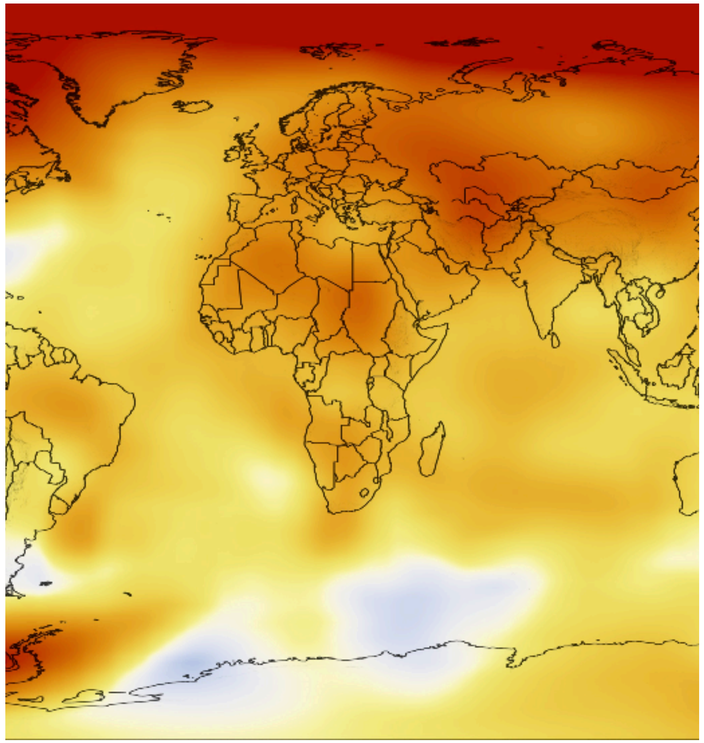


Atomic Humanism for Japan

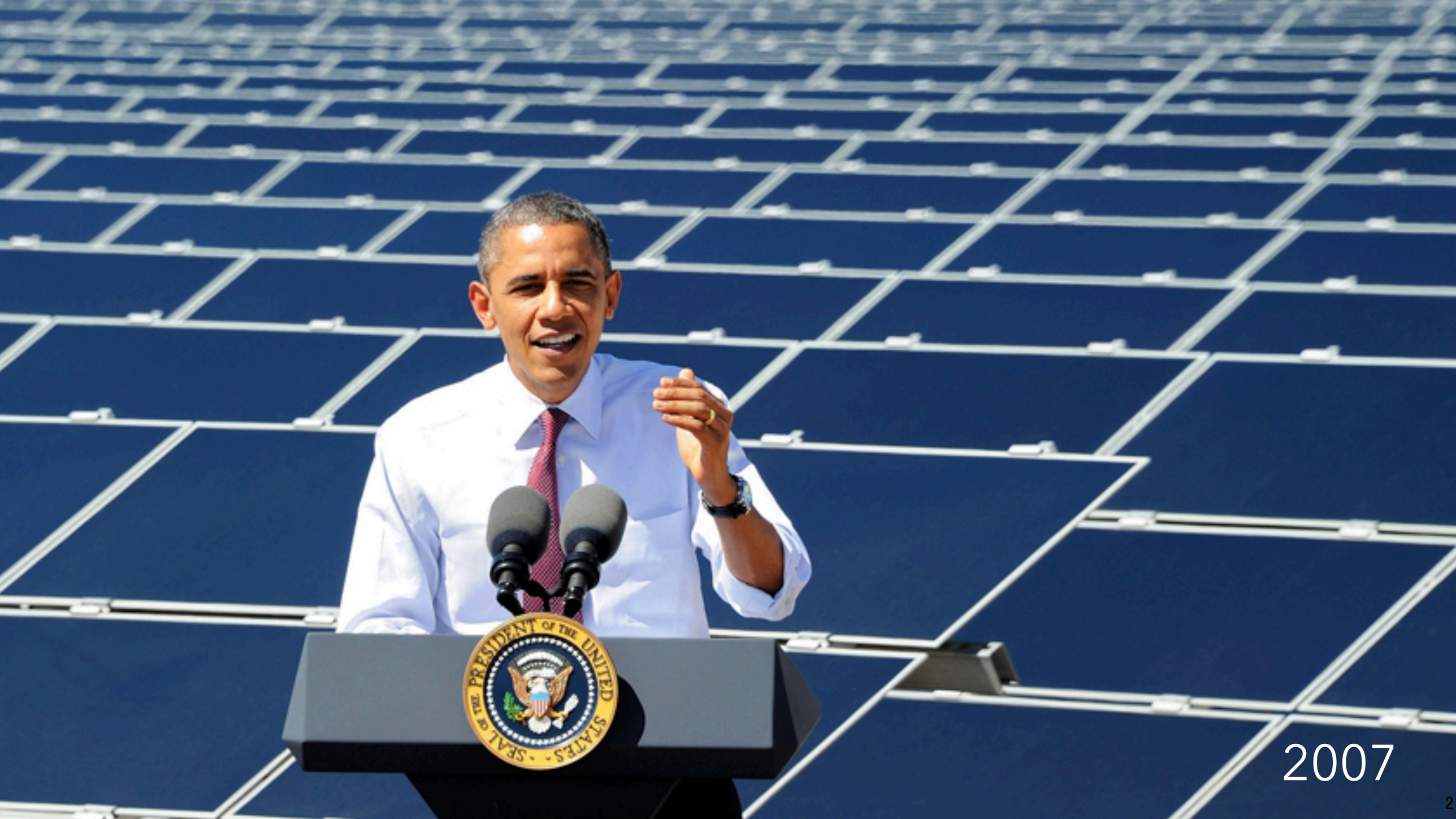
by Michael Shellenberger

Tokyo, Japan :: November 13, 2017

ENVIRONMENTAL PROGRESS

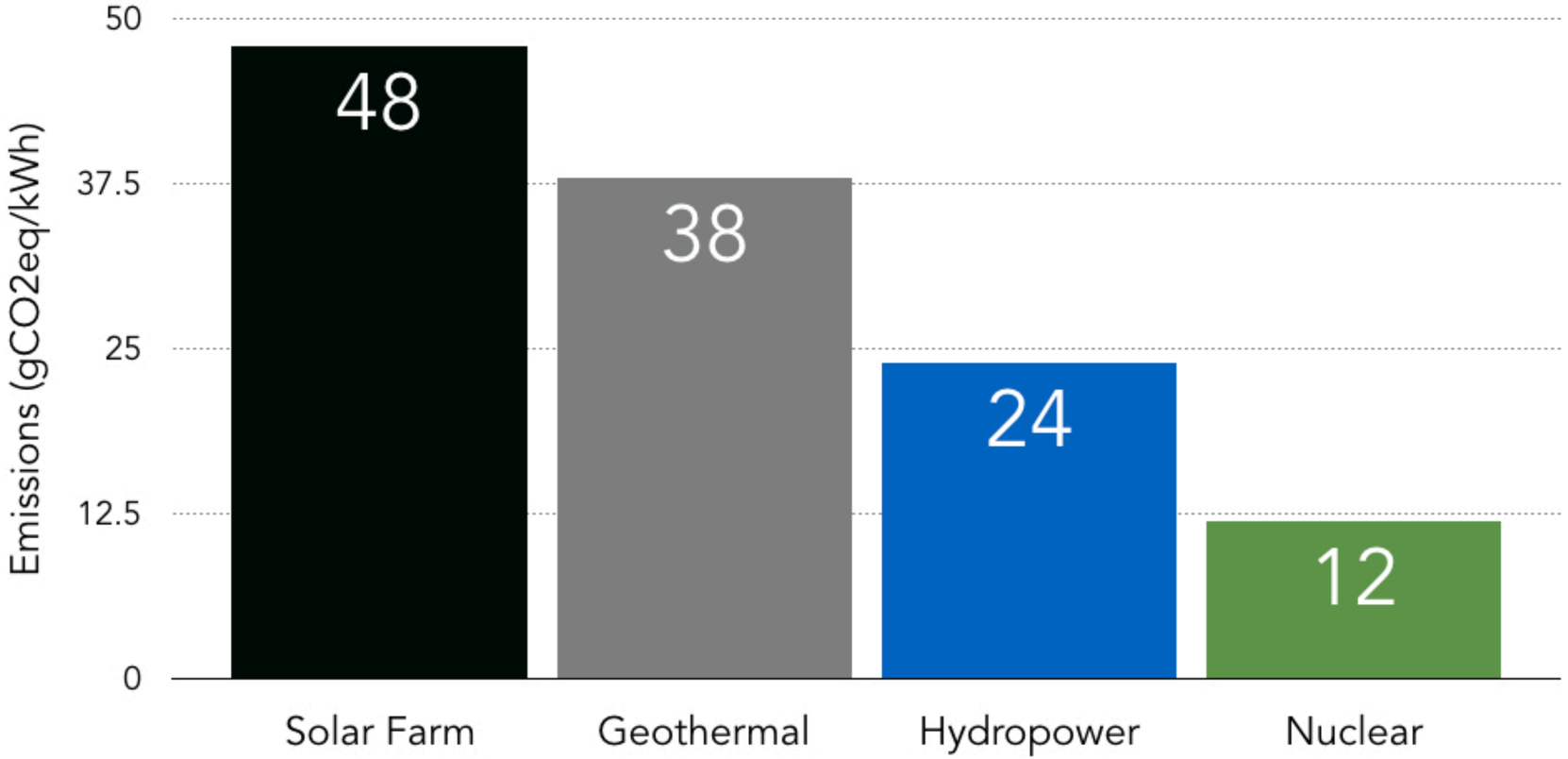
CLEAN ENERGY
OAKLAND
APOLLO
ALLIANCE
GOOD JOBS

2003


2007

2005

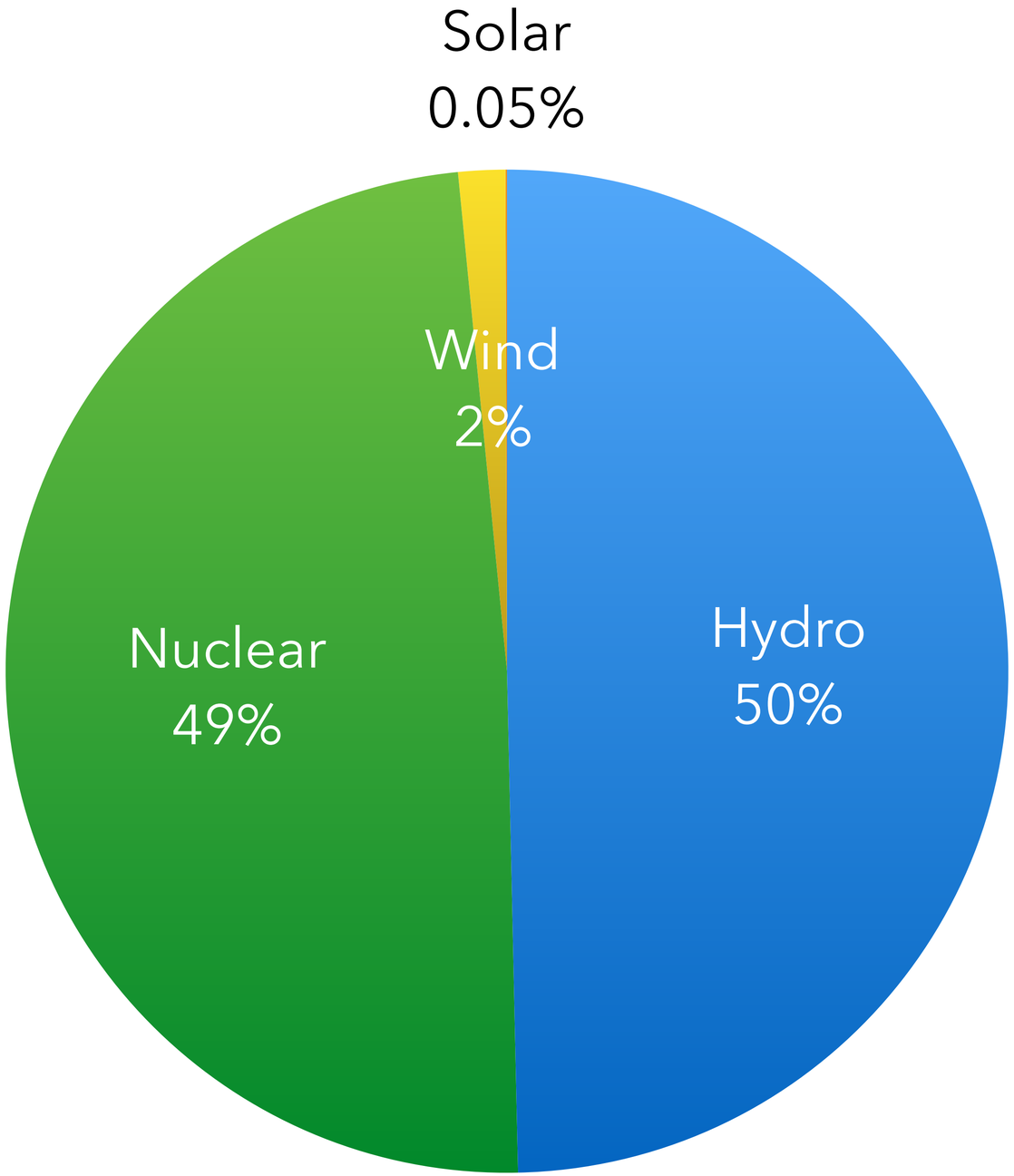
Nuclear produces four times less carbon pollution than solar farms



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.

ENVIRONMENTAL PROGRESS



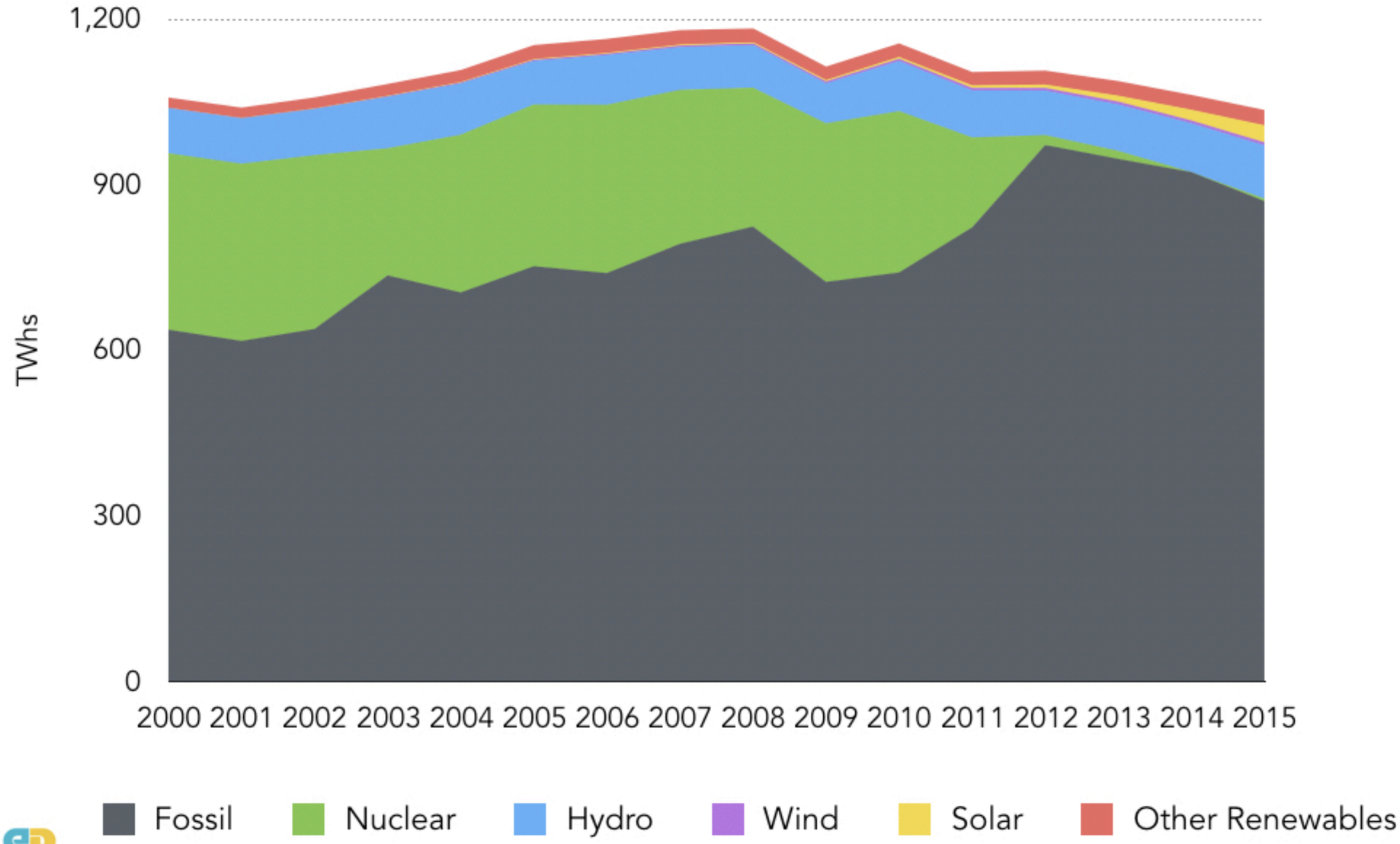
2005


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

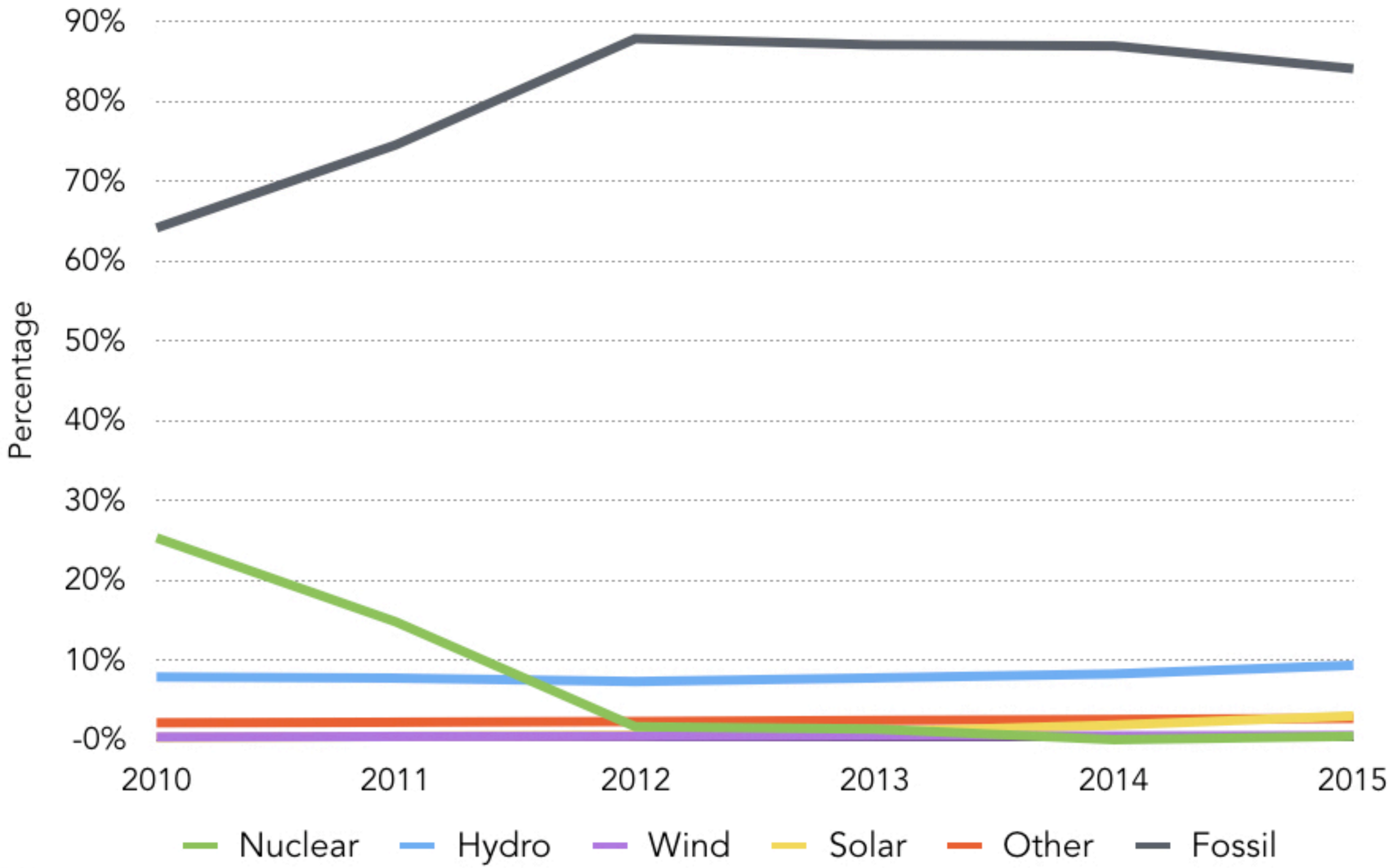
Japan electricity, 2000-2015



ENVIRONMENTAL PROGRESS

Source: BP Global Outlook 2016

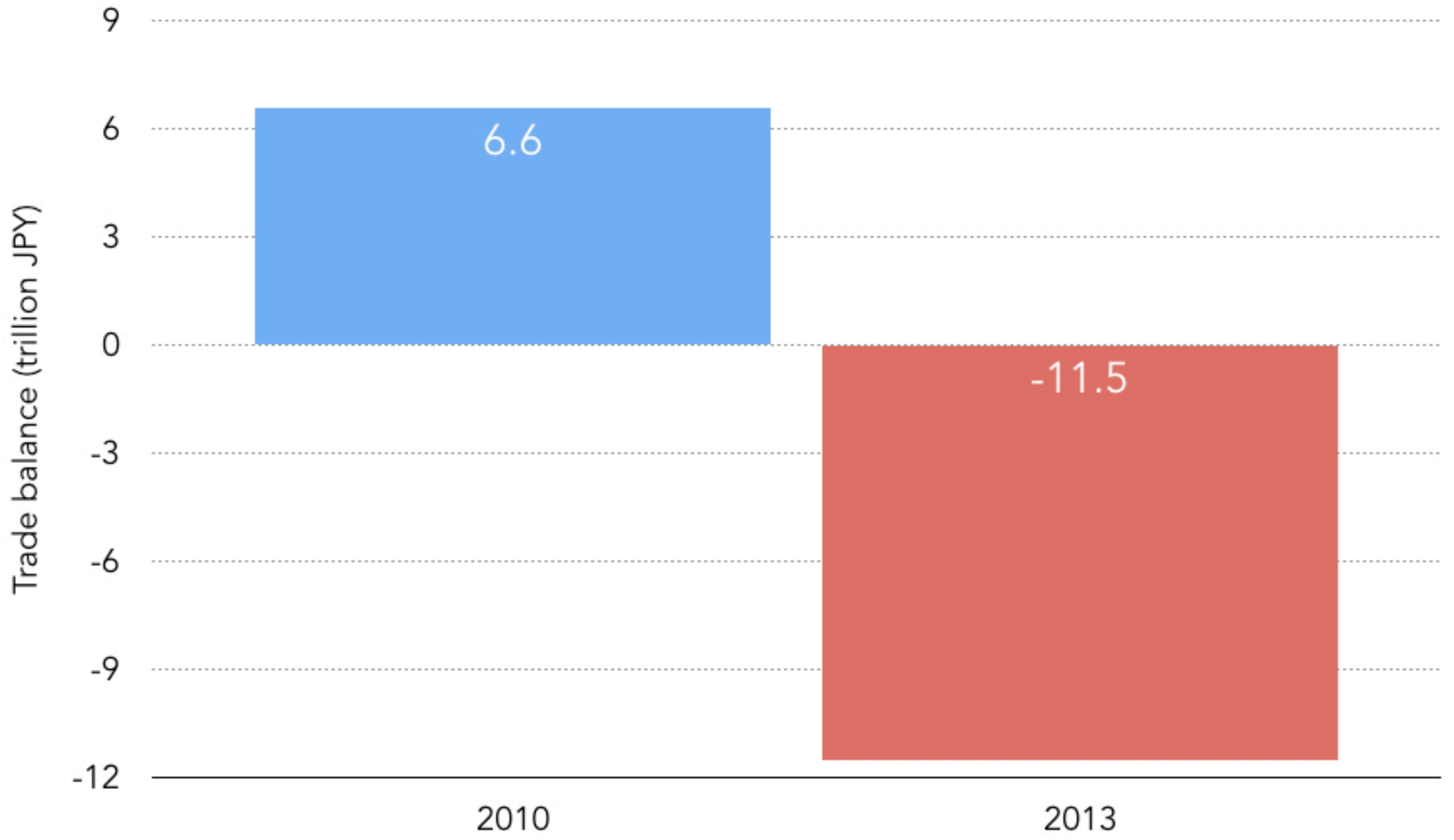
Japan's share of clean electricity, 2010-2015



ENVIRONMENTAL PROGRESS

Source: BP Global Outlook 2016

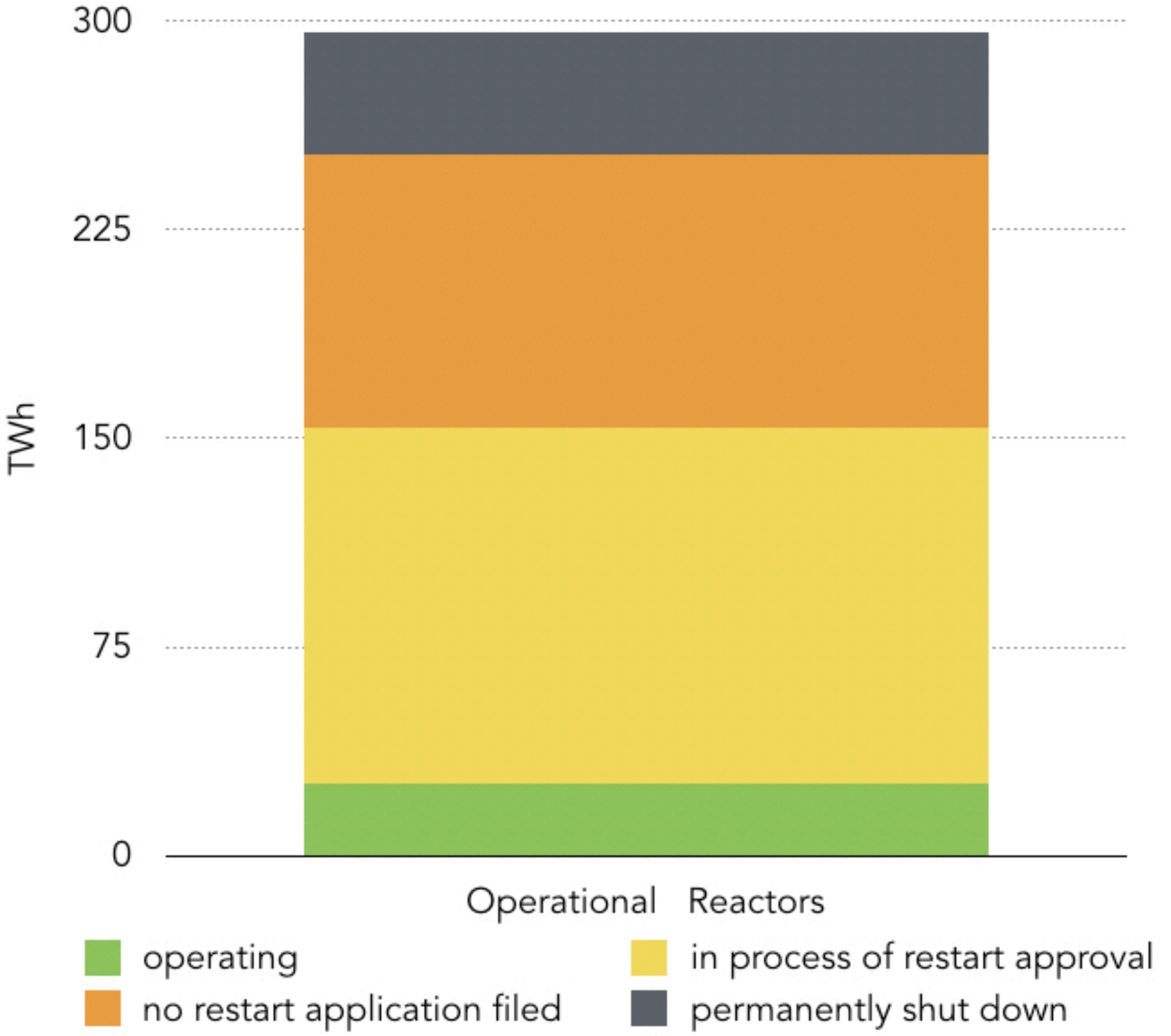
Japan's trade balance went from being a surplus to a deficit from 2010 to 2013 due to increased fossil fuel imports.



