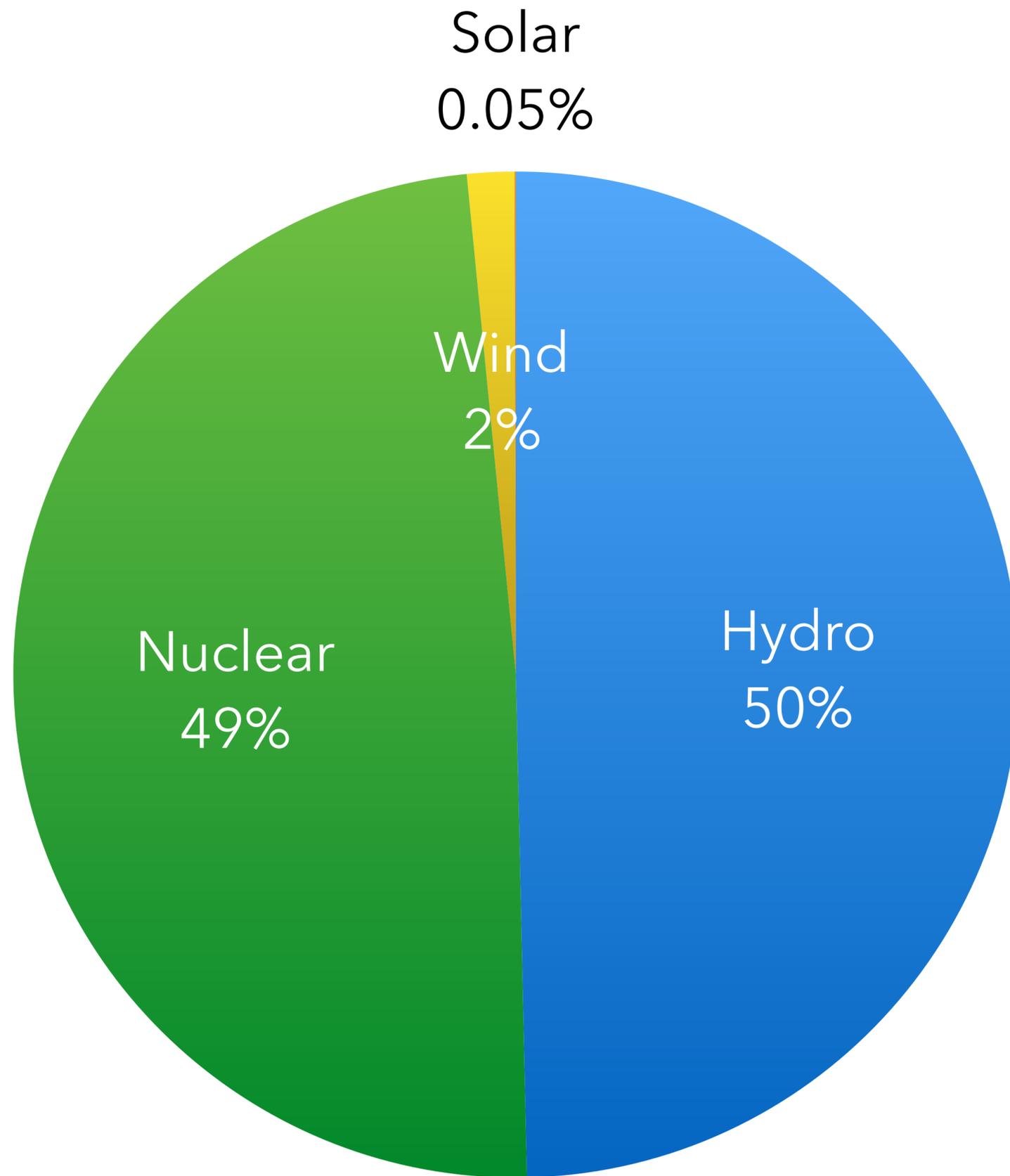
2005

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.



2005



2011

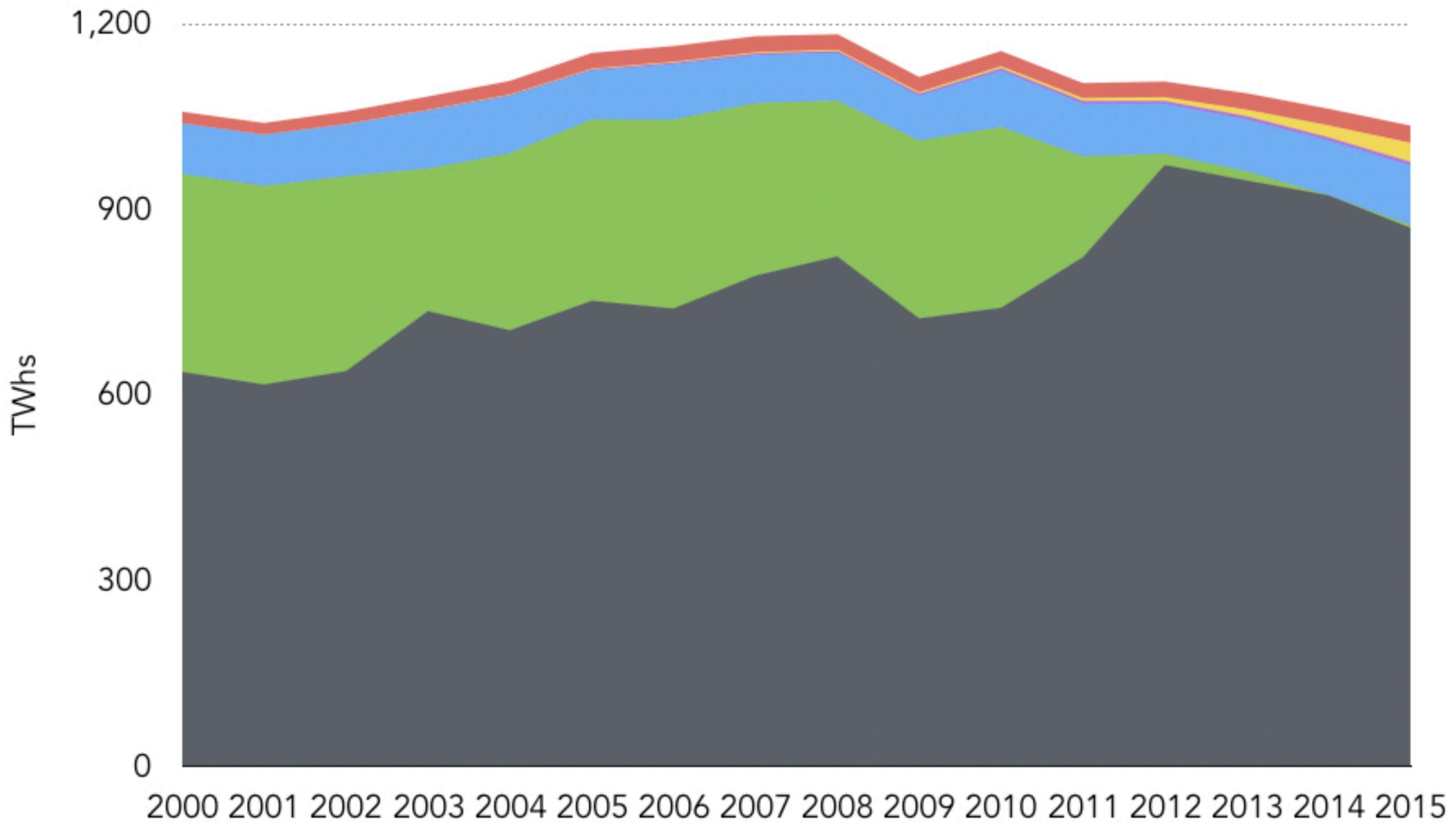


“The anti-nuclear movement to which I once belonged has misled the world about the impacts of radiation on human health.”

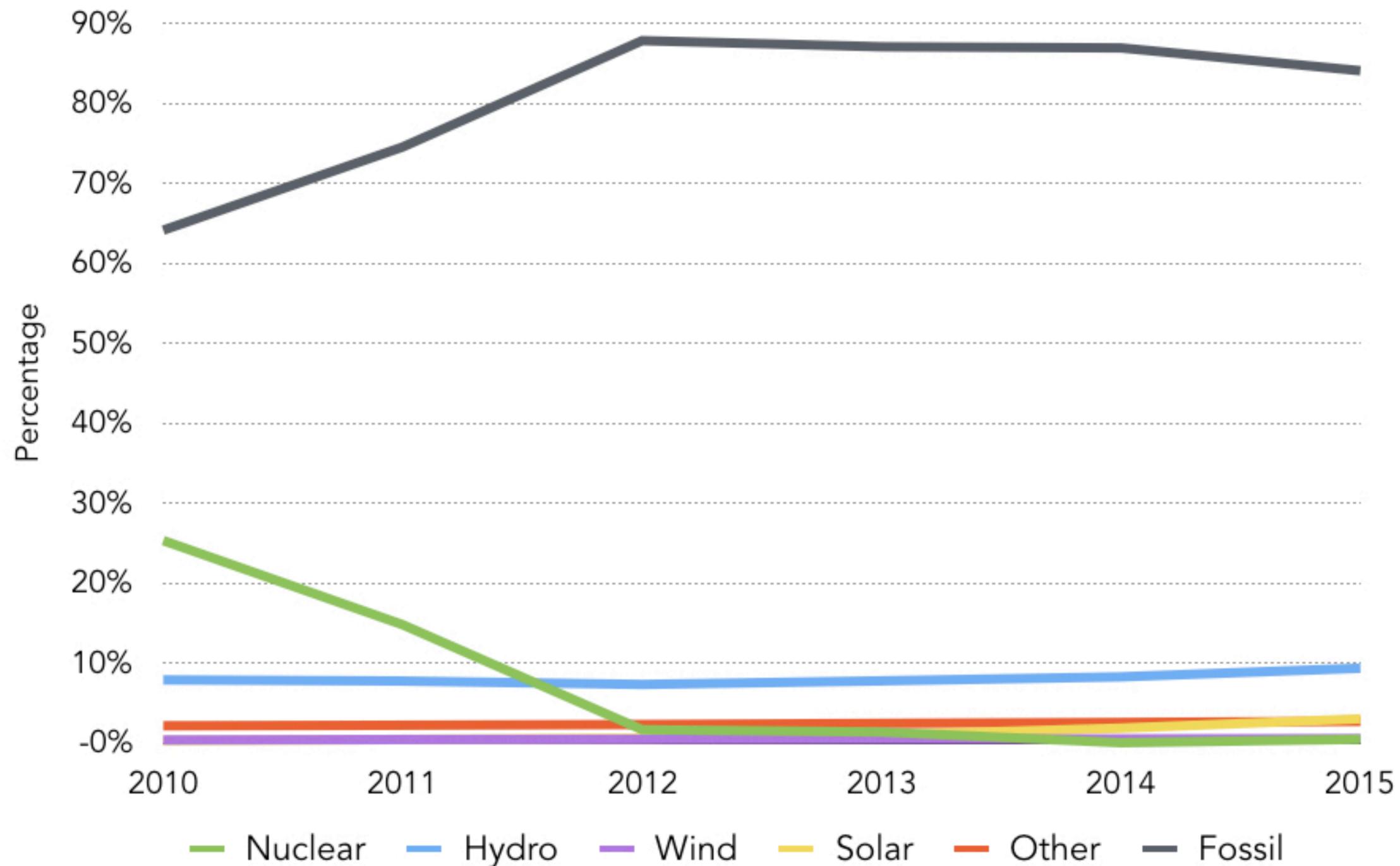
– George Monbiot,
The Guardian, April 2011



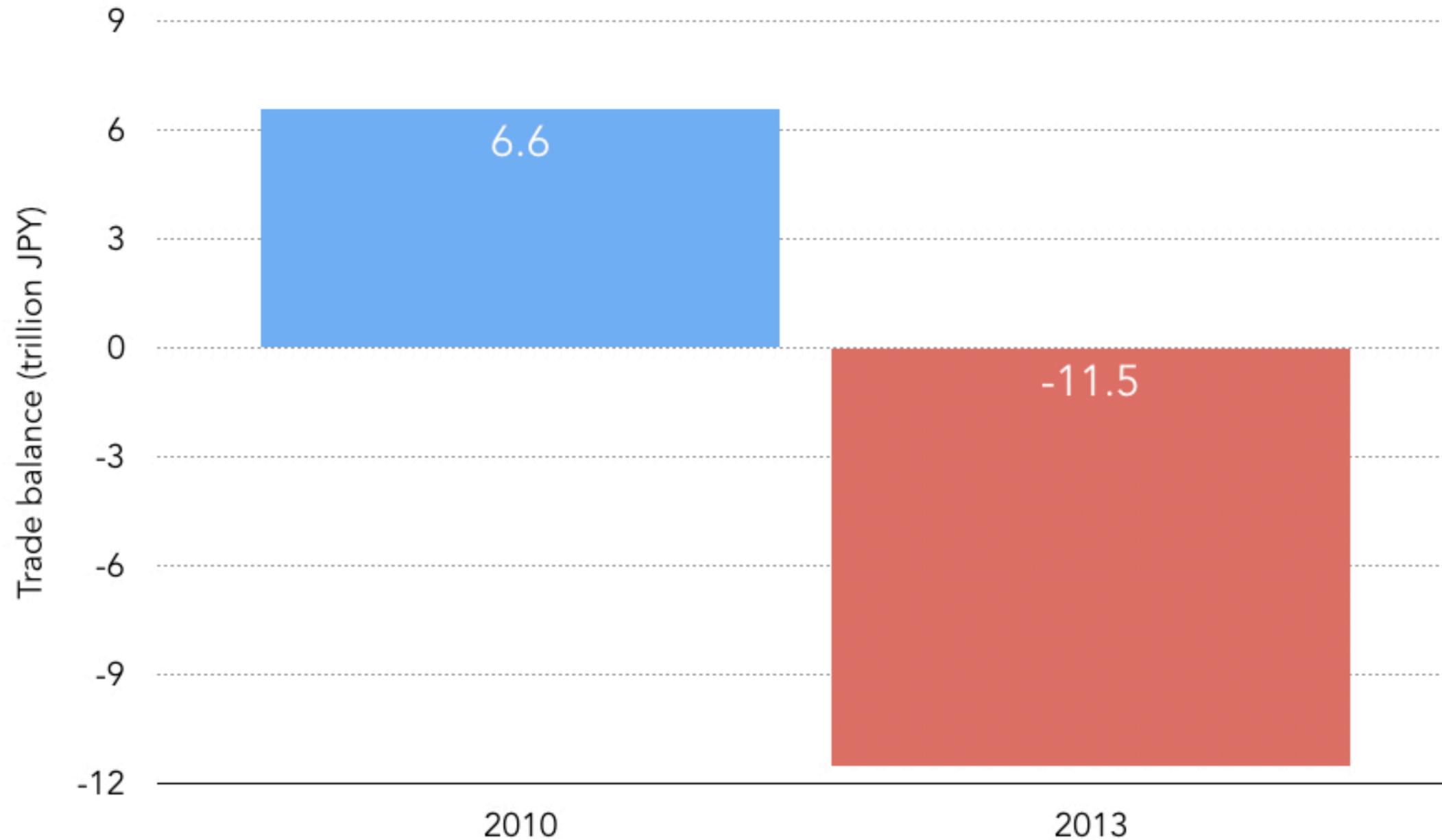
Japan electricity, 2000-2015



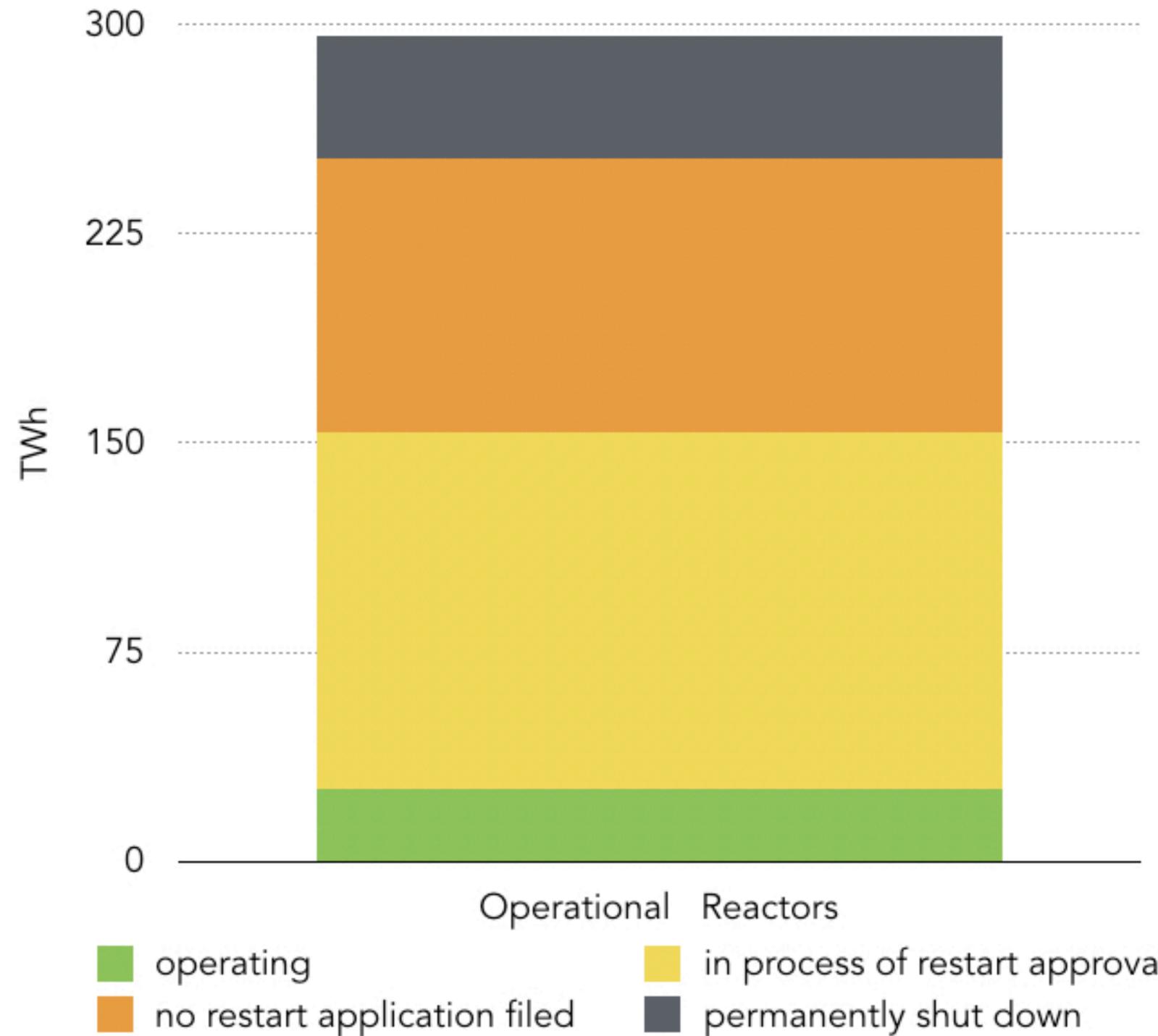
Japan's share of clean electricity, 2010-2015



