



# 에너지와 환경의 경제 논리와 정치화



경 · 제 · 지 · 식 · 네 · 트 · 워 · 크



이병태

교수

KAIST 경영대학

대표

경제지식네트워크

# Critics blame politics, ideology, and environmental idealism. The reality: greed, corruption, and scandal.

Howard Neilson-Sewell, a Canadian nuclear industry veteran and advisor to the Barakah project. “South Korea was right on the cusp of taking over the world market.” Not anymore.

MIT  
Technology  
Review

Topics Magazine New

Climate Change

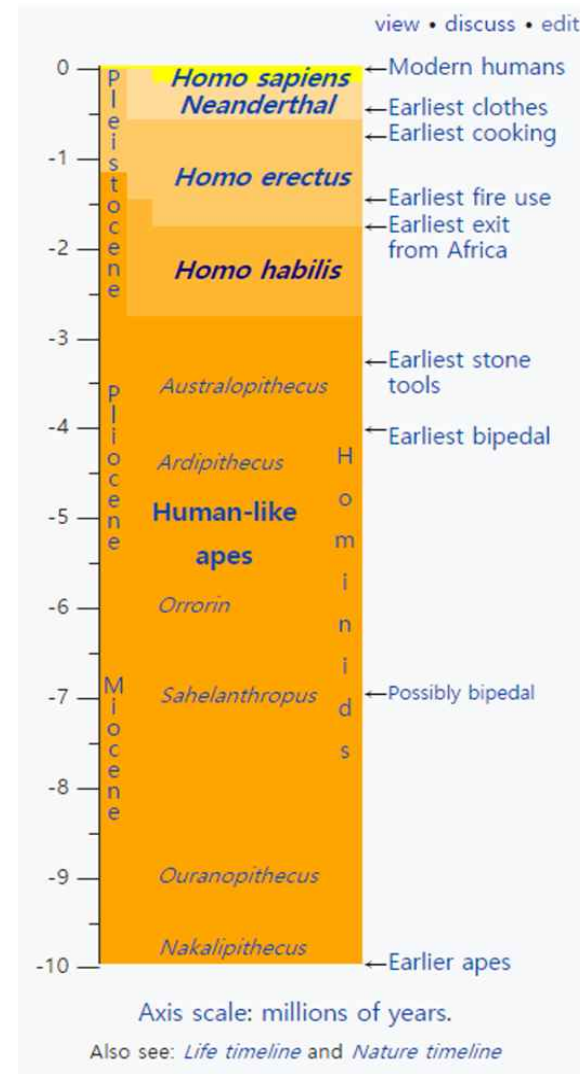
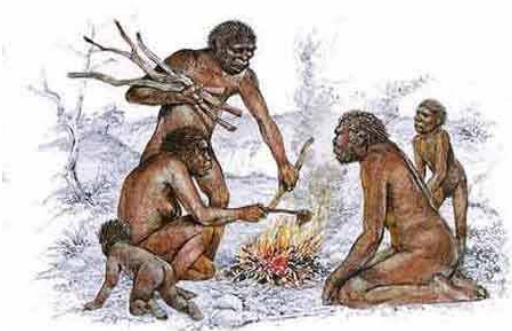
## How greed and corruption blew up South Korea's nuclear industry

Seoul had a solution to the world's energy problems. Then everything went wrong.



# Civilization Ignited by Fire (Energy Technology)

# The Fire that ignited civilization, the gift from Prometh



# The Bigger Brains and Beyond

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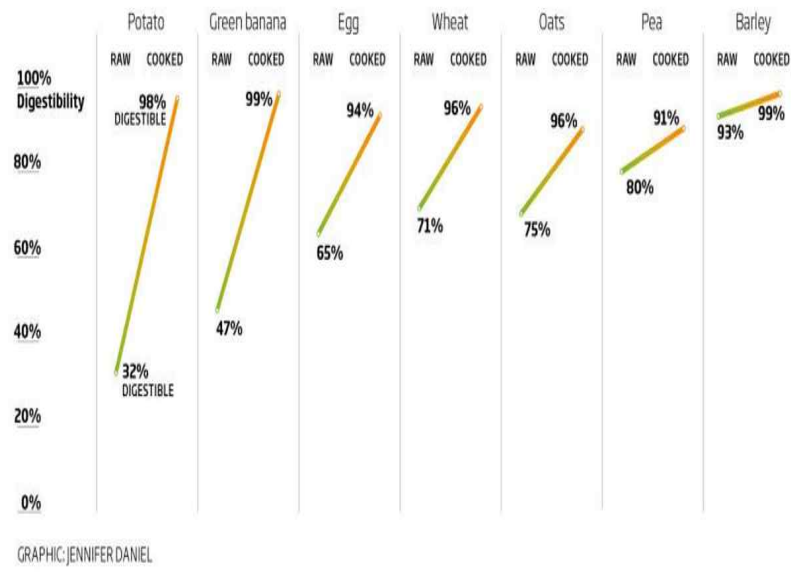
- ▶ Fire: the first General Purpose Technology (GPT)
- ▶ The Most Significant Application of Fire: **Cooking**
  - Broaden food bases dramatically – global presence
  - Cooked food made omnivores & bigger brains (thinking animals)



# Advantages of Cooking

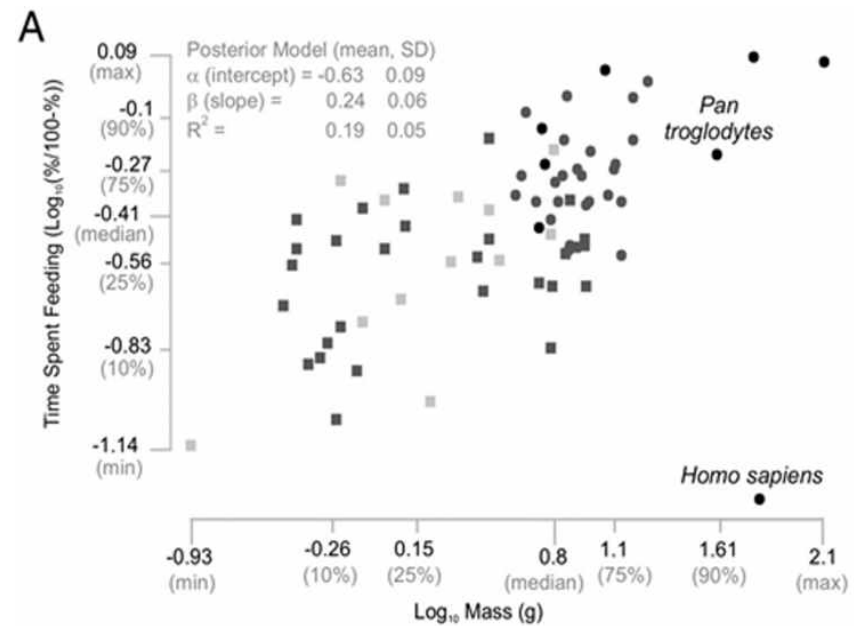
## Get stuffed

Cooked food is easier to digest and extract calories from, which was probably an important factor in human evolution after our ancestors invented cooking about a million years ago.