ENVIRONMENTAL PROGRESS

Source: World Nuclear Association

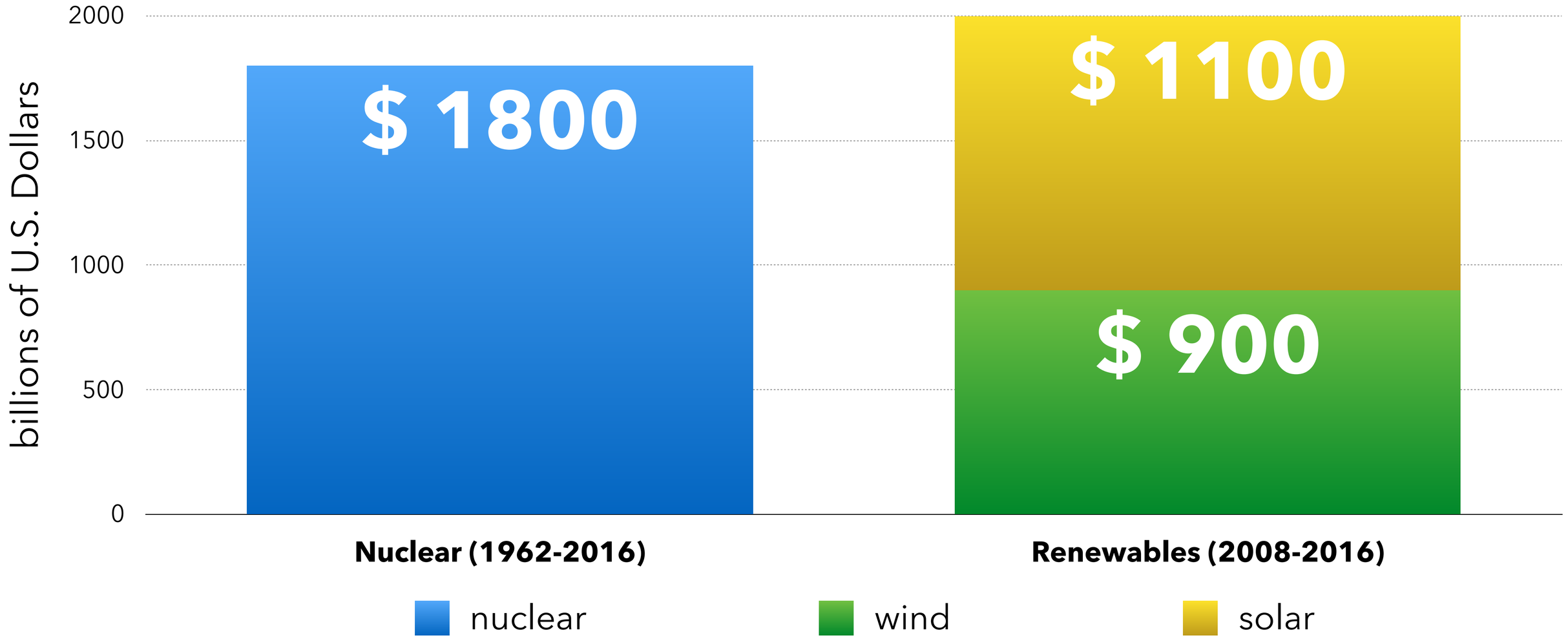
Current status of Japan's pre-Fukushima nuclear electricity generation



ENVIRONMENTAL PROGRESS

Source: World Nuclear Association

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



Source: Mark Nelson et al., "The Power to Decarbonize," EP, November 2017

Based on Bloomberg New Energy Finance, 2017; Lovering et al., "Historical Nuclear Construction Costs," *Energy Policy*, 2016

ENVIRONMENTAL PROGRESS

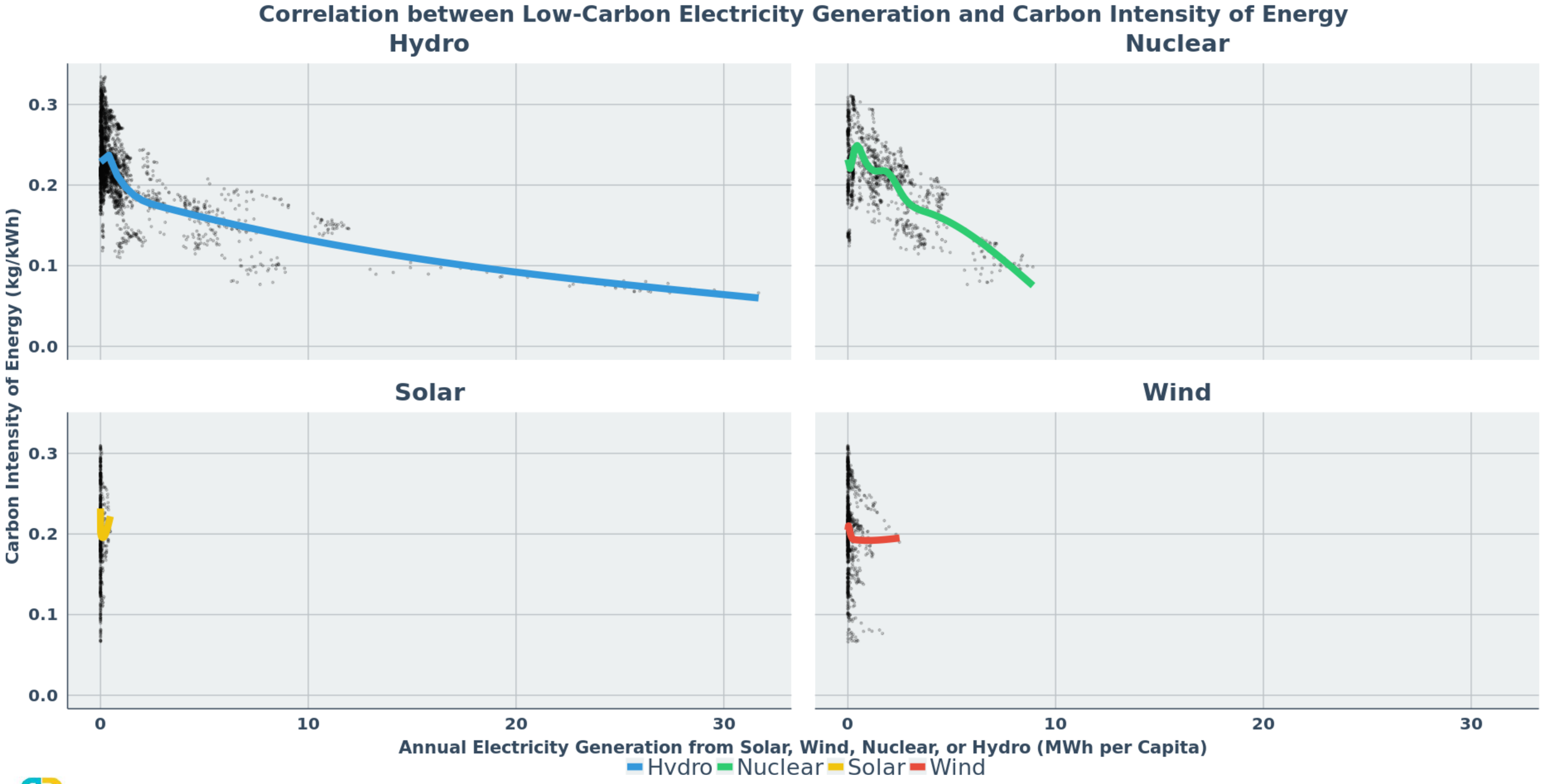
The New York Times

Wind and Solar Power Advance, but Carbon Refuses to Retreat

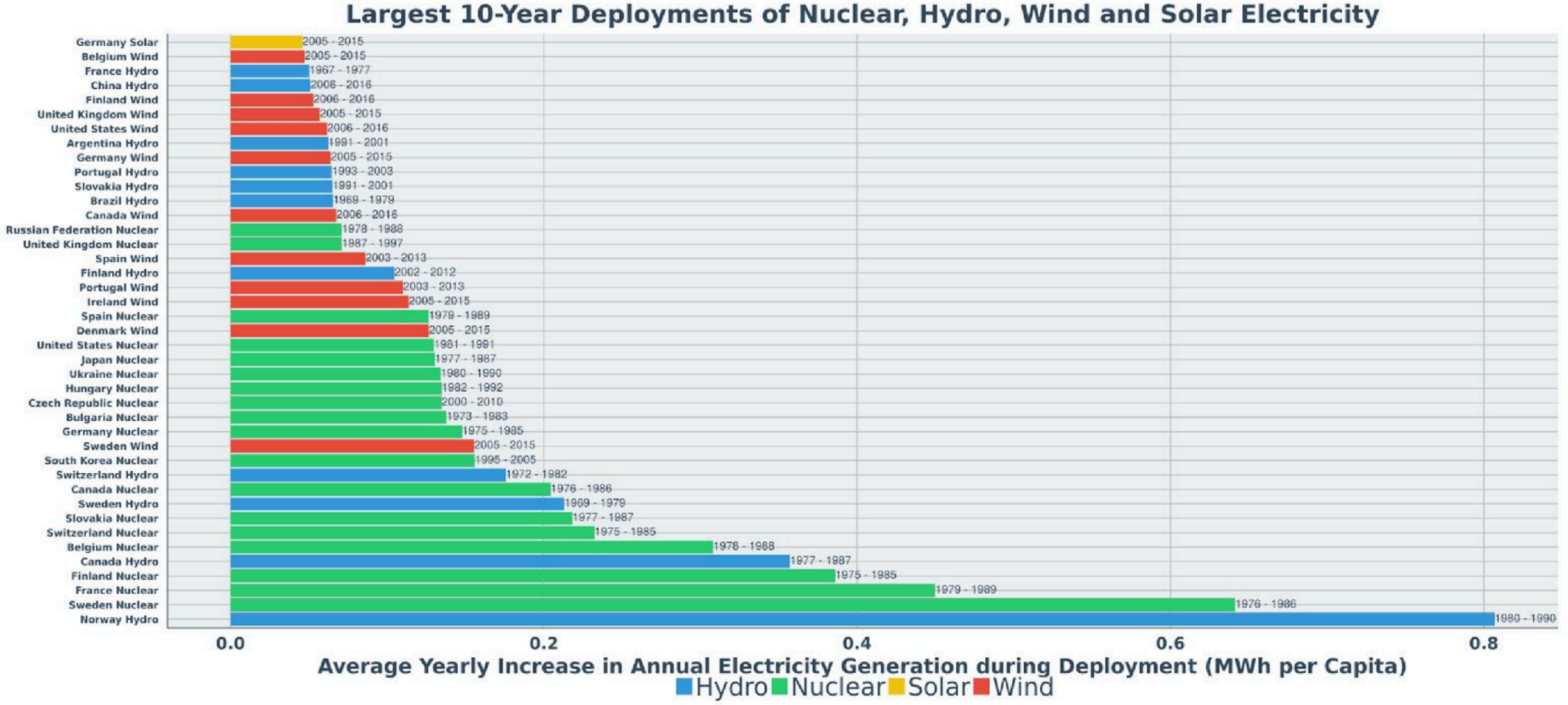
By **EDUARDO PORTER** NOV. 7, 2017

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.



ENVIRONMENTAL PROGRESS

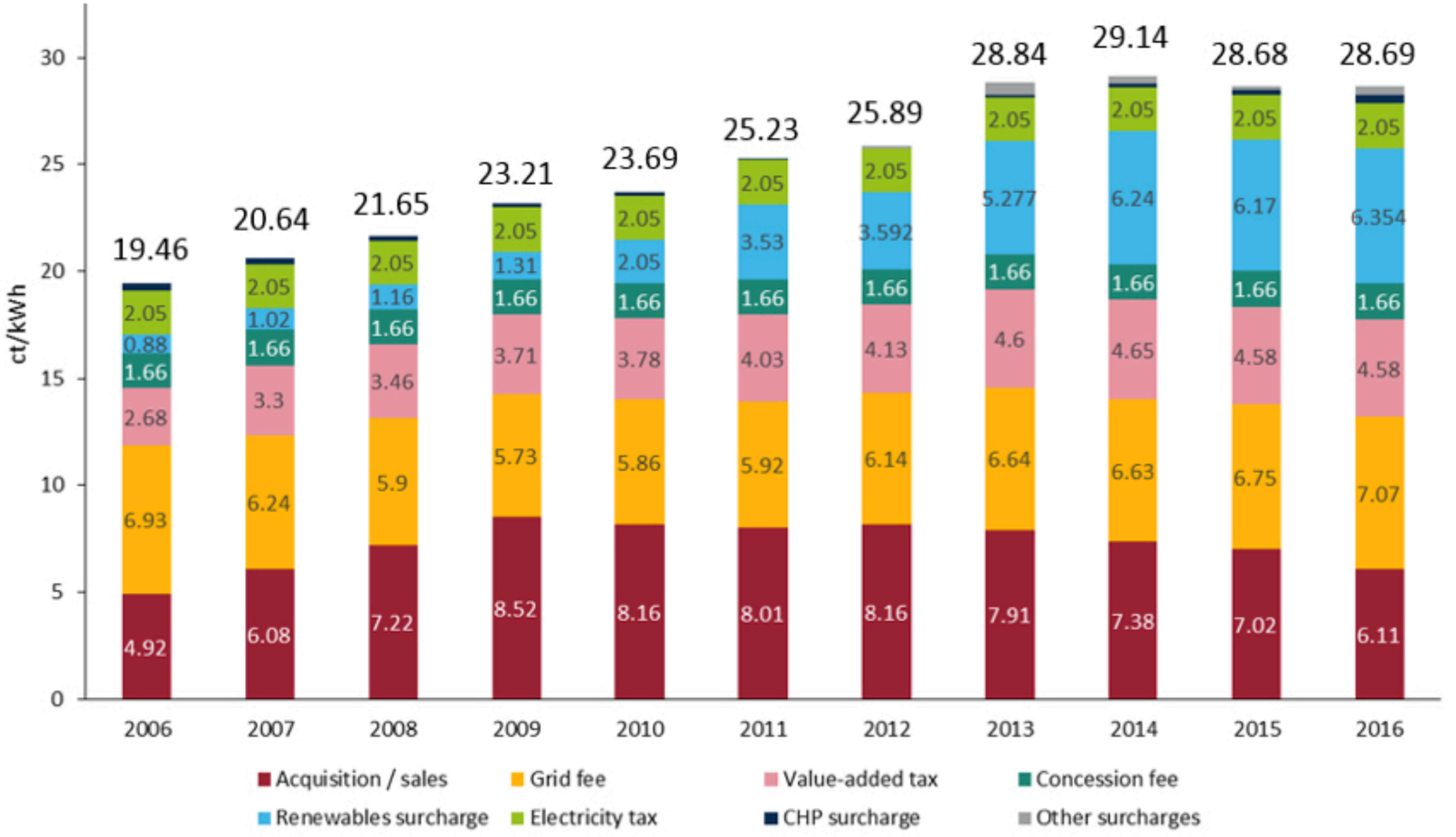

Largest 10-Year Deployments of Nuclear, Hydro, Wind and Solar Electricity
Germany Solar 2005 - 2015
Belgium Wind 2005 - 2015
France Hydro 1967 - 1977
China Hydro 2006 - 2016
Finland Wind 2006 - 2016
United Kingdom Wind 2005 - 2015
United States Wind 2006 - 2016
Argentina Hydro 1991 - 2001
Germany Wind 2005 - 2015
Portugal Hydro 1993 - 2003
Slovakia Hydro 1991 - 2001
Brazil Hydro 1969 - 1979
Canada Wind 2006 - 2016
Russian Federation Nuclear 1978 - 1988
United Kingdom Nuclear 1987 - 1997
Spain Wind 2003 - 2013
Finland Hydro 2002 - 2012
Portugal Wind 2003 - 2013
Ireland Wind 2005 - 2015
Spain Nuclear 1979 - 1989
Denmark Wind 2005 - 2015
United States Nuclear 1981 - 1991
Japan Nuclear 1977 - 1987
Ukraine Nuclear 1980 - 1990
Hungary Nuclear 1982 - 1992
Czech Republic Nuclear 2000 - 2010
Bulgaria Nuclear 1973 - 1983
Germany Nuclear 1975 - 1985
Sweden Wind 2005 - 2015
South Korea Nuclear 1995 - 2005
Switzerland Hydro 1972 - 1982
Canada Nuclear 1976 - 1986
Sweden Hydro 1969 - 1979
Slovakia Nuclear 1977 - 1987
Switzerland Nuclear 1975 - 1985
Belgium Nuclear 1978 - 1988
Canada Hydro 1977 - 1987
Finland Nuclear 1975 - 1985
France Nuclear 1979 - 1989
Sweden Nuclear 1976 - 1986
Norway Hydro 1980 - 1990
0.0
0.2
0.4
0.6
0.8
Average Yearly Increase in Annual Electricity Generation during Deployment (MWh per Capita)
Hydro Nuclear Solar Wind

Germany has invested $222 billion in renewables since 2000

ENVIRONMENTAL PROGRESS

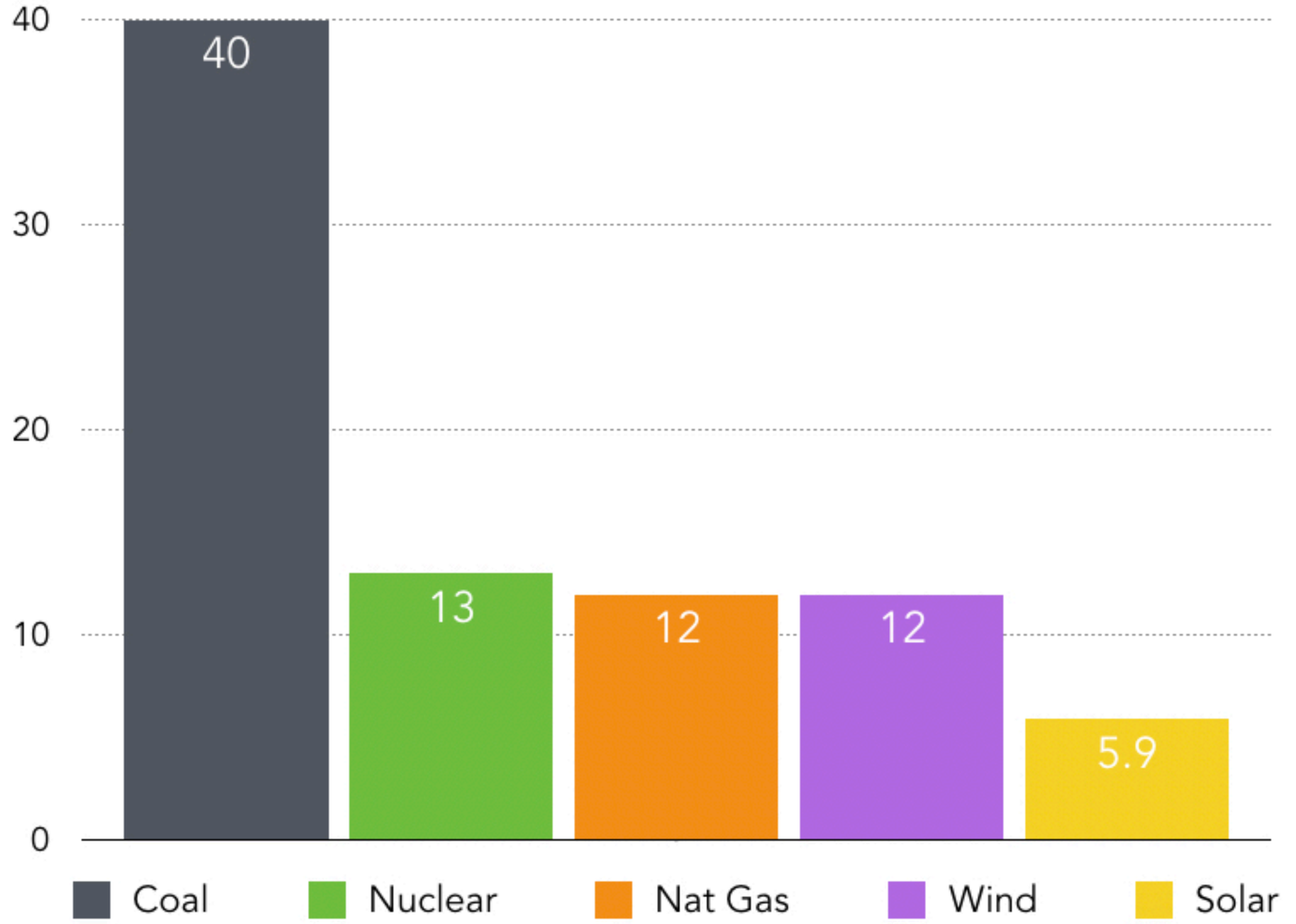
Source: Stanley Reed, "$222 billion shift hits a snag," *New York Times*, October 3, 2017

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.

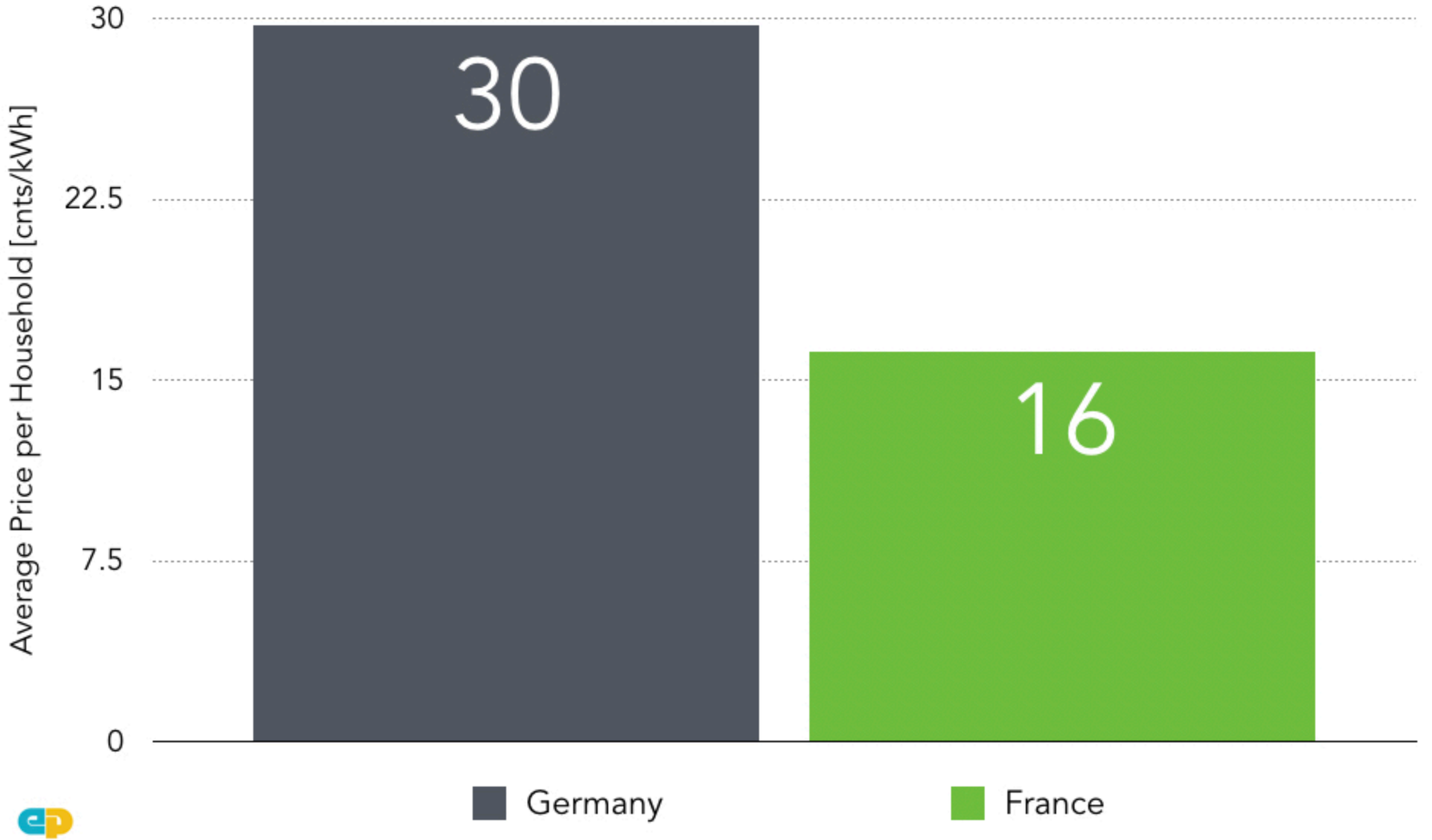
Percent of German electricity in 2016 from coal, nuclear, natural gas, wind and solar



ENVIRONMENTAL PROGRESS

Source: AG Energiebilanzen, 2017

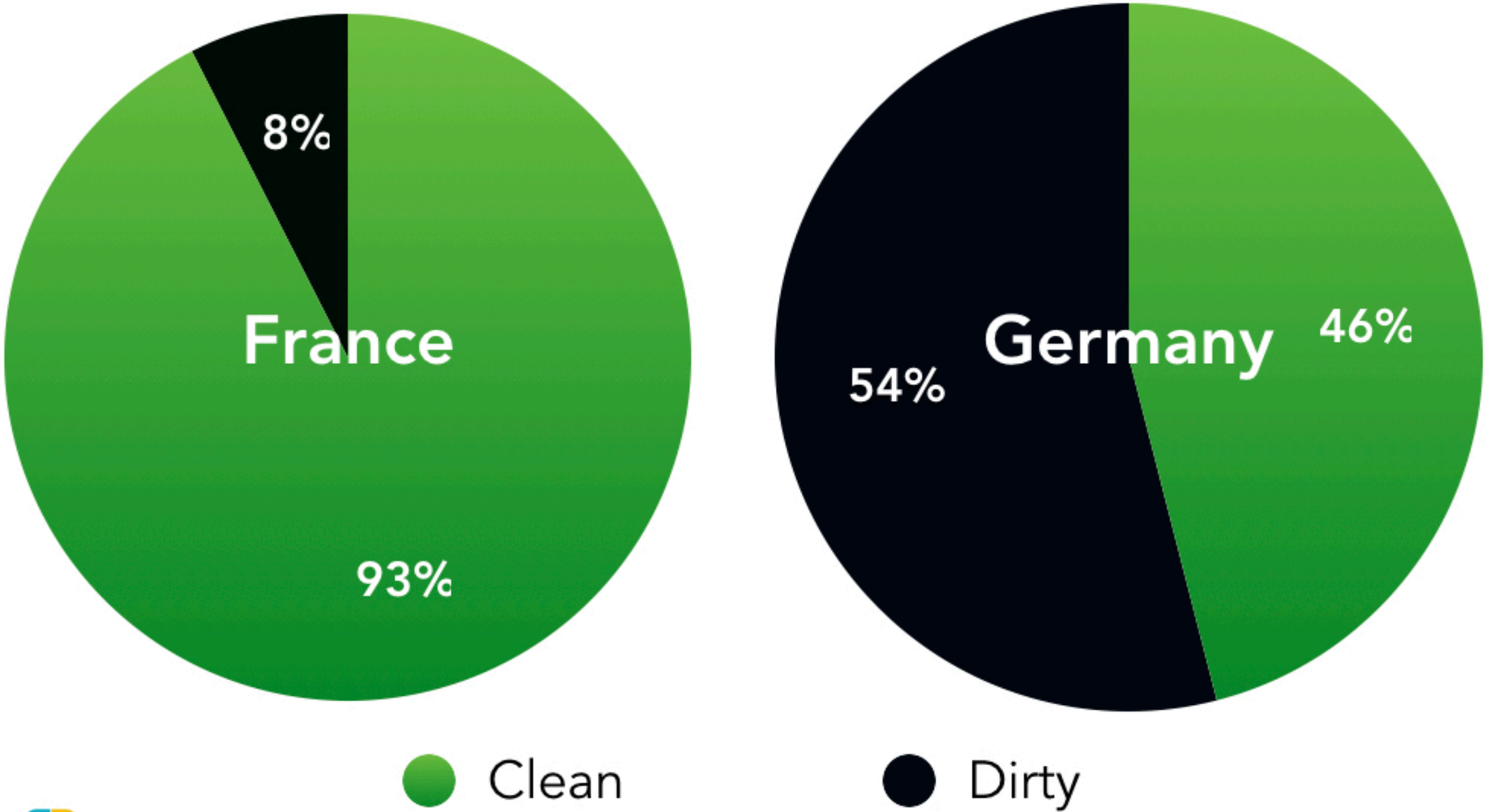
German electricity is 2x more expensive than French electricity.



ENVIRONMENTAL PROGRESS

Source: Eurostat, 2015

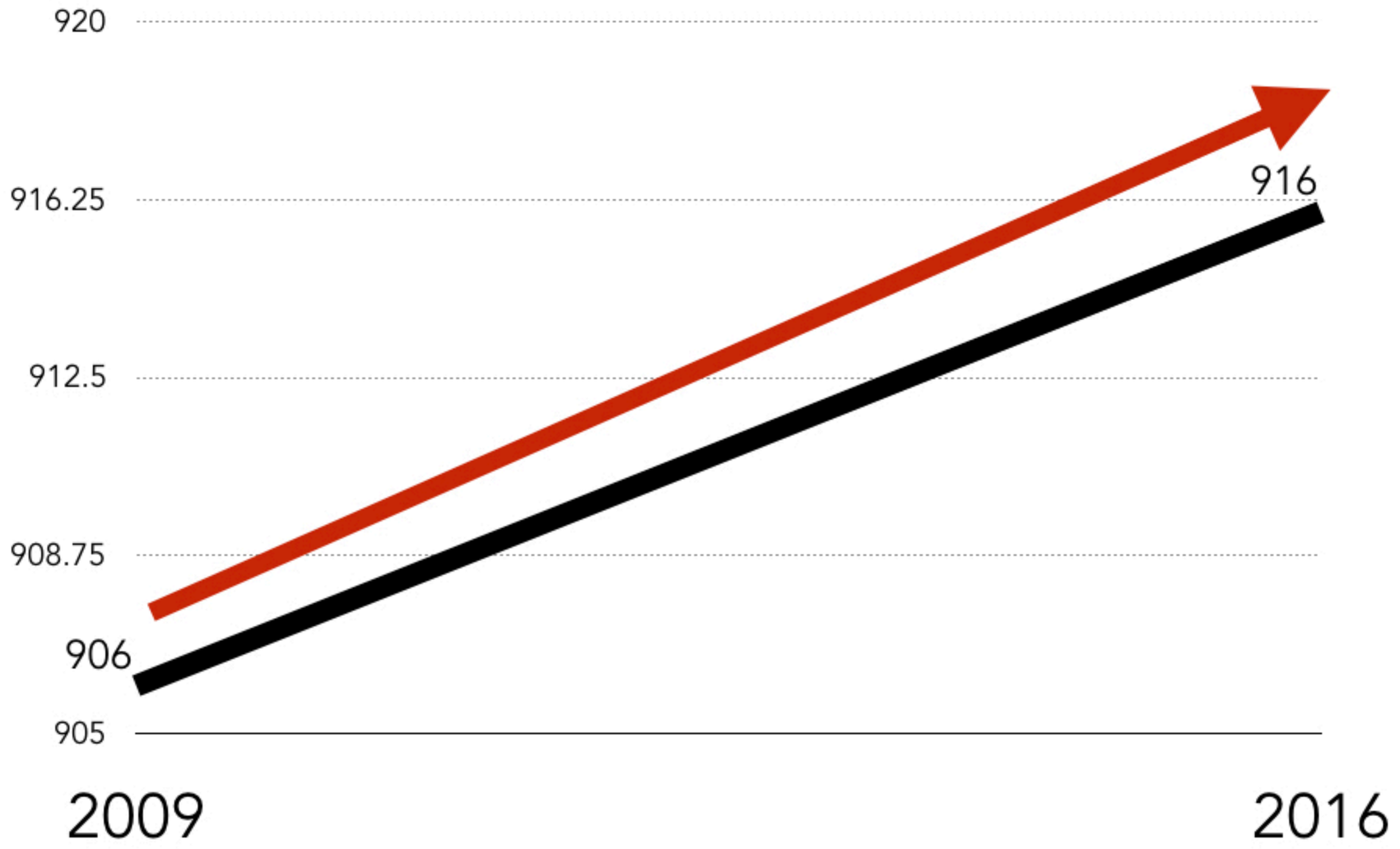
France generates 2x more electricity from clean energy sources than Germany.



ENVIRONMENTAL PROGRESS

Source: BP Energy Outlook 2016

German emissions have been rising since 2009



ENVIRONMENTAL PROGRESS

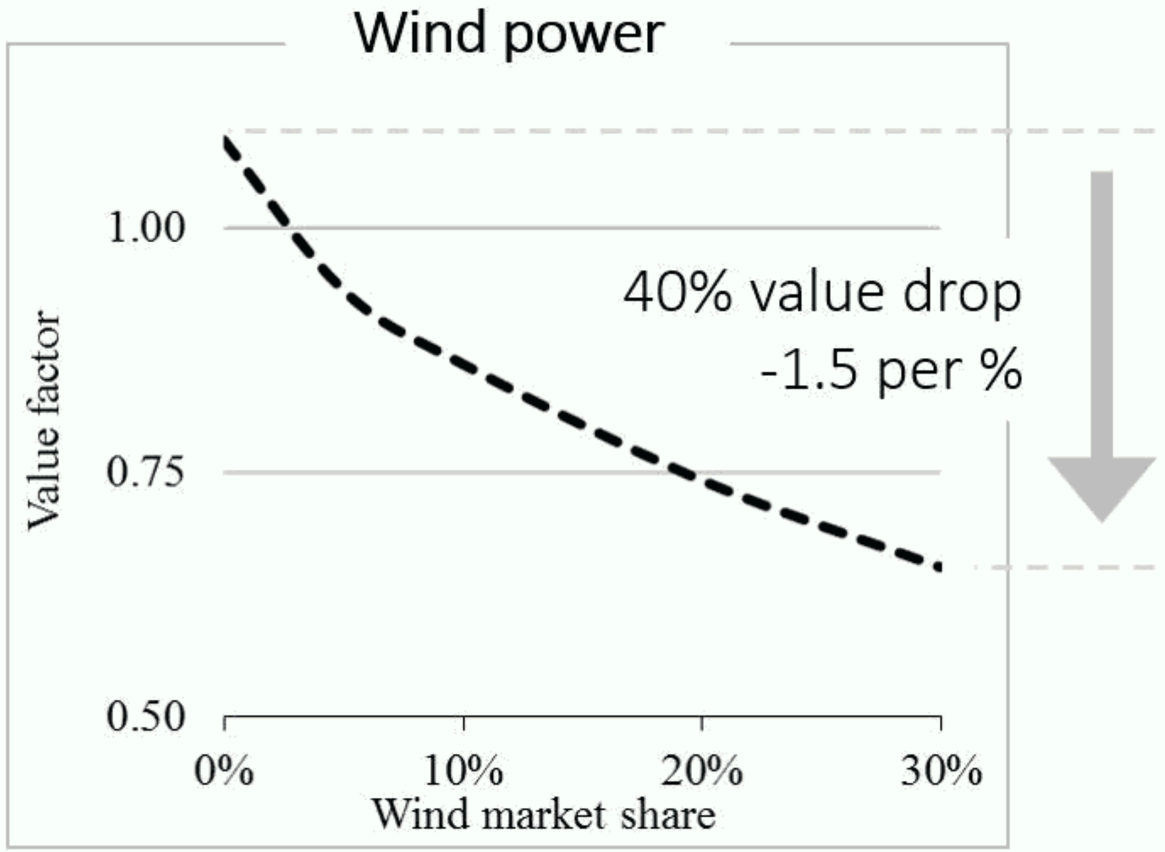
Source: Agora Energiewende; Franhofer Institute; German Statistical Office Data

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

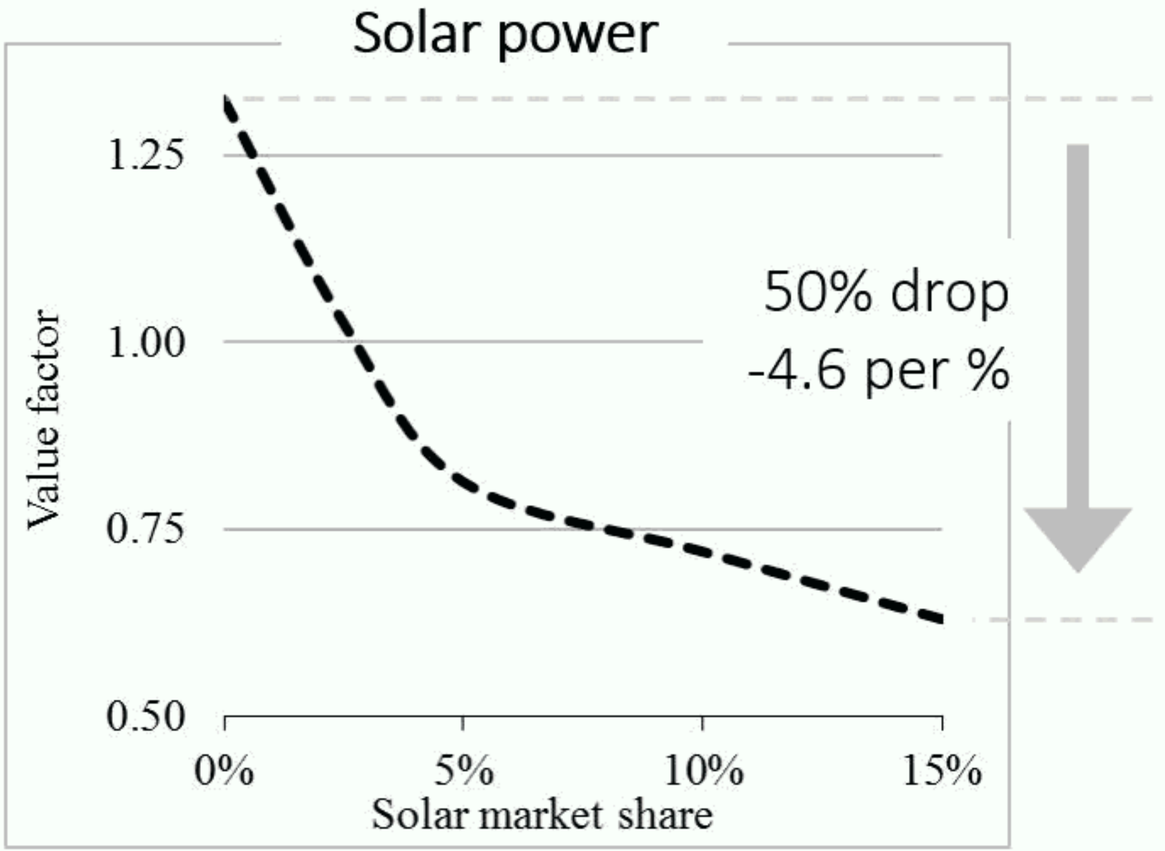
ENVIRONMENTAL PROGRESS

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

ENVIRONMENTAL PROGRESS



Source: updated from Hirth (2013): Market value



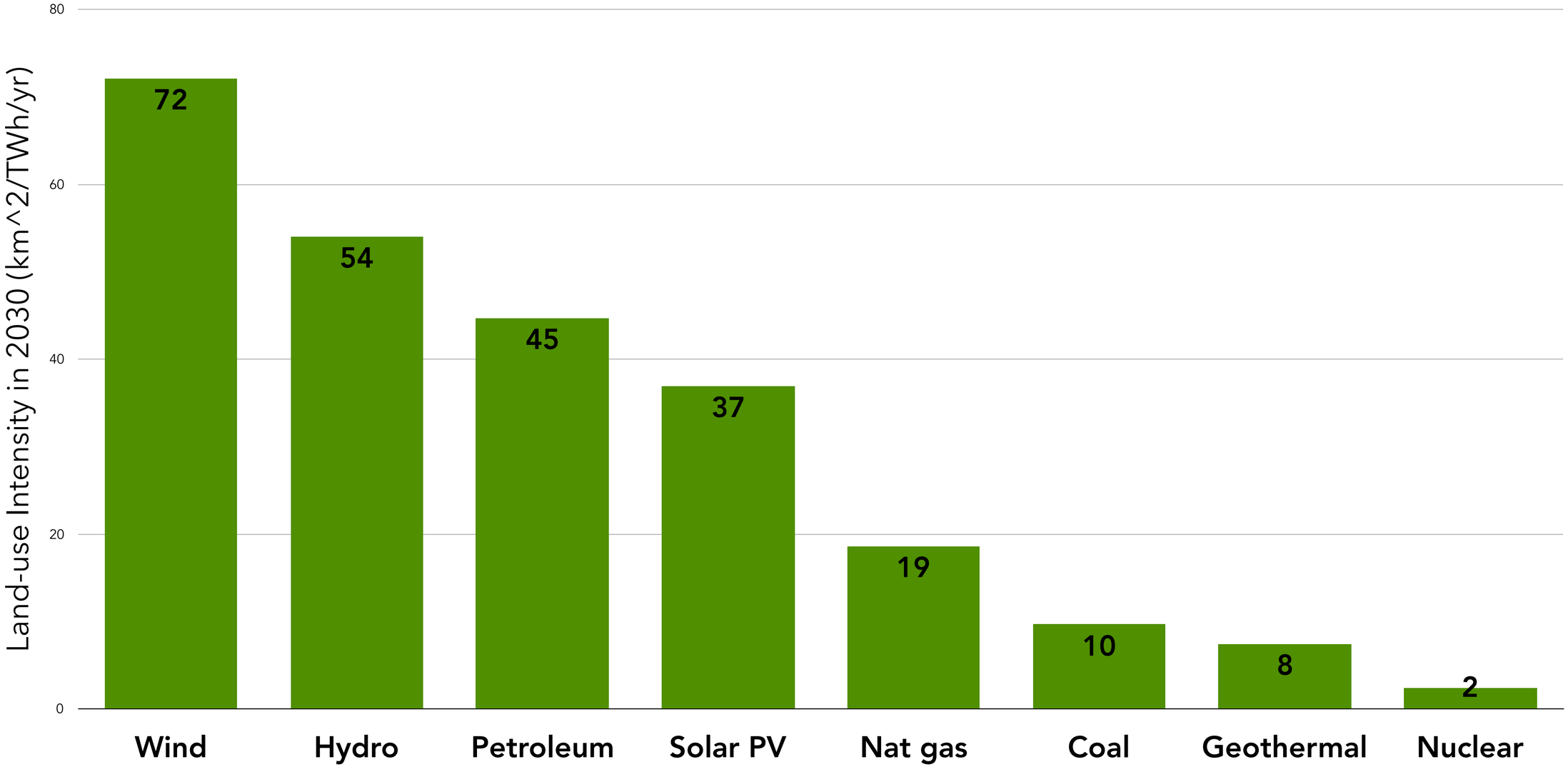
Source: updated from Hirth (2015): Market value of solar

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.