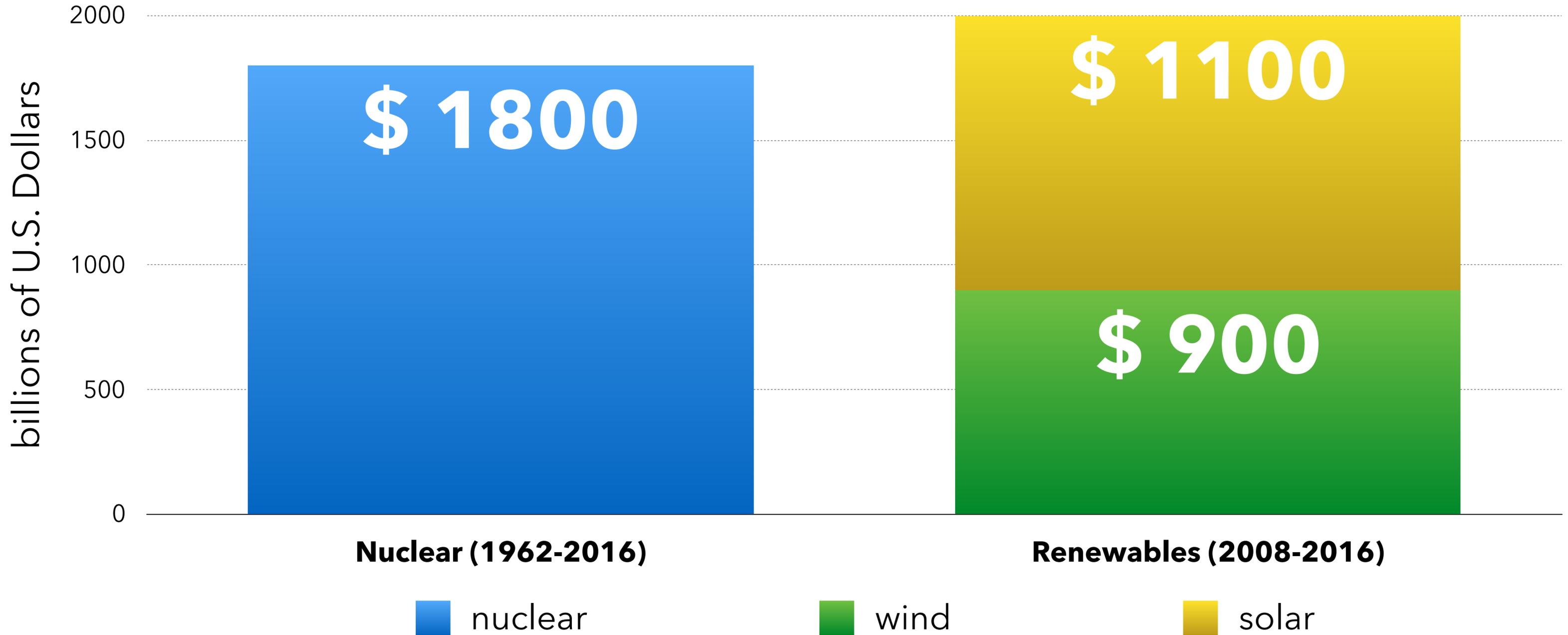
Japan's trade balance went from being a surplus to a deficit from 2010 to 2013 due to increased fossil fuel imports.



Current status of Japan's pre-Fukushima nuclear electricity generation



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



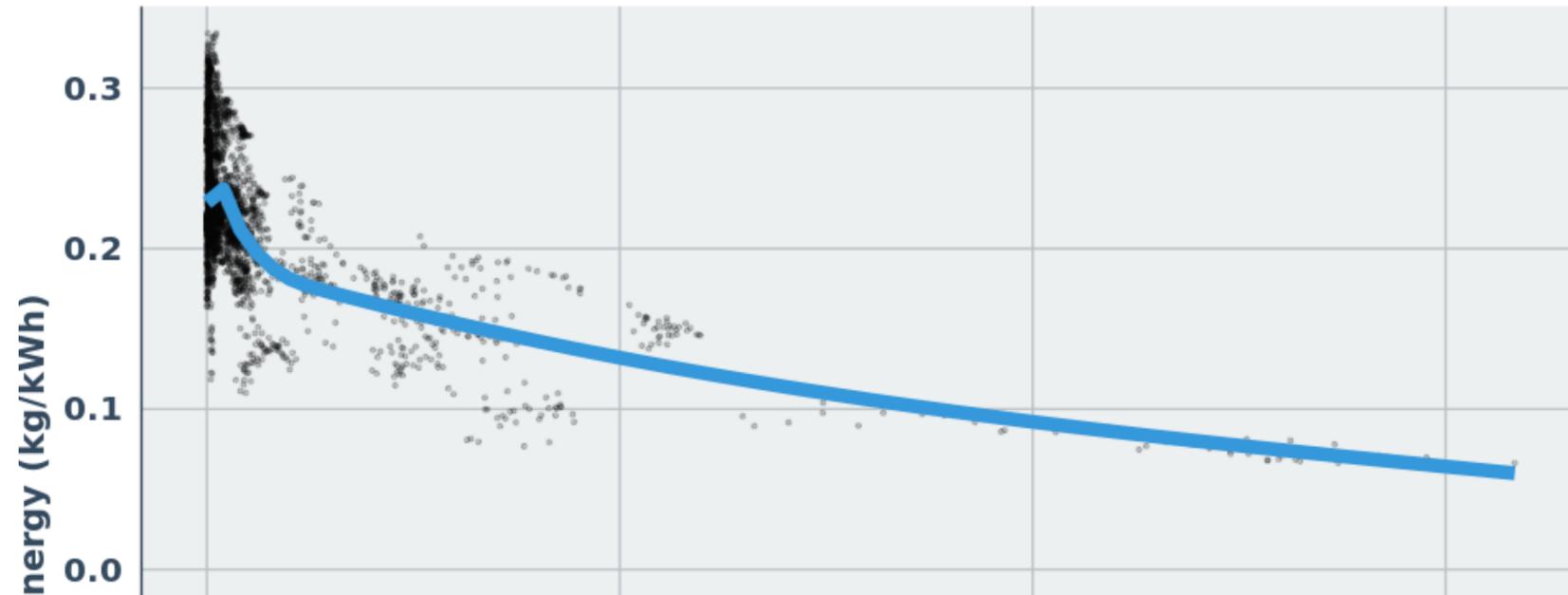
The site in Bonn, Germany, where diplomats from around the world are gathering for a United Nations climate conference this week.

Sean Gallup/Getty Images

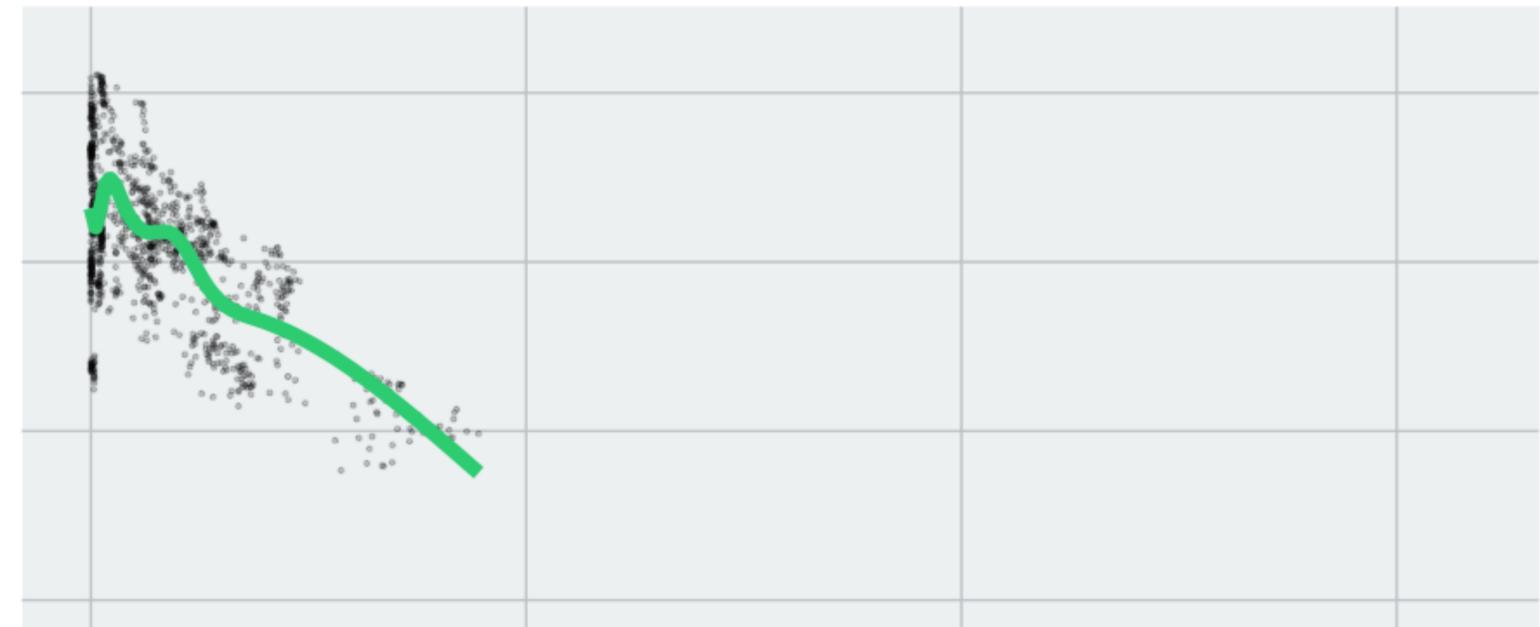
Environmental Progress performed an analysis of the evolution of the carbon intensity of energy in 68 countries since 1965. It found no correlation between the additions of solar and wind power and the carbon intensity of energy: Despite additions of renewable capacity, carbon intensity remained flat.