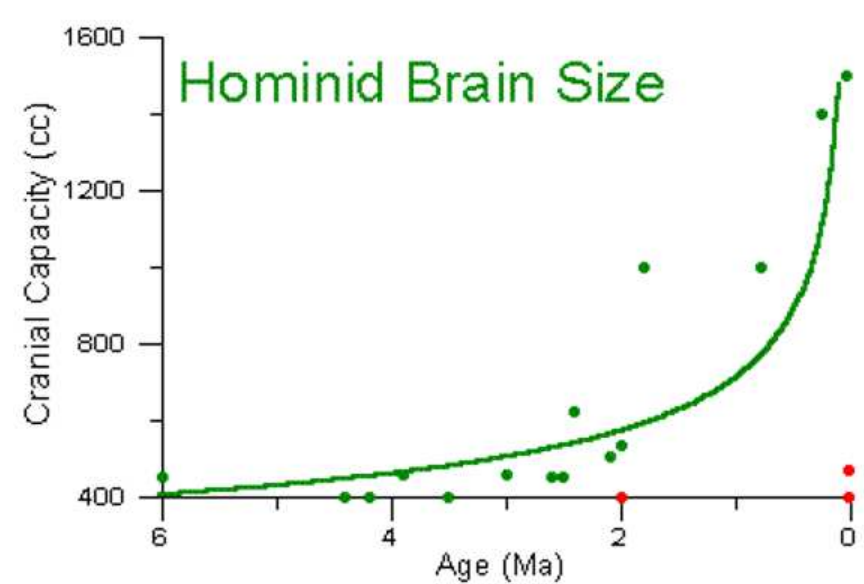
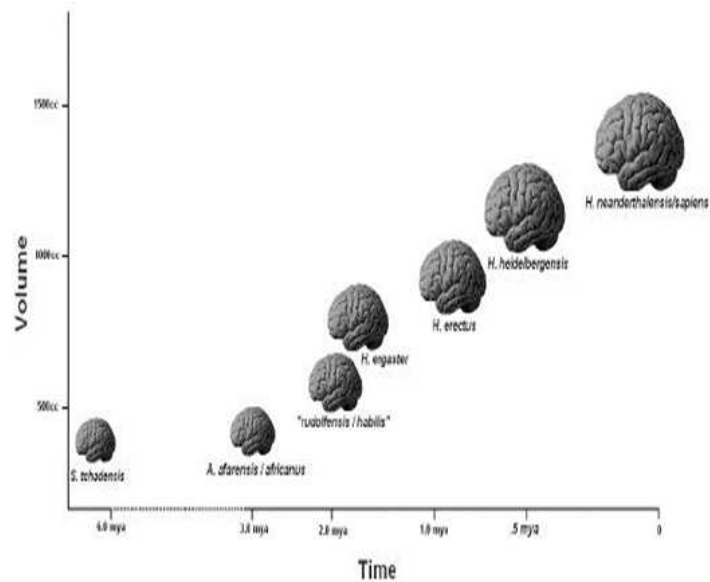


유인원들의 체중 대비 식사시간

침팬지들은 활동시간의 48%를 음식을 씹는데 사용하고 있는 반면에 인간은 4.7%



# Bigger Brains

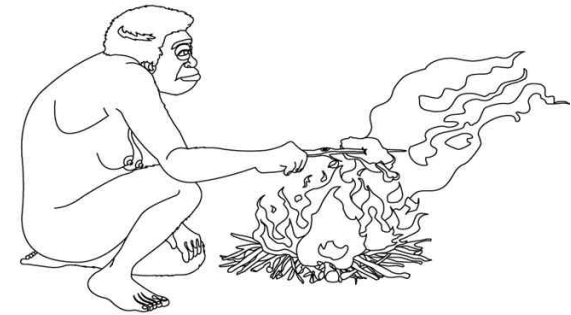


# Version 1 of Wealth System


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## Techno-Physio-Social Co-Evolution in Hunter-gathering

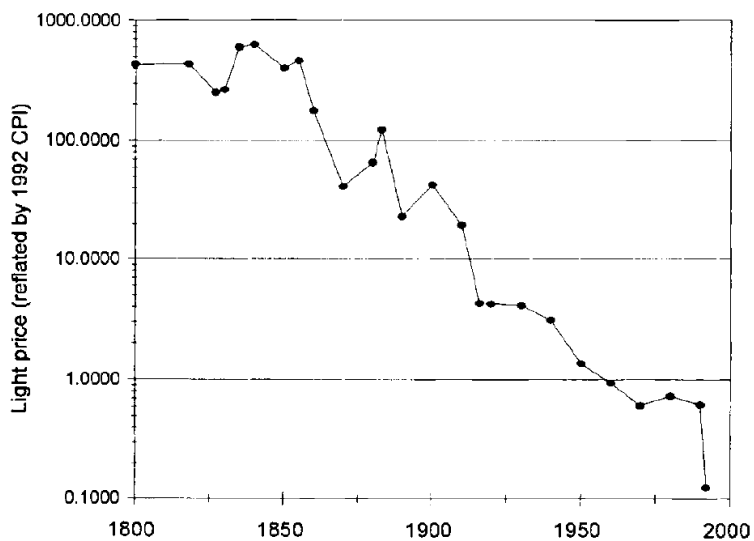
1. Technology: Fire
2. Physiology (Body): Bigger brain
3. Social Systems:
  - ▶ Global Presence (Economic System)
  - ▶ From “Male and Female” to “Husband and Wife”