ENVIRONMENTAL PROGRESS

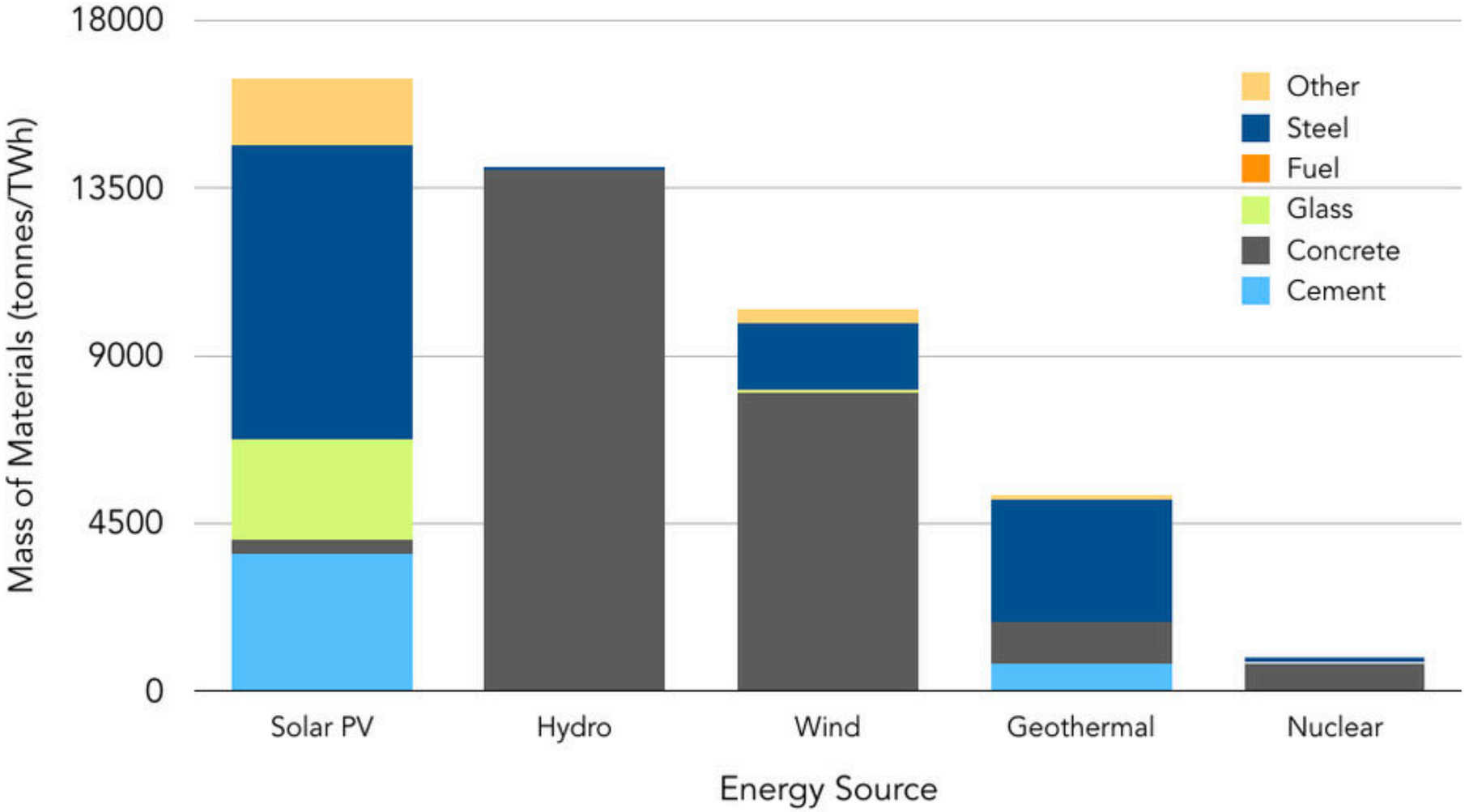
Renewables require 17 - 35 times more land than nuclear



ENVIRONMENTAL PROGRESS

Source: McDonald, R. I., Fargione, J., Kiesecker, J., Miller, W. M., & Powell, J. (2009). Energy sprawl or energy efficiency: climate policy impacts on natural habitat for the United States of America. PLoS One, 4(8), e6802.

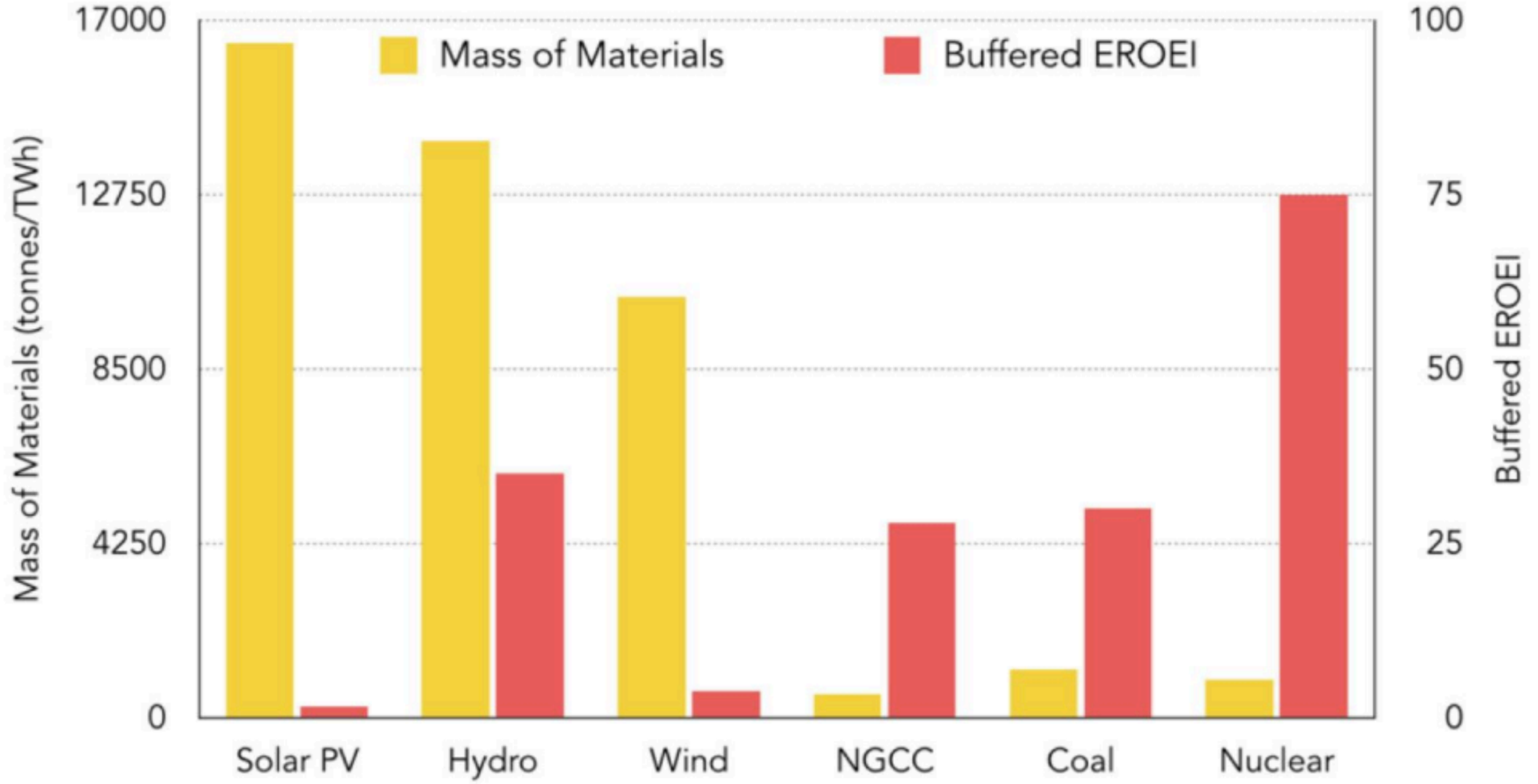
Materials throughput by type of energy source



ENVIRONMENTAL PROGRESS

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



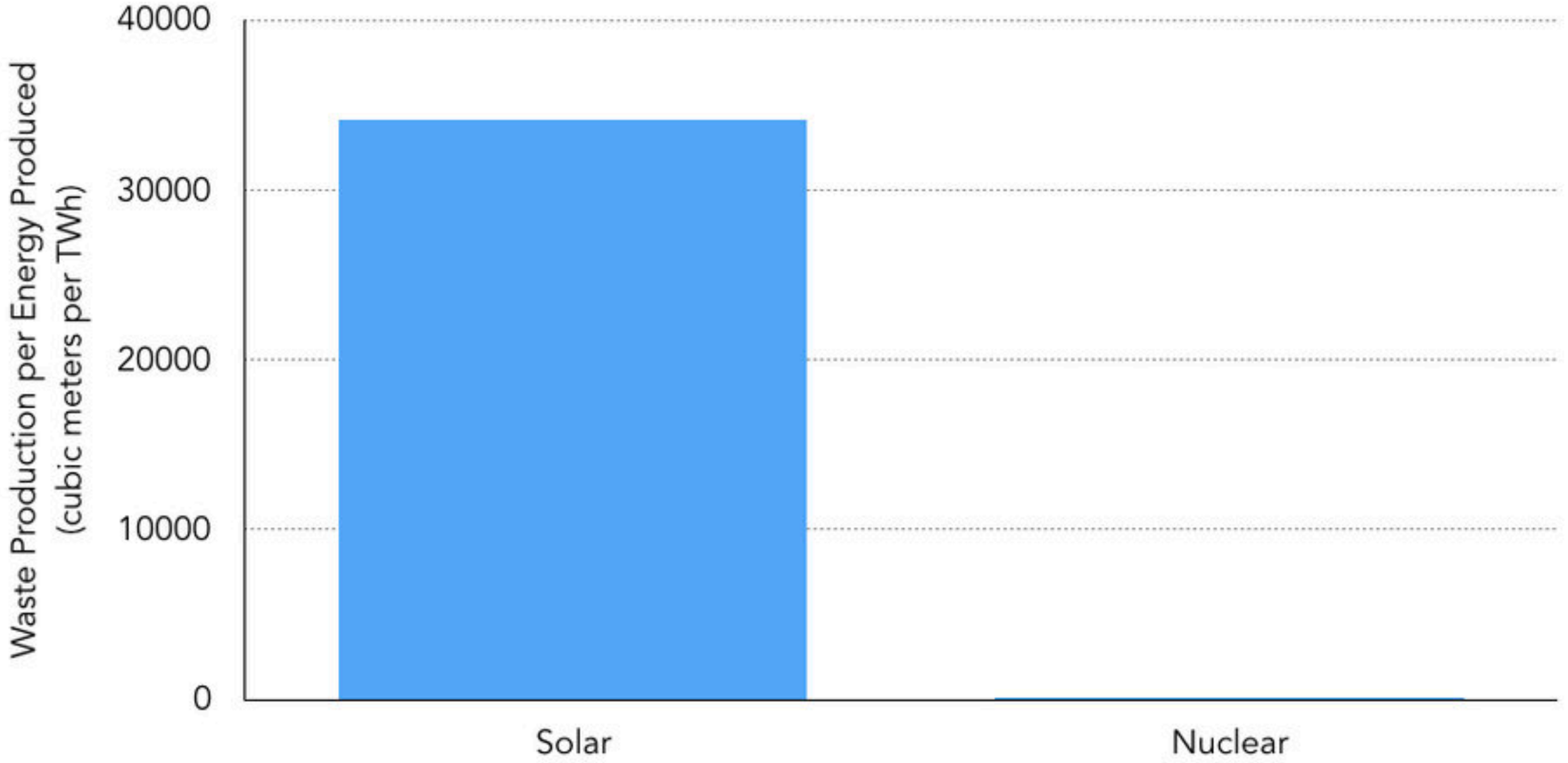
Sources: DOE Quadrennial Technology Review, Table 10.

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

Weißbacha, D., Ruprechta, G., Hukea, A., Czerskia, K., Gottlieba, S., & Husseina, A. Energy intensities, EROIs, and energy payback times of electricity generating power plants.

ENVIRONMENTAL PROGRESS

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

ENVIRONMENTAL PROGRESS

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

ENVIRONMENTAL PROGRESS

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

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

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%**

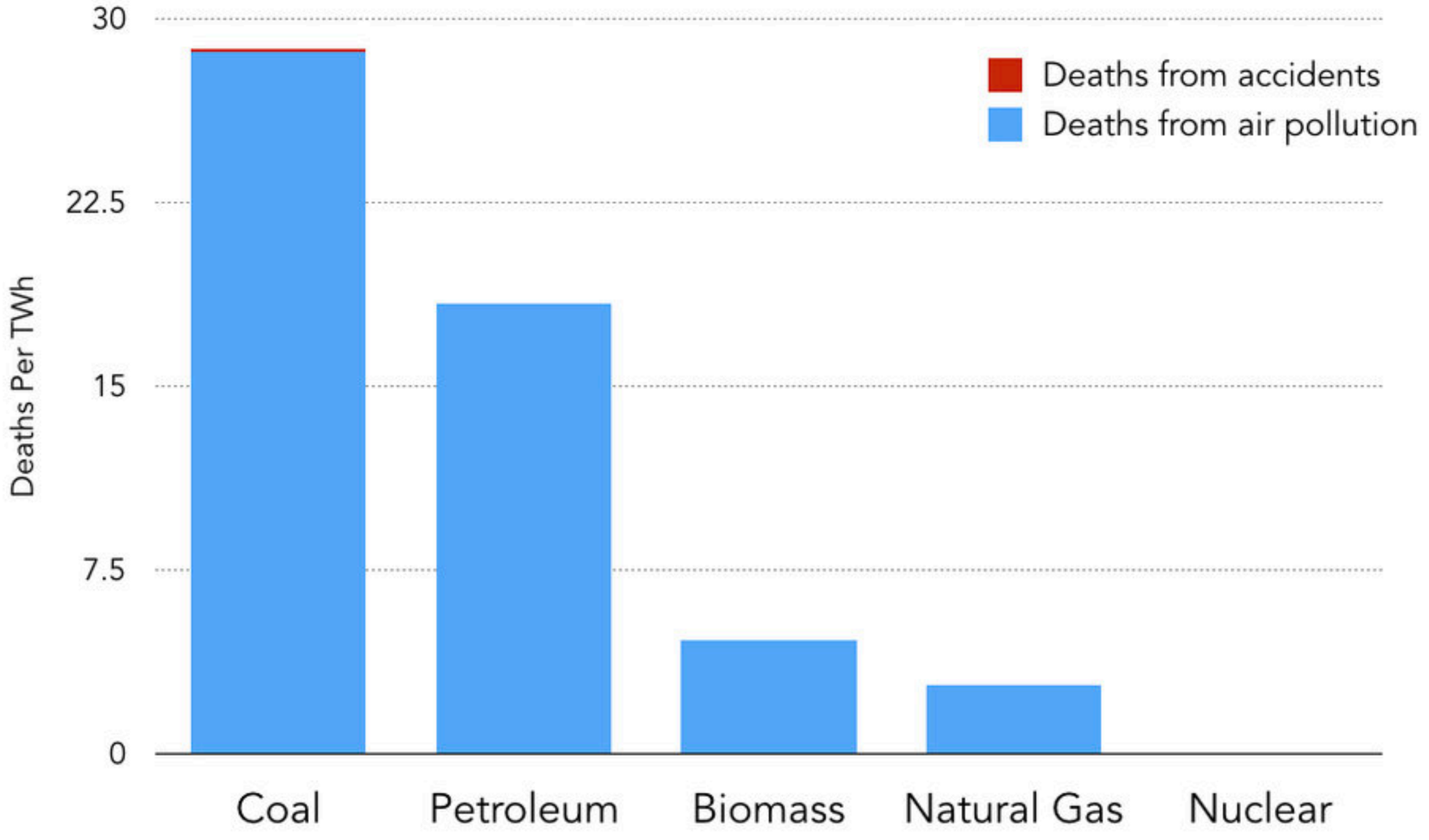
Source: Smith J BMC Pubic Health 2007 7:49

7 million die annually from air pollution

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

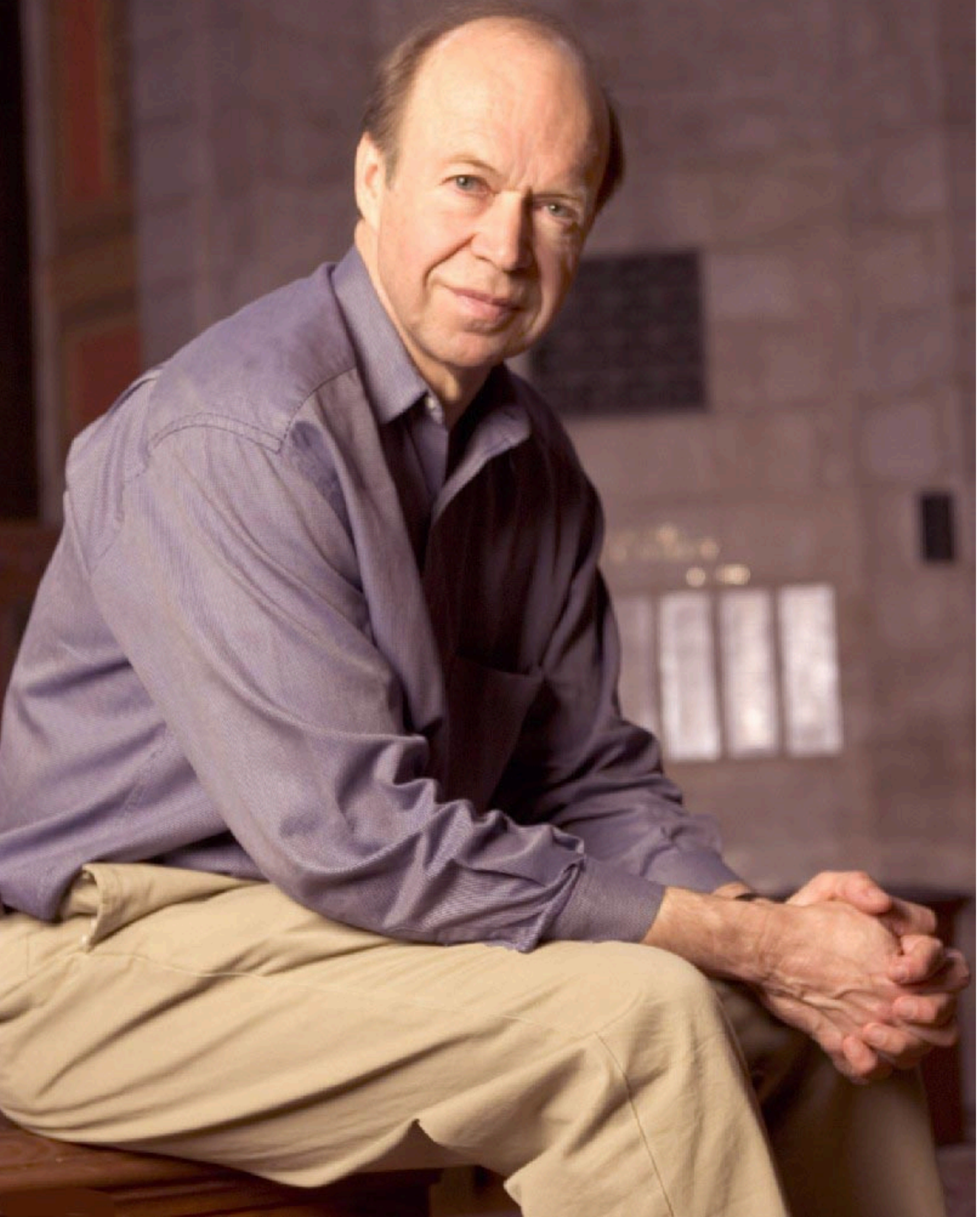
ENVIRONMENTAL PROGRESS

Nuclear is already the safest way to make reliable electricity.



ENVIRONMENTAL PROGRESS

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

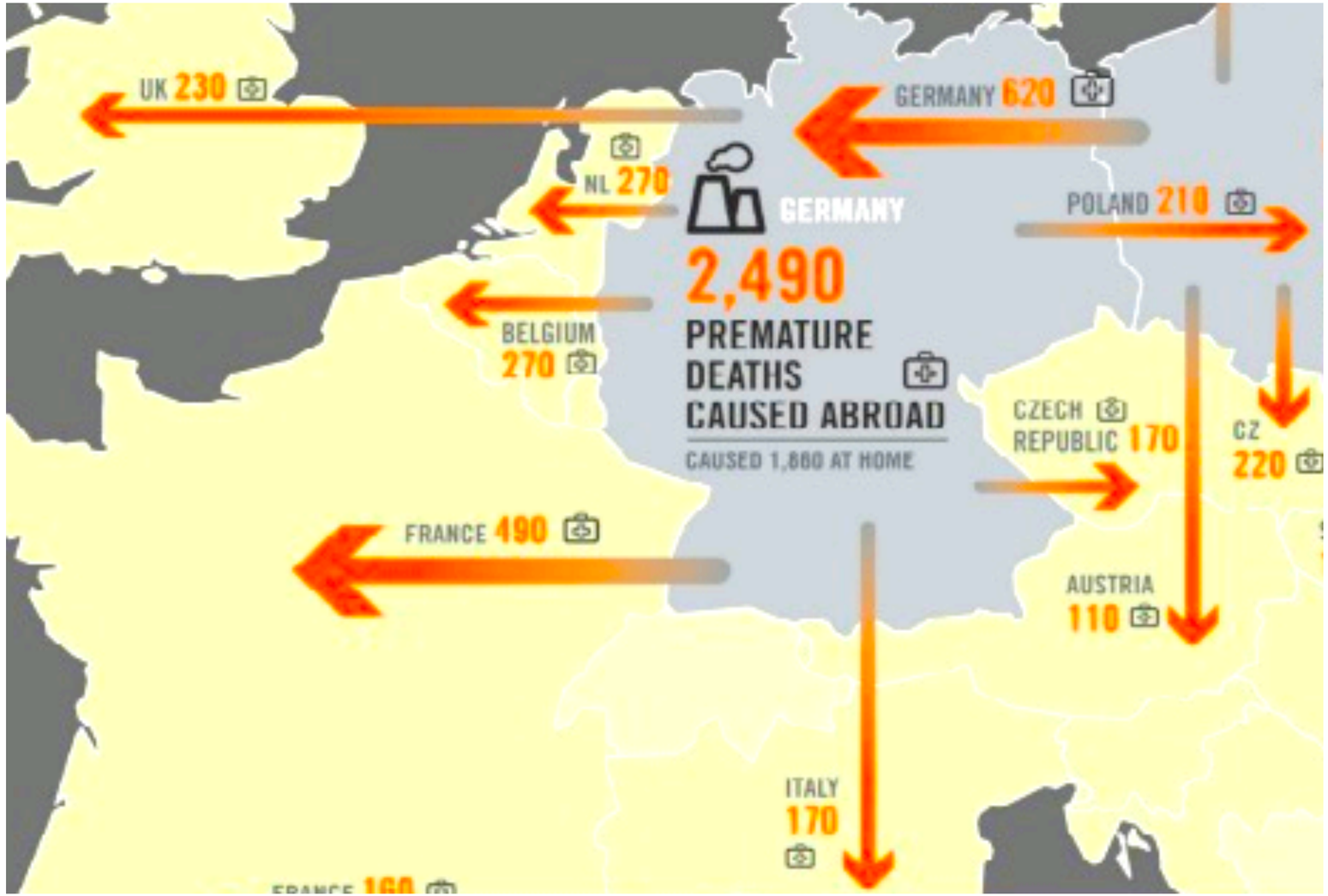


Nuclear power has *saved* 1.8 million lives to date by preventing the burning of fossil fuels.