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

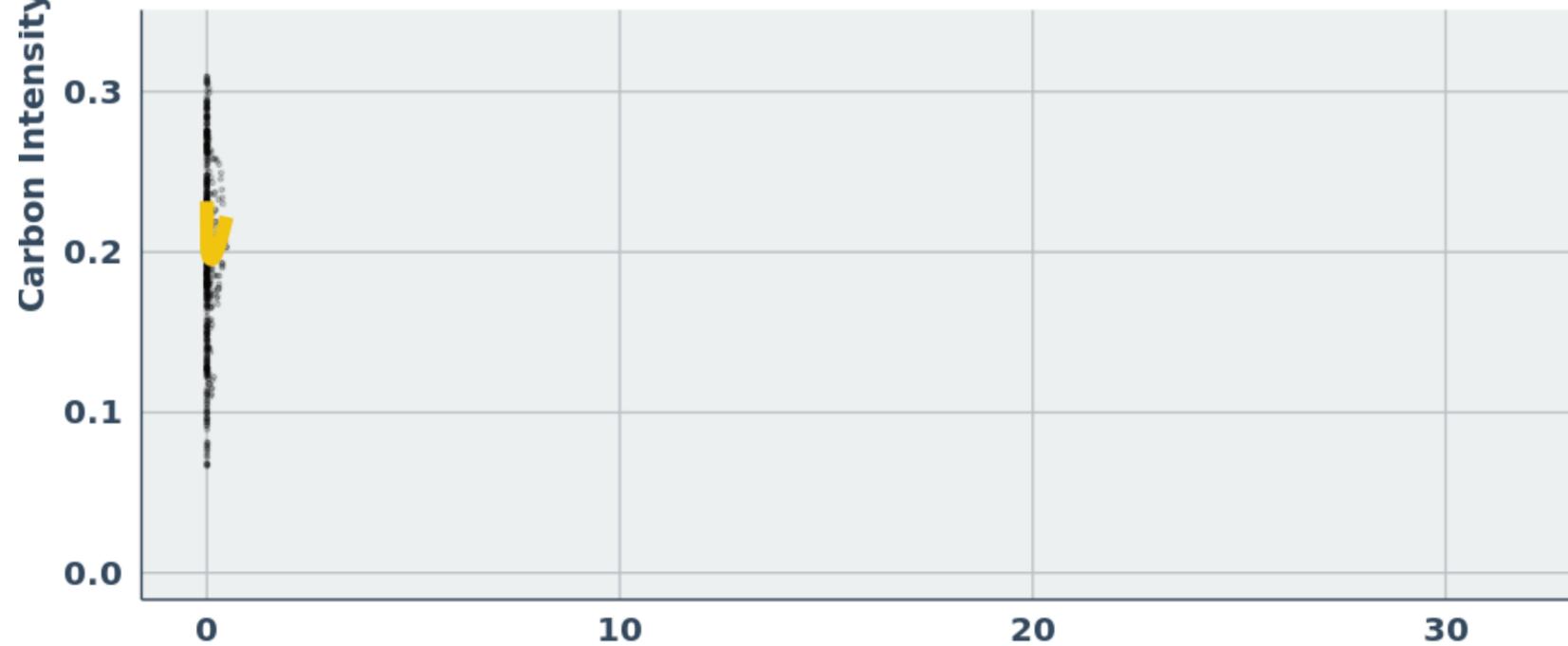
Hydro



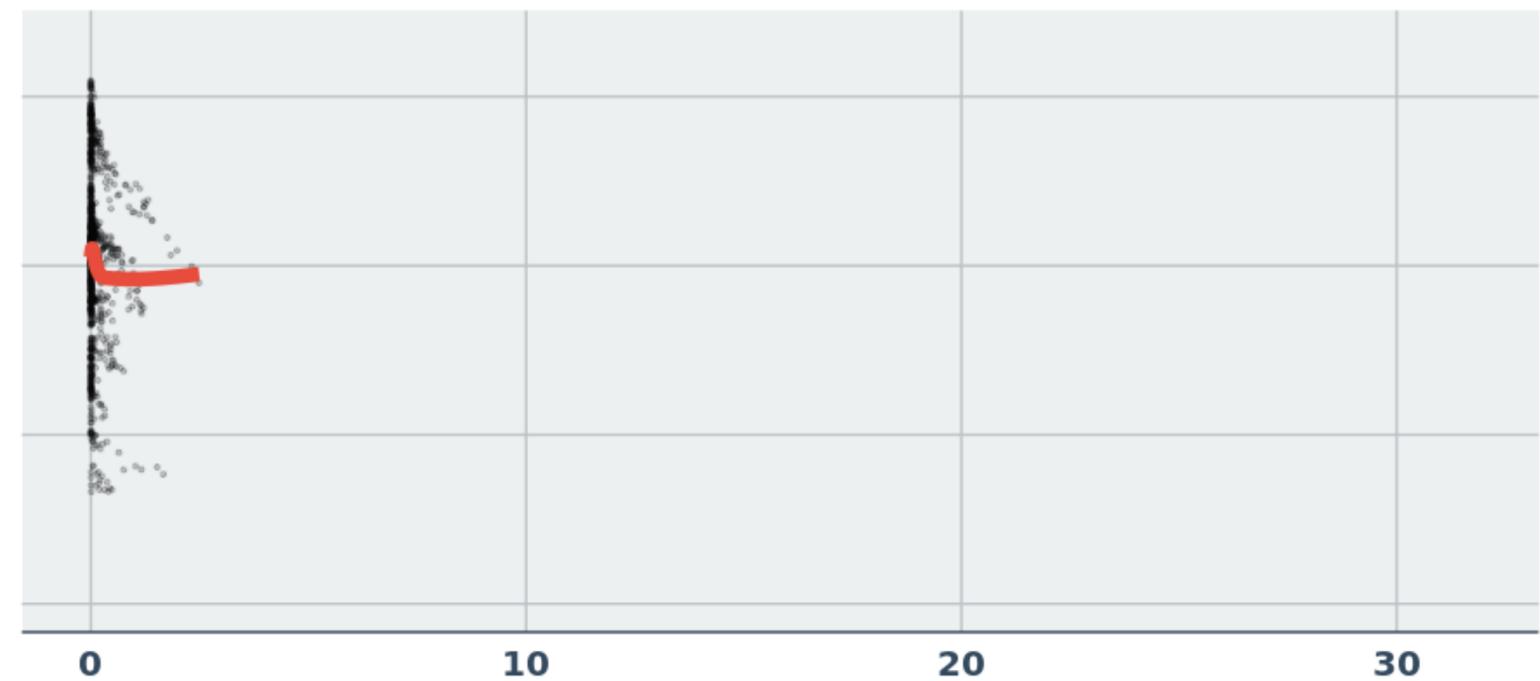
Nuclear



Solar



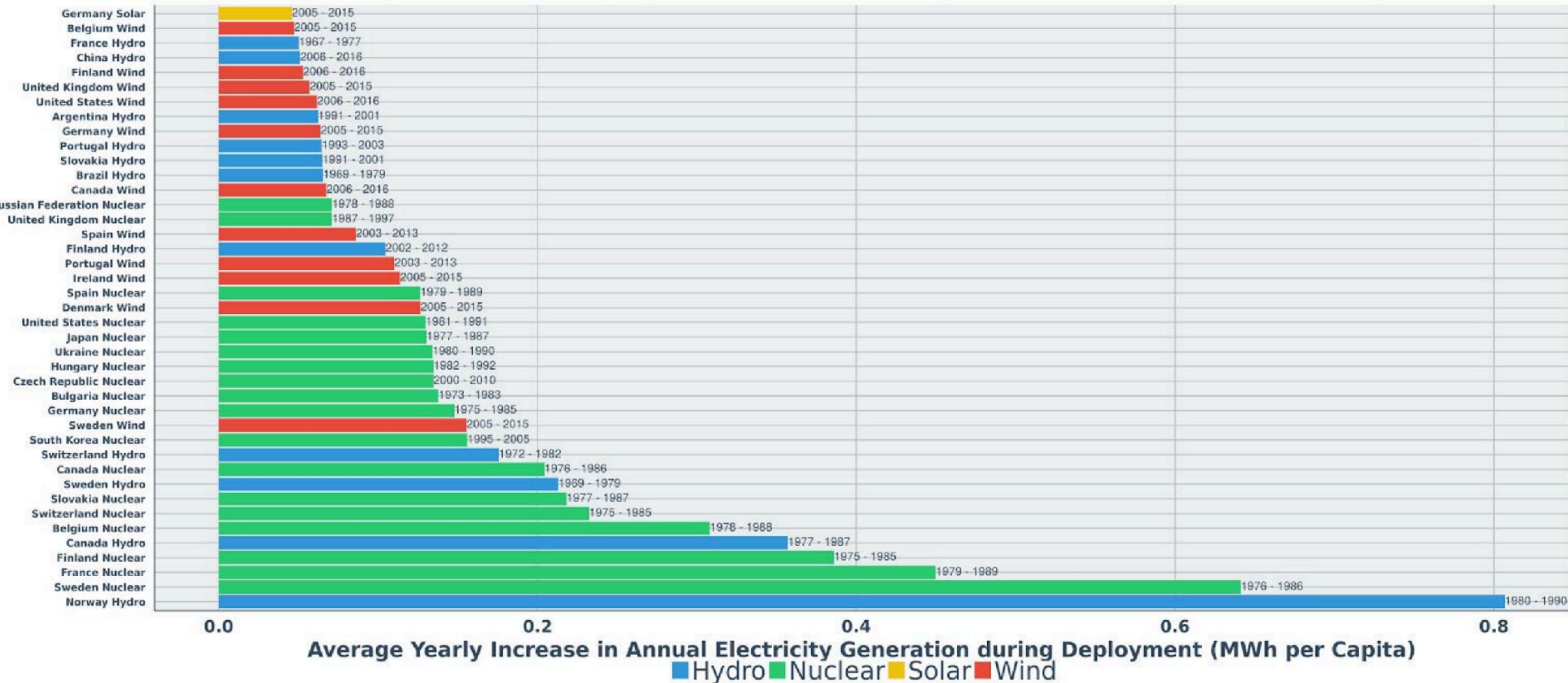
Wind



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

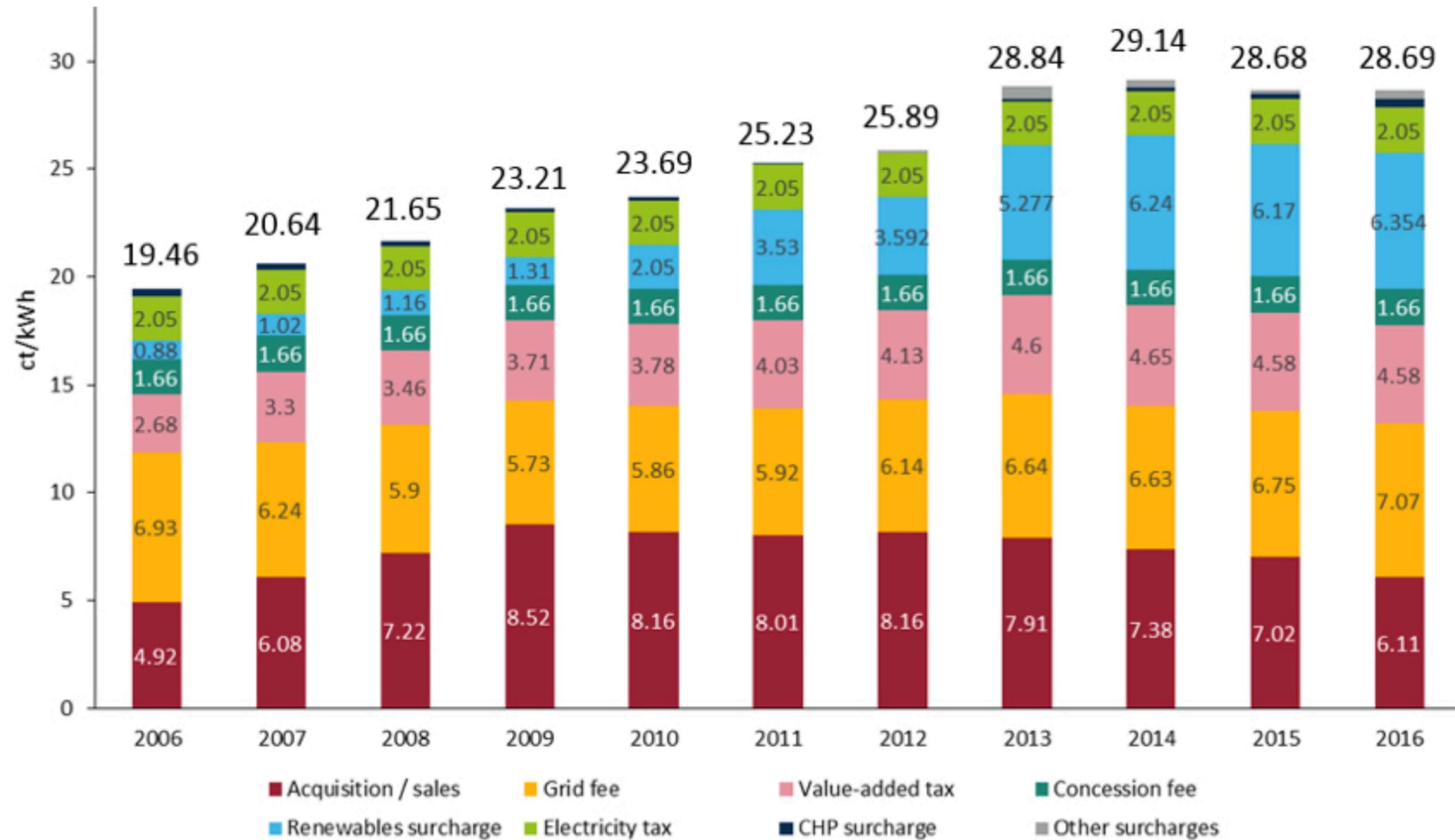
Hydro Nuclear Solar Wind

Largest 10-Year Deployments of Nuclear, Hydro, Wind and Solar Electricity

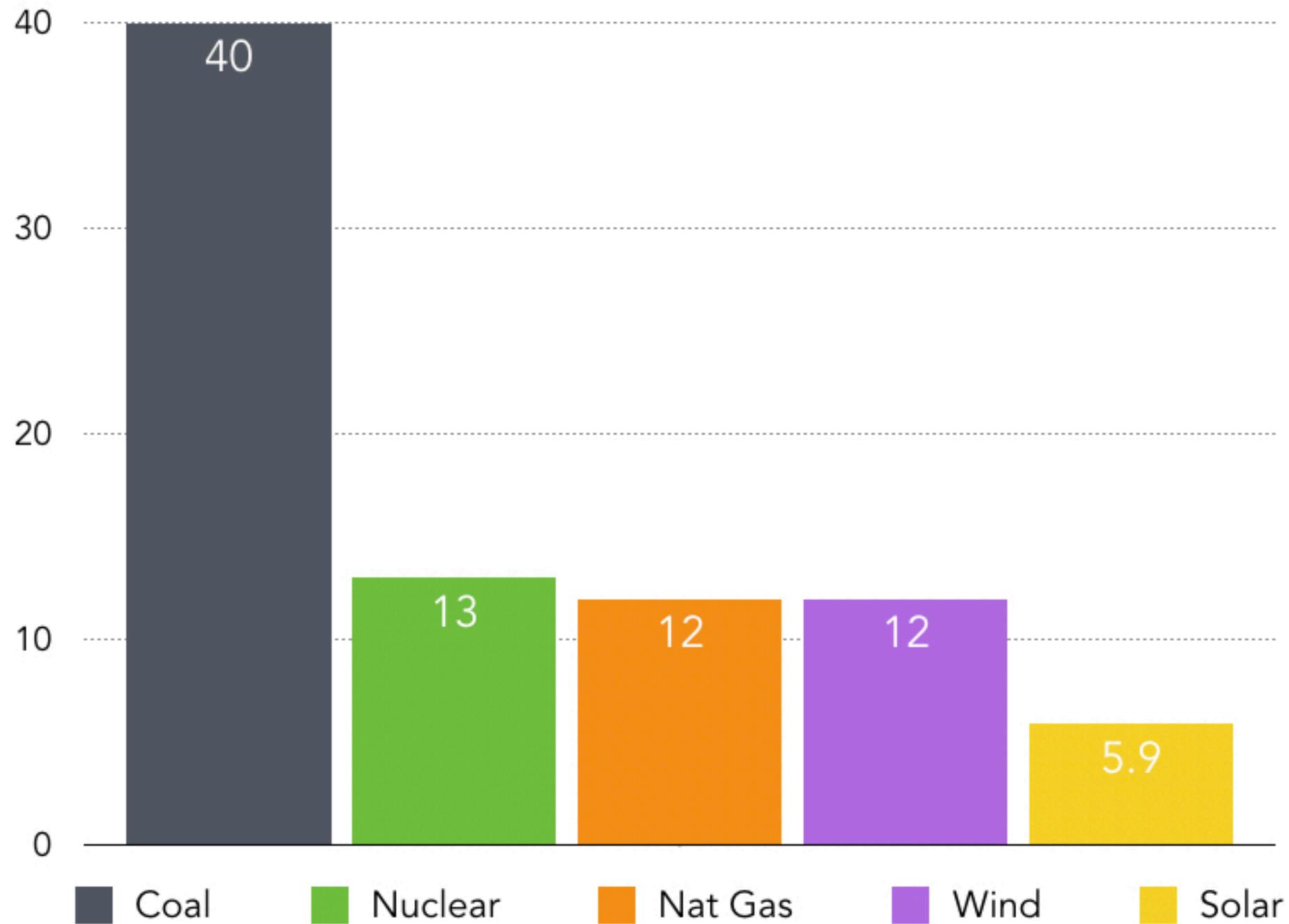


Germany has invested \$222
billion in renewables since
2000

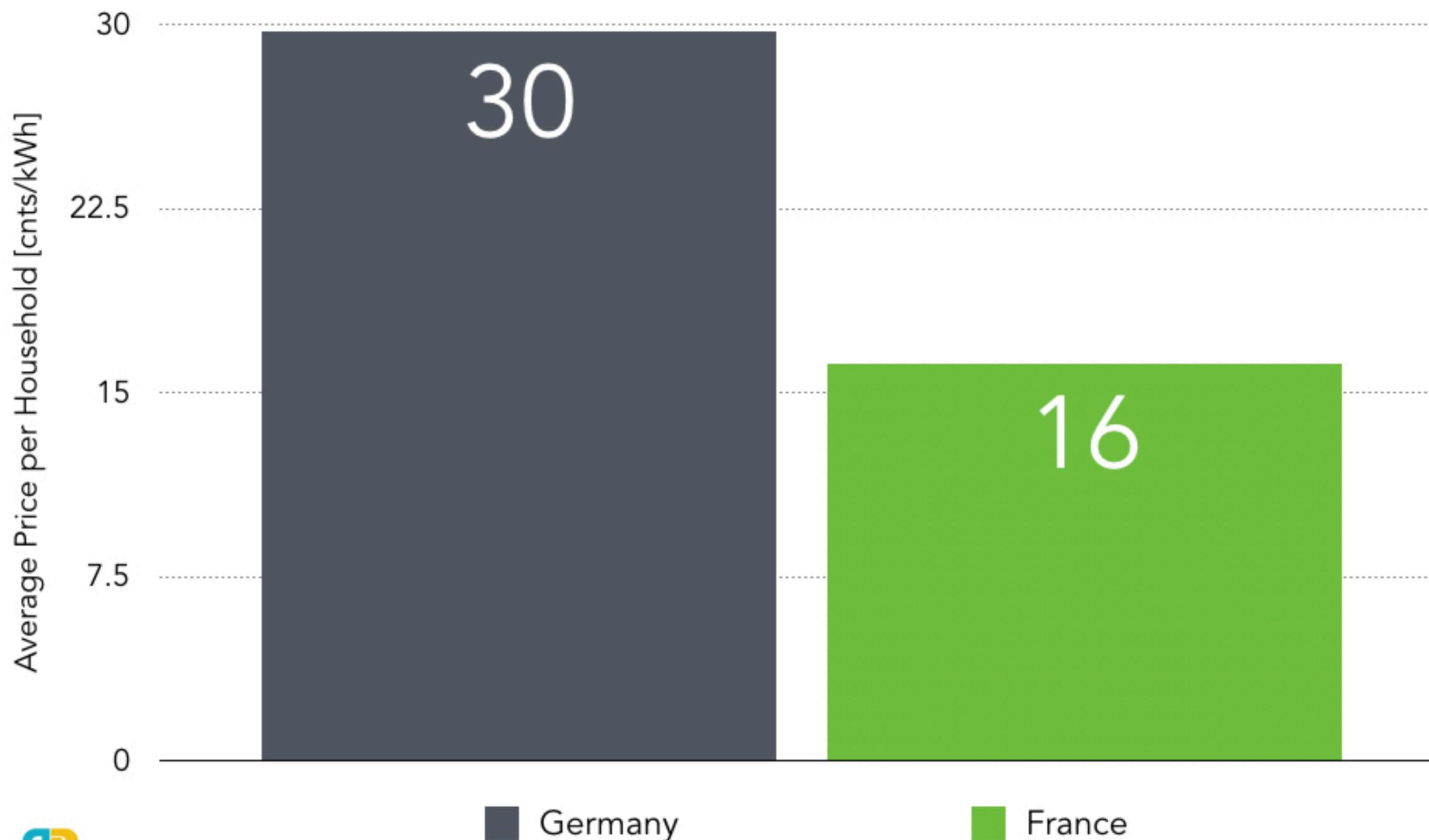
German electricity prices rose 47 percent from 2006 to 2016.