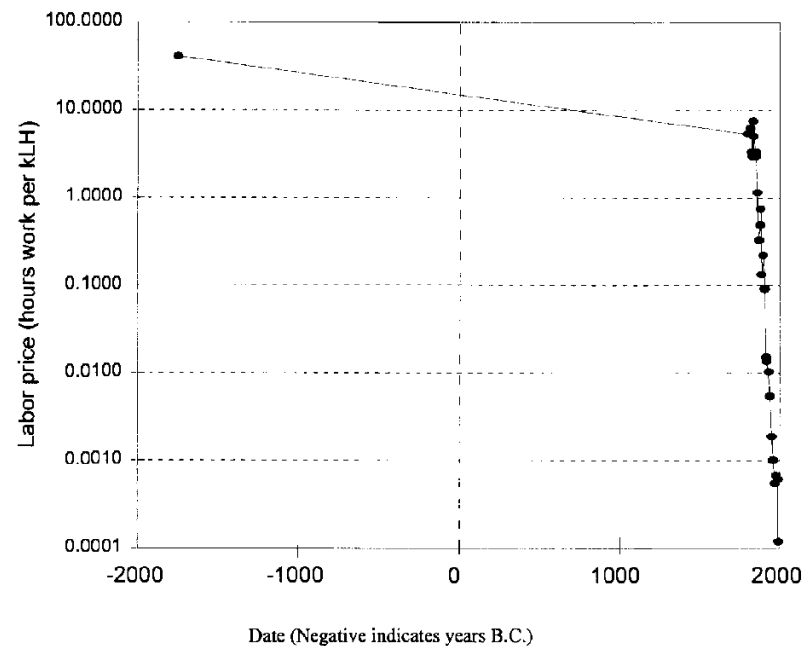
# Energy and Industrial Revolution

Year	1750BC (Babylon)	1800	1880s	1950	Today	Near Future
Light	Sesame Oil lamp 	Tallow candle 	Kerosene lamp 	Incandescent light bulb 	Compact fluorescent bulb 	LED 
Light Intensity (lumen)	24	186	4,400	531,000	84,000,000	84,000,000
Price of Hourly Light (Hrs work)	50 Hours	6 Hours	15 Minutes	8 Seconds	0.5 Second	Less than 0.1 Second

**1,800,000 fold cheaper**



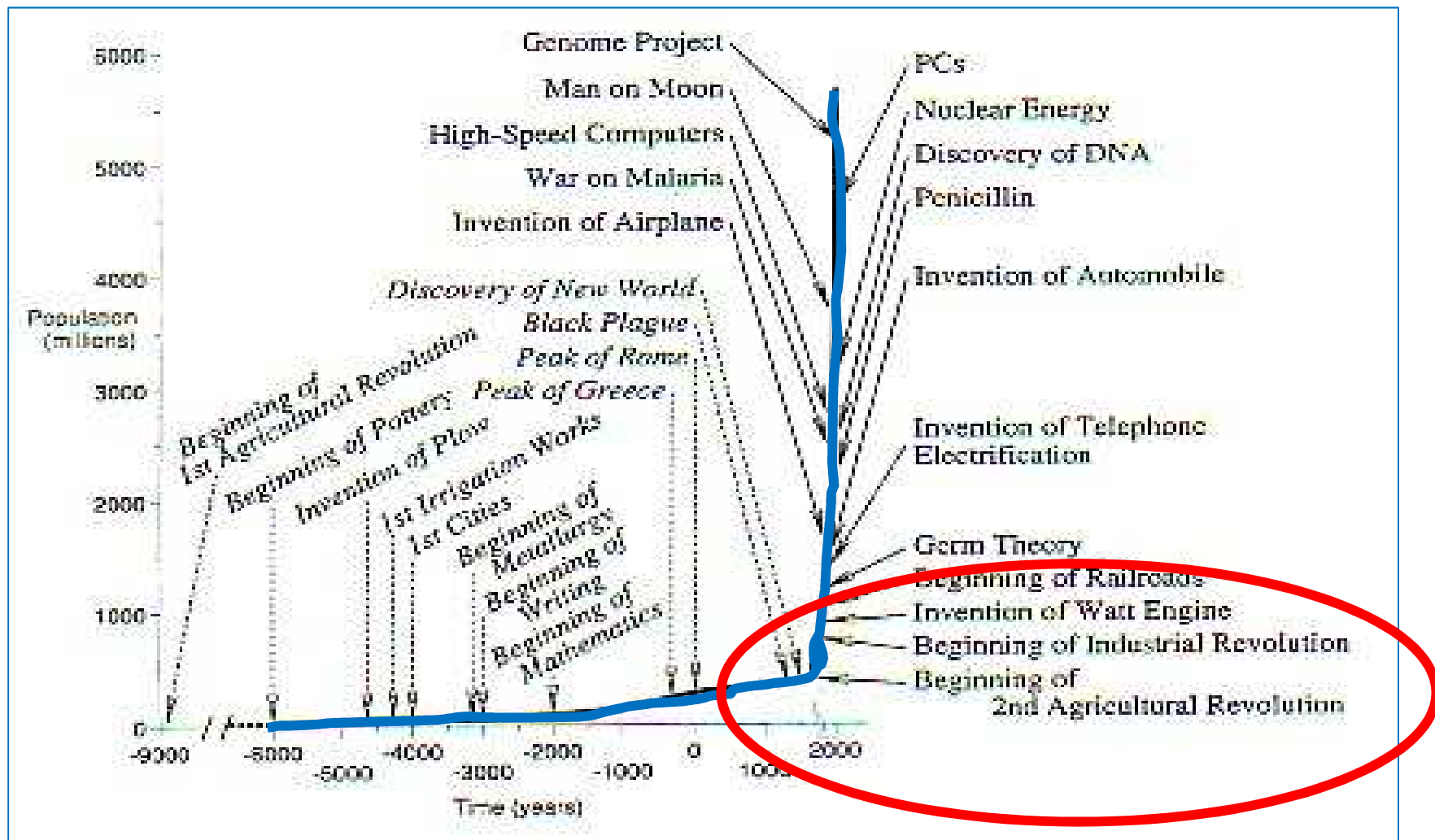
1.3 Deflated price of light (cents per 1,000 lumen-hours)