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

German coal pollution kills 2,490 people/year

WWF



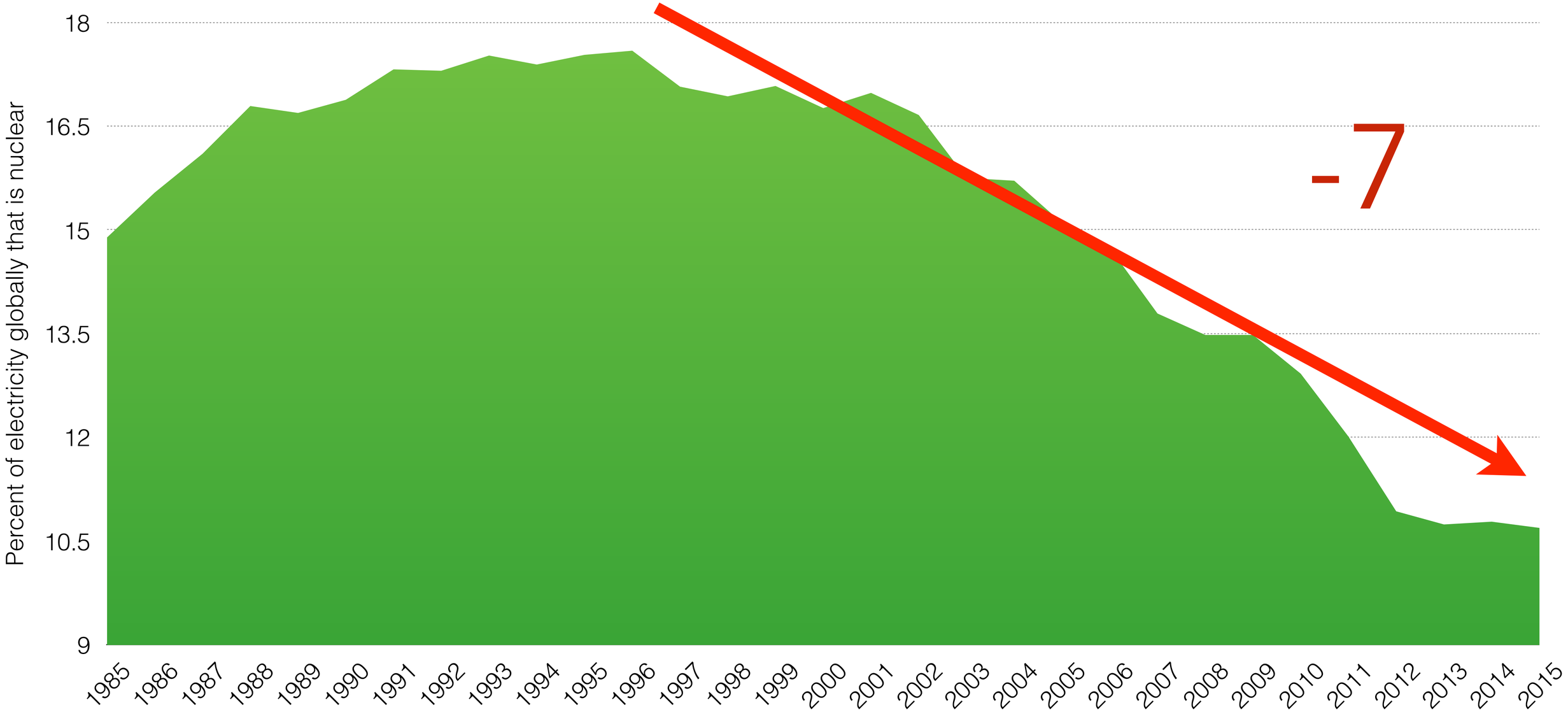
Fukushima Six Years Later

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

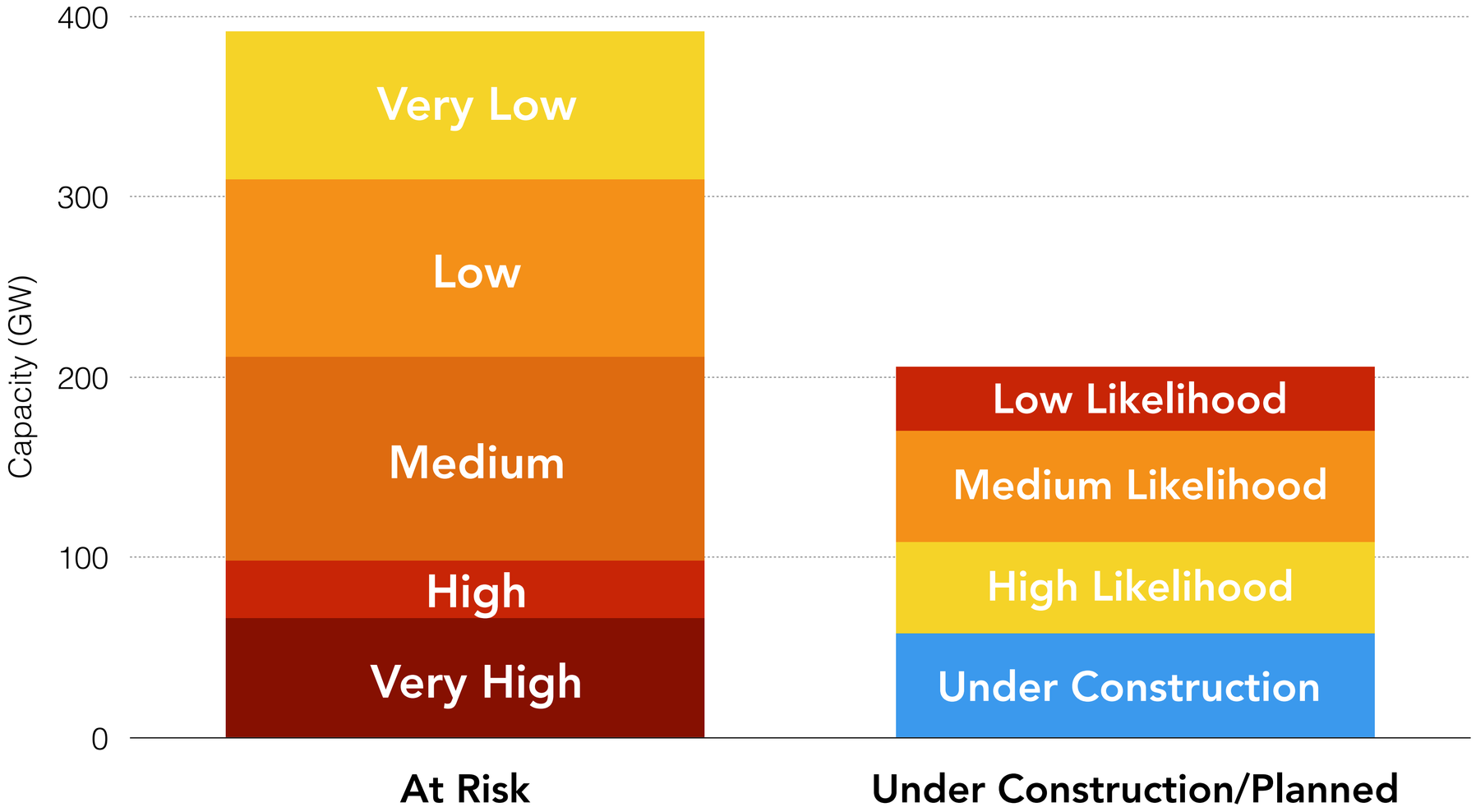
Nuclear on the decline



ENVIRONMENTAL PROGRESS

Source: BP Statistical Review of World Energy, 2015

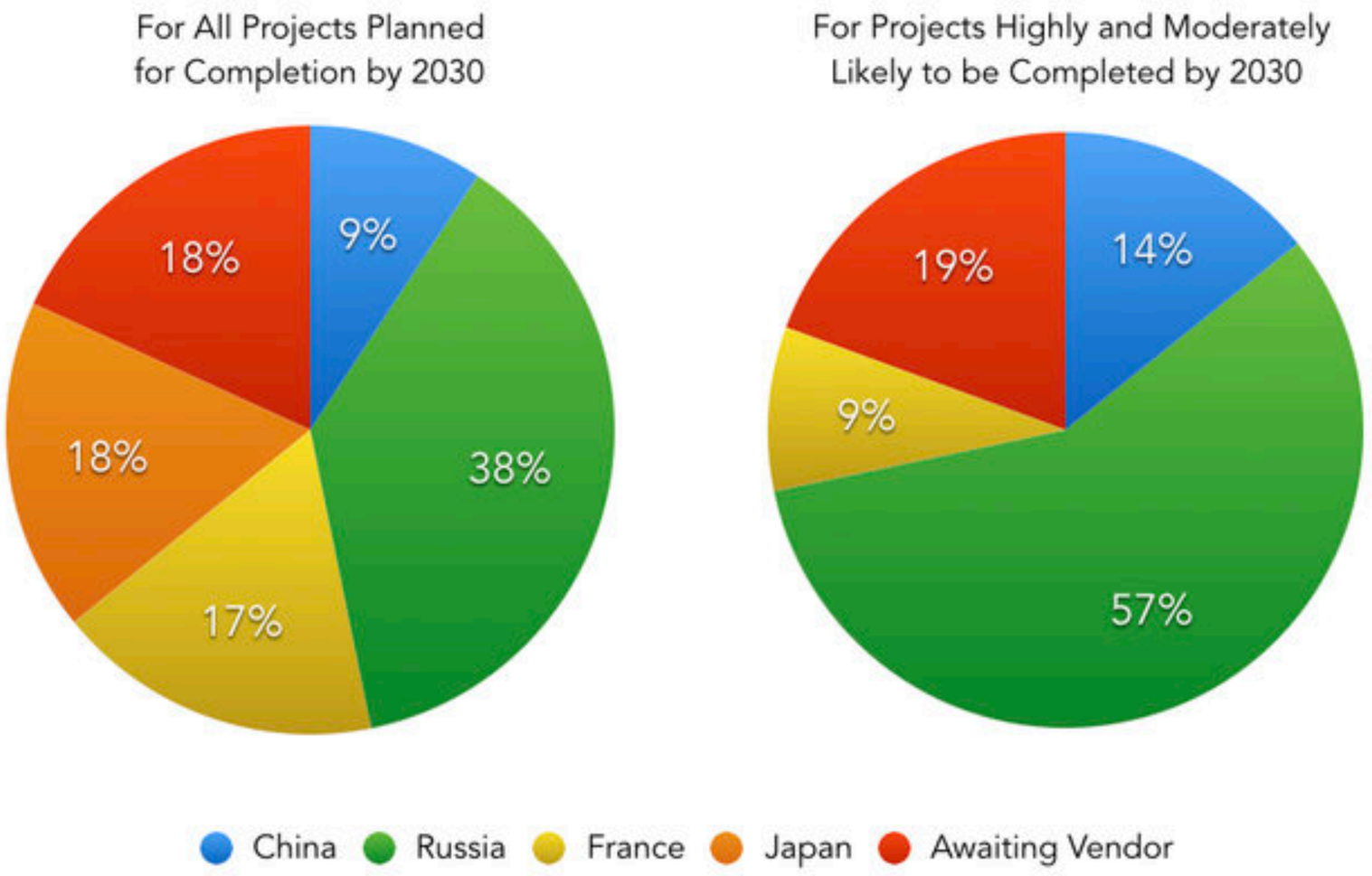
World could lose up to 2x more nuclear than it gains by 2030



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.

ENVIRONMENTAL PROGRESS

Share of Global Nuclear Export Market by Capacity



ENVIRONMENTAL PROGRESS

Source: EP Energy Progress Tracker, 2017.

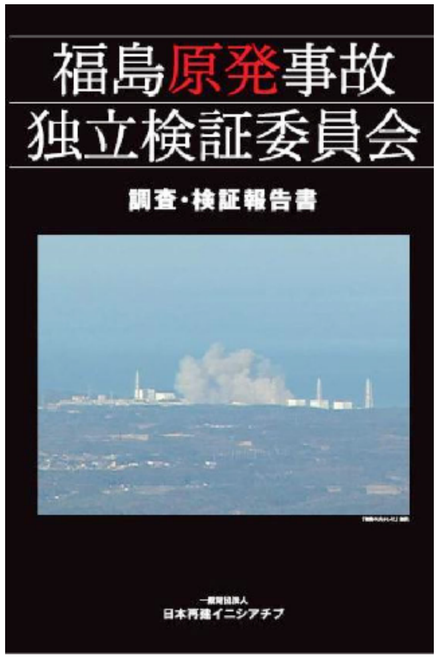
Fukushima Six Years Later

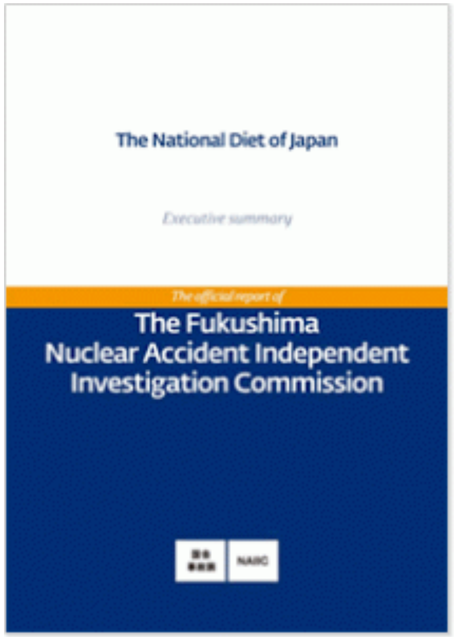
Arrogant overconfidence that Japan immune from nuclear accident

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

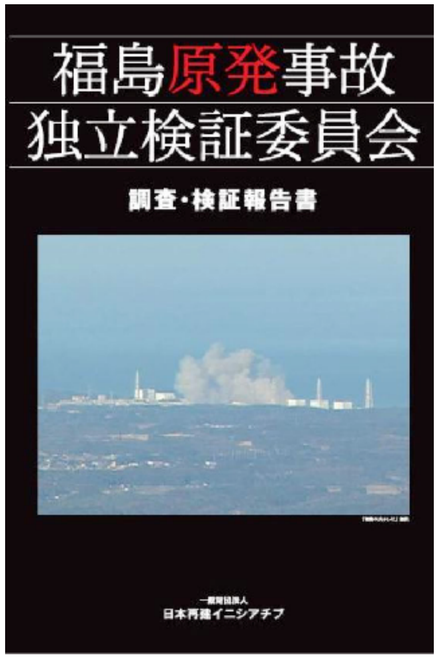
Kyle Clevland, "Significant Breaking Worse," *Critical Asian Studies*, 2014

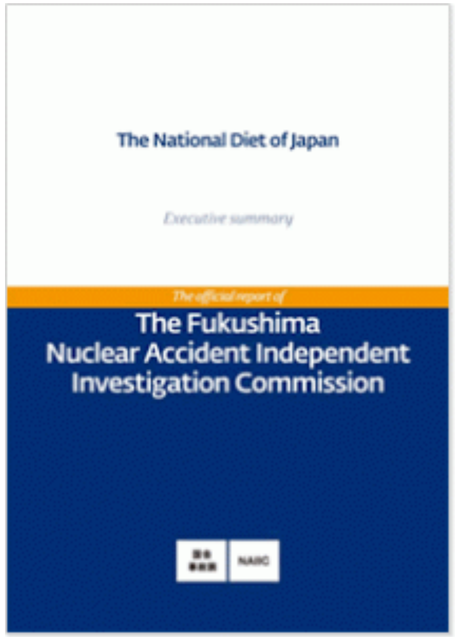
Changing Institutional Culture

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.

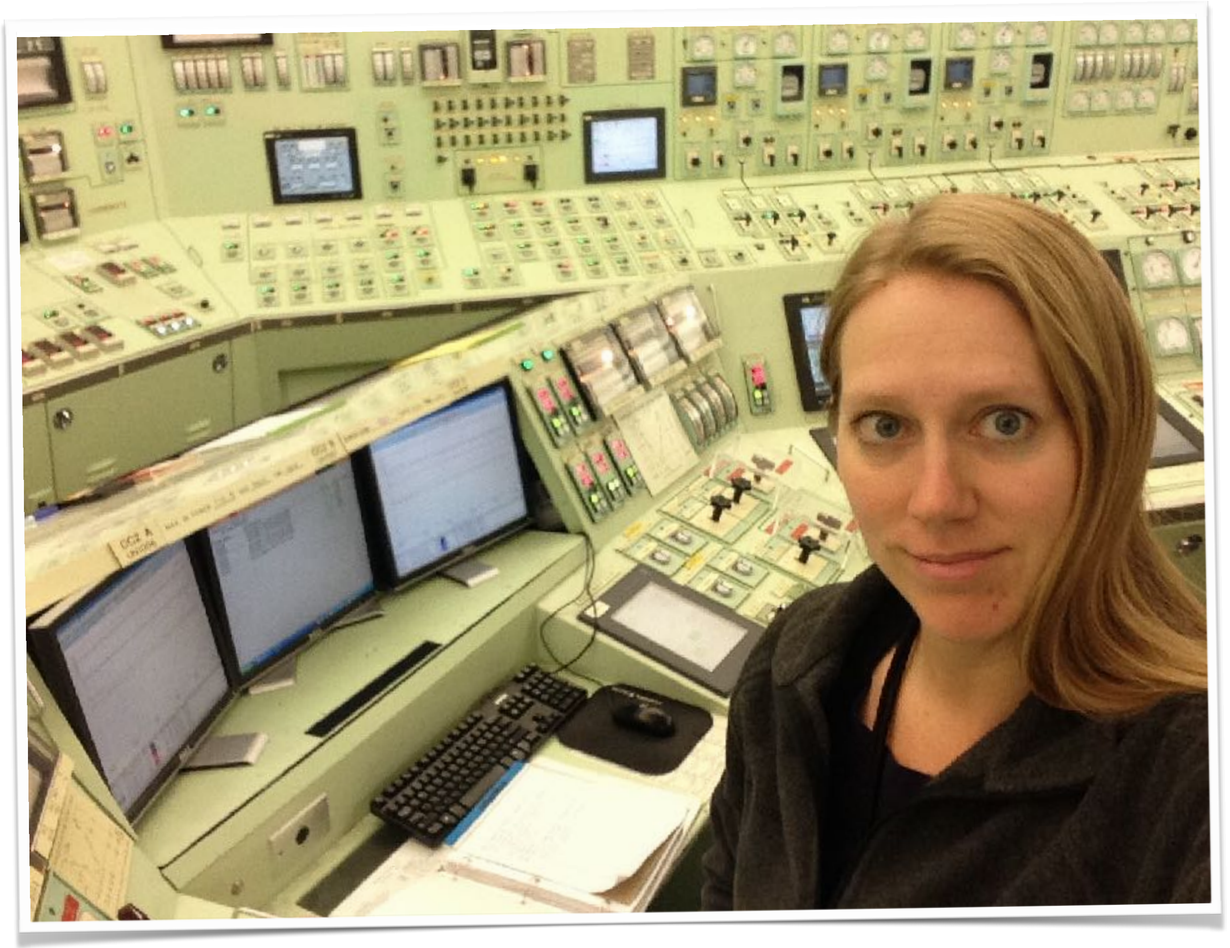
Me. What makes you say that?

Woody: Because the people who work there care!

Woody Epstein, Nuclear Risk Analyst

ENVIRONMENTAL PROGRESS

Heather Matteson



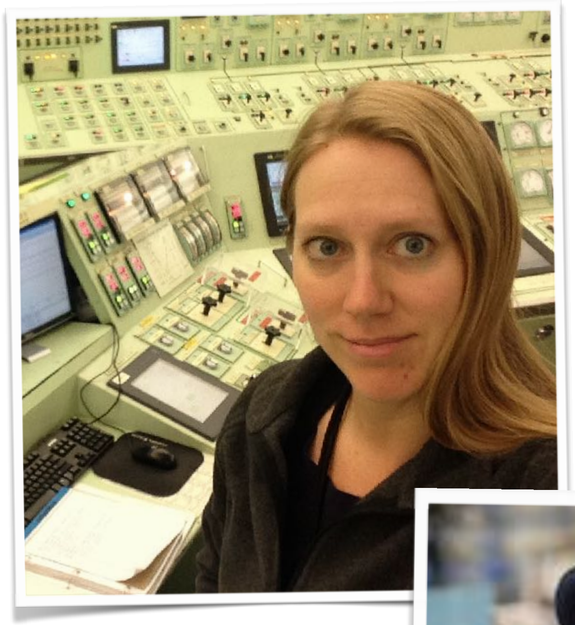
Mother, Environmentalist, Reactor Operator

ENVIRONMENTAL PROGRESS

Inspecting the Diablo Canyon containment dome. It is in excellent condition.

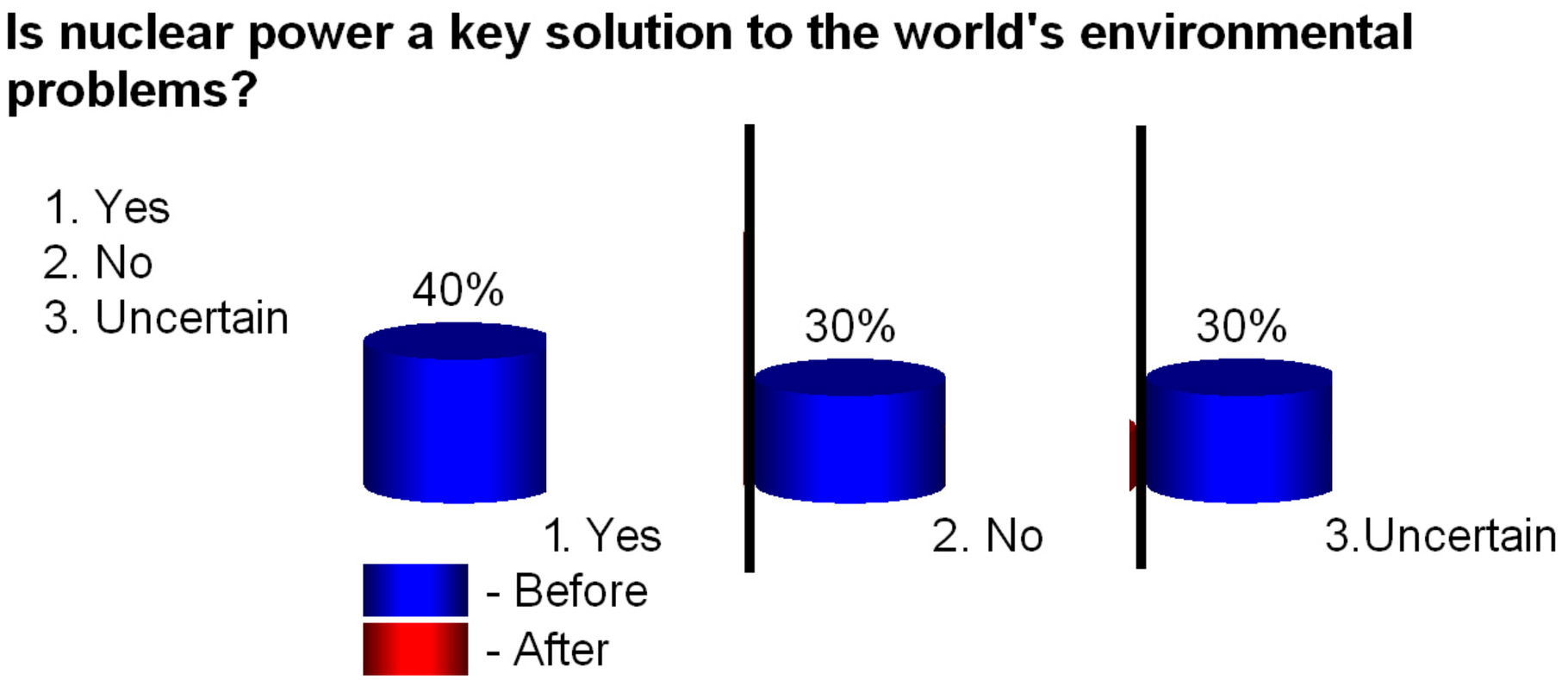
ENVIRONMENTAL PROGRESS

~~What~~ Who makes nuclear safe



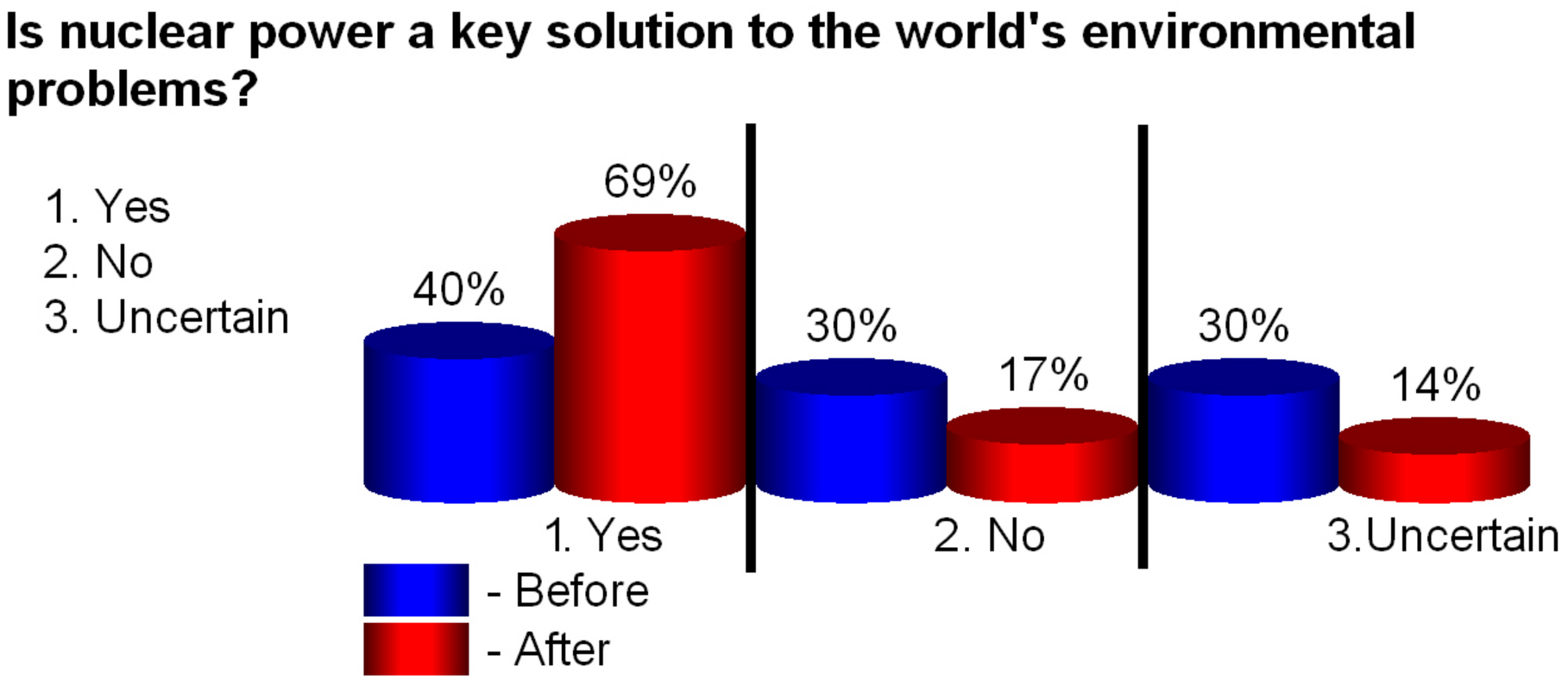
ENVIRONMENTAL PROGRESS

They polled the audience before I was interviewed on stage…



Kent Presents 2016

…they polled them again after I was interviewed



Kent Presents 2016

The High Cost of Fear

공포의 값비싼 대가

한국 탈원전 정책의 원인과
초래하게될 경제적, 환경적 영향의 이해

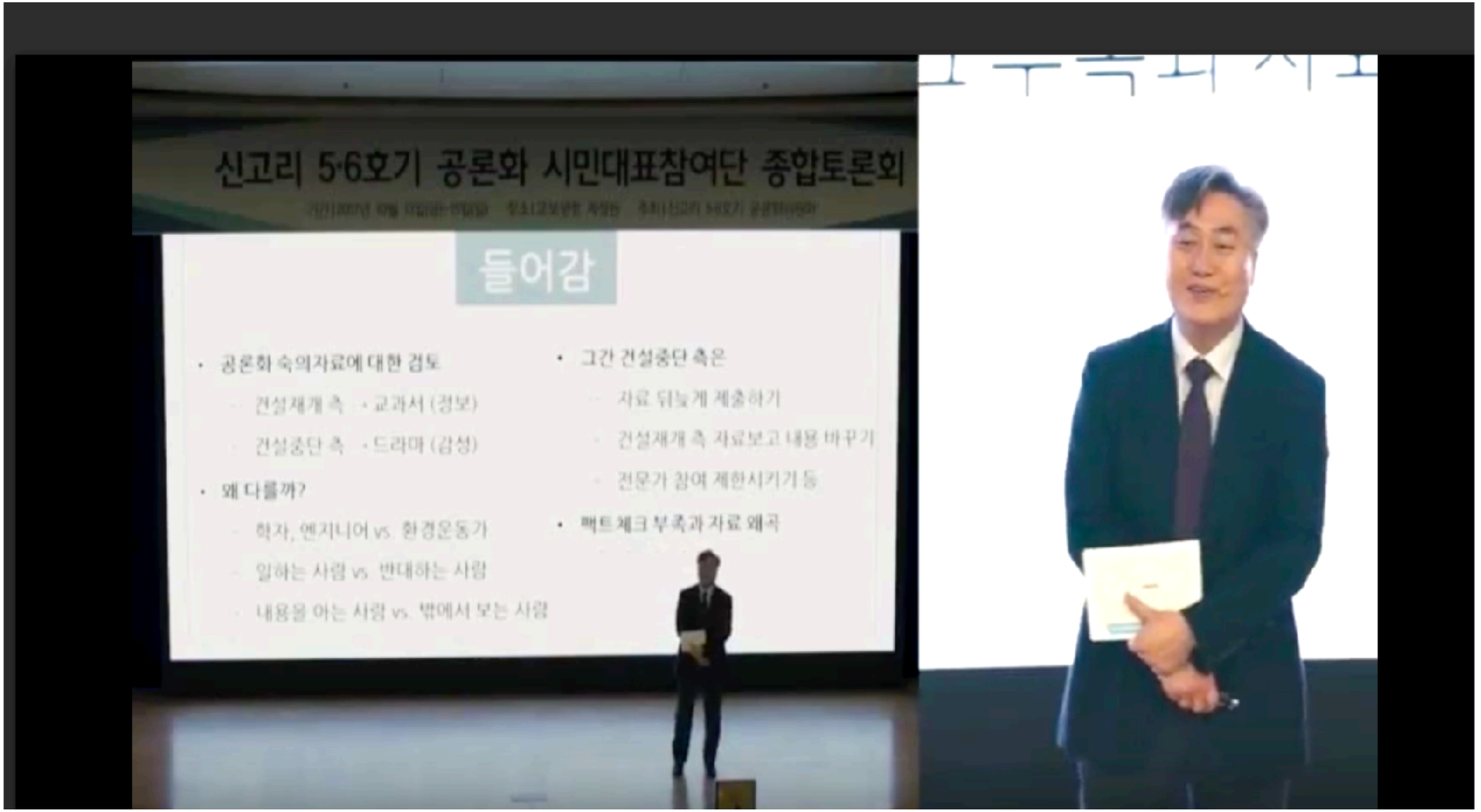
Michael Shellenberger, Mark Nelson, Madi Czerwinski,
Michael Light, John Lindberg, and Minshu Deng 저

August 2017

ENVIRONMENTAL PROGRESS
NATURE AND PROSPERITY FOR ALL

건가… 원전 포기는 비현실적"

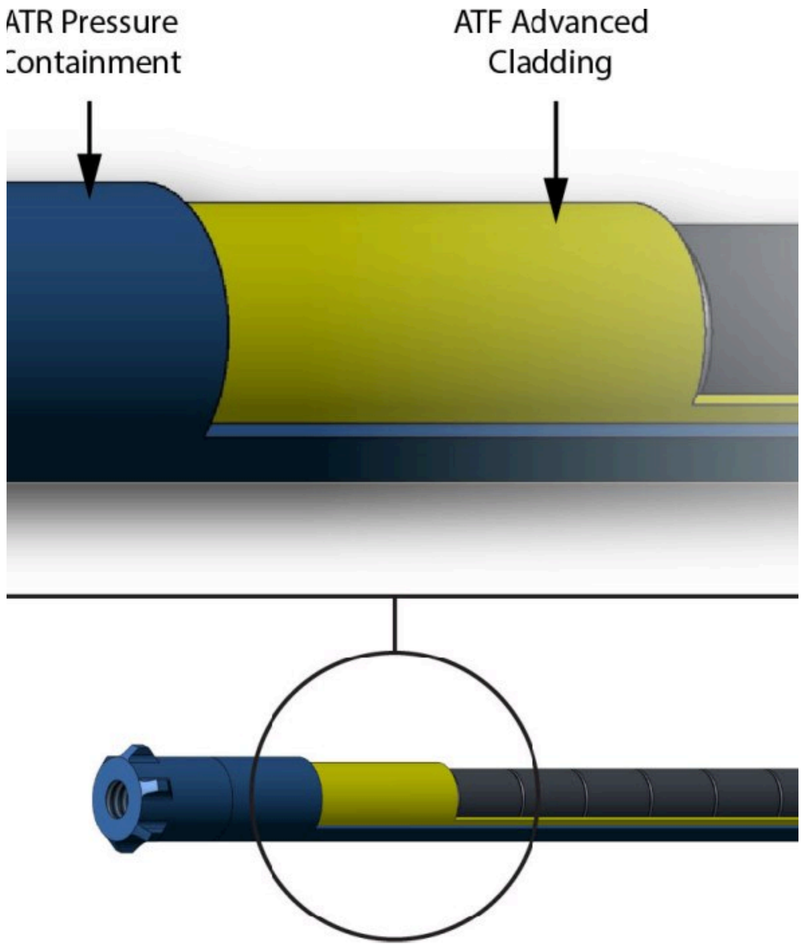
Professor Bum-Jin Chung persuades South Korea's "citizens jury"