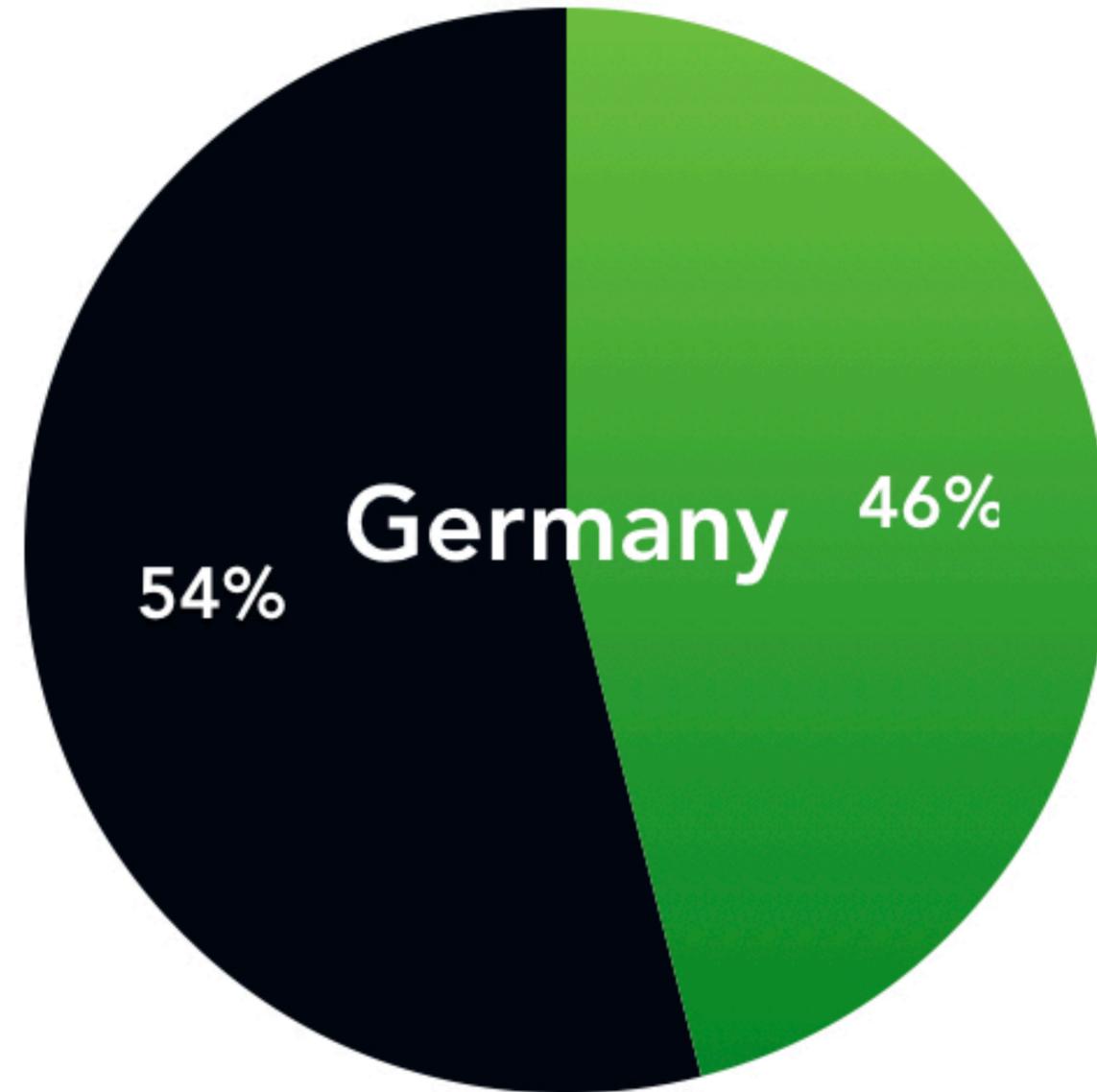
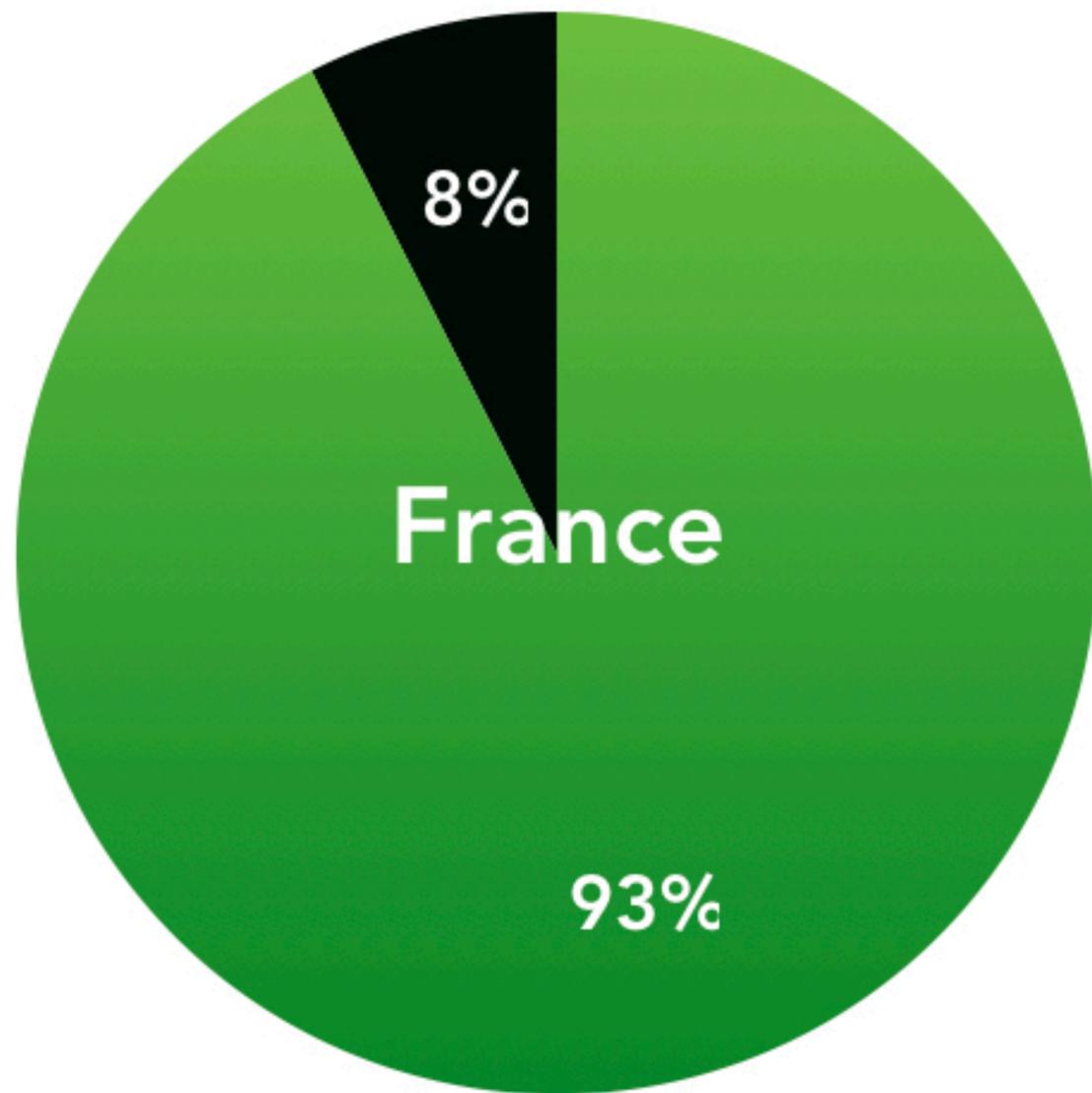
Percent of German electricity in 2016 from coal, nuclear, natural gas, wind and solar



German electricity is 2x more expensive than French electricity.



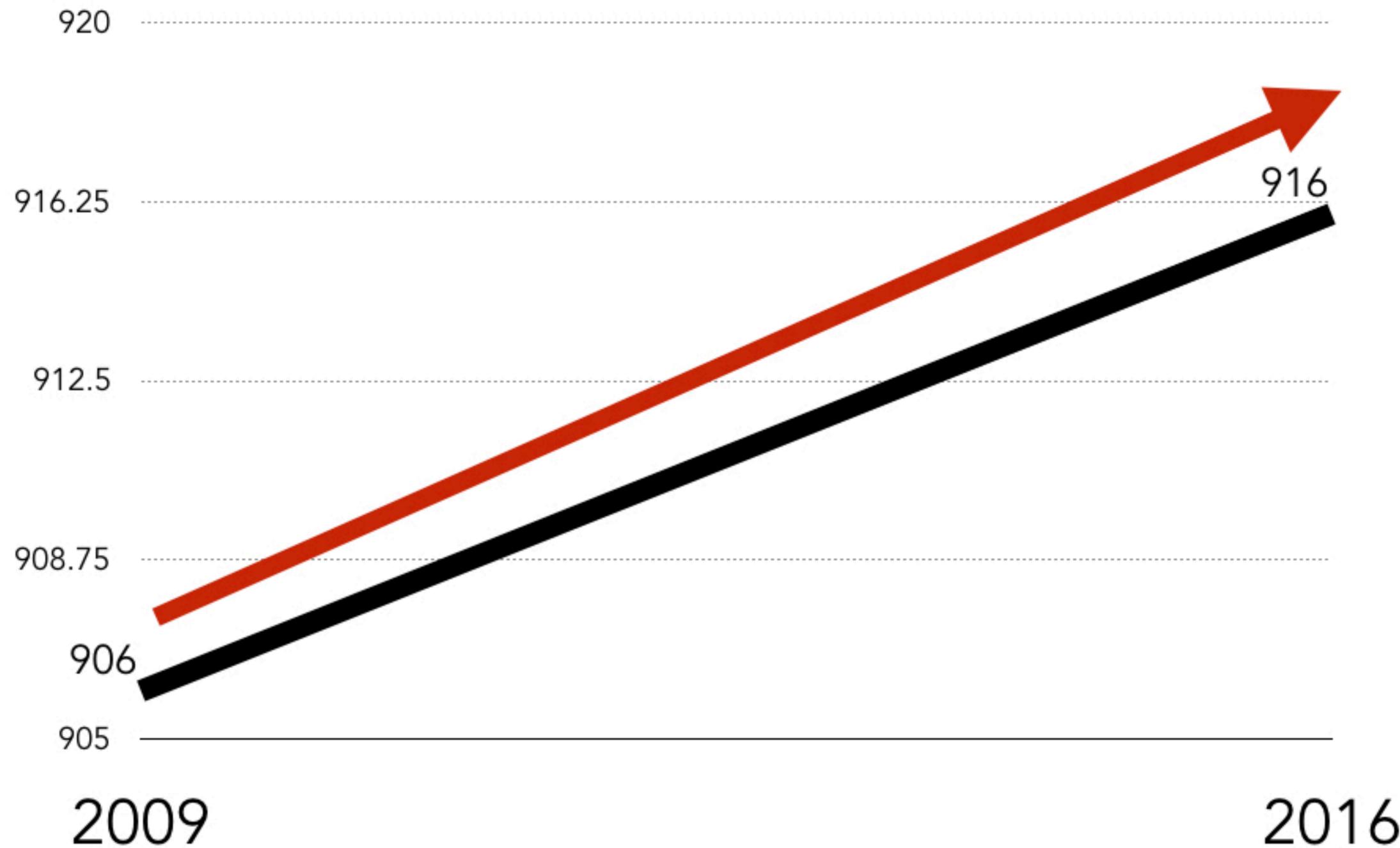
France generates 2x more electricity from clean energy sources than Germany.



● Clean

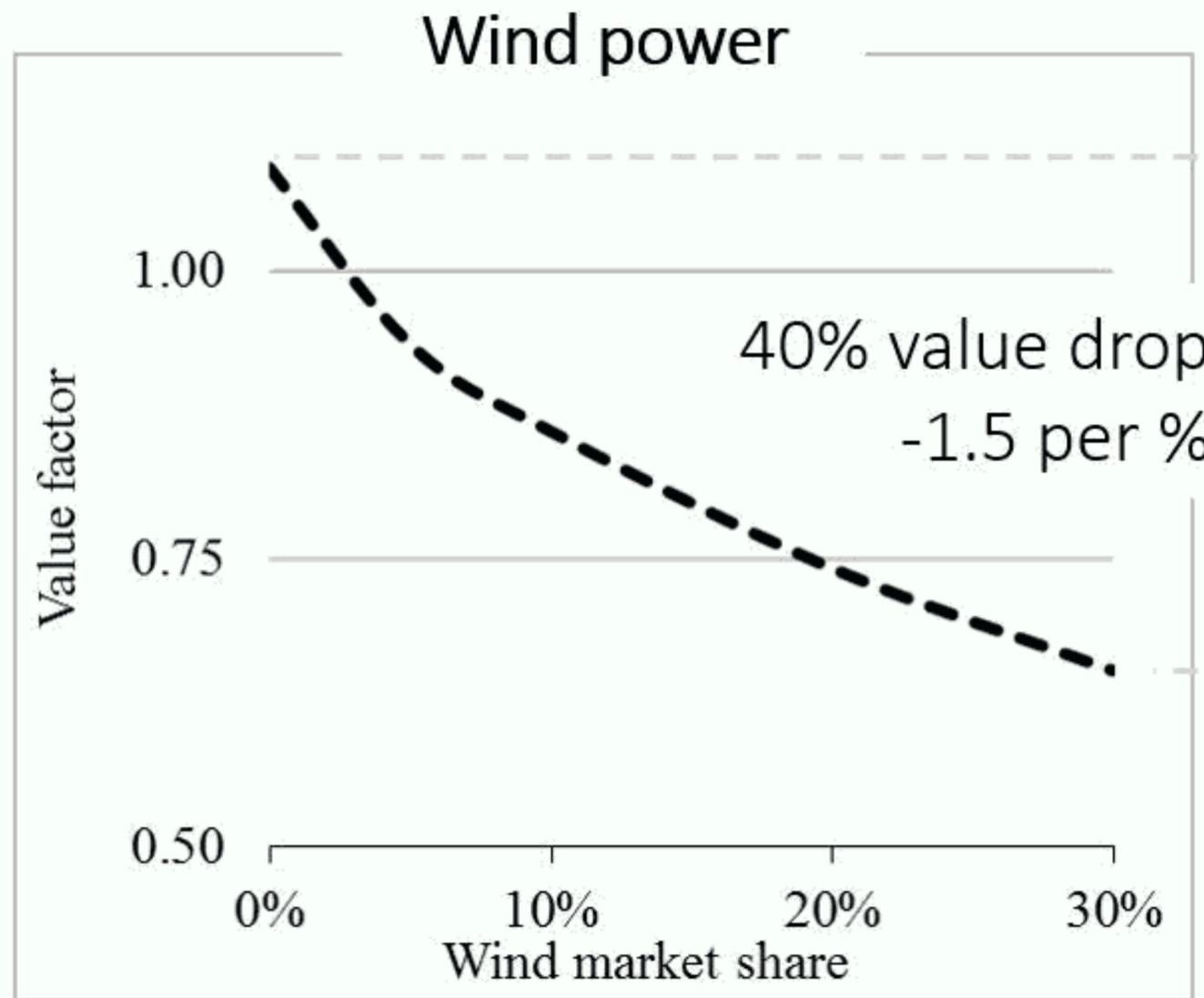
● Dirty

German emissions have been rising since 2009

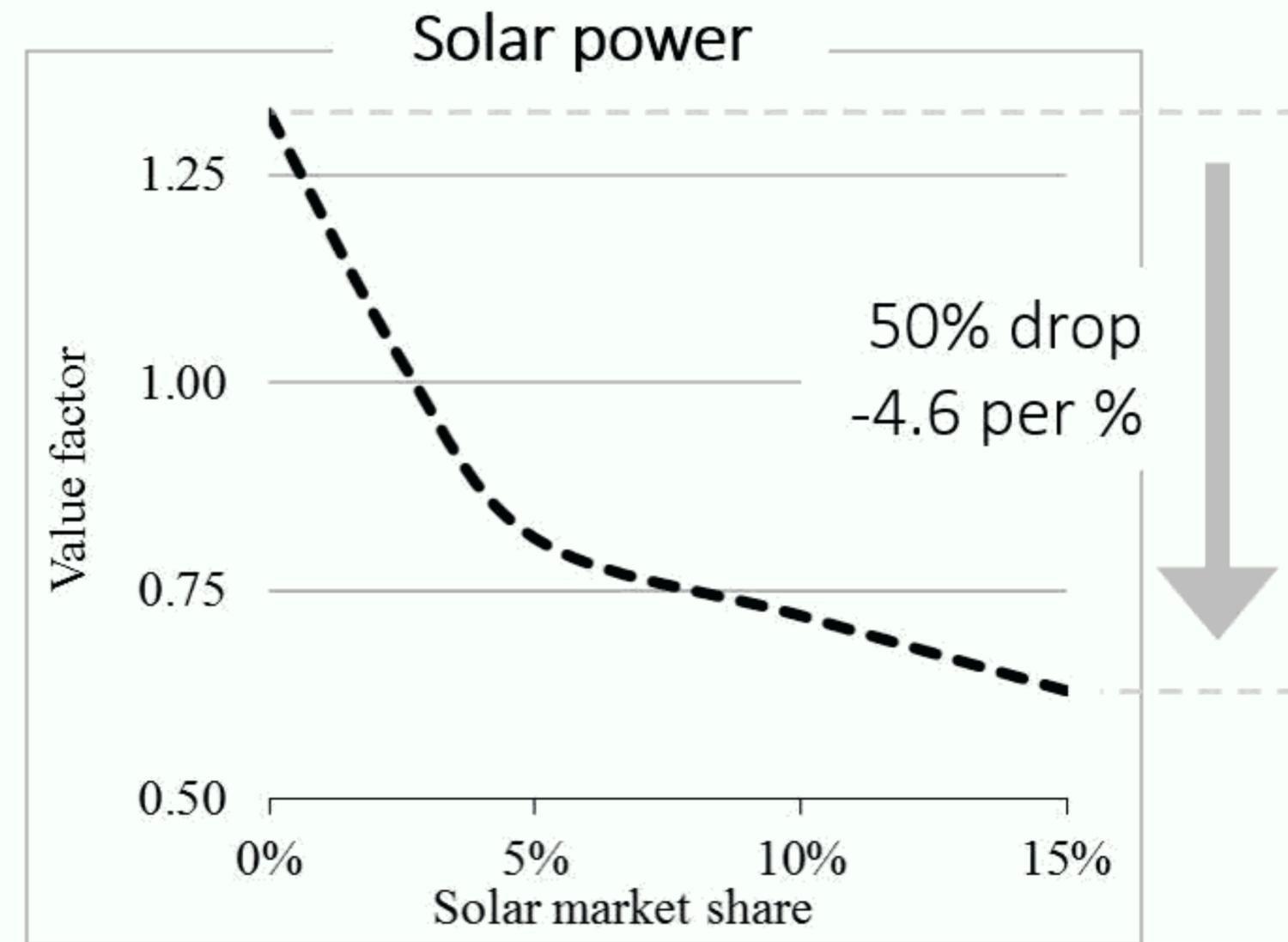


Germany installed 4% *more* solar panels in 2016 – but generated 3% *less* electricity from solar.