5 Labor price of light: 1750 B.C. to present

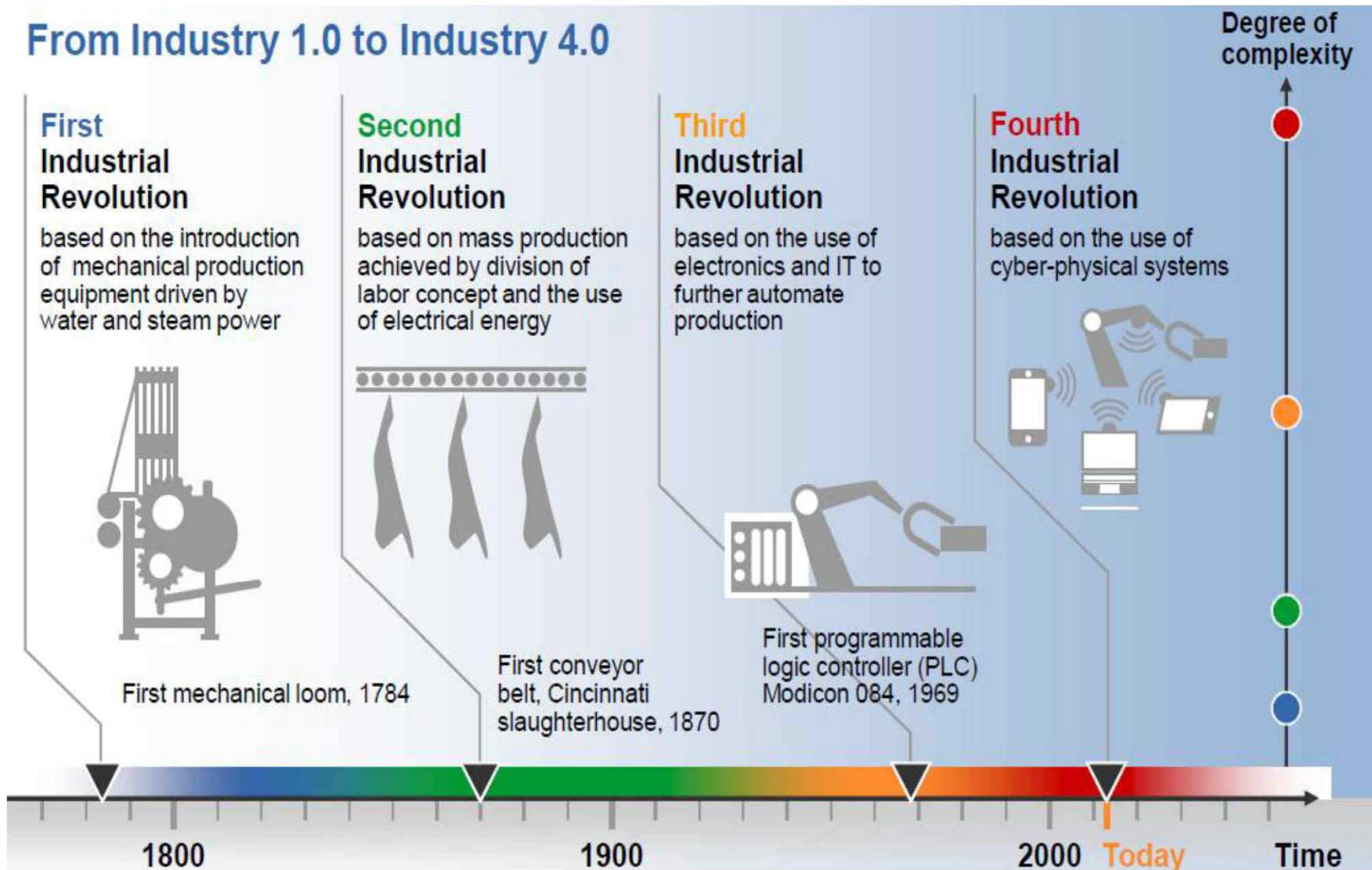
William D. Nordihaus (1996)

# Revolutions in The Big History of Mankind



Source: Fogel, 1999

## From Industry 1.0 to Industry 4.0



Source: DFKI

# Singularity or Tipping Point?

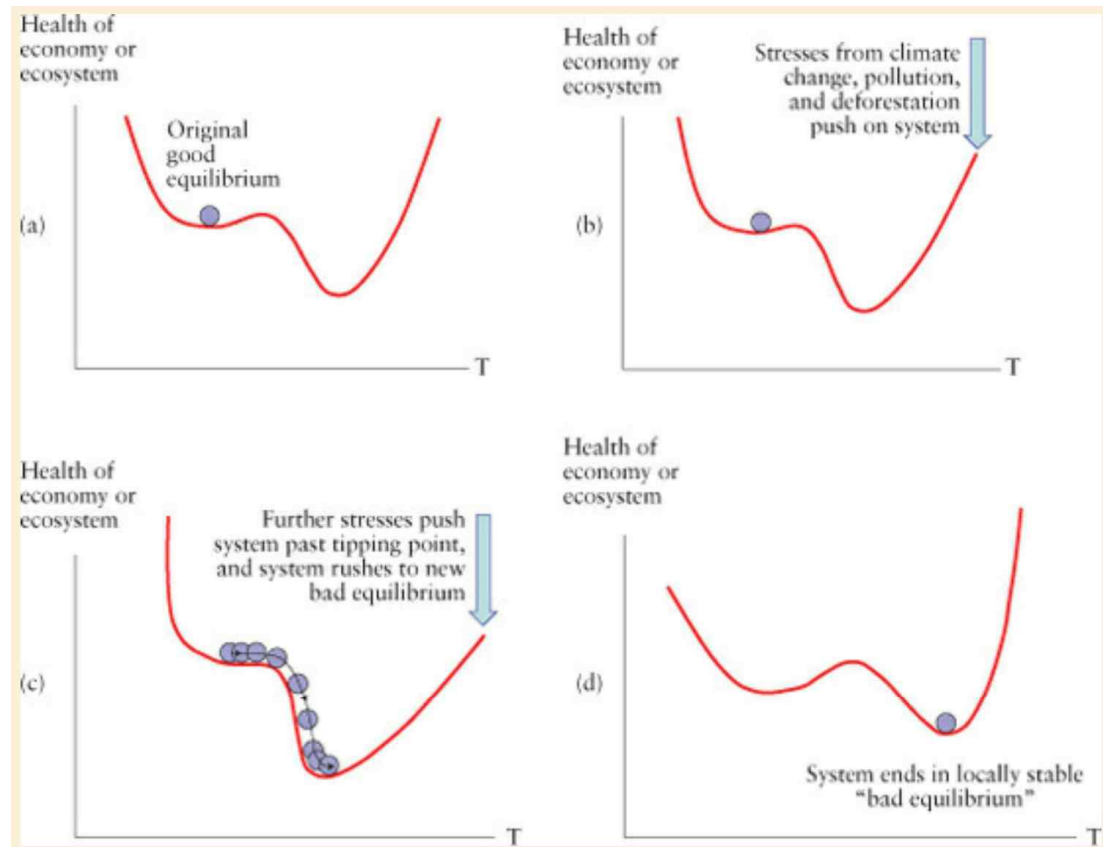


Figure 11. Tipping points: moving from a good to a bad equilibrium. The double-bottomed bowl illustrates how stresses can change a system slowly until a tipping point is reached, after which there are rapid and potentially catastrophic changes. Note that there are two equilibria—a good equilibrium in (a), and a bad equilibrium in (d).

무엇이 불안하게 만들었나?