ENVIRONMENTAL PROGRESS

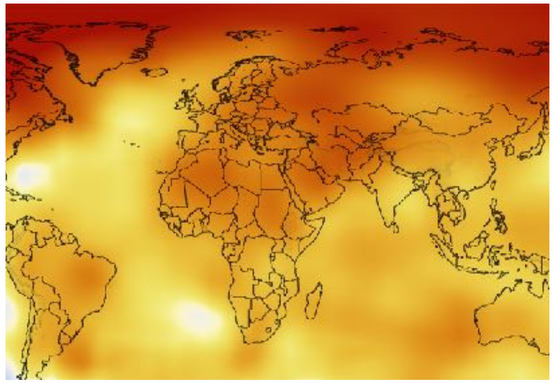
Accident-Tolerant Fuels

- 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



ENVIRONMENTAL PROGRESS

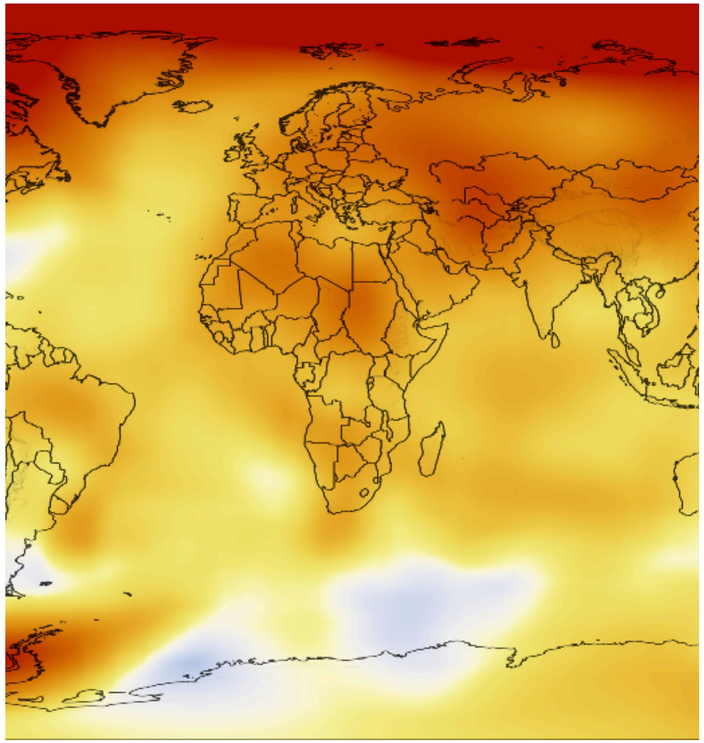
Transcendent Moral Purpose



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

ENVIRONMENTAL PROGRESS

資料1 仮訳



Atomic Humanism for Japan

マイケル・シェレンバーガー

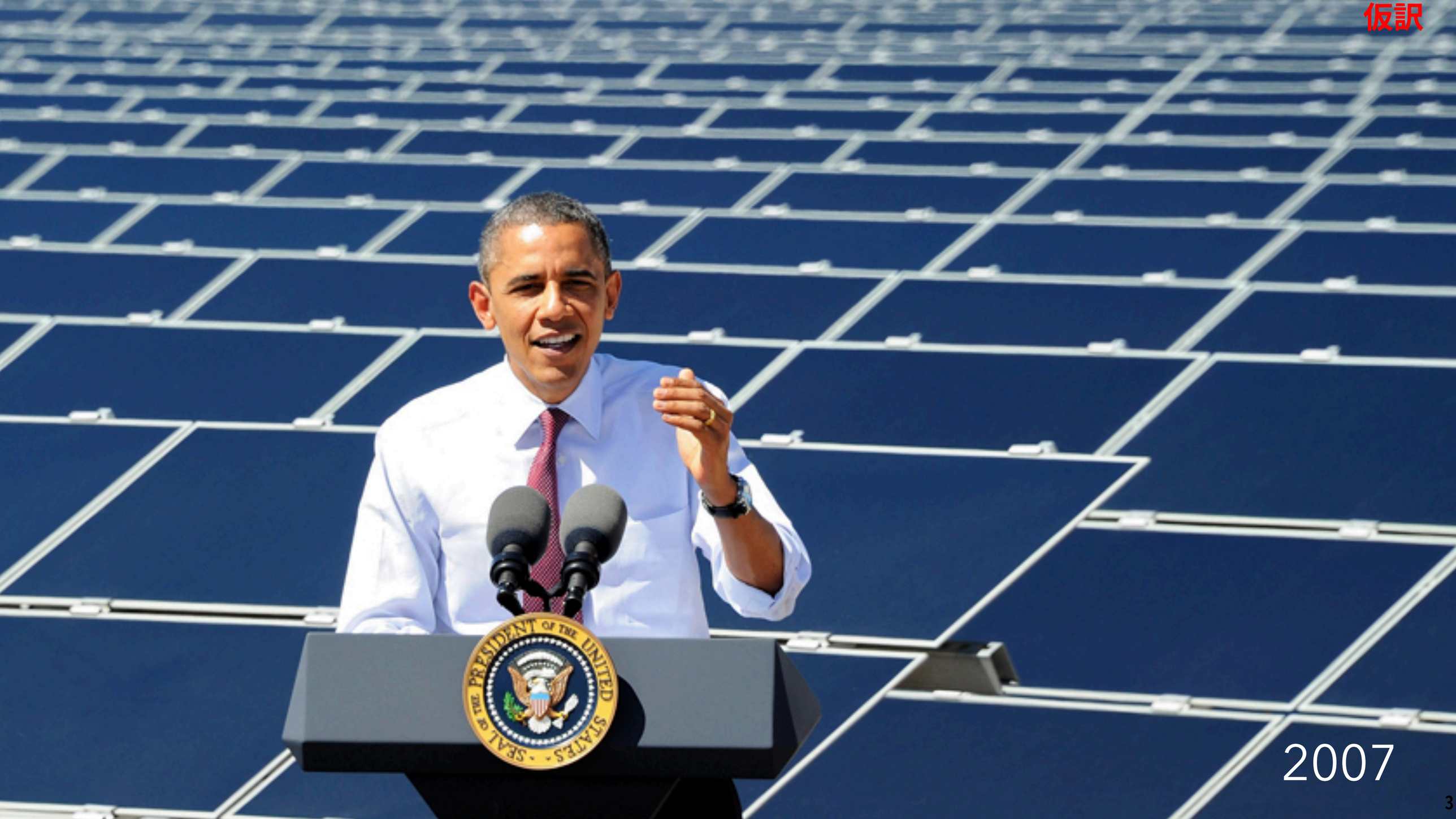
日本（東京） :: 2017年11月13日

ENVIRONMENTAL PROGRESS

仮訳

2003

仮訳

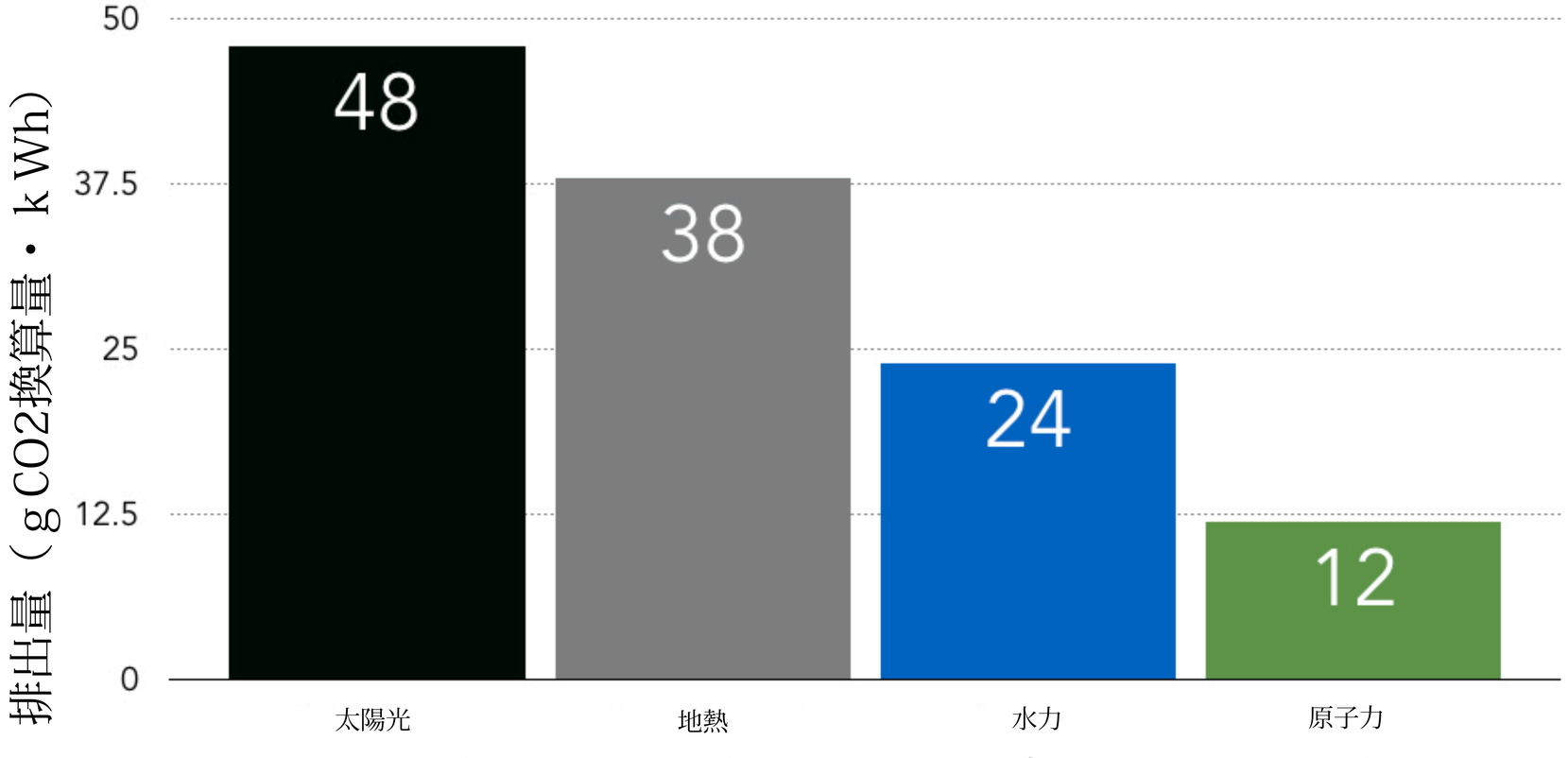


仮訳

2005

仮訳

原子力発電のCO2排出量は太陽光発電の4分の1

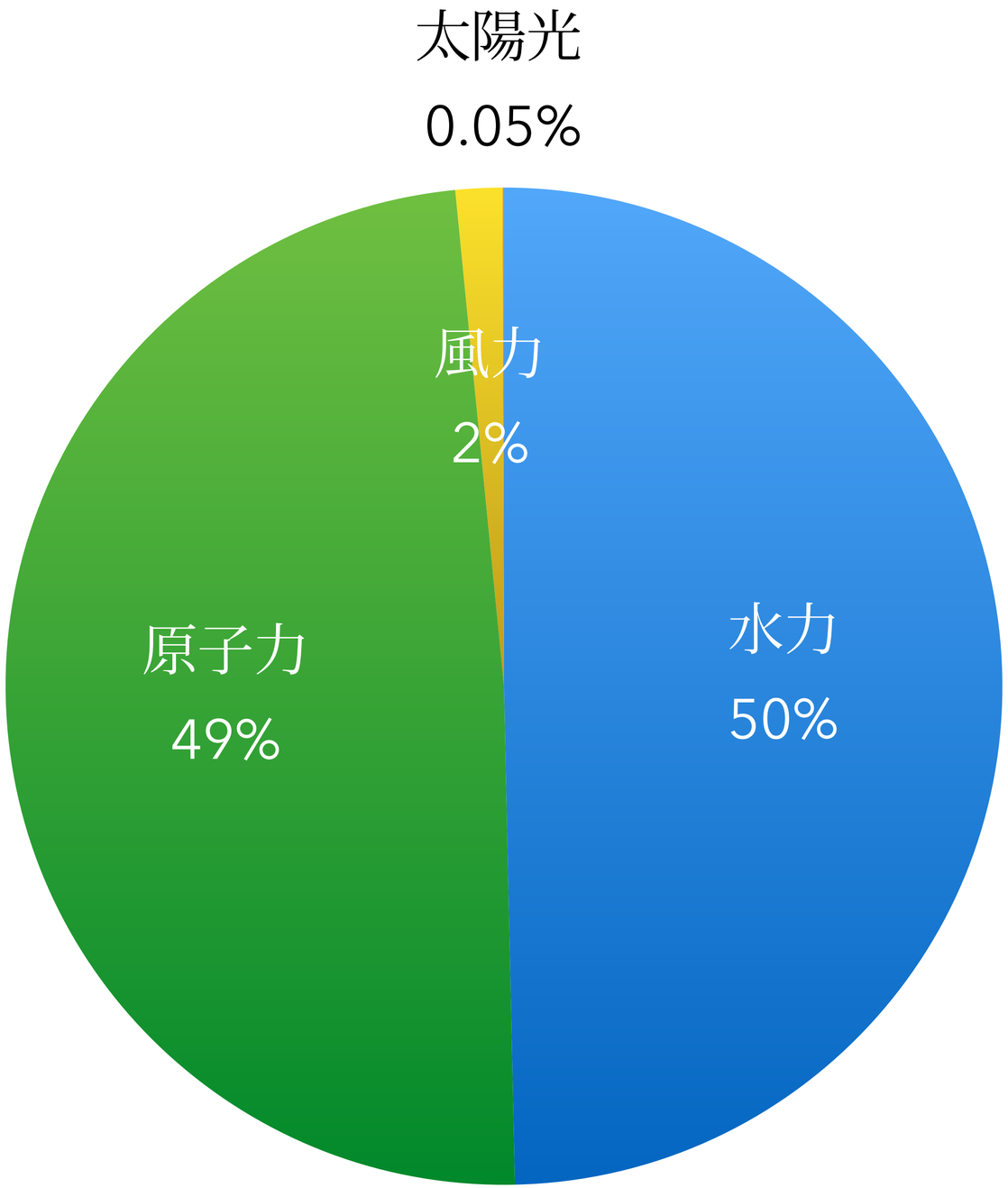


Source: Intergovernmental Panel on Climate Change (IPCC) 2014

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.

ENVIRONMENTAL PROGRESS

仮訳



2005

仮訳

2011

仮訳

「かつて私は反核運動をしており、放射線が人体へ与える影響を世界に誤って発信してしまった。」

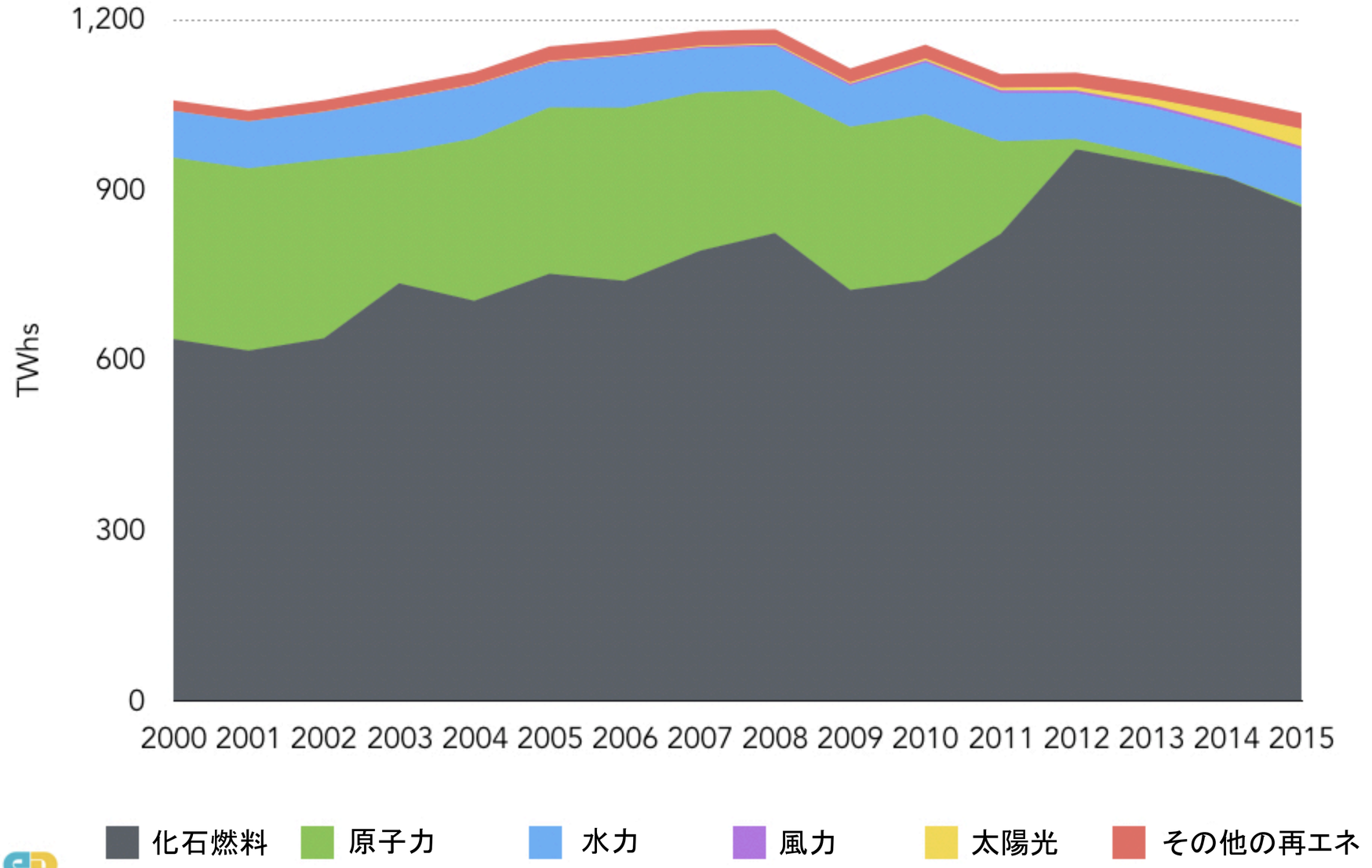
– George Monbiot
*The Guardian*誌（2011年4月）

仮訳

仮訳

仮訳

日本の電力量(2000–2015)

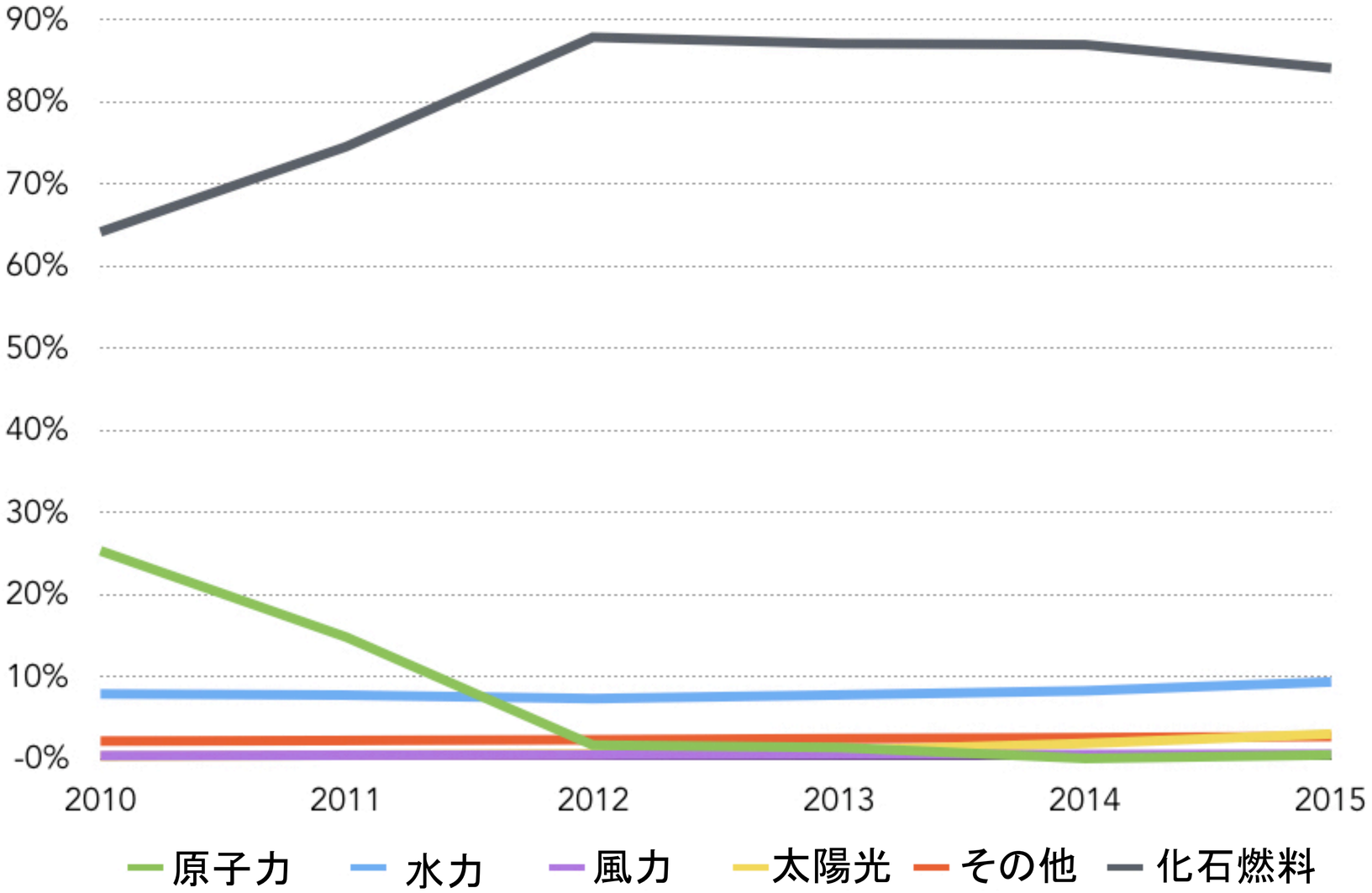


ENVIRONMENTAL PROGRESS

Source: BP Global Outlook 2016

仮訳

日本のクリーン電力シェア（2010–2015）

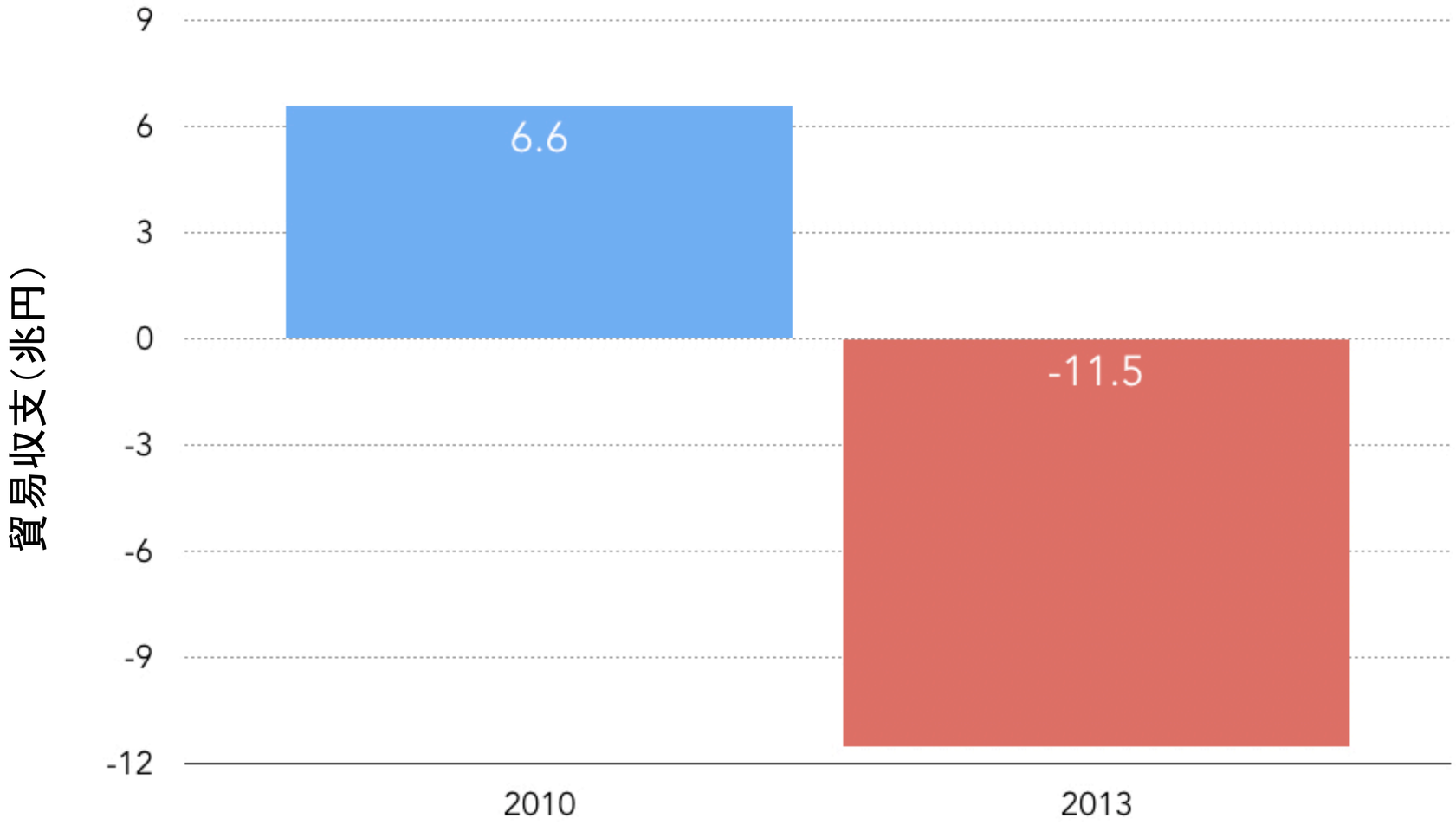


ENVIRONMENTAL PROGRESS

Source: BP Global Outlook 2016

仮訳

化石燃料の輸入増加により、
2010年から2013年で、日本の貿易収支は黒字から赤字へ転落

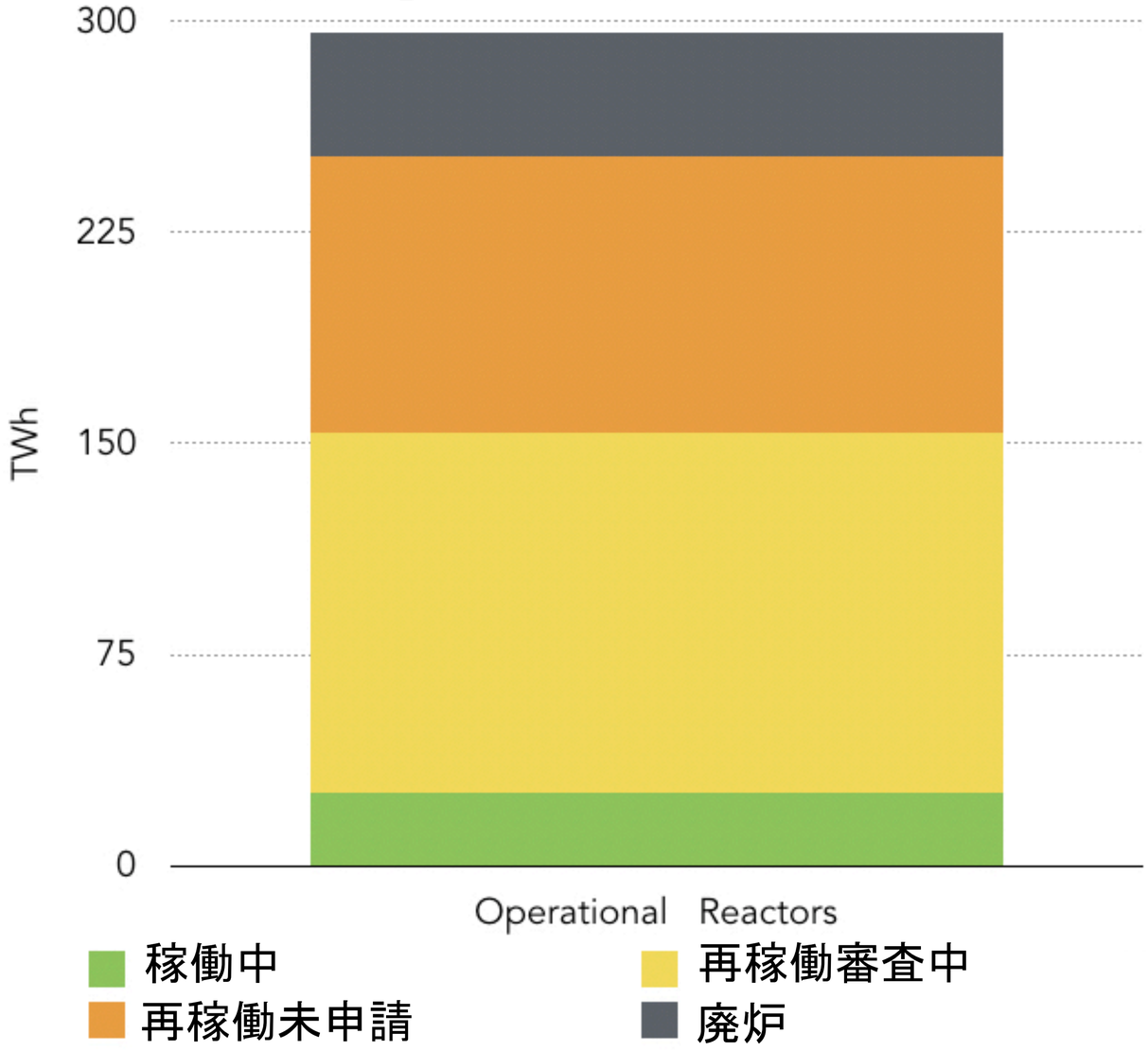


ENVIRONMENTAL PROGRESS

Source: World Nuclear Association

仮訳

日本の原子炉の稼働状況と福島事故前の発電量

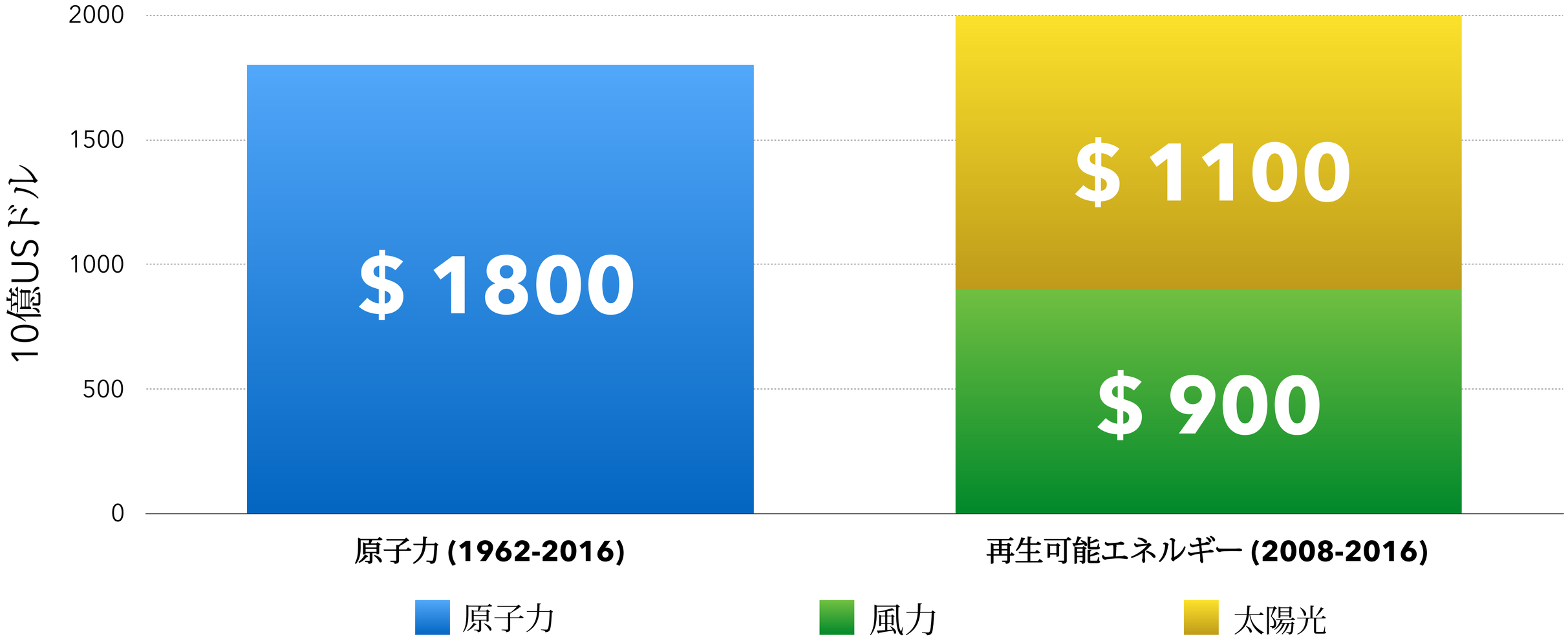


ENVIRONMENTAL PROGRESS

Source: World Nuclear Association

仮訳

「原子力」と「太陽光・風力」に対する公的及び民間投資額はそれぞれ約２兆ドル



Source: Mark Nelson et al., "The Power to Decarbonize," EP, November 2017

Based on Bloomberg New Energy Finance, 2017; Lovering et al., "Historical Nuclear Construction Costs," *Energy Policy*, 2016

ENVIRONMENTAL PROGRESS

仮訳

ニューヨークタイムズ紙

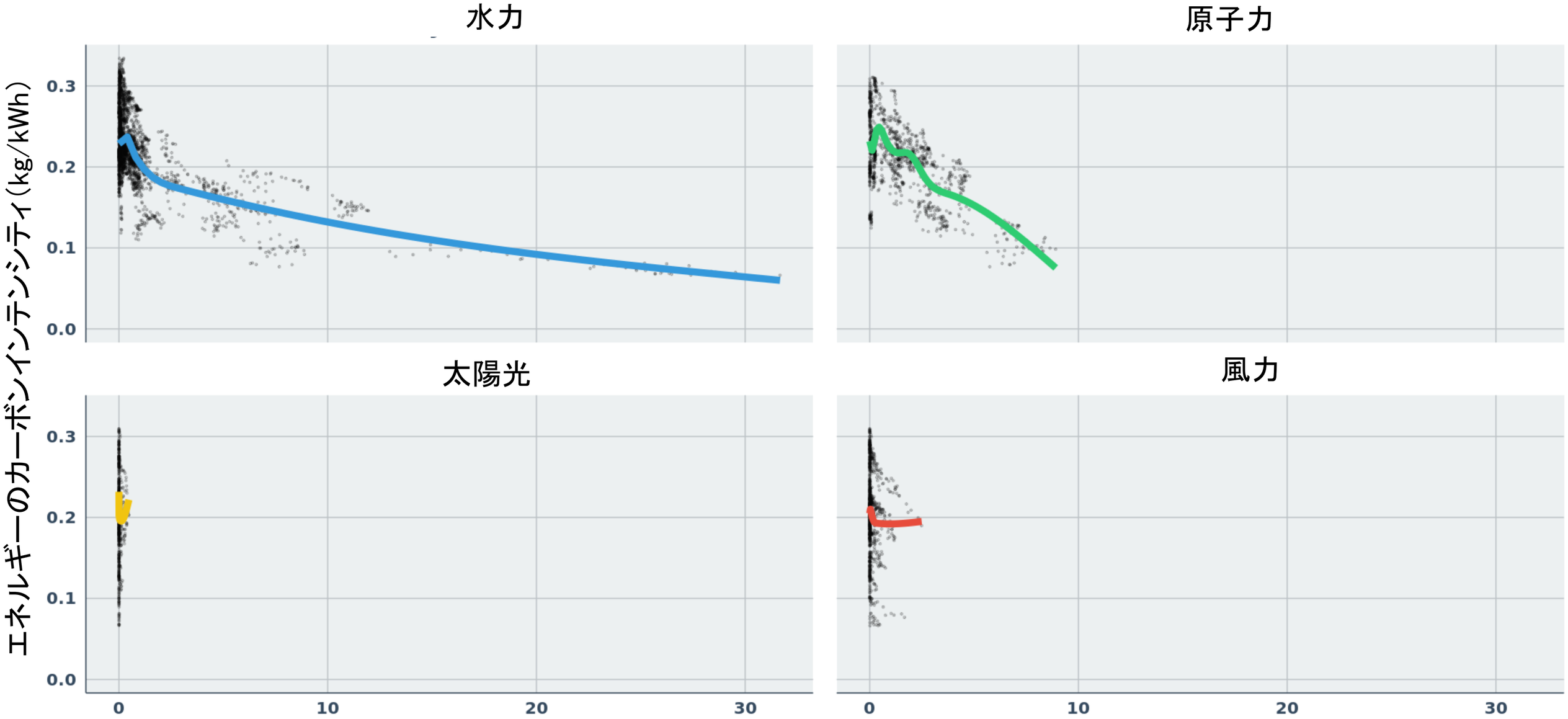
風力と太陽光は前進する一方、炭素排出は後退せず（2017/11/7）

世界中の政府関係者が、気候変動枠組み条約締約国会議（COP23）の為、今週ドイツのボンに集まった

エンバイロメンタル・プログレスは、1965年以来68カ国においてエネルギーのカーボンインテンシティ（CO2排出原単位）の進捗分析を行ってきた。
その結果、太陽光と風力の増加と、カーボン・インテンシティとの相関関係は見つけられなかった（再エネ容量の増加にも関わらず、カーボン・インテンシティに変化は見られなかった）。