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



Source: updated from Hirth (2013): Market value



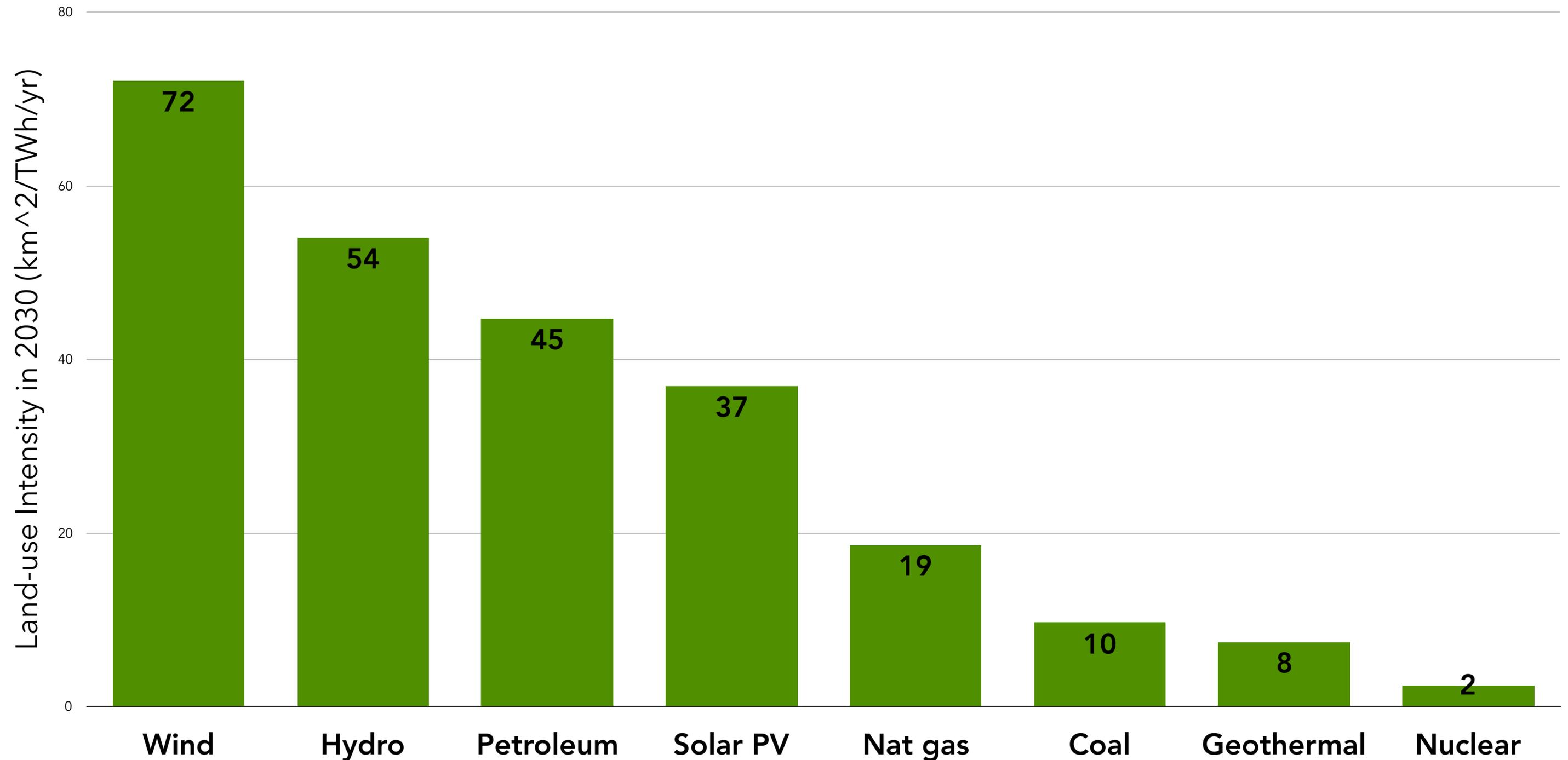
Source: updated from Hirth (2015): Market value of solar



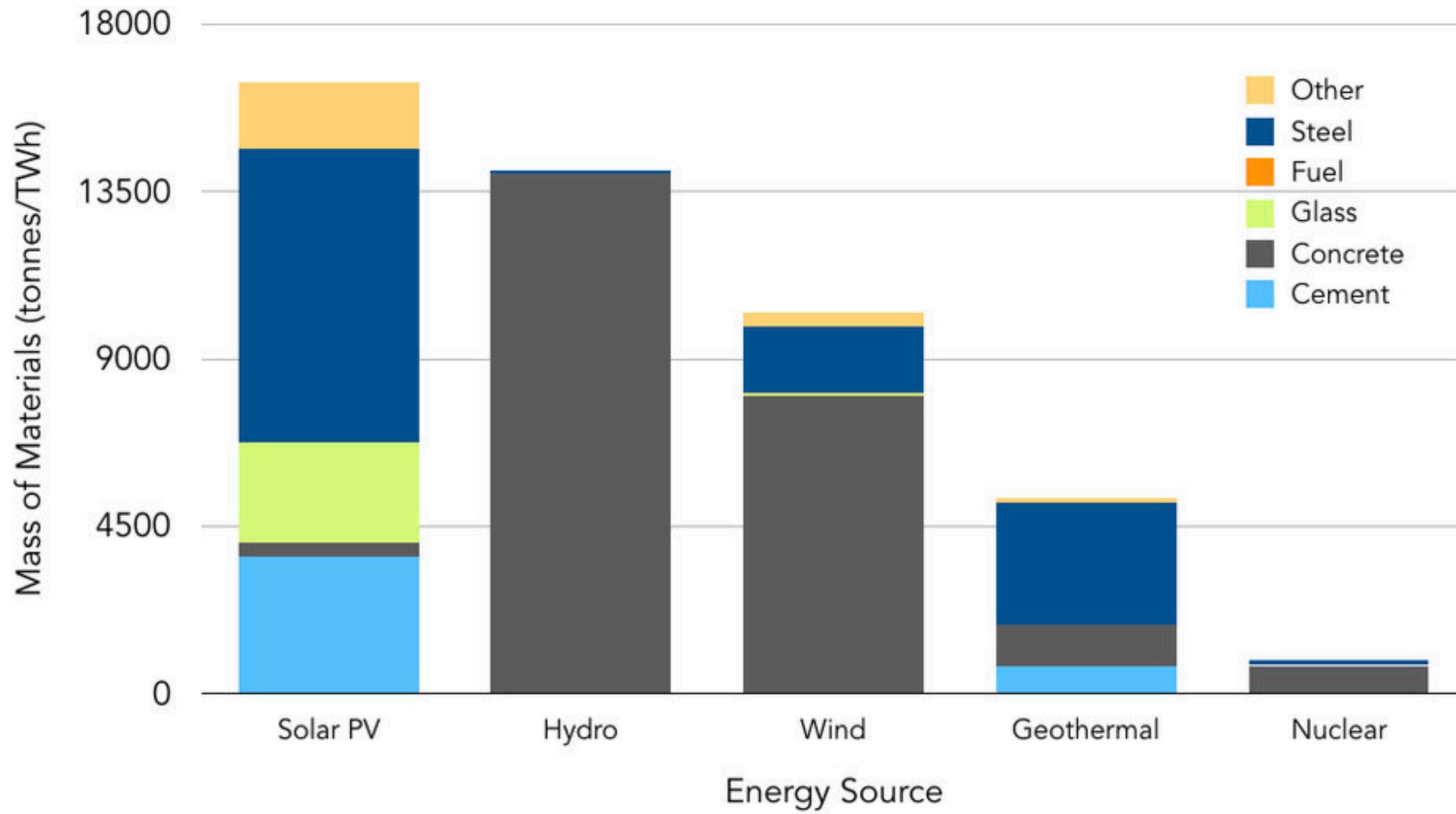
Source: Leon Hirth, "Market Value of Variable Renewables," EUI Working Paper, 2013, http://cadmus.eui.eu/bitstream/handle/1814/27135/RSCAS_2013_36.pdf?sequence

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

Renewables require 17 - 35 times more land than nuclear

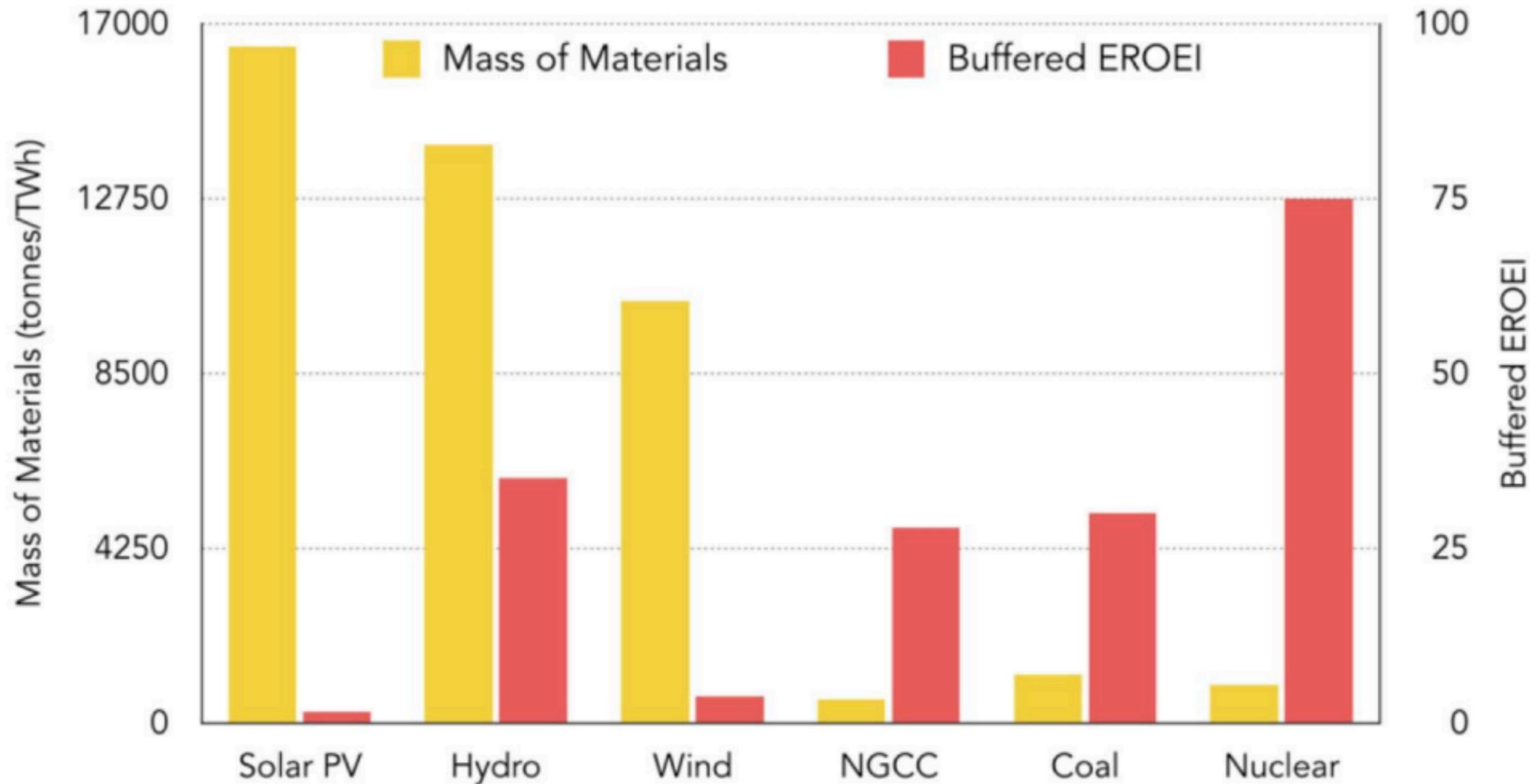


Materials throughput by type of energy source



Sources: DOE Quadrennial Technology Review, Table 10.
Murray, R.L. and Holbert, K.E. 2015. Nuclear energy: an introduction to the concepts, systems, and applications of nuclear processes (7th ed.). Elsevier.

Materials throughput and EROEI by type of energy source

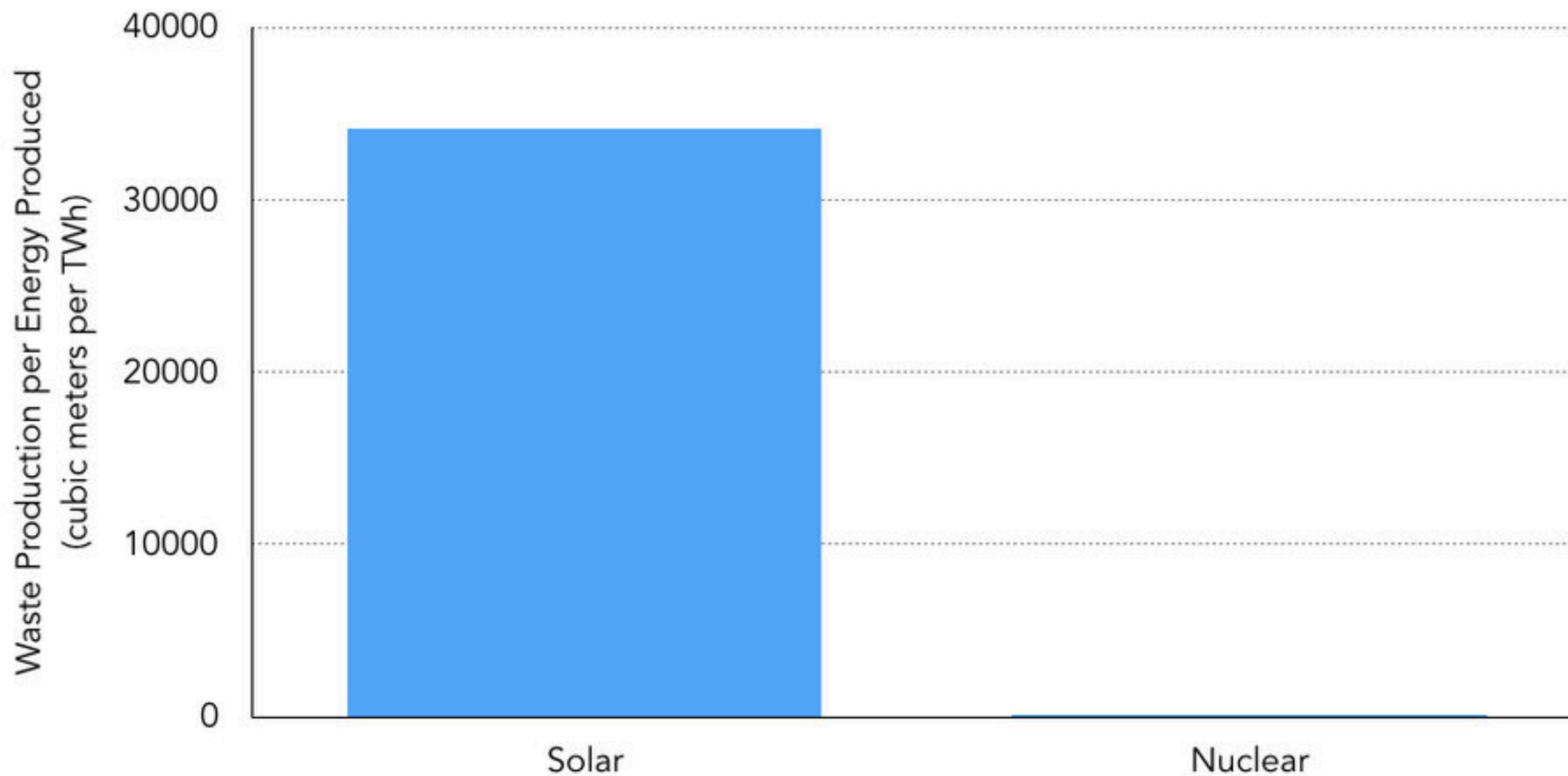


Sources: DOE Quadrennial Technology Review, Table 10.