# 더 안전한 대한민국가?

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# **Hysterical Environmentalist Claims in Modern History**

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- 1. Population Bomb to Cause Global Famine**
- 2. Climate Changes will wipe out Entire Nations (by 1975)**
- 3. Ice Caps Will Melt Away**
- 4. Natural Resources Depletion**
- 5. The Coming Ice Age**
- 6. Air Pollution**
- 7. Water Shortage**
- 8. Chemicals**
- 9. Nuclear Disasters**

# Very Apocalypse Now (1970)

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- ▶ "We have about five more years at the outside to do something," ecologist Kenneth Watt
- ▶ Harvard biologist George Wald estimated that "civilization will end within 15 or 30 years unless immediate action is taken against problems facing mankind."
- ▶ "We are in an environmental crisis which threatens the survival of this nation, and of the world as a suitable place of human habitation," wrote Washington University biologist Barry Commoner
- ▶ New York Times editorial page warned, "Man must stop pollution and conserve his resources, not merely to enhance existence but to save the race from intolerable deterioration and possible extinction."

# 1989.6.29일 AP의 UN 기후변화 관련 기사

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UNITED NATIONS — A senior U.N. environmental official says **entire nations could be wiped off the face of the Earth by rising sea levels if the global warming trend is not reversed by the year 2000.**

Coastal flooding and crop failures would create an exodus of “eco-refugees,” threatening political chaos, said Noel Brown, director of the New York office of the U.N. Environment Program, or UNEP.

He said **governments have a 10-year window of opportunity to solve the greenhouse effect before it goes beyond human control.**

**As the warming melts polar icecaps, ocean levels will rise by up to three feet, enough to cover the Maldives and other flat island nations,** Brown told the Associated Press in an interview on Wednesday.

Coastal regions will be inundated; one-sixth of Bangladesh could be flooded, displacing a fourth of its 90 million people. A fifth of Egypt’s arable land in the Nile Delta would be flooded, cutting off its food supply, according to a joint UNEP and U.S. Environmental Protection Agency study. . . .

## 다른 종말론자들

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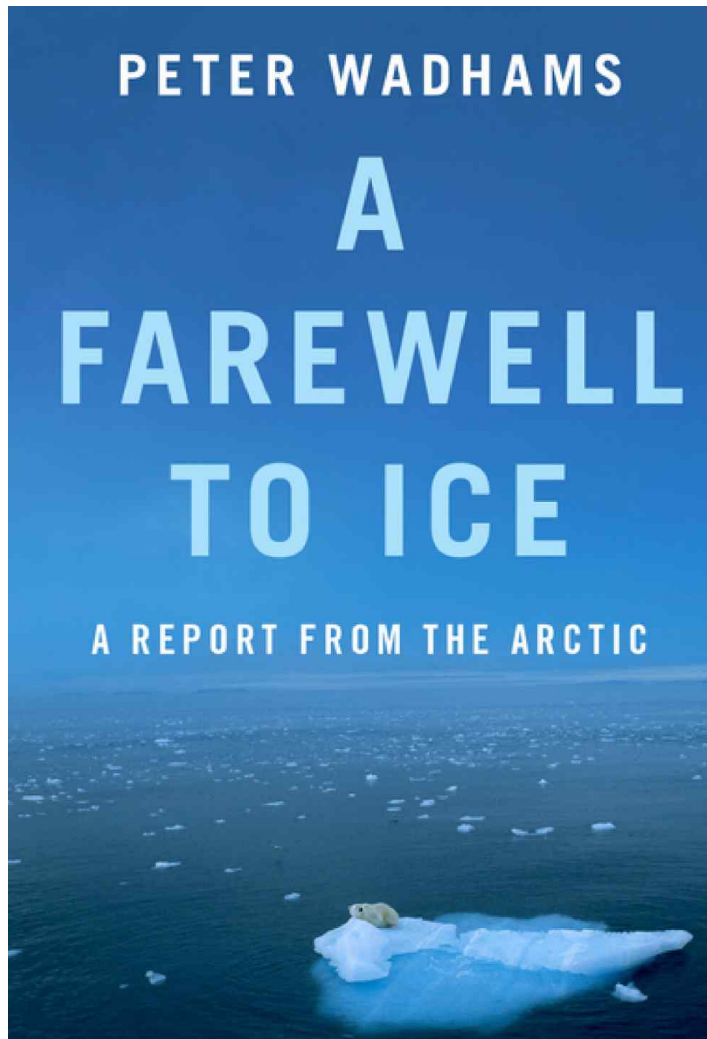
**Al Gore** warning in 2008 that the entire Arctic polar ice cap “may well be completely gone in five years,”

**Alexandria Ocasio-Cortez** asserting in January, 2019 that “the world is going to end in 12 years if we don’t address climate change,”



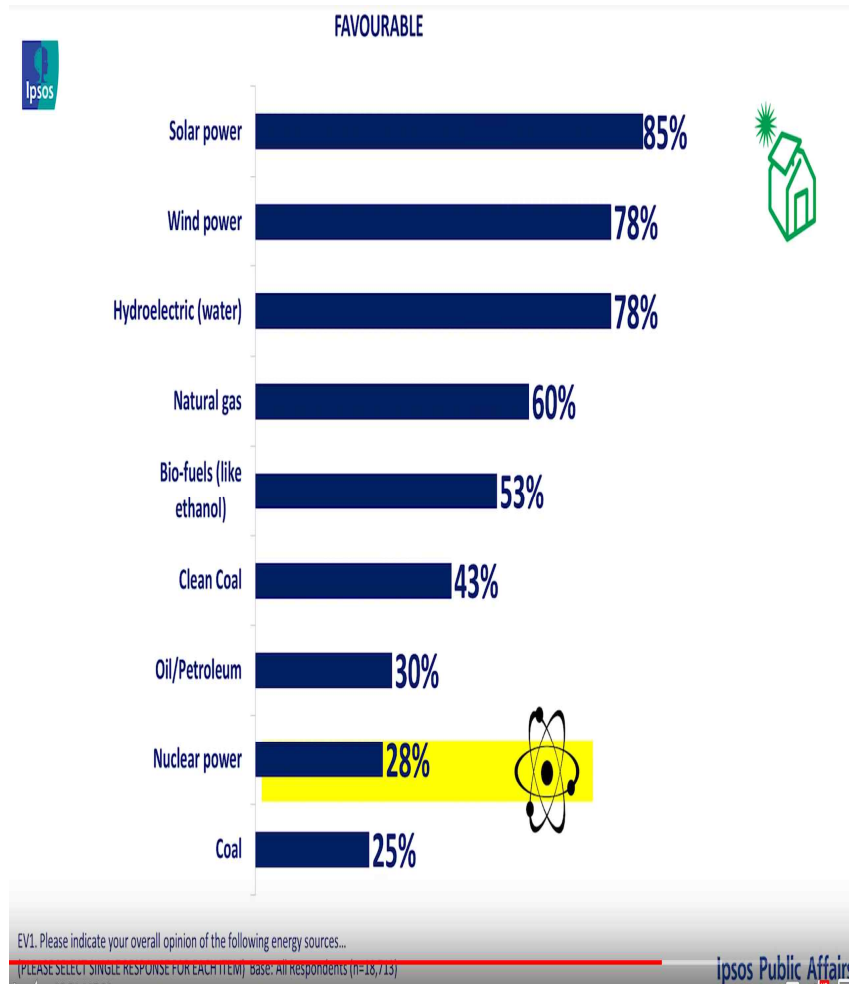
4.6 metric tons of carbon dioxide per year—  
emissions from a typical gasoline-powered  
passenger vehicle