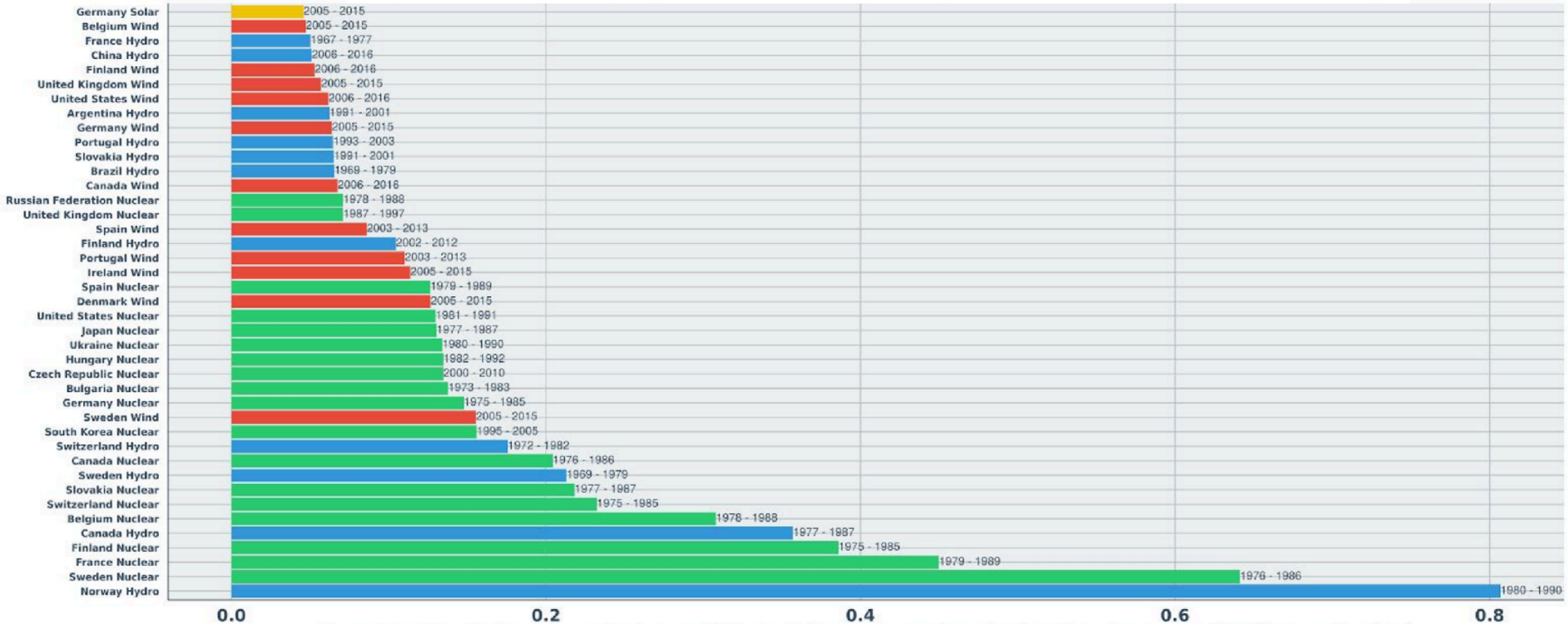
低炭素電力とカーボンインテンシティの相関関係

仮訳



仮訳

10年単位での原子力、水力、風力、太陽光の配備



年間電力量に占める増加量（平均）（MWh/capita）

水力　原子力　太陽光　風力

PROGRESS

仮訳

仮訳

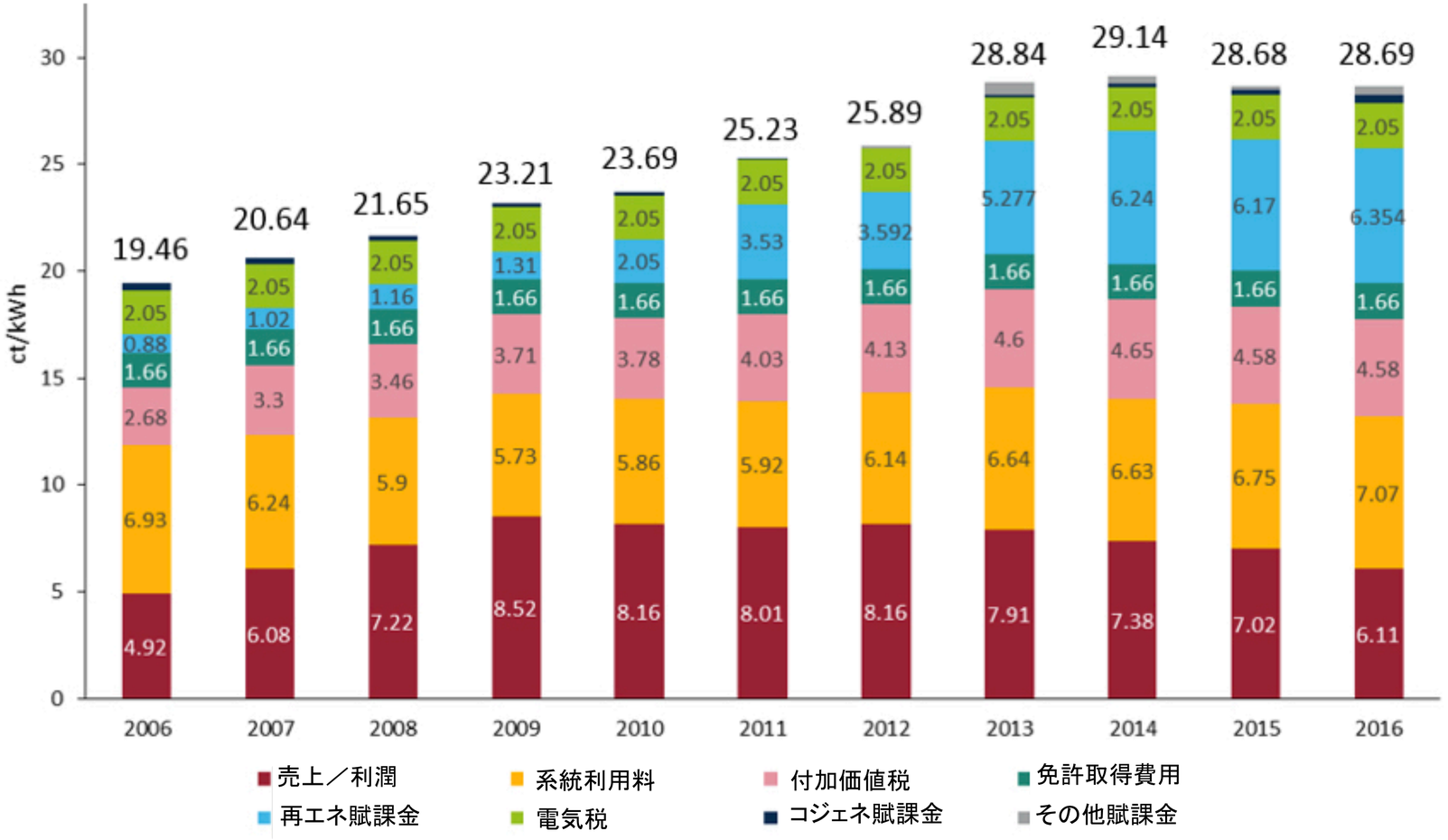
ドイツは2000年以降、
再生可能エネルギーに
2,220億ドルの投資を行った

ENVIRONMENTAL PROGRESS

Source: Stanley Reed, “$222 billion shift hits a snag,” *New York Times*, October 3, 2017

仮訳

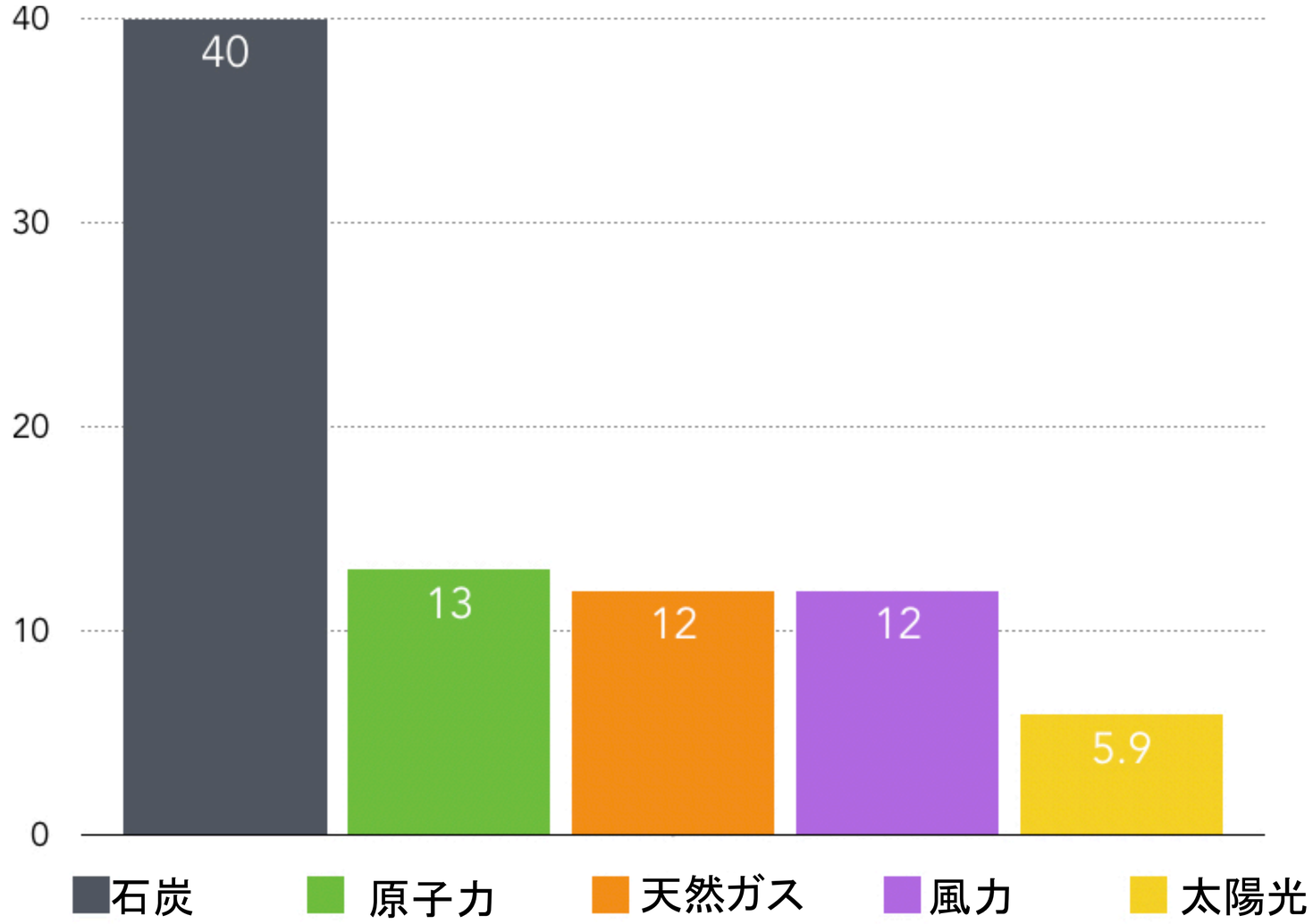
ドイツの電力料金は、2006年から2016年までに47%上昇



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

仮訳

ドイツの電力シェア（2016年、石炭、原子力、天然ガス、風力、太陽光）

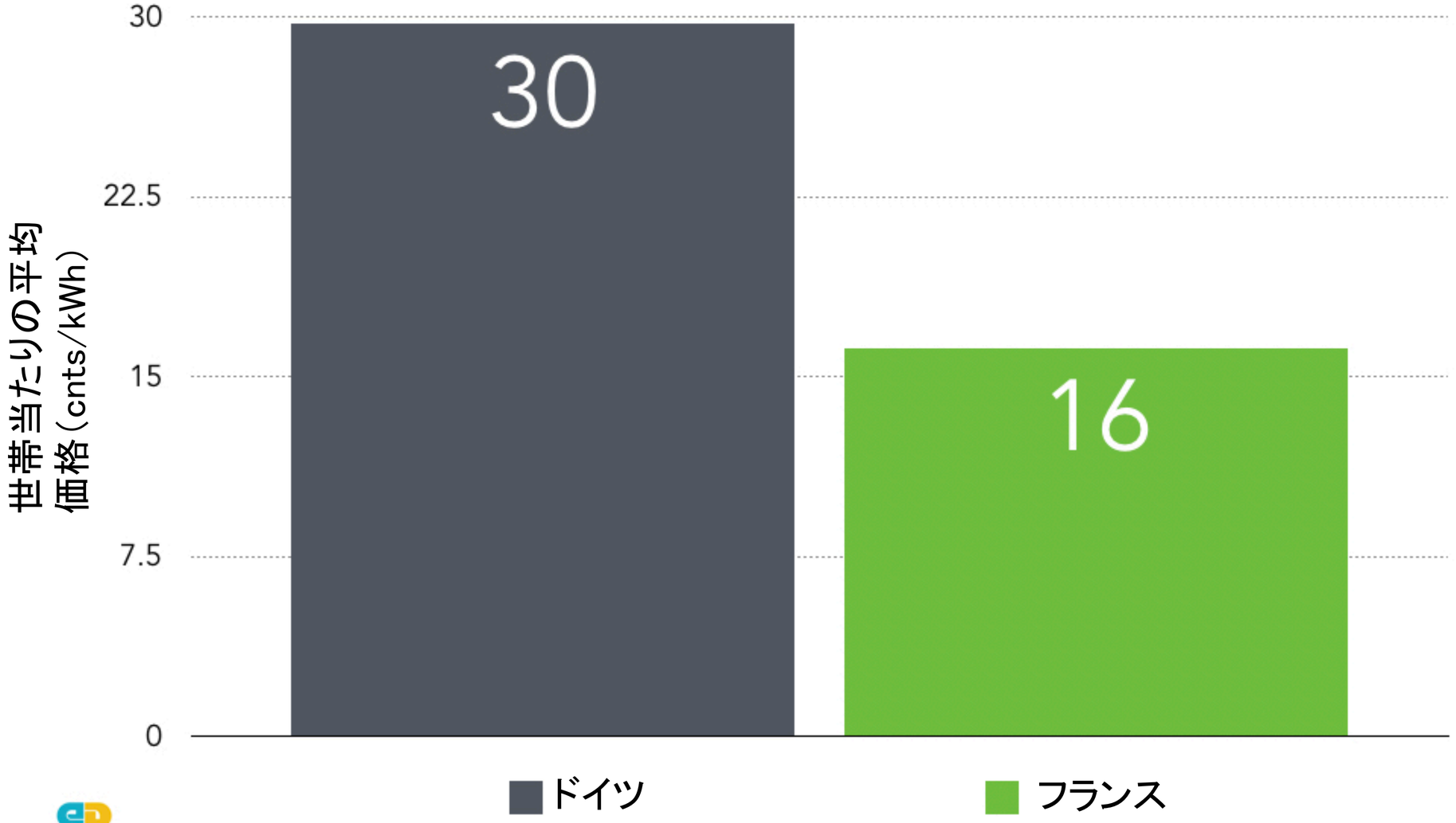


ENVIRONMENTAL PROGRESS

Source: AG Energiebilanzen, 2017

仮訳

ドイツの電気料金は、フランスの2倍

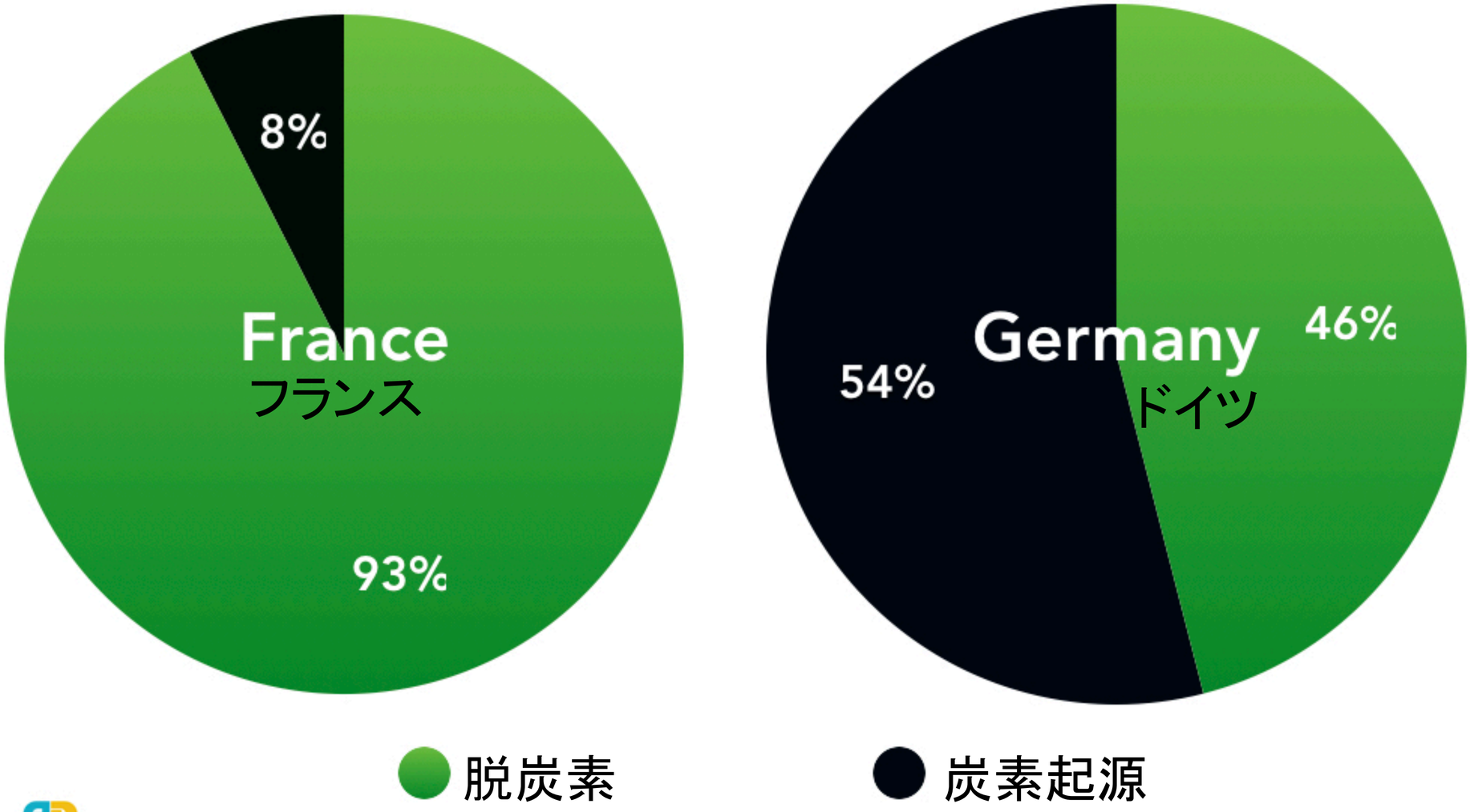


ENVIRONMENTAL PROGRESS

Source: Eurostat, 2015

仮訳

フランスの電気はドイツより2倍以上、クリーンなエネルギー源由来

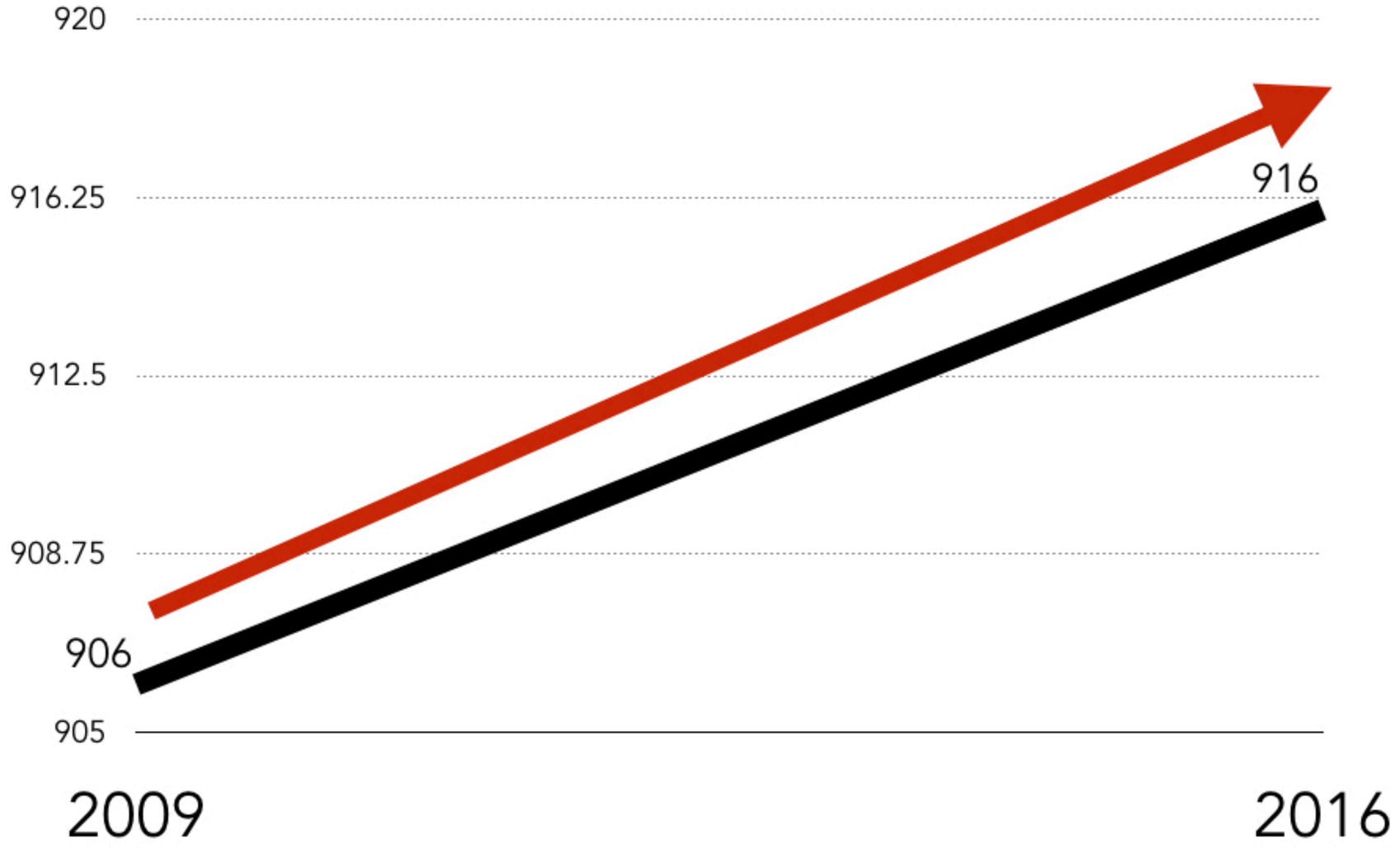


ENVIRONMENTAL PROGRESS

Source: BP Energy Outlook 2016

仮訳

ドイツのCO2排出量は、2009年から上昇



ENVIRONMENTAL PROGRESS

Source: Agora Energiewende; Franhofer Institute; German Statistical Office Data

仮訳

ドイツは2016年に
太陽光発電設備容量を４％増強。
ーしかし、発電量では３％減少。

ENVIRONMENTAL PROGRESS

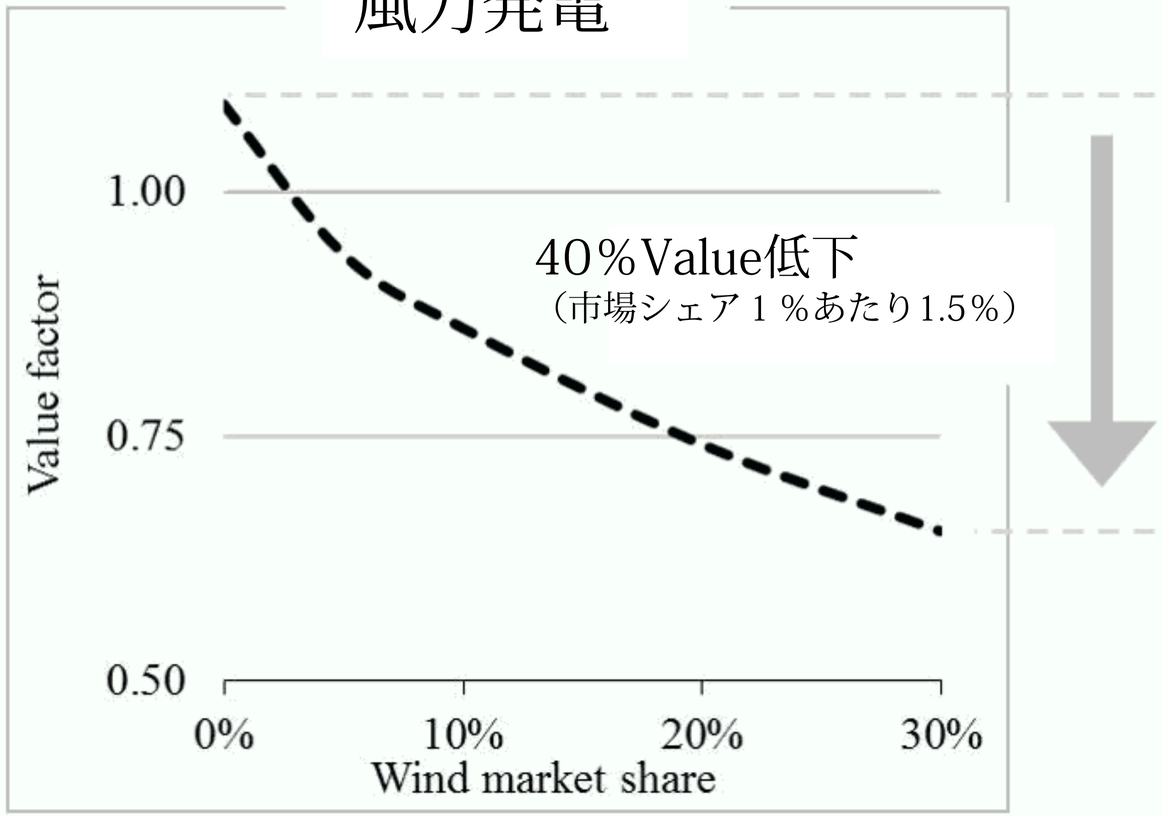
仮訳

ドイツの2016年に
風力発電の設備容量を11％増強。
ーしかし、発電量では２％減少。

ENVIRONMENTAL PROGRESS

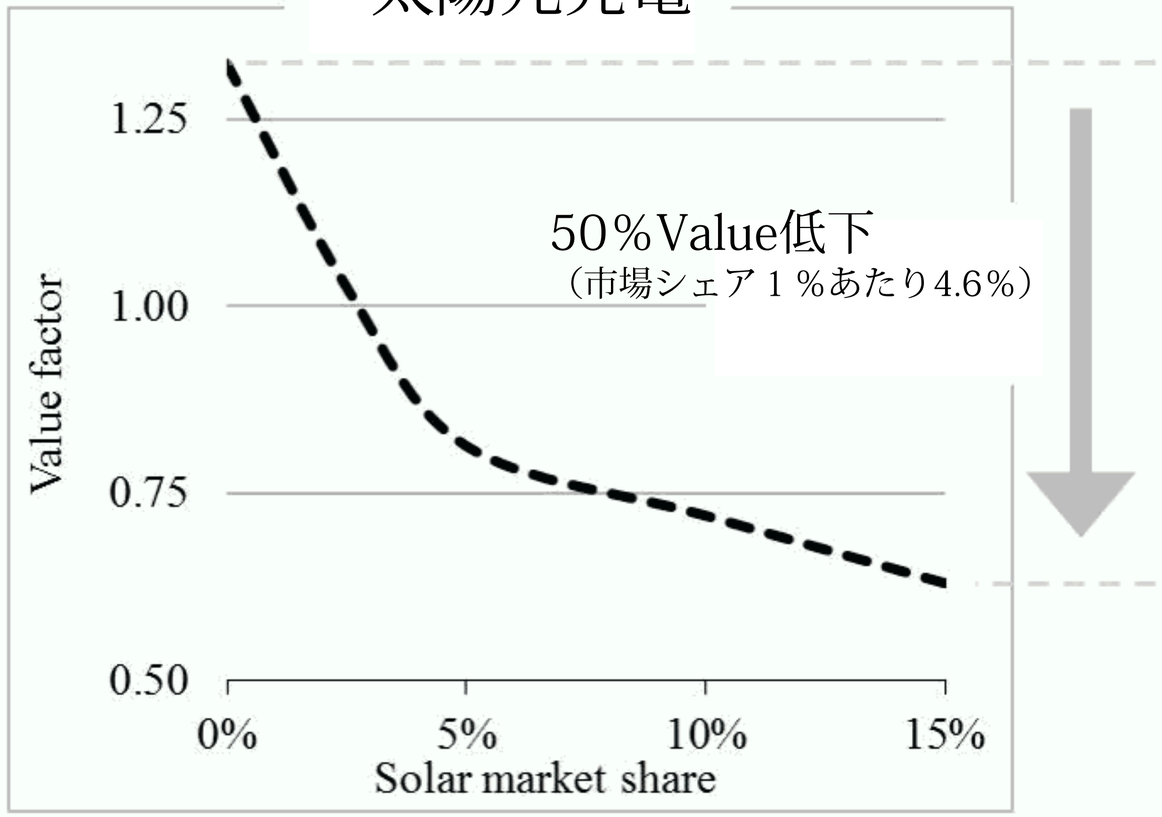
仮訳

風力発電



Source: updated from Hirth (2013): Market value

太陽光発電



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

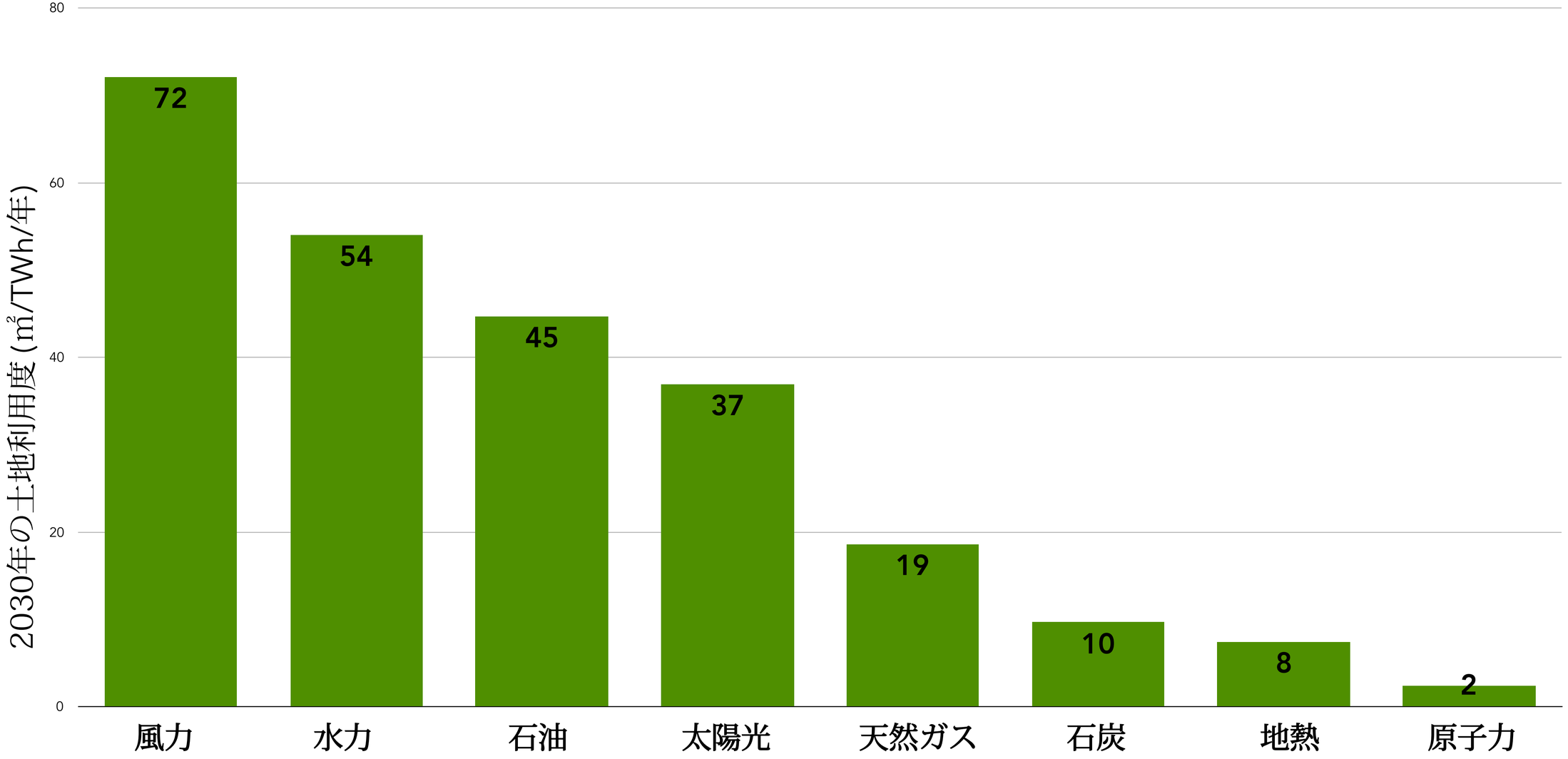
仮訳

カリフォルニアで、
もし仮に既存の蓄電設備と全ての車、
トラックが蓄電に利用されたならば、
23分間分の蓄電設備になる。

ENVIRONMENTAL PROGRESS

仮訳

再生可能エネルギーには、原子力の17～35倍の土地が必要

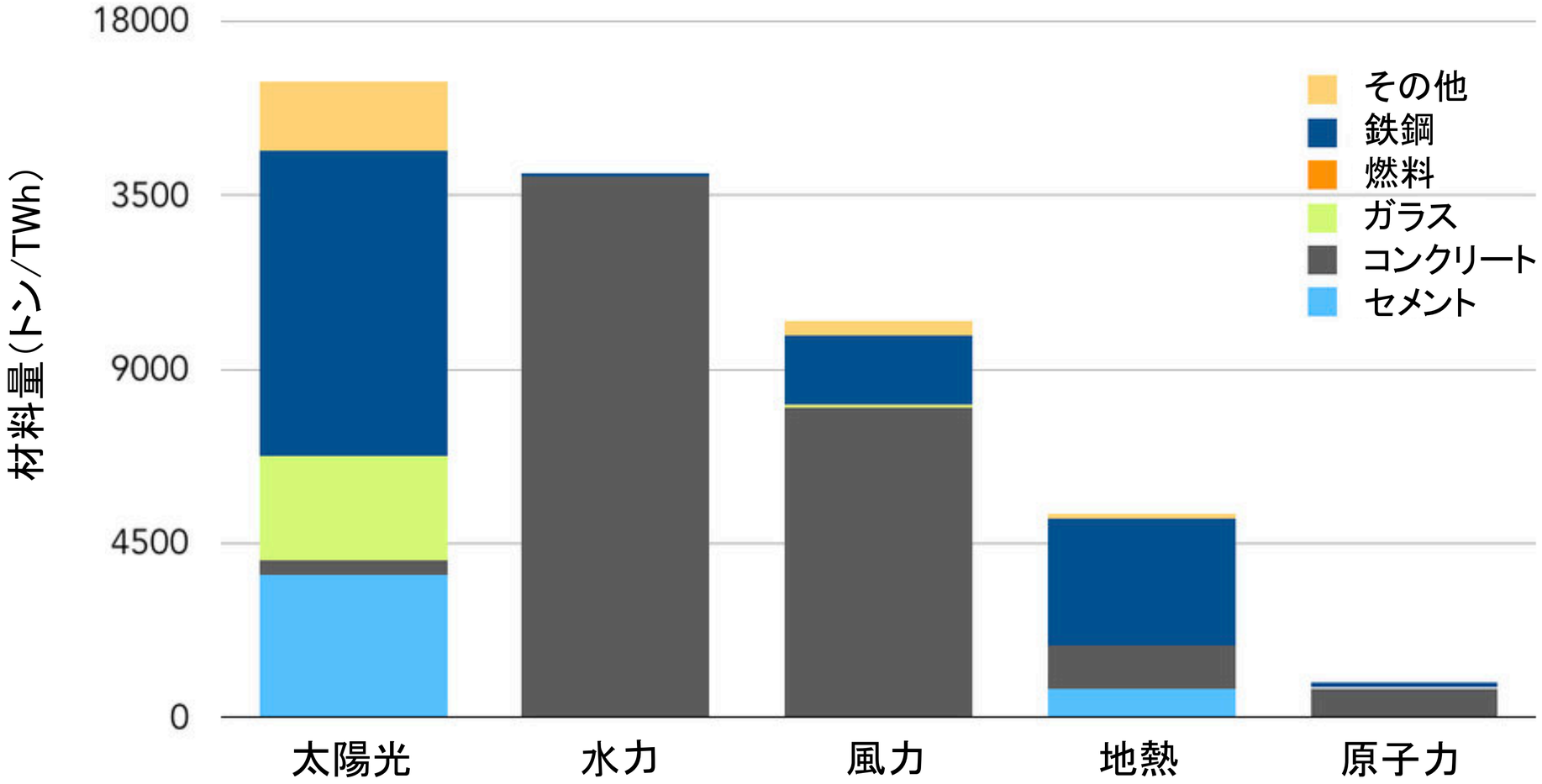


ENVIRONMENTAL PROGRESS

Source: McDonald, R. I., Fargione, J., Kiesecker, J., Miller, W. M., & Powell, J. (2009). Energy sprawl or energy efficiency: climate policy impacts on natural habitat for the United States of America. PLoS One, 4(8), e6802.