Murray, R.L. and Holbert, K.E. 2015. Nuclear energy: an introduction to the concepts, systems, and applications of nuclear processes (7th ed.). Elsevier.

Weißbach, D., Rupprecht, G., Huke, A., Czerskia, K., Gottlieb, S., & Hussein, A. Energy intensities, EROIs, and energy payback times of electricity generating power plants.

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_highlevel_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, <https://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



Is there an alternative to nuclear for cheap, clean energy?

- Carbon capture and storage *must* be more expensive than coal or natural gas alone
- Intercontinental super-grid would be expensive
undermine energy security
- Geo-engineering doesn't solve problems but creates new ones



Chernobyl



- 28 deaths from acute radiation syndrome
- 15 deaths from thyroid cancer in 25 years
- 1% death rate overall predicted for thyroid cancer.
- 16,000 excess thyroid cancers in total predicted, thus 160 deaths predicted
- 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

Fukushima

- No radiation deaths
- Over 1,500 deaths from radiophonic panic, evacuation & stress
- Over 15,000 killed by in tsunami
- Unlikely to be any increase in thyroid cancer
- No impact on adverse pregnancy



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%



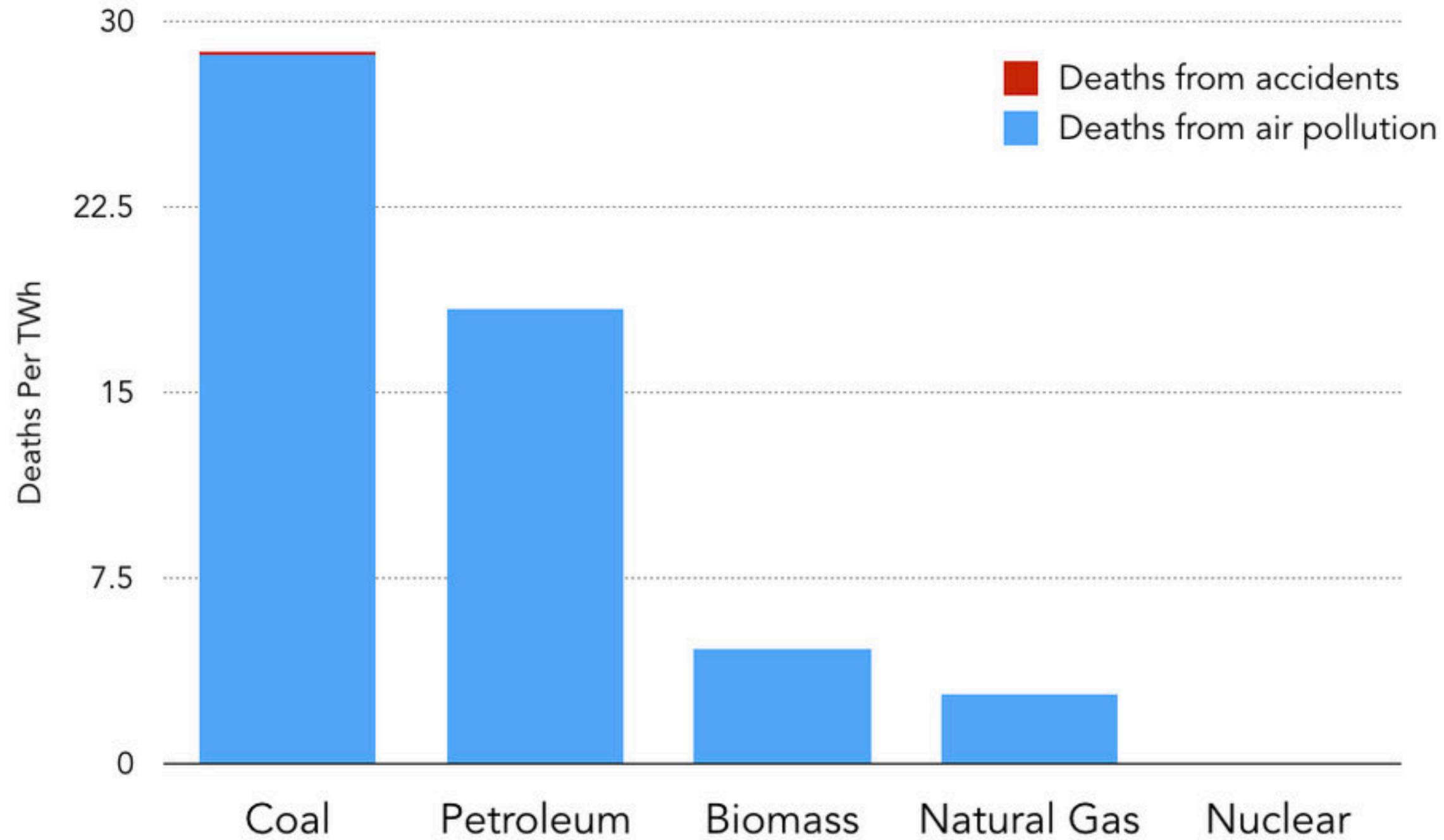
Source: Smith J BMC Public Health 2007 7:49



WHO

7 million die
annually from air
pollution

Nuclear is already the safest way to make reliable electricity.

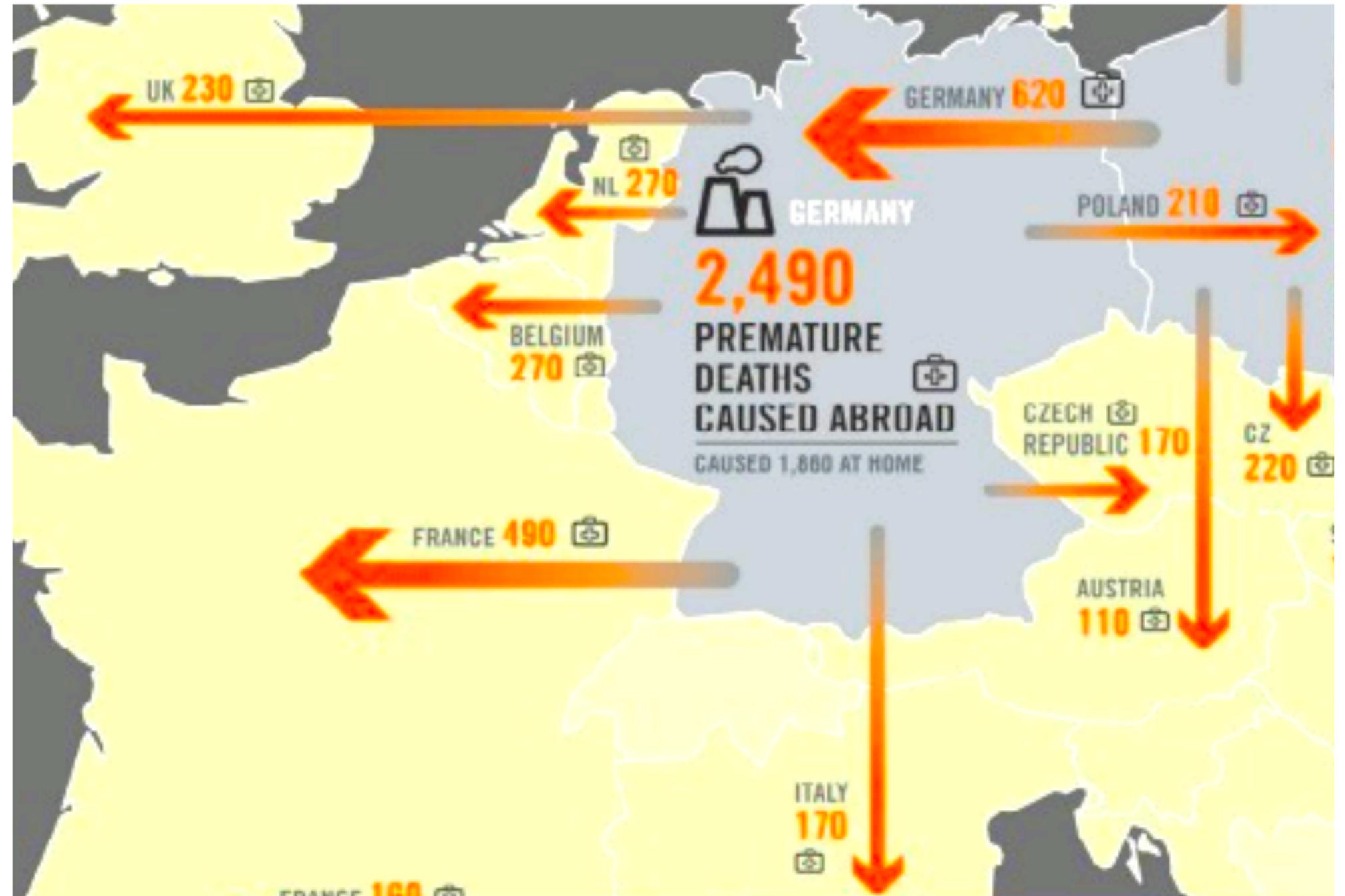


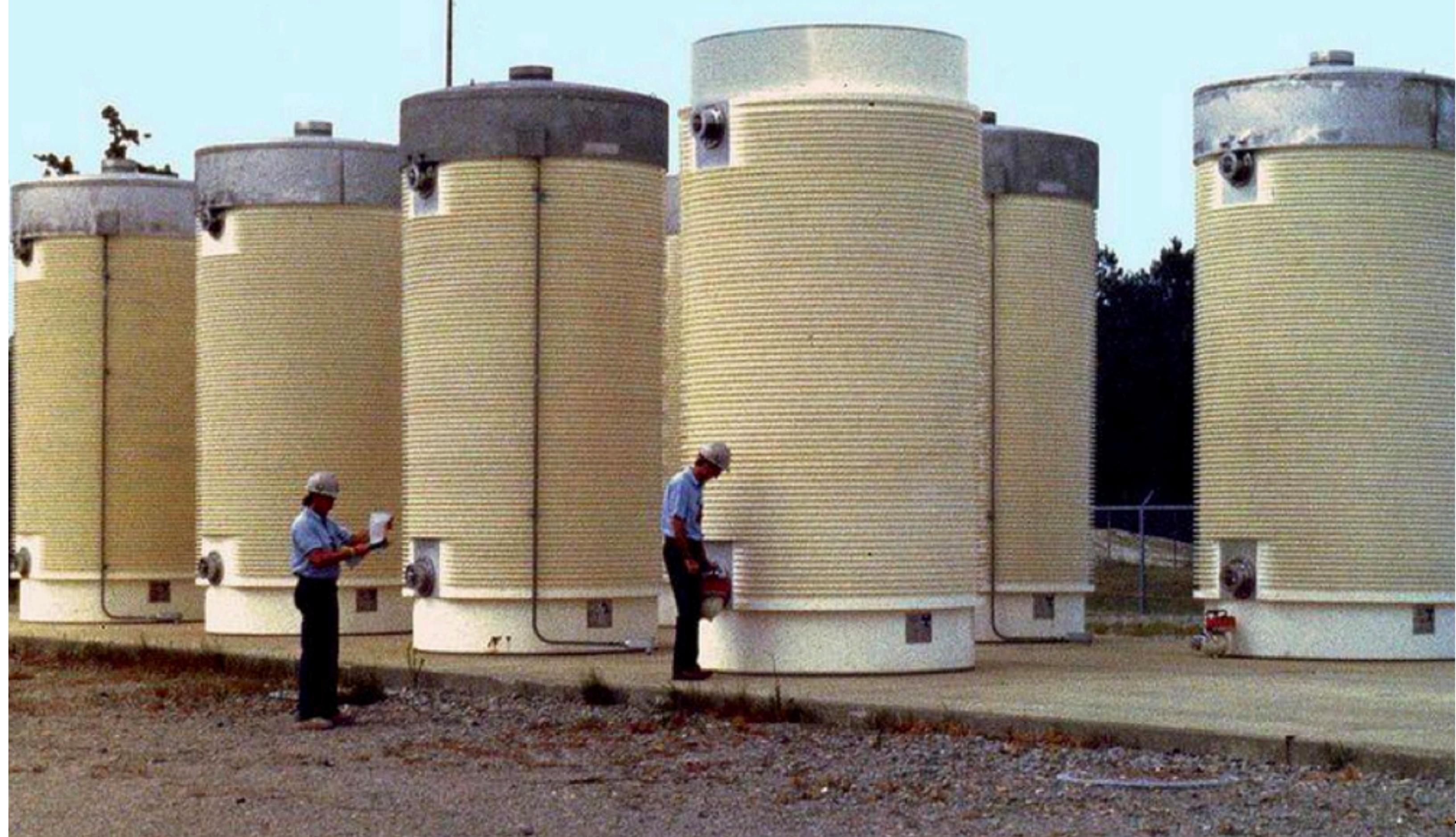


Nuclear power has *saved* 1.8 million lives to date by preventing the burning of fossil fuels.

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

German coal pollution kills 2,490 people/year





Fukushima Six Years Later

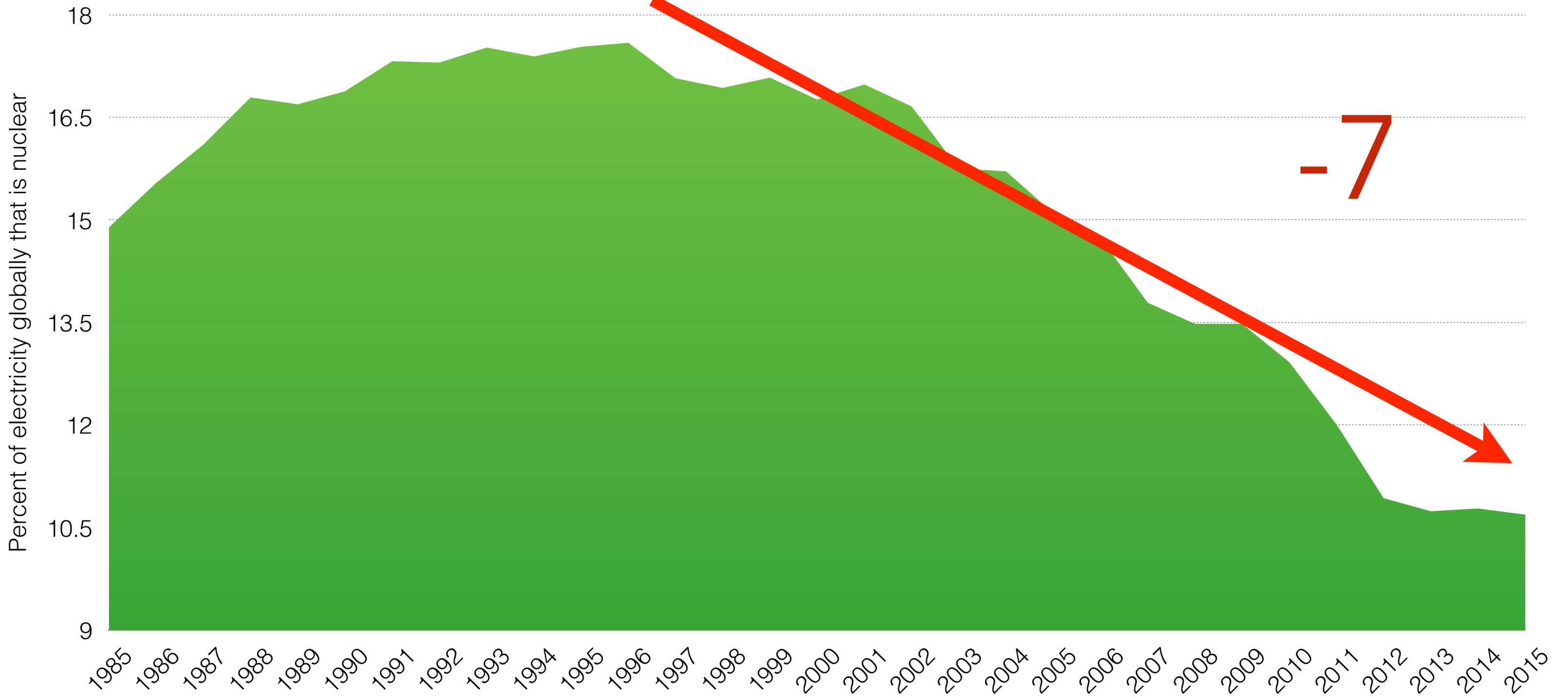
Fears from Fukushima has had significant *international* impacts (eg, Germany, Taiwan, S. Korea)