—March 2018, US Environmental Protection Agency



- Al Gore said at a conference in 2009 that a scientist predicted a “75 percent chance that the entire polar ice cap during some of the summer months could be completely ice free within five to seven years.”
- “A Farewell to Ice,” Peter Wadhams, predicted that polar ice in the Arctic would be gone by mid-decade.
- Between 2012 and 2016, Arctic ice increased from an average of 2.2 million square miles to 3.3 million square miles, according to The Telegraph.

# 인간은 나쁜 소식에 잘 반응한다

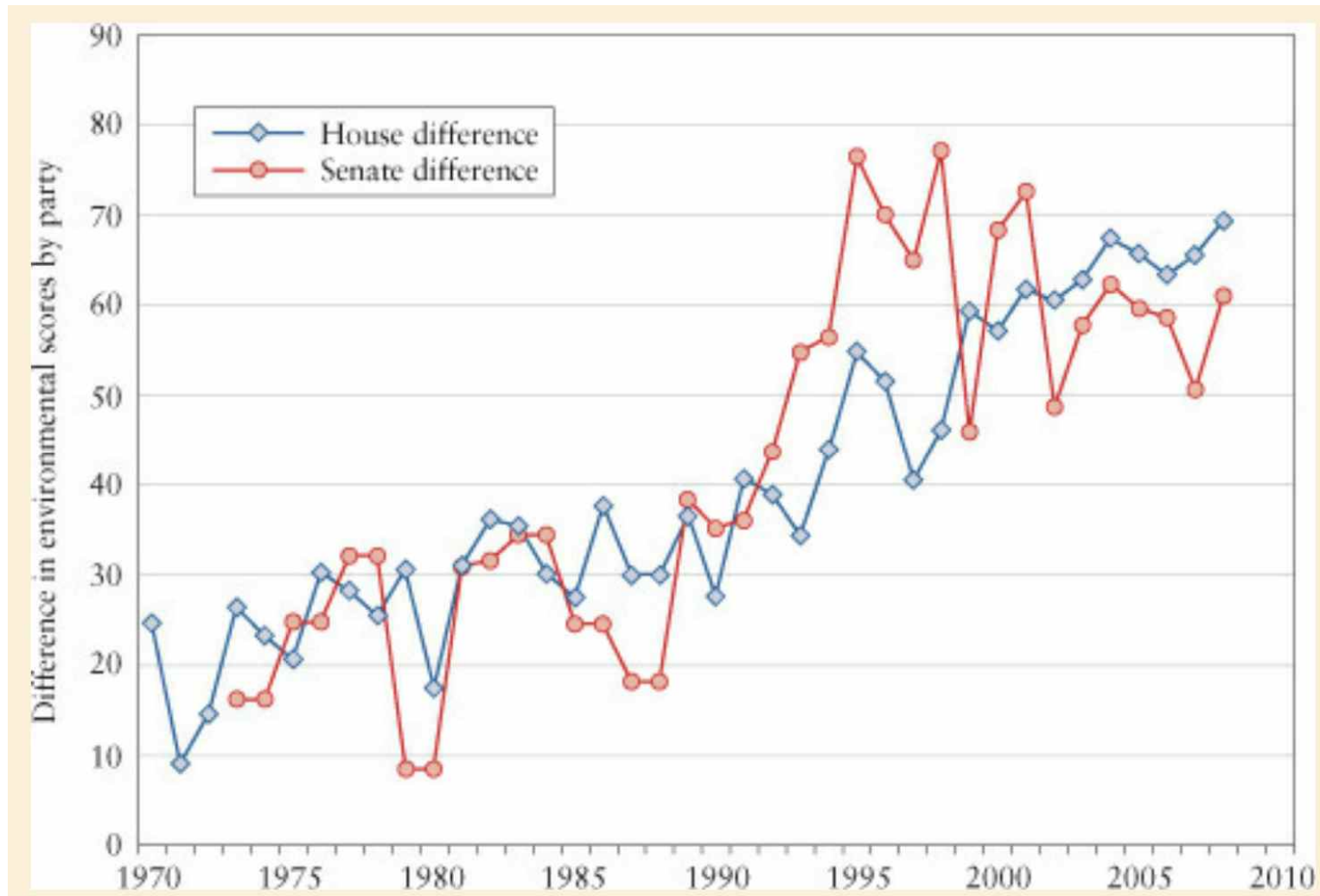


- ▶ 환경론자들은 끊임없이 종말론을 주장해 왔다.
- ▶ 언제나 과학적 연구를 내세웠다
- ▶ 그들의 종말론이나 비판론은 언제나 틀려왔다

이들을 왜 의심해야 하나?



# 환경은 정치적으로 갈라진 이슈



# 그들은 자본주의(시장경제)를 부정한다

## Climate Change Isn't Your Fault. It's Capitalism's.

The Myth That Individual Change is a Substitute for Systemic Transformation



Eudaimonia (2019.5.15) (2019.4.16)



CAPX (2019.4.16)



## A new quasi-religious cult



- ▶ Declaration: We, the undersigned, declare our decision not to bear children due to the severity of the ecological crisis and the current inaction of governing forces in the face of this existential threat. Insecurity of future, despair at our species' relationship to our habitat and each other, channelling time into activism and rebellion, are all common motivations.

# 자본주의를 포기하라



Opinion Climate change

Ending climate change requires the end of capitalism. Have we got the stomach for it?