仮訳

エネルギー源による必要な材料量の違い

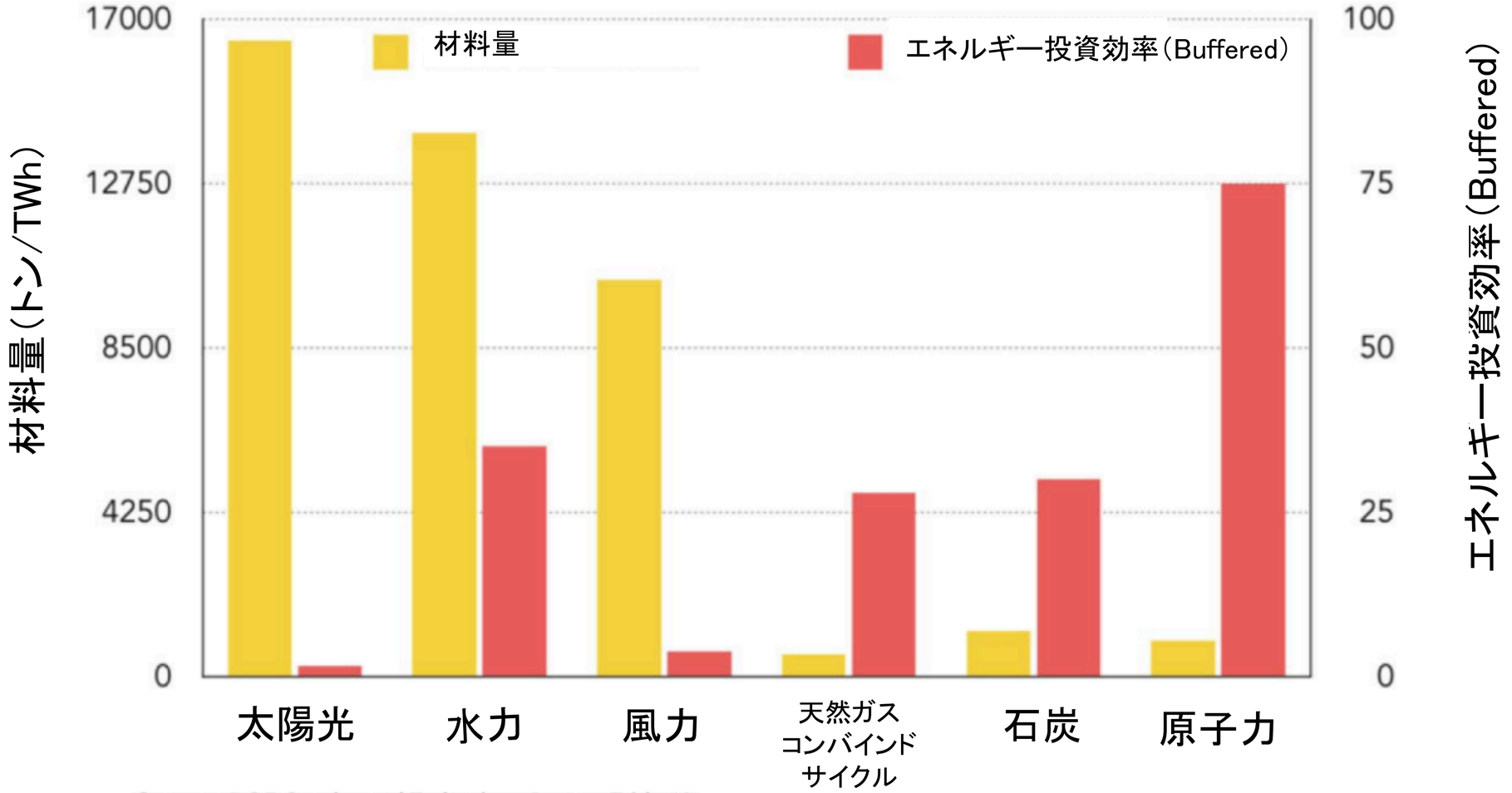


ENVIRONMENTAL PROGRESS

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.

仮訳

エネルギー源による
材料量とエネルギー投資効率の違い

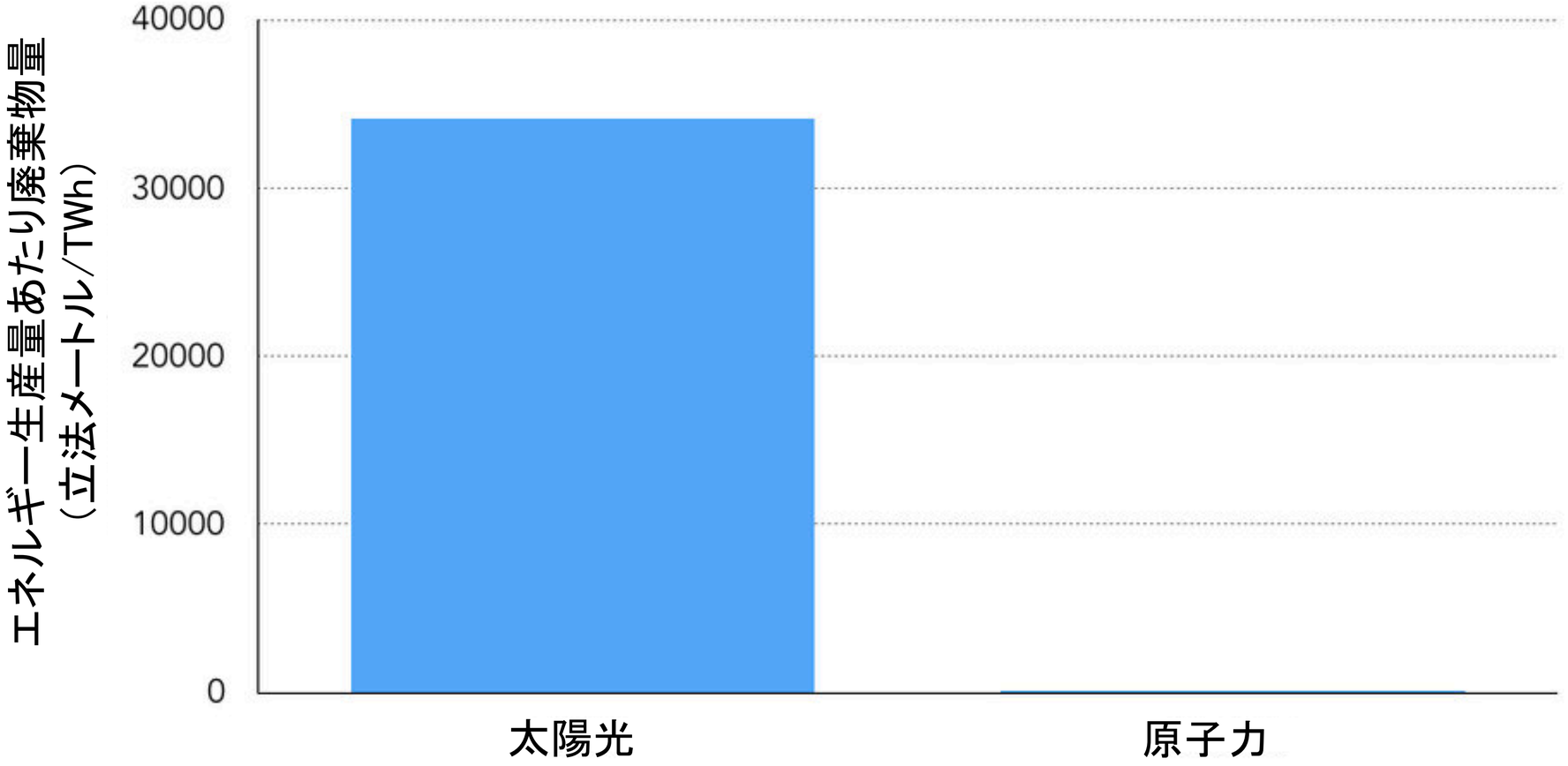


Sources: DOE Quadrennial Technology Review, Table 10.
Murray, R.L. and Holbert, K.E. 2015. Nuclear energy: an introduction to the concepts, systems, and applications of nuclear processes (7th ed.). Elsevier.
Weißbacha, D., Ruprechta, G., Hukea, A., Czerskia, K., Gottlieba, S., & Husseina, A. Energy intensities, EROIs, and energy payback times of electricity generating power plants.

ENVIRONMENTAL PROGRESS

仮訳

同じ量のエネルギーを生み出すとき太陽光パネルは原子炉の300倍以上の廃棄物を生む



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

ENVIRONMENTAL PROGRESS

仮訳

仮訳

コストの低さ、クリーンさで
原子力を代替できるエネルギー源があるのか

- CCSを利用すれば、石炭や天然ガスを単独で利用する場合に比べ、コストは必ず高くなる
- 国際連系線もコストが高く、エネルギーセキュリティも低下する
- ジオエンジニアリングは問題解決にならず、新たな問題を生む

ENVIRONMENTAL PROGRESS

仮訳

チェルノブイリ

- 28人が急性放射線症候群で死亡
- 15人が25年で甲状腺がんで死亡
- 甲状腺がんでの死亡率は全体の１％と予測
- 16,000人を超える甲状腺がん患者が見込まれるうち、死亡者は160人
- 生殖能力、奇形児率、乳児死亡率への影響はない
- 有害な妊娠や出産について、結論は出ていない
- 遺伝的影響は見られず、当時の線量では考えにくい
- 事故処理作業員を含め、他のどのようながんの増加も証明されていない

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

仮訳

福島

- 放射線による死者はなし
- パニックや避難、ストレスから1500人以上が死亡
- 津波によって15,000人以上が死亡
- 甲状腺がんの増加は全く見込まれない模様
- 有害な妊娠影響もなし

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

仮訳

大都市での生活は
チェルノブイリ事故以上に死亡リスクが増加

大都市 vs 田舎の生活	**2.8%**
受動喫煙	**1.7%**
250mSvの被爆 (チェルノブイリ事故処理作業員)	**1.0%**
100mSvの被爆 (チェルノブイリ事故処理作業員)	**0.4%**

Source: Smith J BMC Pubic Health 2007 7:49

仮訳

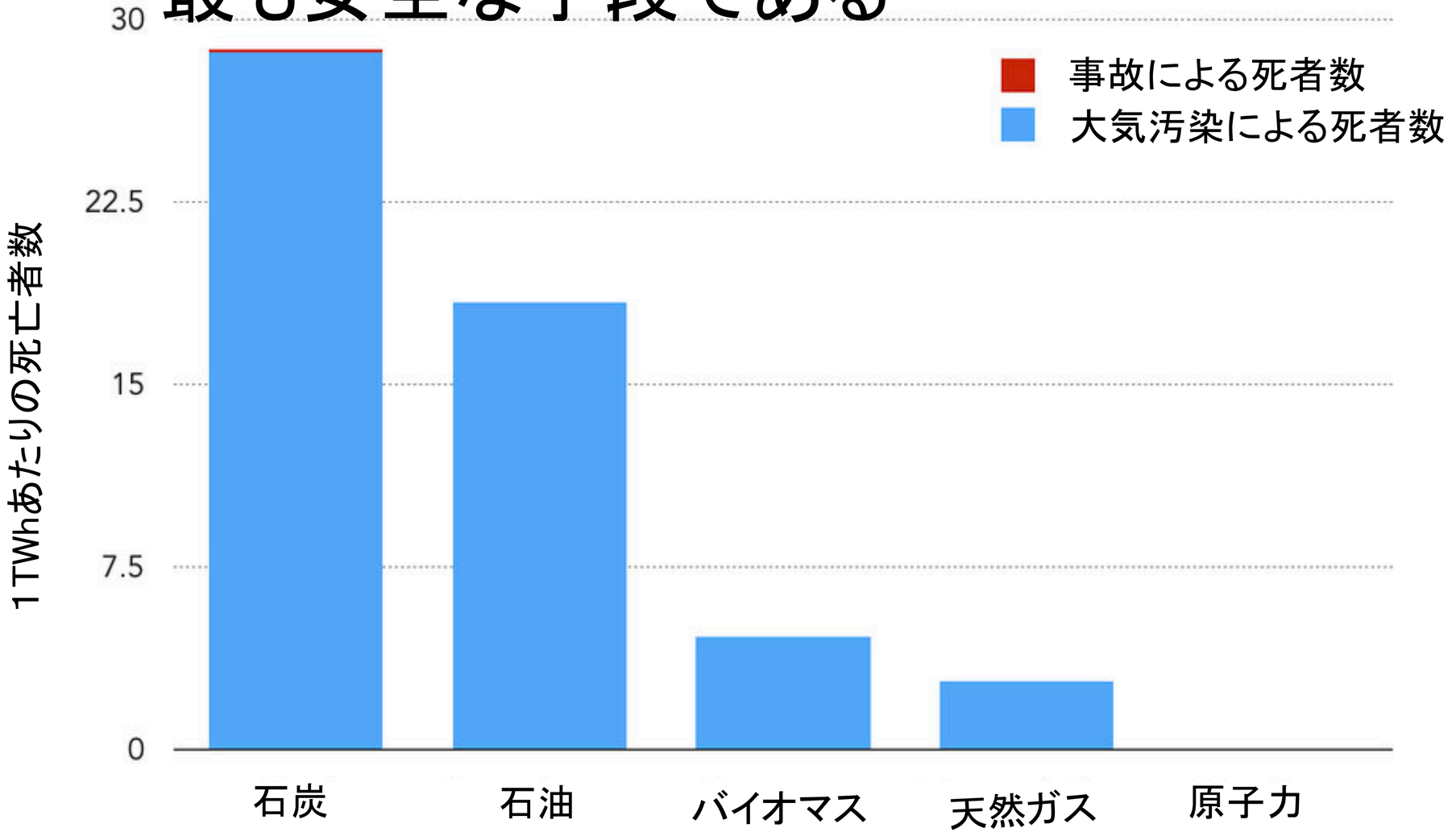
大気汚染が原因で
毎年700万人が
亡くなっている

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

ENVIRONMENTAL PROGRESS

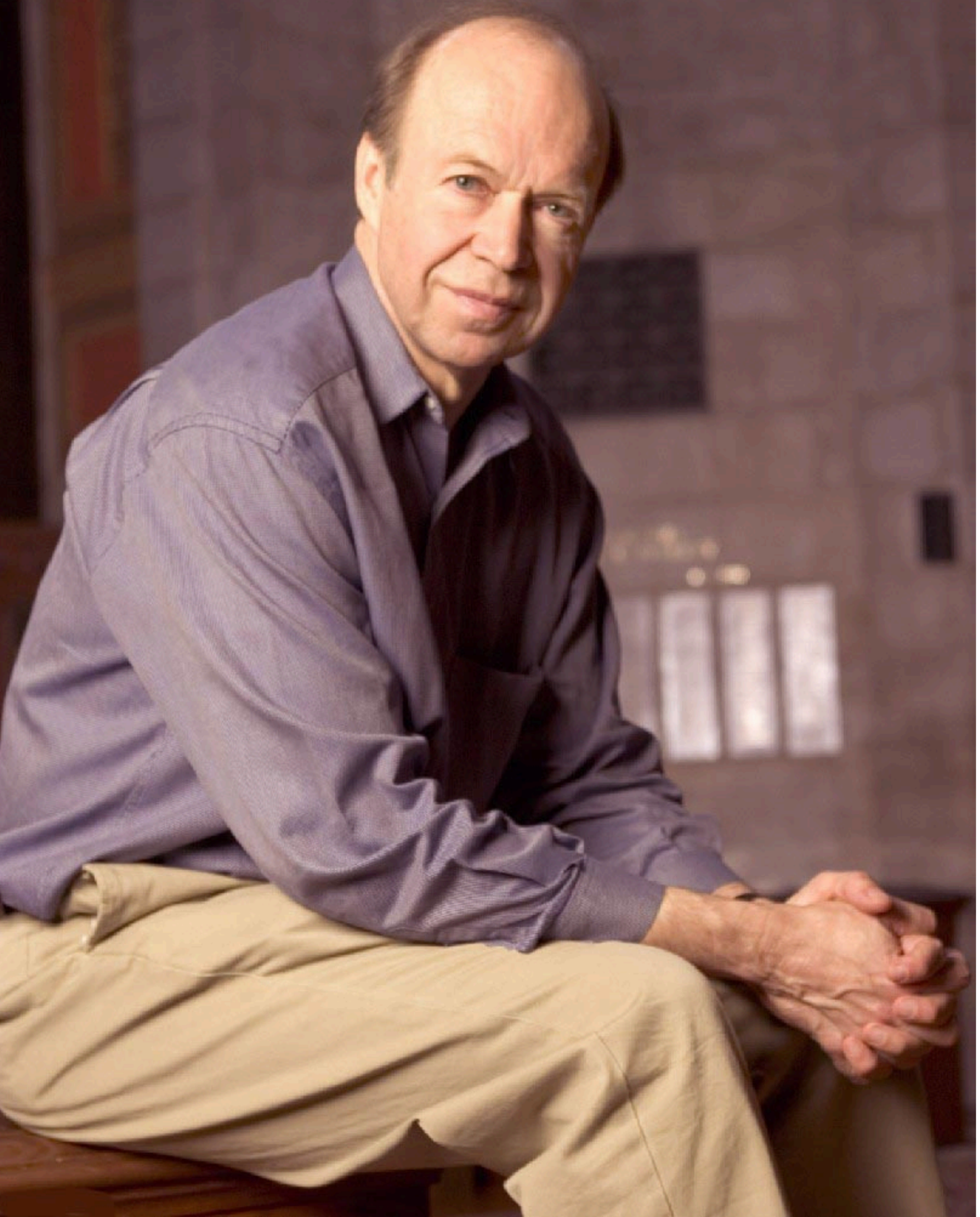
仮訳

原子力は既に、信頼性ある電気を生み出す最も安全な手段である



ENVIRONMENTAL PROGRESS

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



仮訳

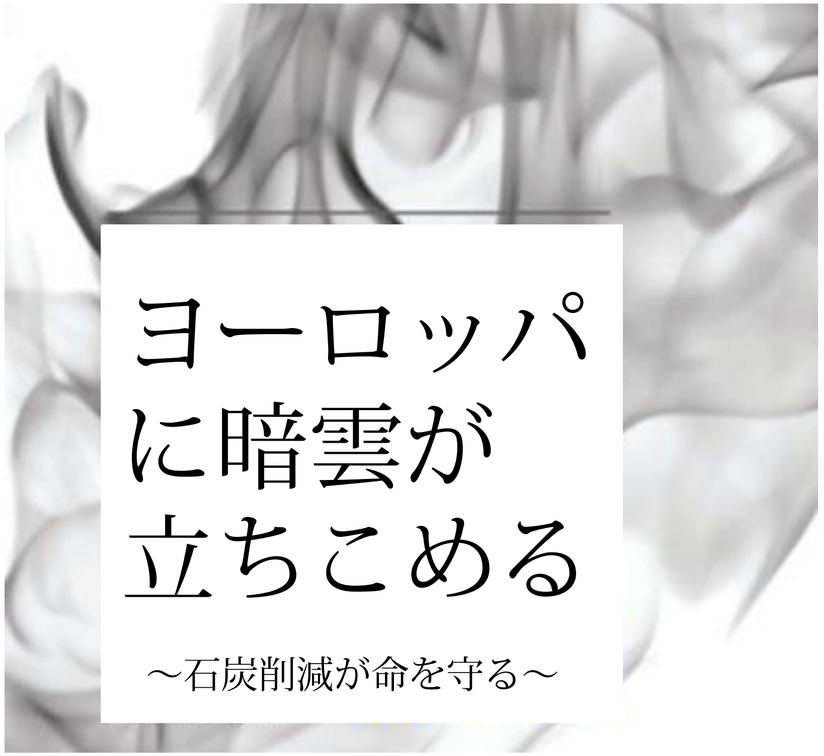
原子力発電は、
化石燃料の代替として
１８０万人の命を救ってきた。

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

仮訳

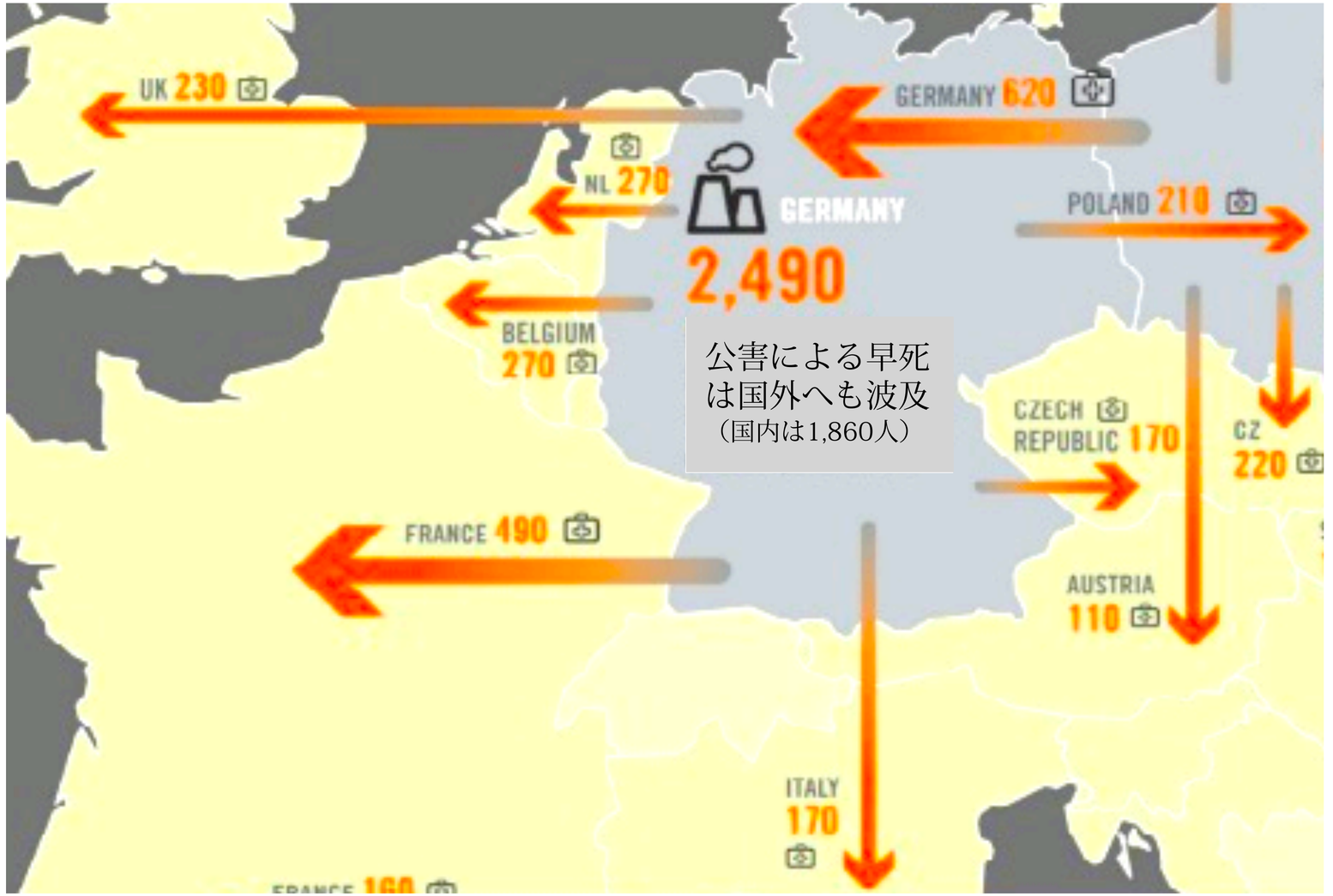
ドイツの石炭公害により、年間2,490人が亡くなる。

WWF



ヨーロッパに暗雲が立ちこめる

～石炭削減が命を守る～



仮訳

仮訳

仮訳

事故から６年目を迎えた福島

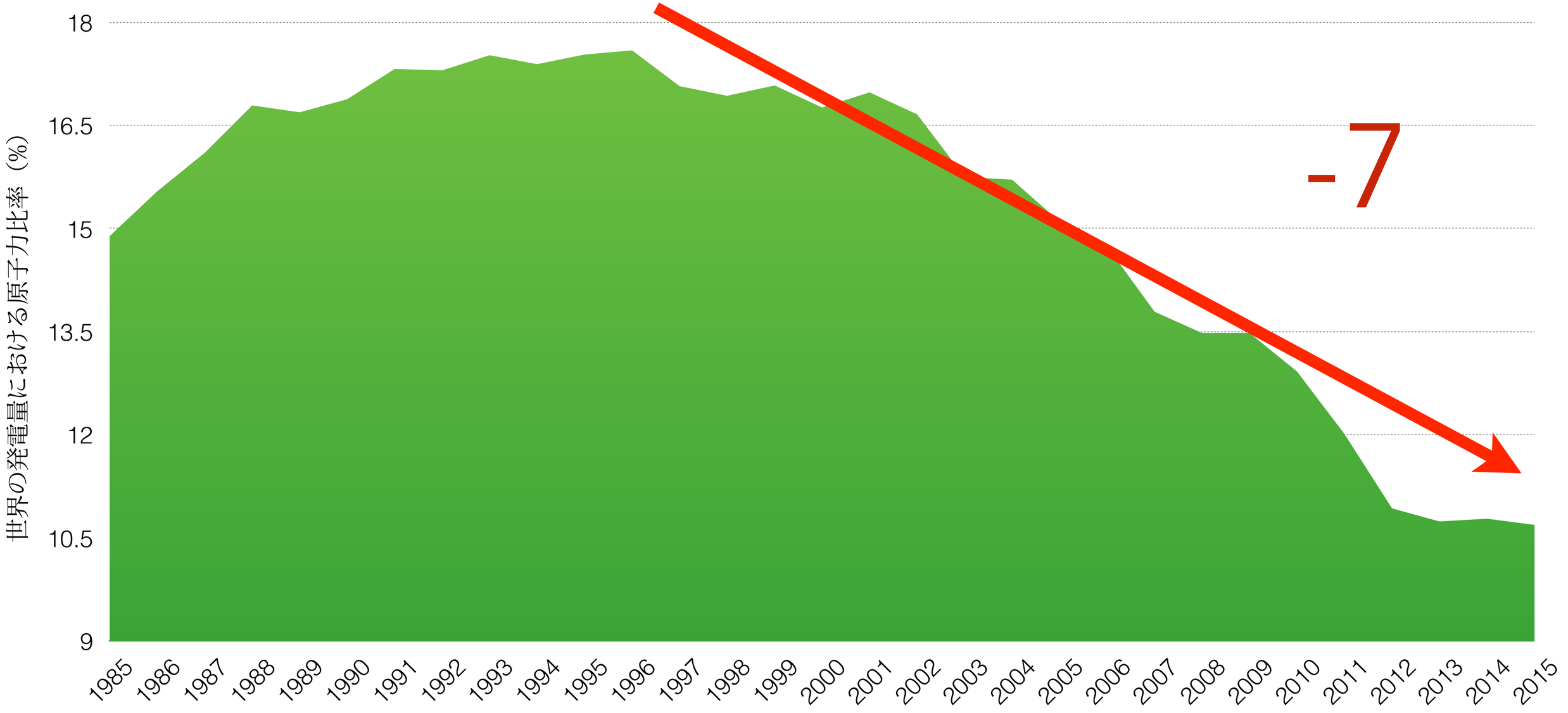
福島事故の恐怖は、
国際的に影響を及ぼしている
（例：ドイツ、台湾、韓国）

気候変動と環境にとって
原子力の国民の理解は重要な問題

除染やトリチウム水の貯留が、
人々に不合理な恐怖を与えた

仮訳

原子力発電の比率は減少

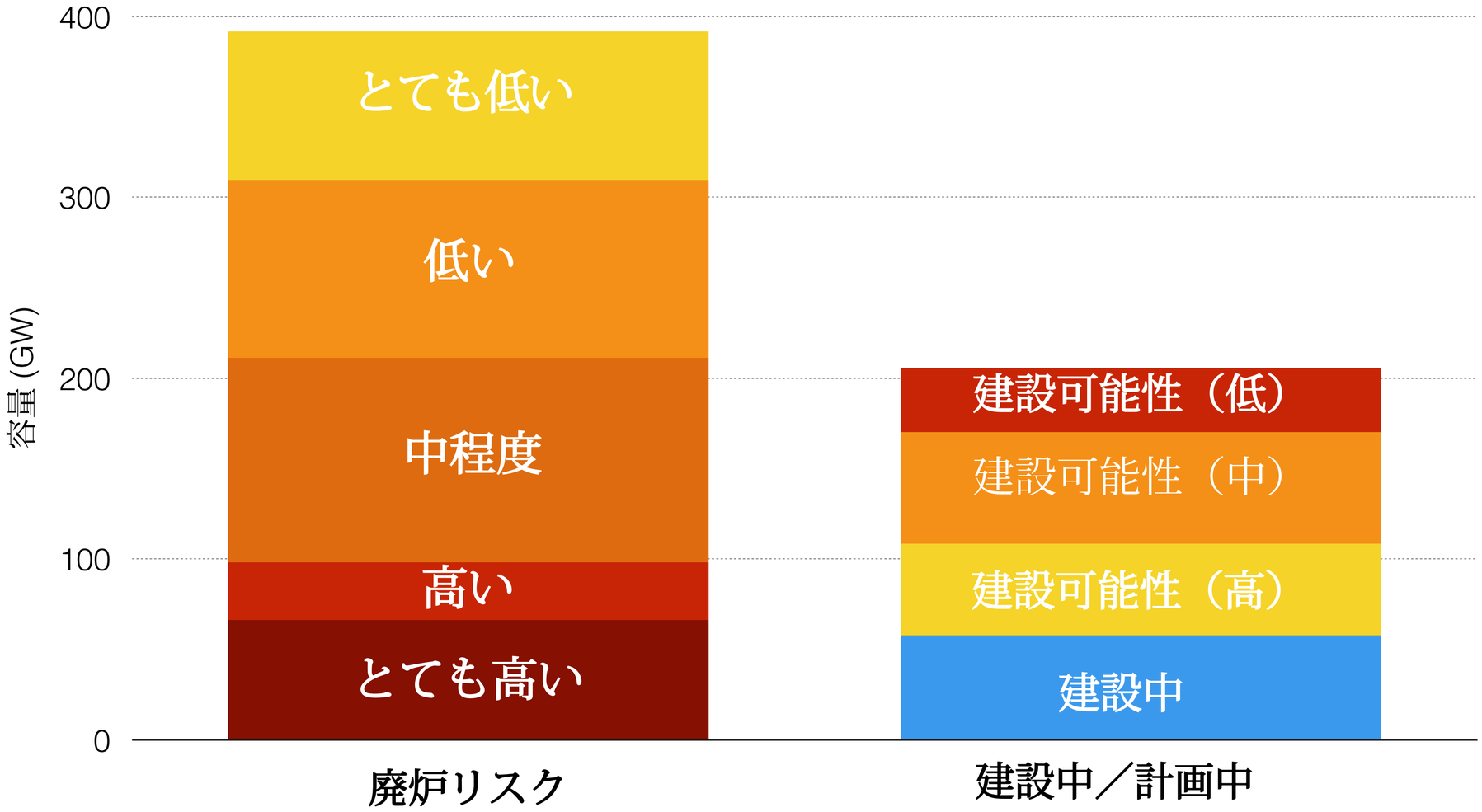


ENVIRONMENTAL PROGRESS

Source: BP Statistical Review of World Energy, 2015

2030年までに、建設中・計画中の容量の2倍以上の原子力発電所が閉鎖する可能性もある

仮訳



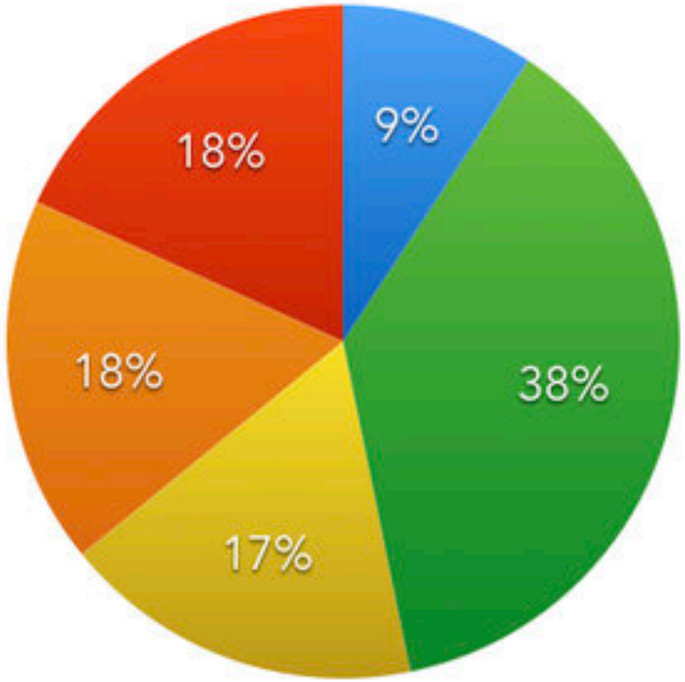
Source & Methods: EP Energy Progress Assessment, 2017. Plant-specific rankings based on economic and energy trend analysis, political and societal assessment, and expert elicitations. Longer methodology discussion can be found at environmentalprogress.org/research Last updated March 2, 2017. Email info@environmentalprogress.org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