Public acceptance of nuclear main issue for climate change and environment

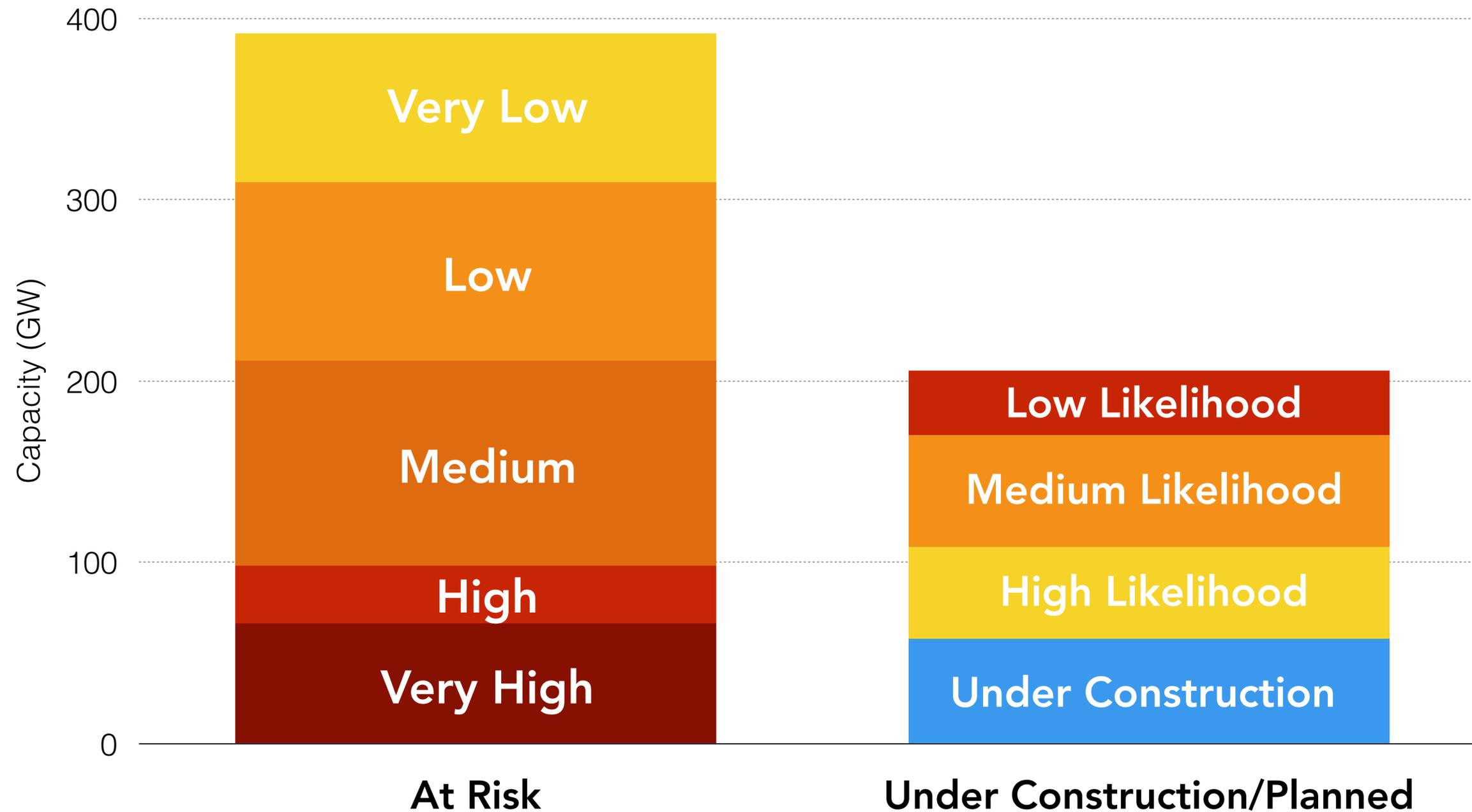
Soil clean-up and tritiated water retention reinforced irrational fears



Nuclear on the decline



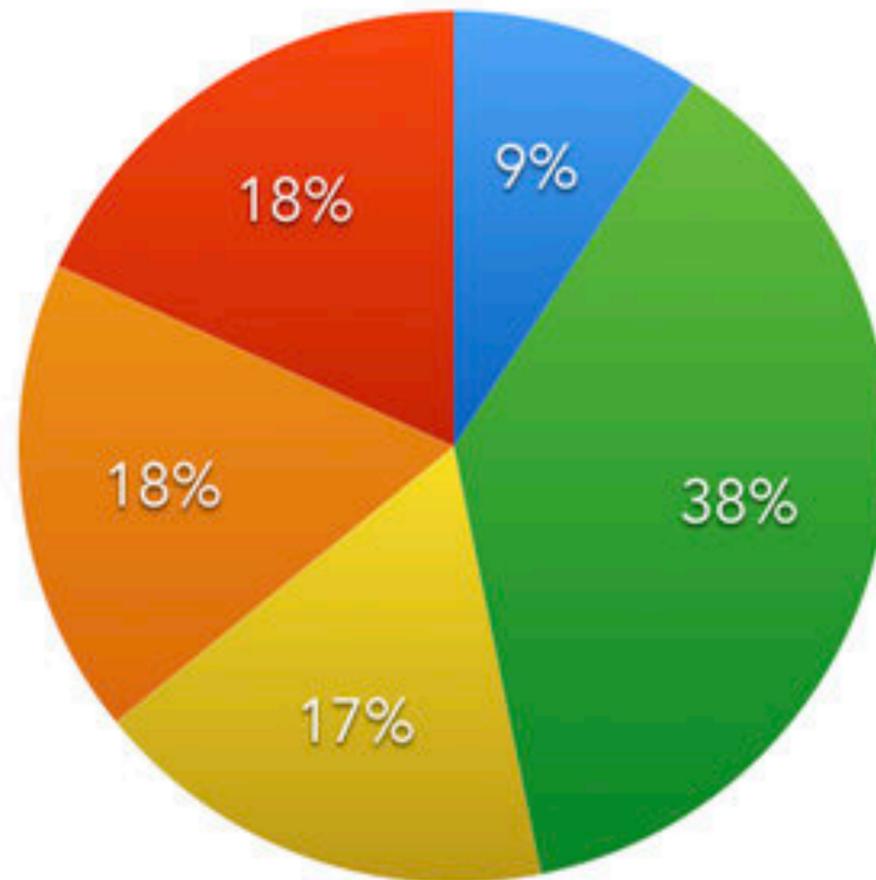
World could lose up to 2x more nuclear than it gains by 2030



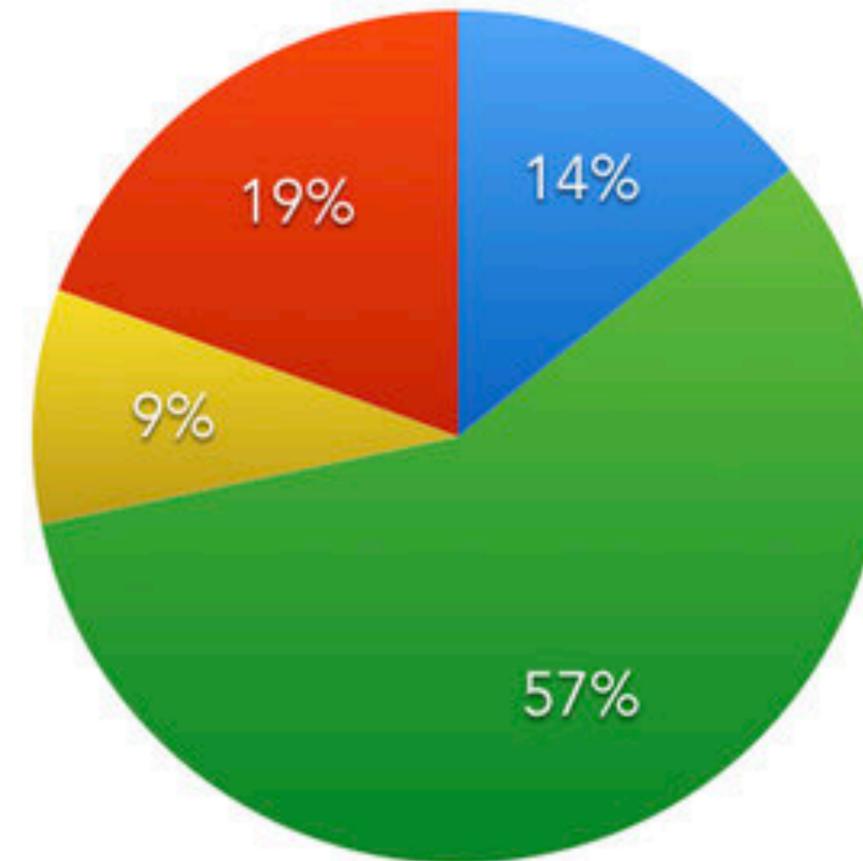
Source & Methods: EP Energy Progress Assessment, 2017. Plant-specific rankings based on economic and energy trend analysis, political and societal assessment, and expert elicitations. Longer methodology discussion can be found at environmentalprogress.org/research Last updated March 2, 2017. Email info@environmentalprogress.org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

Share of Global Nuclear Export Market by Capacity

For All Projects Planned for Completion by 2030



For Projects Highly and Moderately Likely to be Completed by 2030



● China ● Russia ● France ● Japan ● Awaiting Vendor

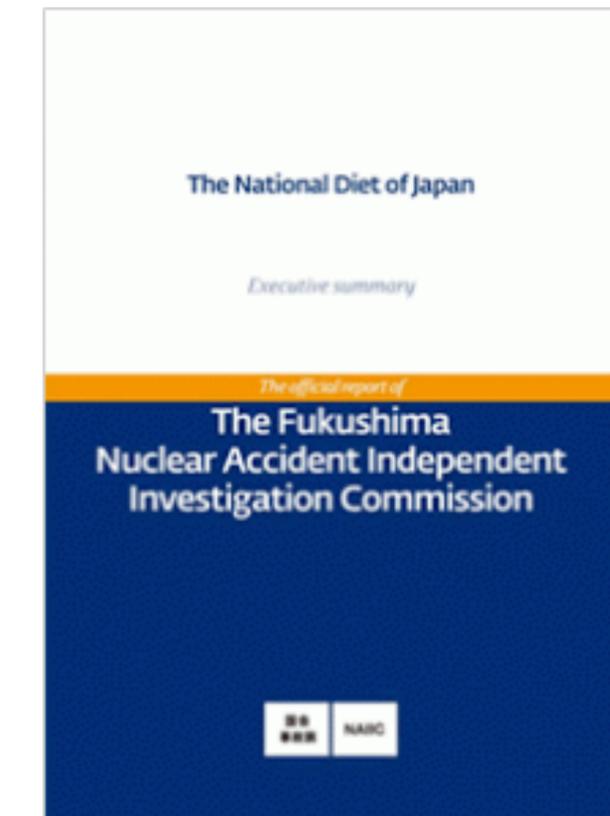
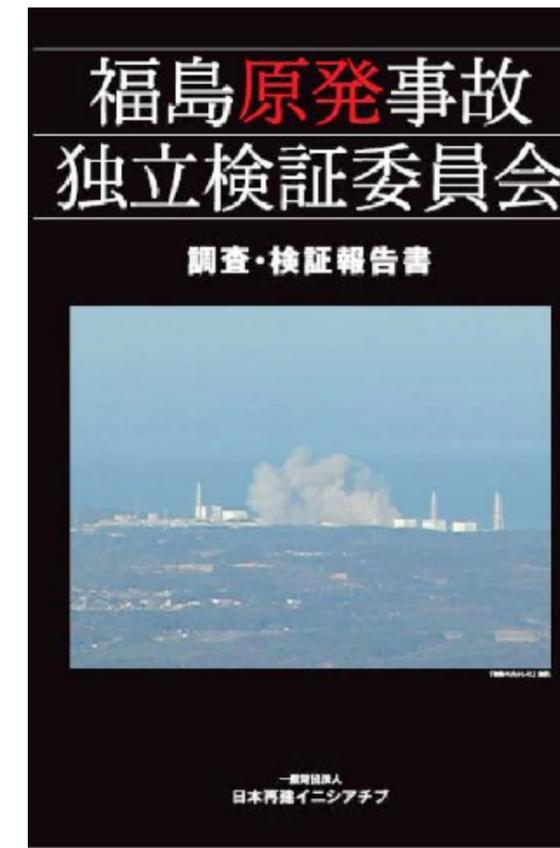
Fukushima Six Years Later

Arrogant overconfidence that Japan immune from nuclear accident

Little to no accident preparedness

Fear of alarming public near plant behind lack of preparedness

Pre-Fukushima public education focused on avoidance of accident not benign nature of low-dose radiation



Nuclear Safety Myth

Rests upon following:

- "Radiation = super-potent toxin" (radiophobia)
- "Gov't will prevent us from accidents" (paternalism)
- "We are different from other nations that had accidents" (arrogance)

When accident occurs, public loses trust, and panics



Visitor Exhibit, Shin-Kori, South Korea (top)



Shika, Japan visitor center with "Alice in Wonderland" characters (NY Times)

Fukushima as “Elite Panic”

Elite panic = when governmental or industrial elites panic in fear of public panic

Example: PM Kan interfering in chain-of-command (Funabashi, 2012)

Failure of public education → superstitious fears of radiation → panic



Yoichi Funabashi, *Testimony*, Rebuild Japan.





Fukushima as “Moral Panic”

Moral panics = blaming *already distrusted* members of society for things largely out of their control

Reaction to Fukushima manifested previously-held resentment of nuclear village



Kyle Cleveland, “Significant Breaking Worse,” *Critical Asian Studies*, 2014

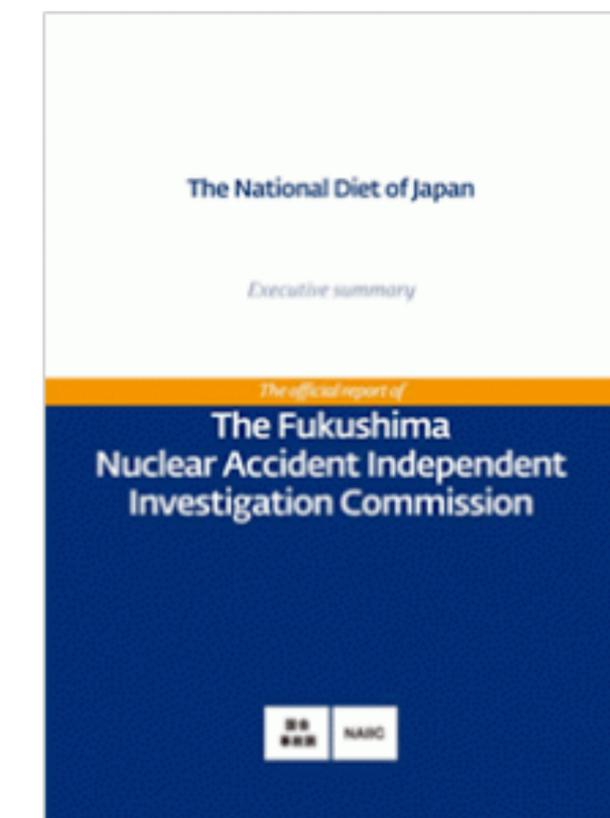


Changing Institutional Culture

Need for change to “institutional culture” – not “institutions” & not “culture”

Need *new story* of Japan and Fukushima

Generational change – empower young leaders within institutions





Me: What do you think of Diablo Canyon?

Woody: It's a great plant.

Me. What makes you say that?

Woody: Because the people who work there care!