*Phil McDuff*

Policy tweaks won't do it, we need to throw the kitchen sink at this with a total rethink of our relationship to ownership, work and capital

@Mc\_Heckin\_Duff

Mon 18 Mar 2019 12:09 GMT

he school strike for climate movement

Think we should be at school? Today's climate strike is the biggest lesson of all

We are among the young people striking against climate change in every corner of the globe - adults should join us too

**Greta Thunberg, Anna Taylor and others**

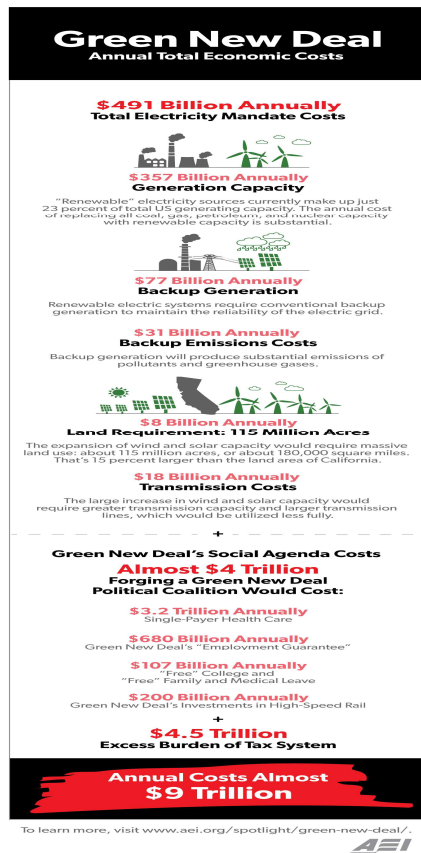
Fri 15 Mar 2019 06:00 GMT



8,520



# An Extreme Proposal



## The Green New Deal: Economics and Policy Analytics

Author:  
**Benjamin Zycher**

GND Policy	Cost	Total Cost
Renewable Electricity Mandate		490
New Renewable Power Capacity	357	
Backup Capacity, Generation	76.9	
Emissions from Backup Generation	30.8	
Transmission	18	
Land	7.8	
Budget Cost of Forging a GND Political Coalition		4,000
Excess Burden of the Tax System		4,460
<b>Annual Total</b>		<b>8,950</b>

## 환경론자들의 The Politics of limits

- ▶ 인간은 자연과 구분된 존재
- ▶ 인간은 가해자이고 환경은 피해자
- ▶ 부정적 동사는 인간에게 긍정적 형용사는 자연에게
- ▶ Economic growth is a cause not solution to ecological crisis.
- ▶ Global Warming as evolution not pollution
- ▶ 인간은 “stop”, “restrict, reverse, prevent regulate, constrain”의 대상 (사회주의, 전체주의의 특성)
- ▶ “preserving nature” preserve, conserve clean air and water (경제개발에 반함)

Environmentalists have long misunderstood, downplayed, or ignored the conditions for their own existence. They

- 
- 환경근본주의자들은 수박이다
- ▶ 종교적 (정치적) 신념
  - ▶ 위장된 사회주의자들
  - ▶ 이해집단



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왜 계속 속는가?

유토피아 = 배부르게 먹을 수 있는 세상



a utopian world on earth full of meal and pleasures

Waking up in the Land of Cockaigne (1567, Pieter Breugel)





## The Left and Environmentalism – Enemies of Civilization

Until about the 1960s the political left never cared about environmentalism. Previously it was, if anything, more likely to be opposed to it. In fact, the command economies of the former communist bloc, i.e. the countries in which socialism had been realized to its full extent, were the worst polluters in all of human history. As an example, after German reunification air pollution in the former socialist GDR was found to be between 8 to 12 times higher than in West Germany.

# 사회주의자들이 공산화 몰락 후에 환경론자가 되었다

- ▶ This makes it quite ironic that environmentalism and the Left have found each other in the West, but the lefties evidently realized that concerns about the environment could be used to promote their anti-capitalist agenda. The merger deepened after the former sugar daddy of Western Marxists in Moscow suddenly expired. To their horror, even China decided that crony capitalism was to be preferred over Marxism, although it did of course retain many of the central planning features beloved by the authoritarian left.
- ▶ Authoritarian is the key term here. We are certainly not saying one should not care about the environment, but as the experience of real socialism so vividly demonstrates, nothing is more likely to preserve a livable environment than strong property rights – which are the very thing constantly under attack by the left. Idealistic leftists – those Lenin referred to as “useful idiots” – are merely economically ignorant. As Friedrich Hayek once said: “*If socialists understood economics they wouldn’t be socialists*”.

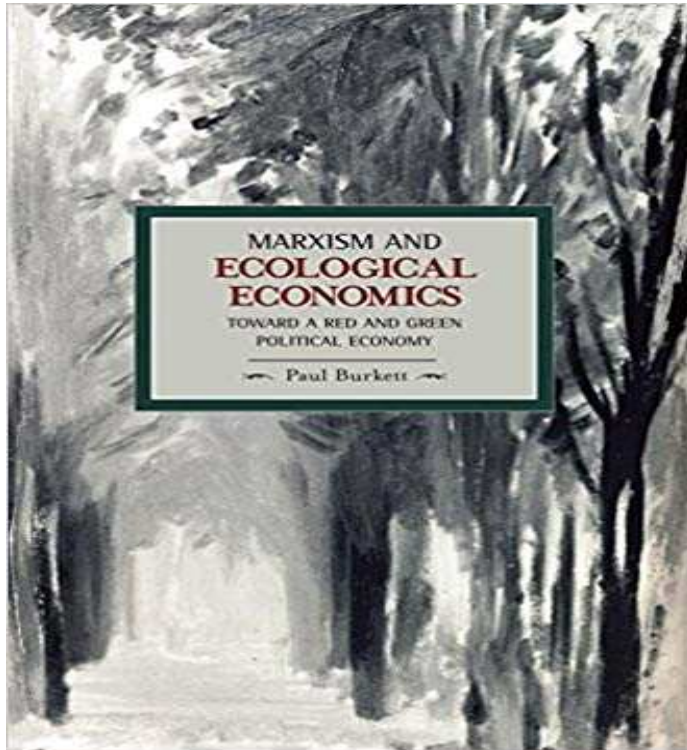
Exploitation is the key to socialists and environmentalists

The basic error of socialists is to regard the economy as static, as providing an unchanging “fixed pie”. They wrongly think that people can only become rich by exploitation, that their existence automatically implies that there must be a vast class of losers who continue to become ever more poor. Thus, the main task of politics is to “fairly distribute” this fixed pie. There are of course notable exceptions to this fairness doctrine, namely the ruling comrades at the top and their cronies. One must of course understand that enormous responsibilities are weighing on them once they have attained power; it follows that they will deserve a larger share of the pie (sorry, we forgot that they are all angels and will of course resist abusing their power to their own advantage).