ENVIRONMENTAL PROGRESS

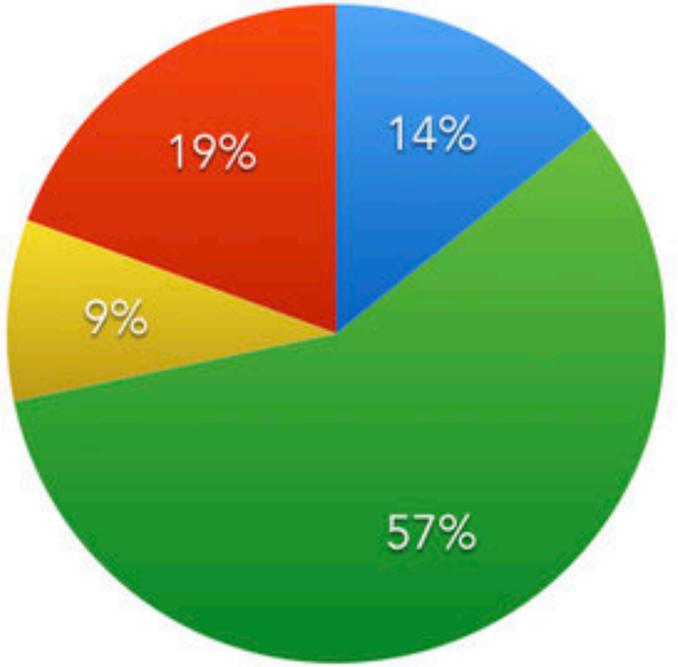
仮訳

世界の原子力輸出市場のシェア（容量）

2030年までに
計画されているプロジェクト



2030年までに
完成する可能性が高い又はその
可能性があるプロジェクト



中国　ロシア　フランス　日本　その他

ENVIRONMENTAL PROGRESS

Source: EP Energy Progress Tracker, 2017.

仮訳

仮訳

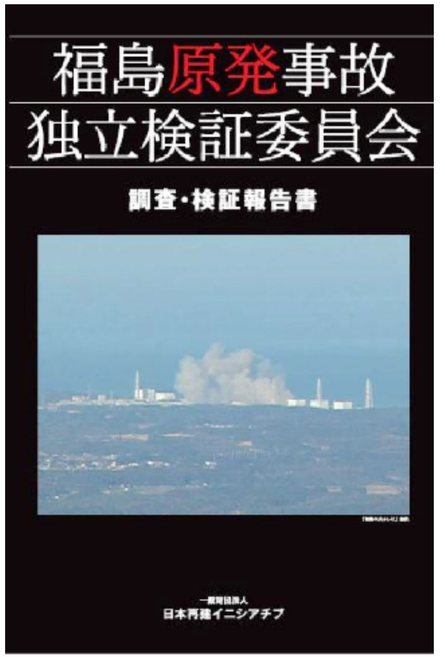
福島の事故から６年目を迎えて

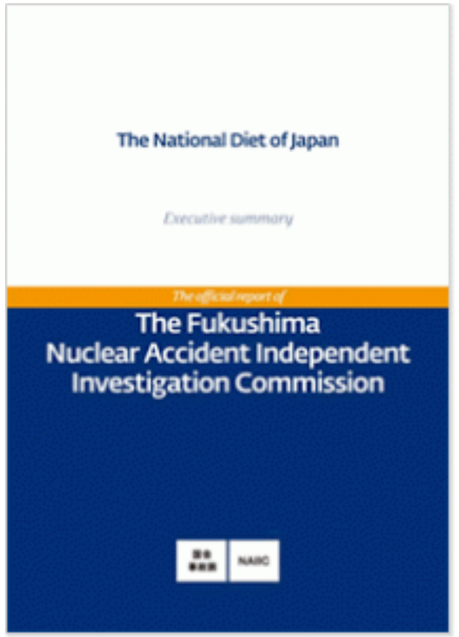
日本は原子力事故に遭わないという過信

完全に不足した事故への備え

事故への備えが不足した原子力発電所の
近隣に住む人々の恐怖

福島事故以前の啓蒙活動は、
事故の回避に焦点
（自然放射線などの無害性ではなく）





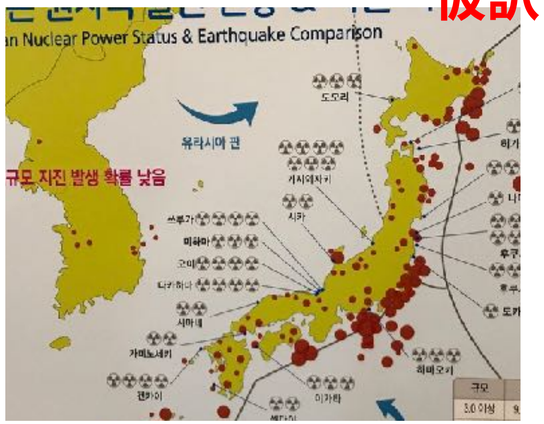
原子力安全の神話

仮訳

信じられていたこと：

- "放射線 = 超強力な毒素" (放射線恐怖症)
- "政府は事故から我々を守ってくれる" (パターナリズム)
- "我々は、事故を起こした他国とは違う" (傲慢)

ひとたび事故が発生すると、国民は信任しなくなり、パニックが生じる。



新古里原発の展示（韓国）

アリス館志賀の原子力展示

仮訳

福島　"エリートパニック"

エリートパニック = 政府高官や産業界のトップが、国民の混乱を恐れて判断を誤ってしまうこと

例: 菅首相の指揮系統への干渉

一般国民向け啓蒙活動の失敗

–> 放射線に対する迷信に基づく恐怖

–>　国民の混乱

船橋　洋一、「Tesimony」、日本再建イニシアティブ

仮訳

福島における「モラル・パニック」

モラル・パニック =社会秩序への脅威とみなされたグループに対して発せられる、多数の人々による激しい感情

福島での反応は、人々が以前から持っていた原子力村に対する憤慨の出現。

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

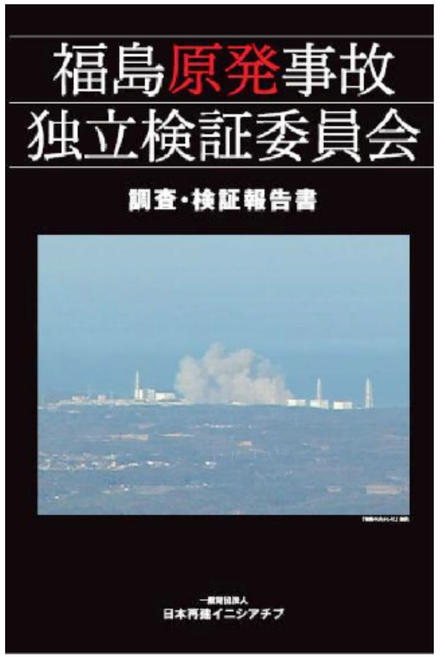
仮訳

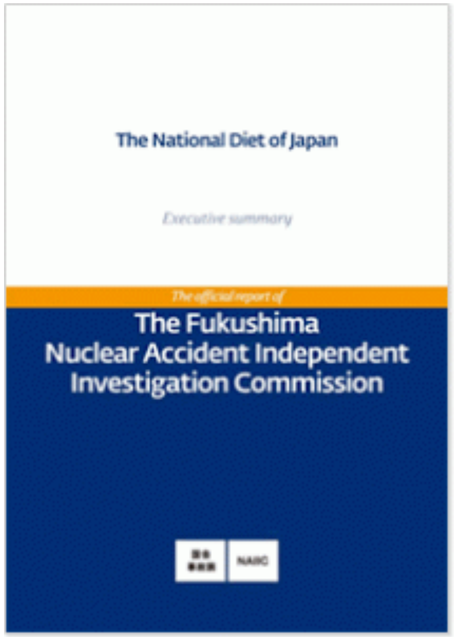
組織文化の変革

”組織文化”変革の必要性
　— “組織”でも “文化”でもない

日本とフクシマの新たなストーリーの必要性

世代交代
　— 組織内における若手リーダーの権限強化





仮訳

仮訳

仮訳

自分: ディアブロ・キャニオン
原発についてどう思う？

ウーディ: 素晴らしいプラントだ。

自分：なぜ、そう言える？

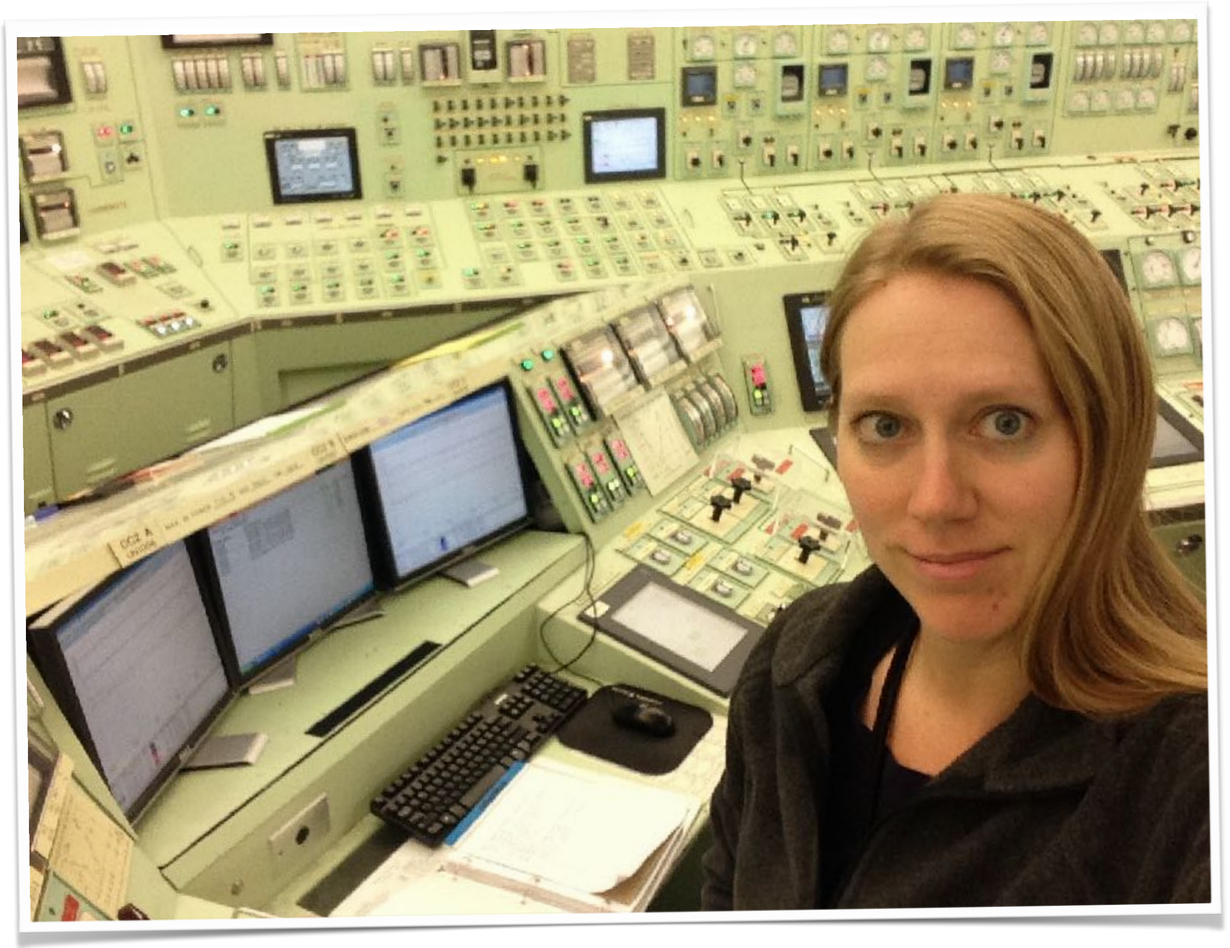
ウーディ: そこで働く人たち
がきちんとケアしているから。

ウーディ・エプステイン
原子力リスクアナリスト

ENVIRONMENTAL PROGRESS

仮訳

ヘーザー・マテソン



母であり、環境活動家であり、原子炉オペレーター

ENVIRONMENTAL PROGRESS

仮訳

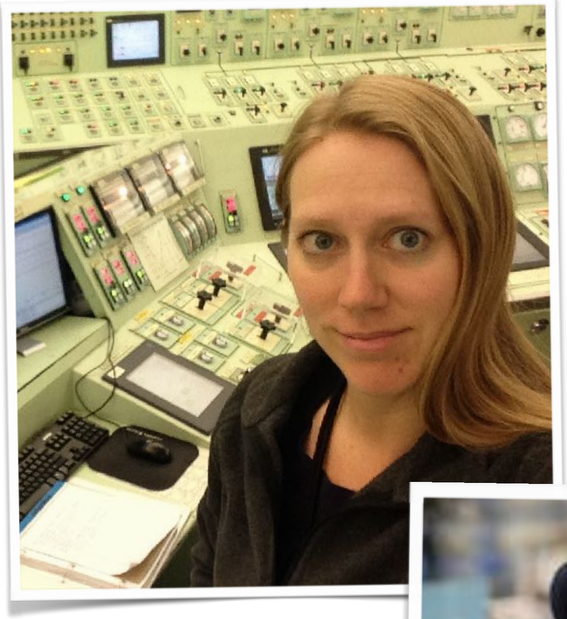
ディアブロ・キャニオン原発の格納容器を検査中。コンディションは良好。

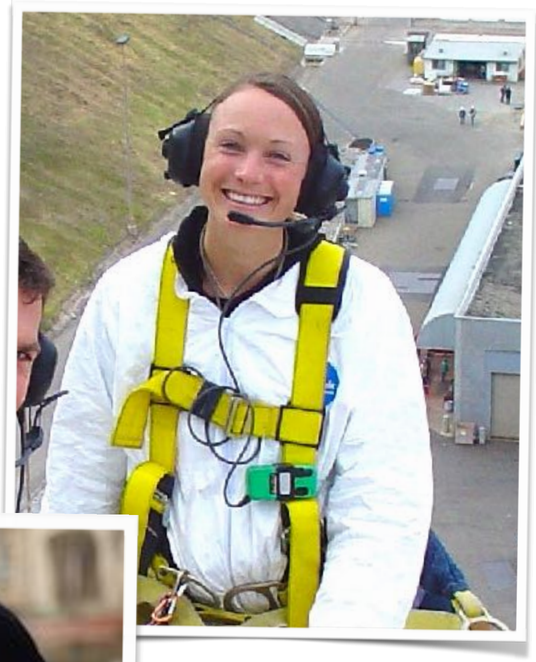
Inspecting the Diablo Canyon containment dome. It is in excellent condition.

ENVIRONMENTAL PROGRESS

仮訳

~~何~~が、誰が、原発を安全にするか。





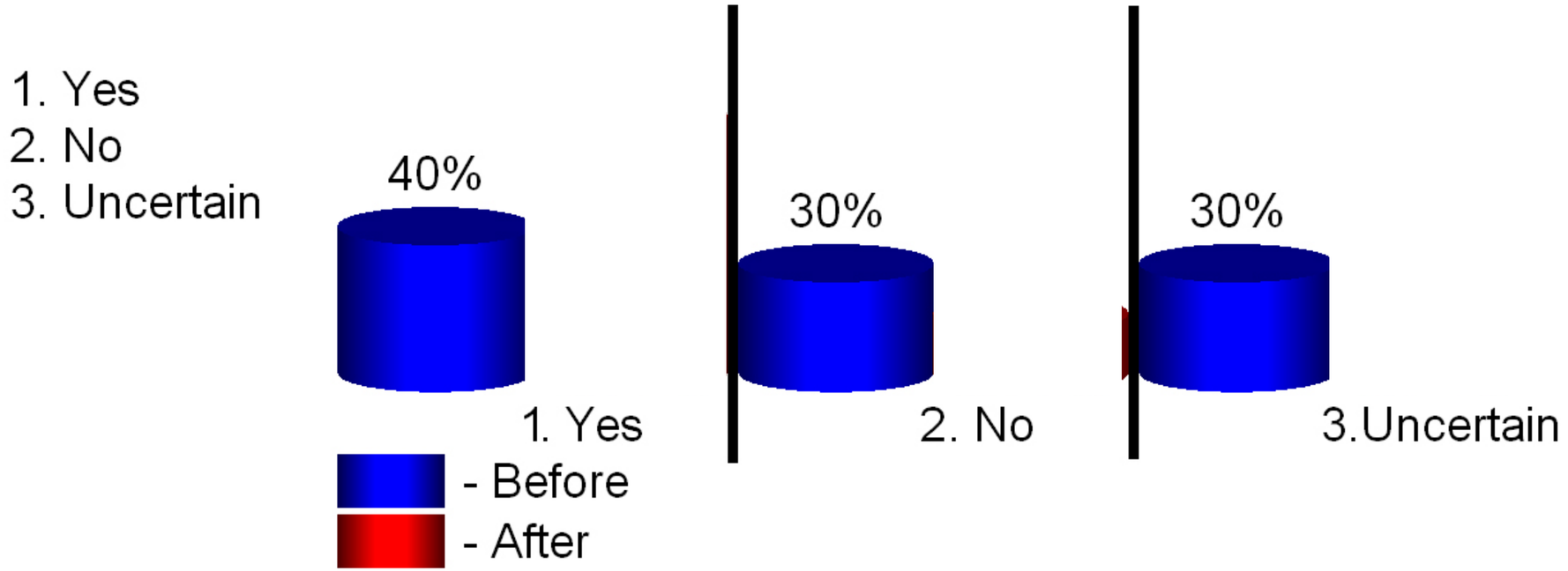
ENVIRONMENTAL PROGRESS

仮訳

仮訳

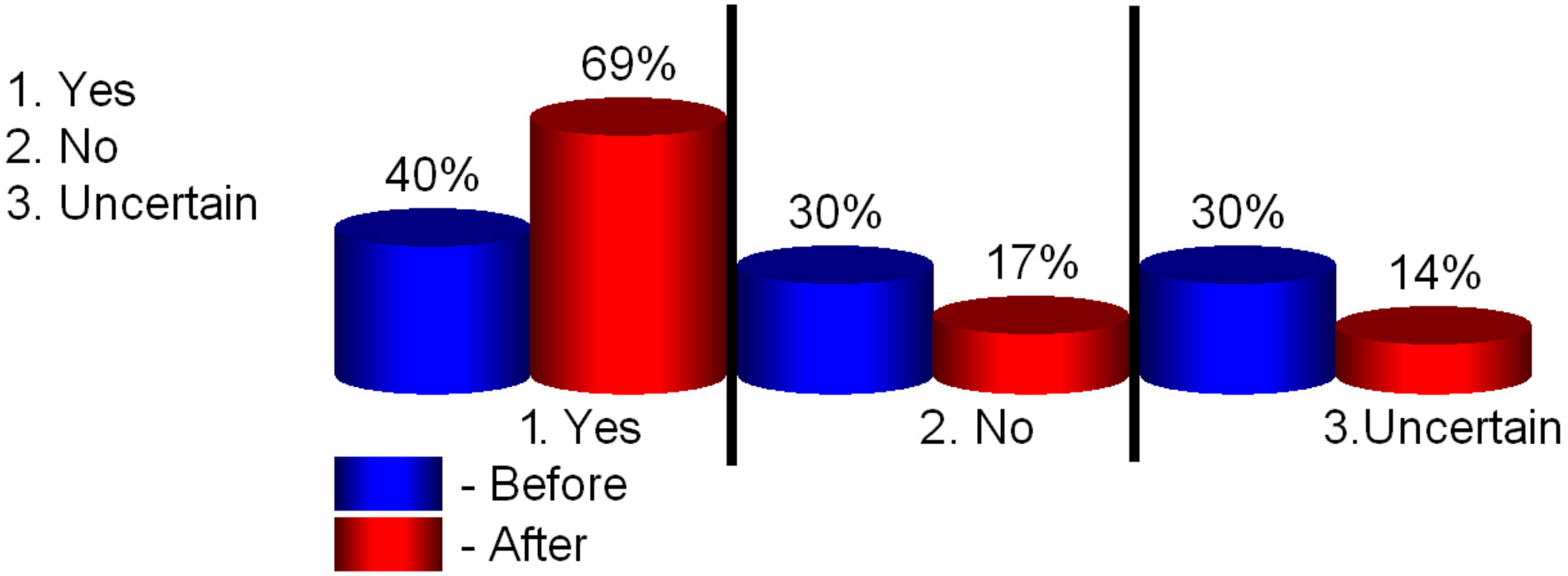
私がインタビューを受ける前の投票調査では・・・

原発は、世界が直面する環境問題への打開策と考えるか？



仮訳

私がインタビューを受けた後、再度投票調査をしてみると・・・
原発は、世界が直面する環境問題への打開策と考えるか？



ENVIRONMENTAL PROGRESS

The High Cost of Fear

공포의 값비싼 대가

한국 탈원전 정책의 원인과
초래하게될 경제적, 환경적 영향의 이해

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

August 2017

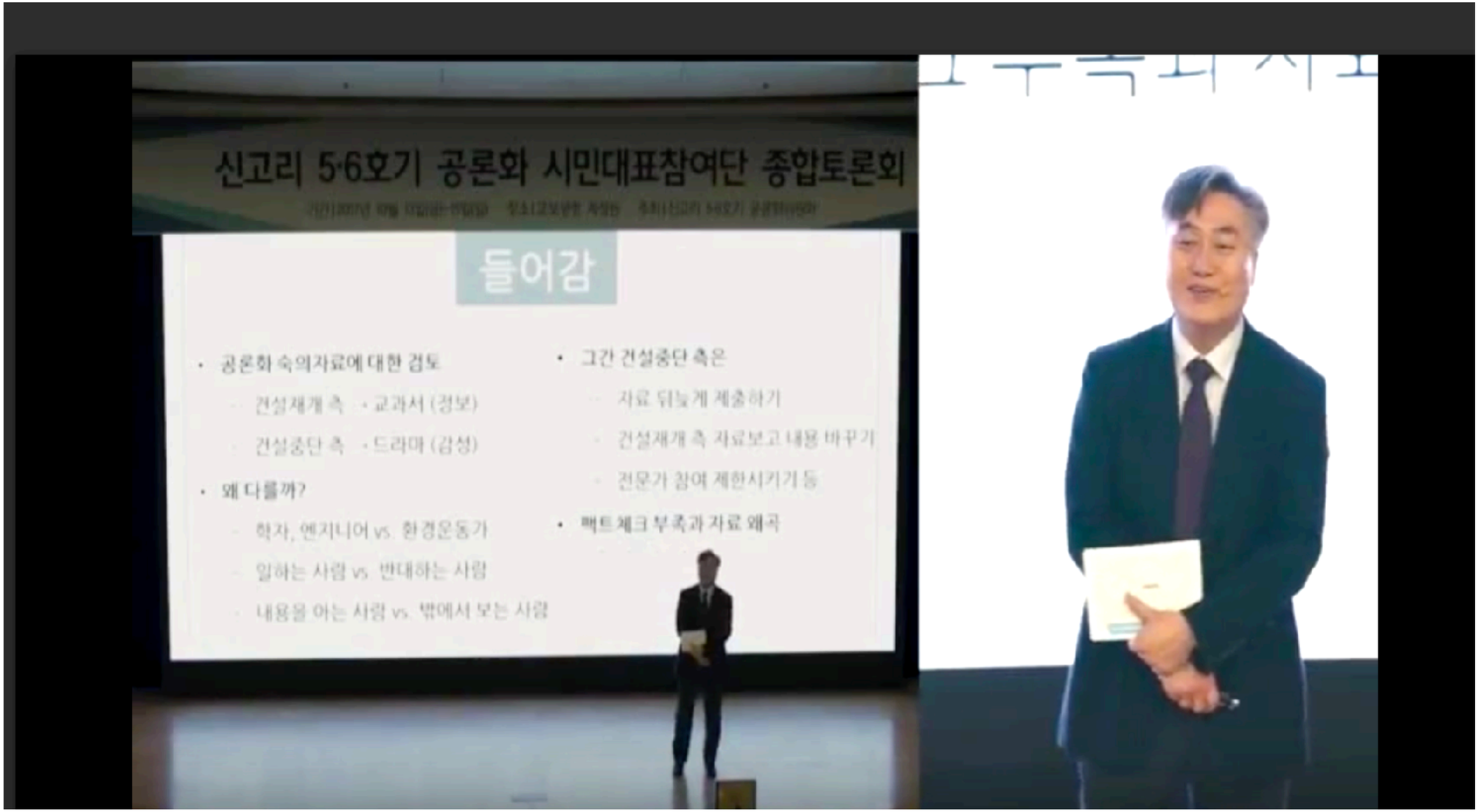
ENVIRONMENTAL
PROGRESS
NATURE AND PROSPERITY FOR ALL

仮訳

…건가… 원전 포기는 비현실적"

仮訳

韓国のチャン・ブンジン教授は、韓国の市民参与団を説得。

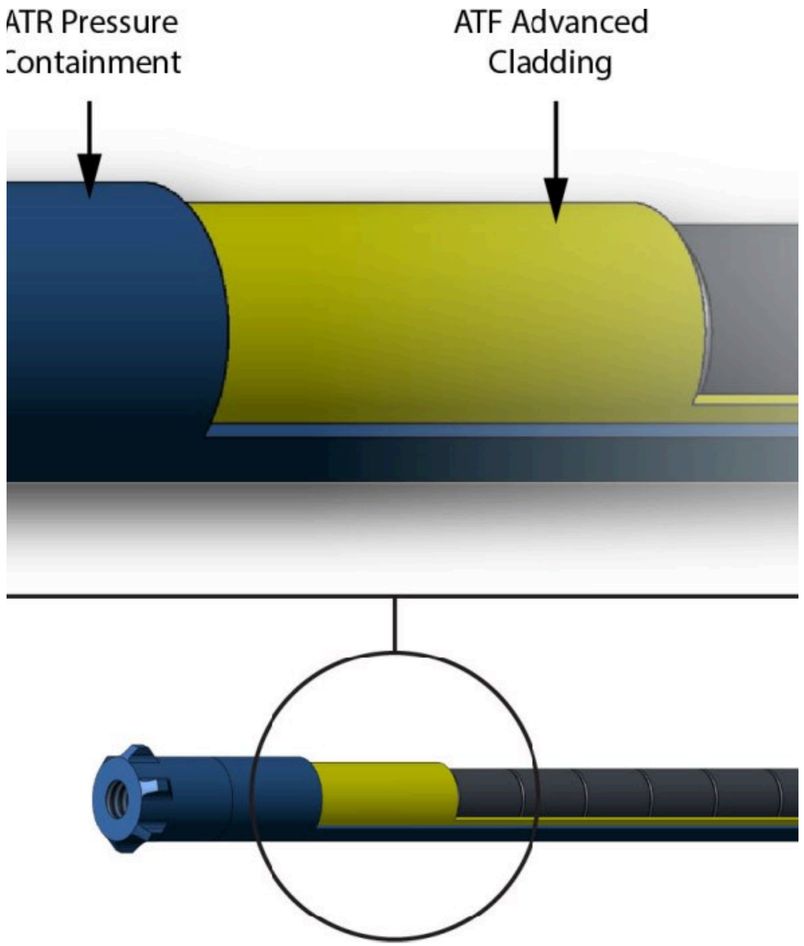


ENVIRONMENTAL PROGRESS

仮訳

事故耐性燃料

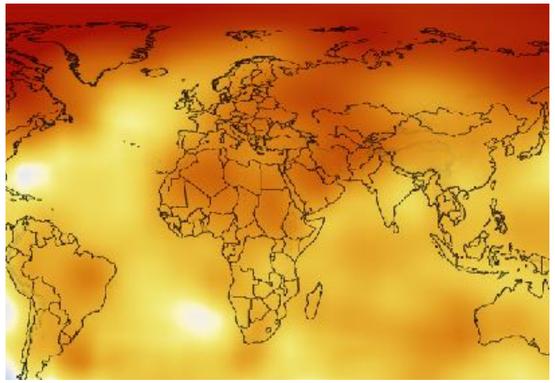
- 冷却材喪失後も、～８時間程度メルトダウンを遅らせることが可能
- 水素爆発回避が可能となる
- 現在の第2世代原子炉（軽水炉等）は、第4世代原子炉並みに
- 運転維持費は15％～30％低減
- 米国では今秋・来春に2つの原子炉に装填
- 2020年半ばには米国の全ての原子炉に装填



ENVIRONMENTAL PROGRESS

仮訳

極めて倫理的な手法



原発だけが、
環境保護に貢献しつつ、
全人類を貧困から脱却させる。
世界平和をもたらしながら。

ENVIRONMENTAL PROGRESS