Woody Epstein, Nuclear Risk Analyst

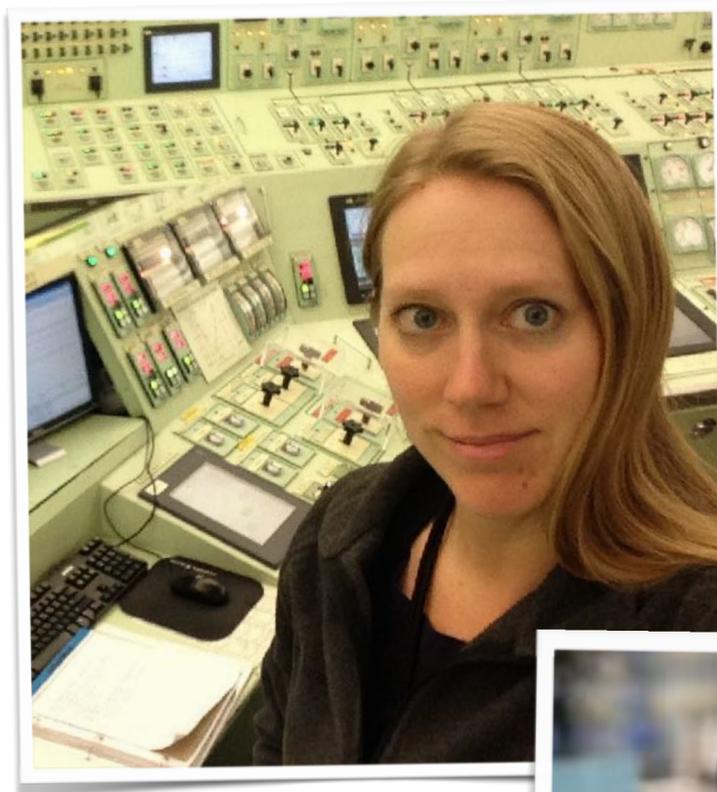
Heather Matteson



Mother, Environmentalist, Reactor Operator



~~What~~ Who makes nuclear safe

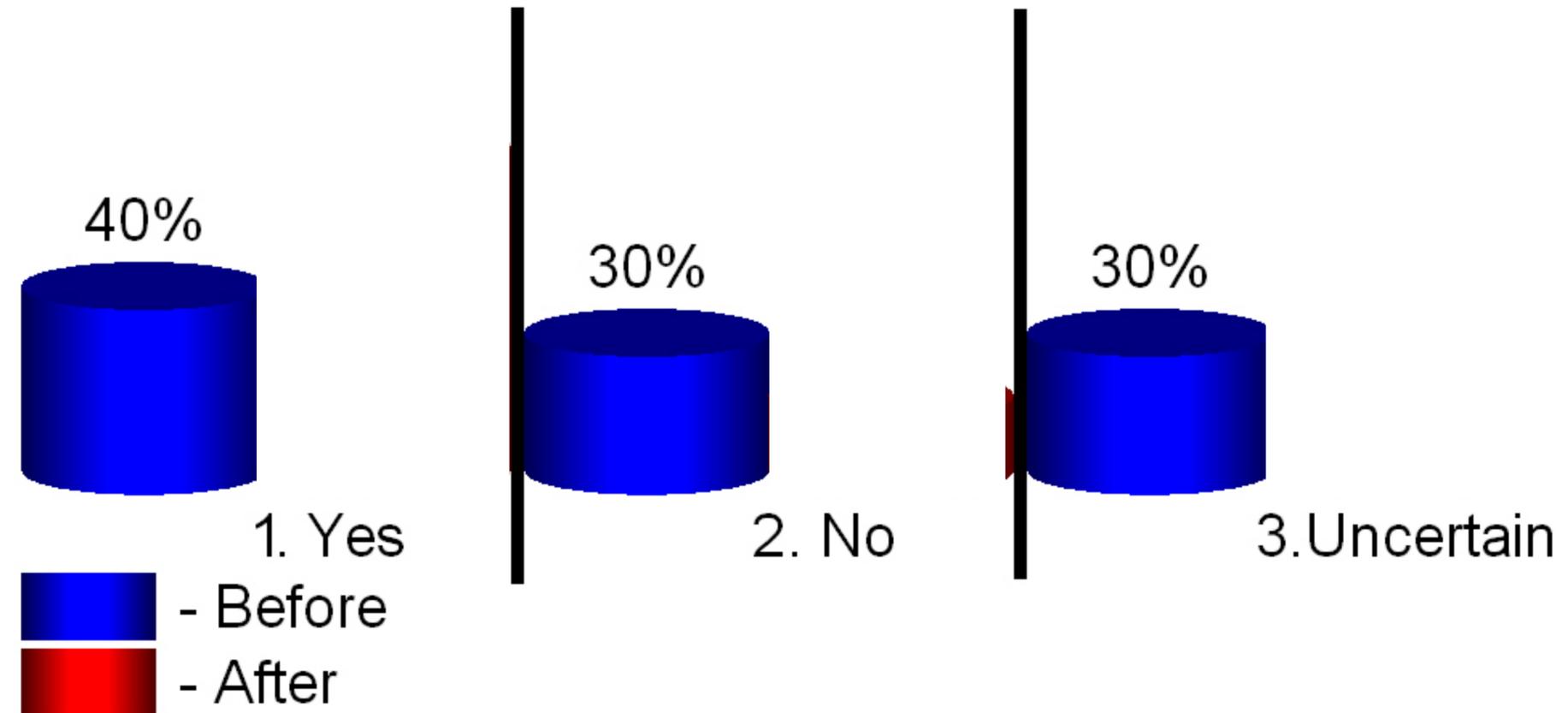




They polled the audience before I was interviewed on stage...

Is nuclear power a key solution to the world's environmental problems?

- 1. Yes
- 2. No
- 3. Uncertain

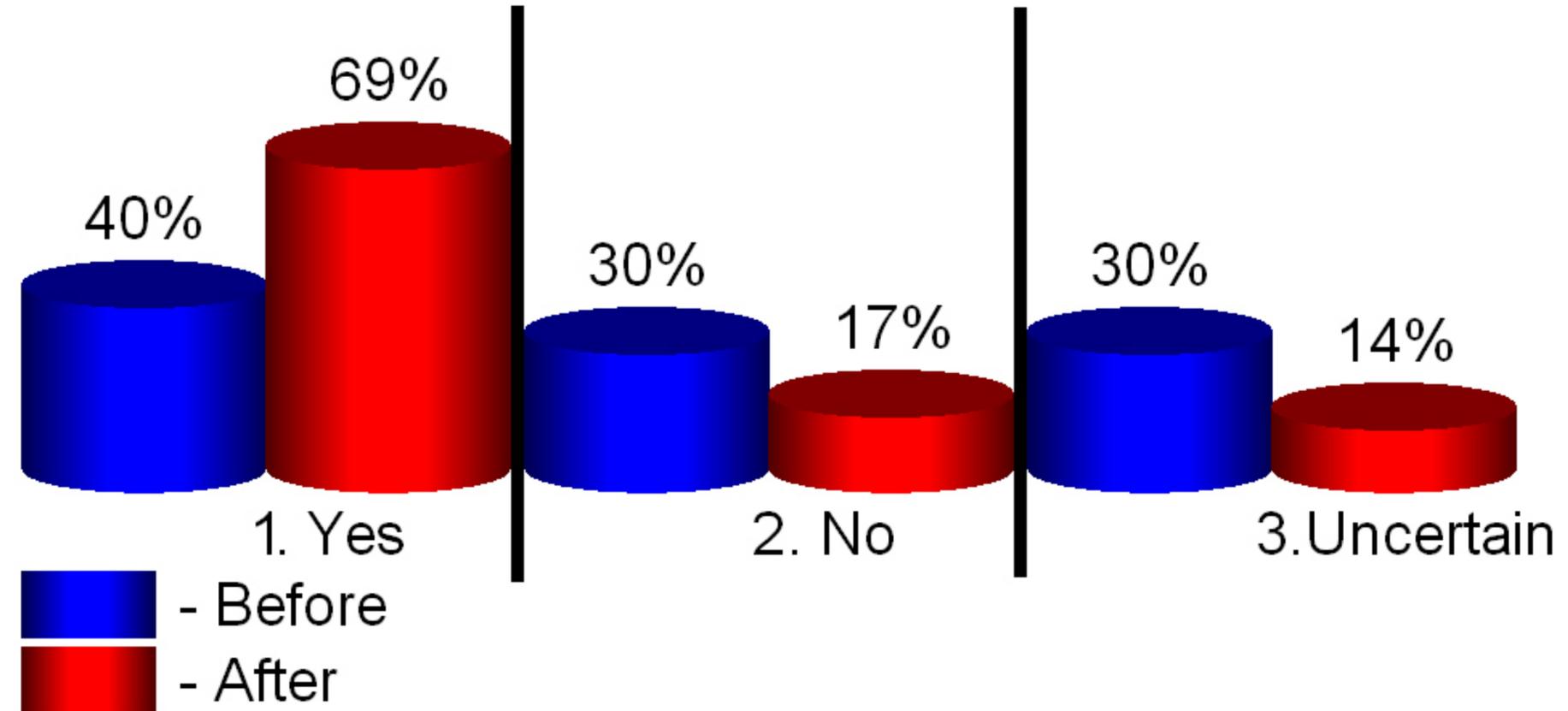


Kent Presents 2016

...they polled them again after I was interviewed

Is nuclear power a key solution to the world's environmental problems?

- 1. Yes
- 2. No
- 3. Uncertain



Kent Presents 2016

The High Cost of Fear

공포의 값비싼 대가

한국 탈원전 정책의 원인과
초래하게 될 경제적, 환경적 영향의 이해



Michael Shellenberger, Mark Nelson, Madi Czerwinski,
Michael Light, John Lindberg, and Minshu Deng 저

August 2017



원전 포기... 원전 포기는 비현실적



5일 마이클 셸렌베거(오른쪽) '환경 진보' 대표가 중부구에 있는 국민인수위원회를 찾아 미국 내 전문가 그룹 30명의 의견을 담은 서한을 지베형 사무관에게 제출했다. 전문가들은 이 서한에서 "한국은 저렴한 비용으로 질 좋은 원자력발전소를 하는 원전 선진국"이라며 새 정부의 원전 재조정에 대한 재검토를 요구했다.

감아진다."

자시인들의 적극적 역할을 주문했다. "넷플릭스(동영상 스트리밍 서비스)를 통해 완전 재난을 다룬 한국 영화 '관도라'를 보고 깜짝 놀랐다. 이 영화는 문재인 대통령이 지난해 12월 관람했다. 원자

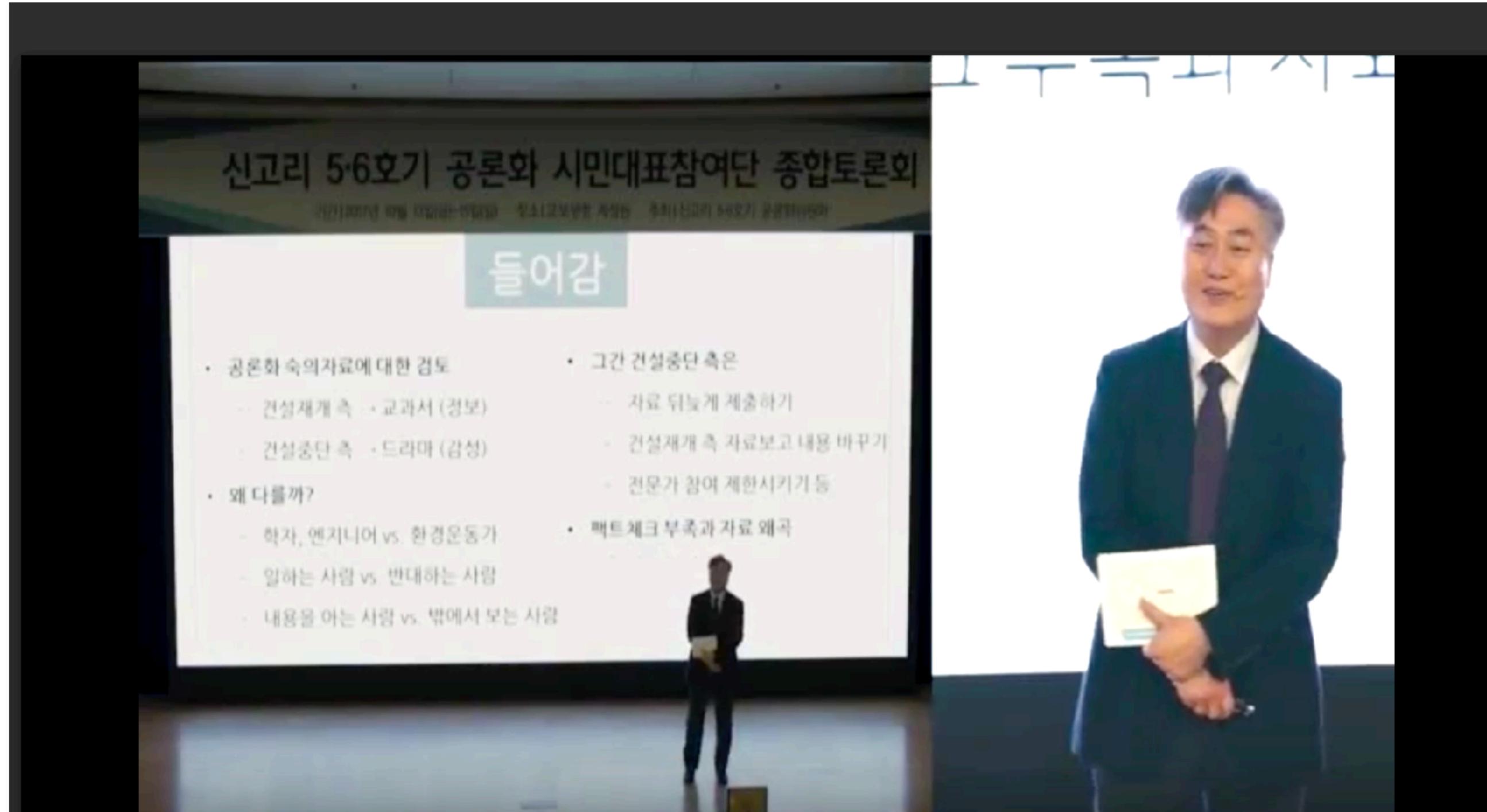
력에 대한 그릇된 이해에서 비롯된 영화다. 한국의 새 정부는 천연가스 수입을 늘려 원전을 대체하겠다는데 나라의 범용이 걸린 에너지를 외국에만 의존할 수는 없는 노릇이다. 올바른 여론 형성을 위해 관련 전문가들이 '원전은 악(惡)'이라는 프

로파간다는 게 대일장서야 한다. 한국에서 머문 시간만 20여 명을 인터뷰했다. 소셜미디어 등을 통해 한국에 원전 재조정을 재고하도록 부탁했다. 에너지는 백년대계다. 시간을 두고 면밀한 계류는 세워 접근해야 한다." 김은중 기자



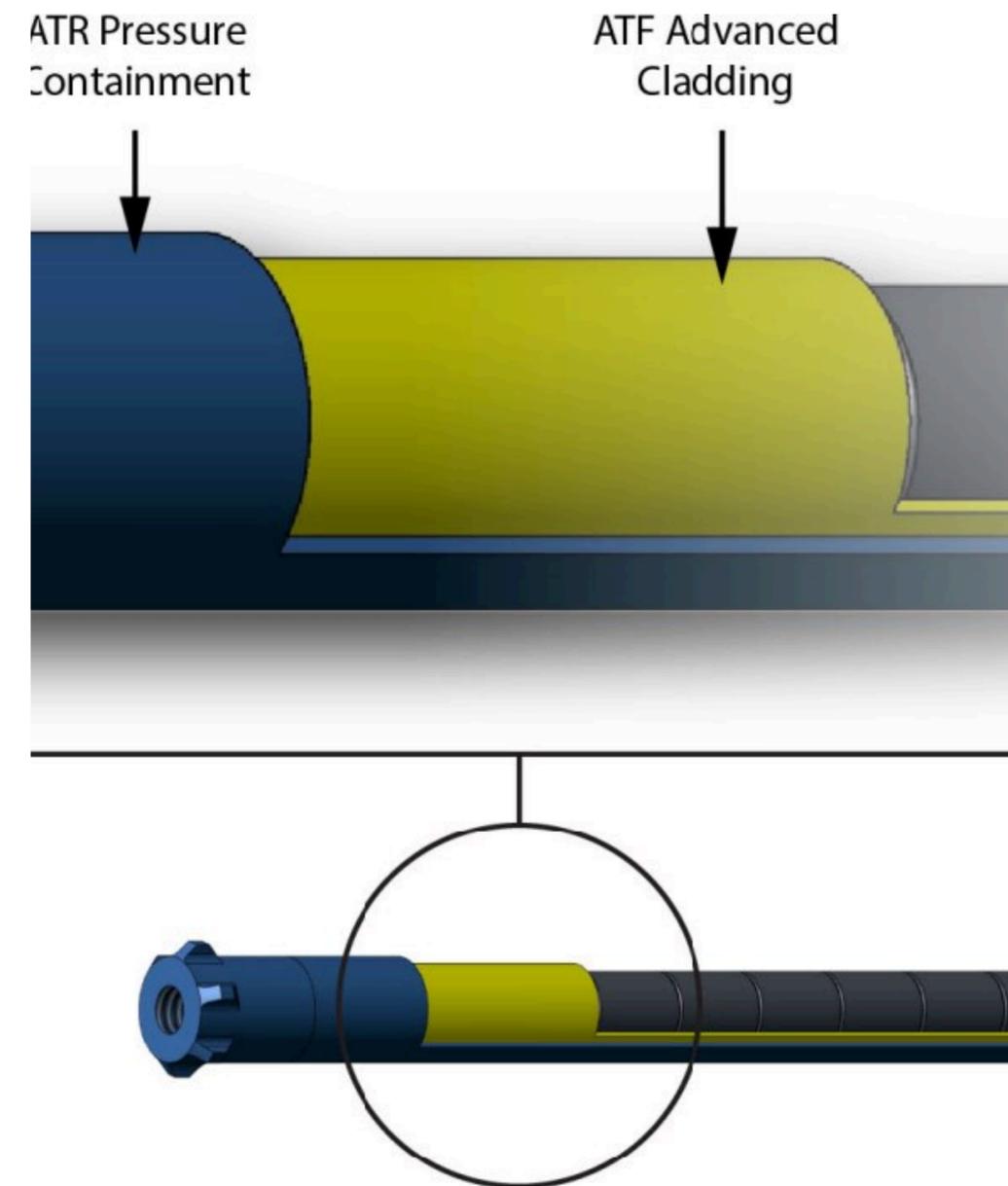
마이클 셸렌베거 환경운동가
기후변화 해결을 위해 싱크탱크 활동을 했고, 재생 에너지로는 충분한 에너지 생산이 불가능하다는 결론에 도달했습니다.

Professor Bum-Jin Chung persuades South Korea's "citizens jury"



Accident-Tolerant Fuels

- Could delay meltdown ~8 hours after loss-of-coolant
- Would prevent hydrogen gas explosion
- Could make today's Gen II reactors into Gen IV equivalent
- Could reduce operations costs by 15 - 30 percent
- Being loaded into two US nuclear plants this fall and next spring
- Could be in all US plants by mid-2020s



Transcendent Moral Purpose

Only nuclear can lift all humans out of poverty while saving the natural environment while creating peace on earth.