- ▶ We regard the unholy alliance of Marxism and Greens (a.k.a. watermelons) as enemies of civilization and humanity itself.

*Marxism and Environmentalism: The Unholy Alliance*  
March 25, 2016, Author: Peter Tenebrarum

## Marxist Economists = Environmentalists



It shows how Marxism can help ecological economics fulfill its commitments to methodological pluralism, inter-disciplinarity, and openness to new visions of structural economic change that confront the current biospheric crisis.

# 탈원전은 이성적 정책의 이슈인가 신념의 체계인가?

Economics and  
Environmentalism Belief  
Systems at Odds

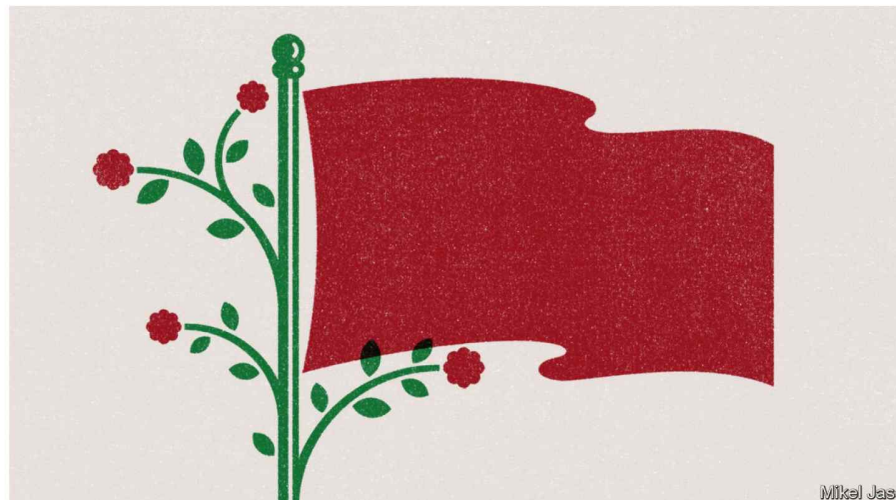
F ROBERT H. NELSON

- ◆ **Economics and environmentalism are belief systems** that shape their adherents' way of thinking about the world. We might just as accurately characterize them as **secular religions**.
- ◆ I find little disagreement with the idea that **environmentalism is a religion**—to most economists, the claim seems fairly obvious. Environmentalists often react similarly, but the other way around: economics, for most environmentalists, is a religion. Neither group, however, is comfortable with the characterization of their own thinking as religious

Out of left field

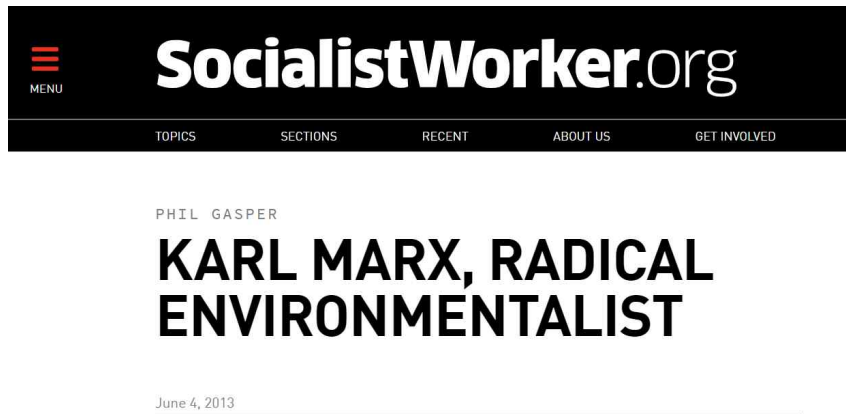
## Millennial socialists want to shake up the economy and save the climate

*Do they make sense?*



# 공산주의 전통과 환경론

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In his book *Marx's Ecology*, published in 2000, Foster shows that ecological ideas were central to Marx and Engels' materialist outlook from the early 1840s.

- ▶ The slogan was well received, as growing numbers of environmental activists recognize that only fundamental social and economic changes can solve the deepening global ecological crisis.
- ▶ But what kinds of changes are needed and what strategies can win them?
- ▶ What I want to argue here is that activists have much to gain by engaging with the ecological critique of capitalism first developed by Karl Marx and Frederick Engels in the 19th century.

# Marx was an environmentalist as was Engels

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In his 1844 *Economic and Philosophical Manuscripts*, Marx wrote:

Man lives on nature--means that nature is his body, with which he must remain in continuous interchange if he is not to die. That man's physical and spiritual life is linked to nature means simply that nature is linked to itself, for man is a part of nature.

Both Marx and Engels point out in their later writings that capitalism disrupts the link between humans and the rest of the natural world, to the detriment of both.

It is not the *unity* of living and active humanity with the natural, inorganic conditions of their metabolic exchange with nature, and hence their appropriation of nature, which requires explanation or is the result of a historic process, but rather the *separation* between these inorganic conditions of human existence and this active existence, a separation which is completely posited only in the relation of wage labor and capital. – Capital (Grundrisse)

# 사회주의 심리학

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- 루트비히 폰 미제스 - 경제적 무지나 지적오류가 아니라 심리적 문제, 노이로제
- 자유주의를 반대하는 그 뿌리는 이성적인 방법으로는 찾을 수 없다. 그 반대는 이성이 아니라 병든 정신 상태에서 기인한다. 프랑스 사회학자의 이름으로, 르 따온 푸리에 콤플렉스라 할 수 있는 분노와 신경질적 상태다.
- 분노와 신경질적 상태로 만들기 위해 사회문제를 끊임없이 과장
- 분노는 가학증을 불러온다. 분노의 나락에 떨어진 사람들은 적대 계급이 그들과 함께 고통 받을 수만 있다면 자신의 성공보다는 실패를 원할 것이다.
- 심리학자 조던 피터슨은 사회주의란 분노를 연료로 삼은 체제



## 탈원전 2012년에 시도되었을 것이다

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- 김익중 교수, 2012년 문재인 대선캠프에 참여
- 2014년 11월 11일 탈핵에너지 교수모임 축사,
- 문재인 의원 (새정치민주연합 원전대책특별위원회 위원장)
- 2017년 대선공약 “원전해체기술을 확보하여 경제도 살리고 안전도 챙기겠습니다 ”

문재인 대통령은 판도라 영화를  
보고 탈원전을 선언했는가?

# 끈질긴 탈핵 운동의 역사

1986- 2004, 학습없는 아홉번의 시도와 시패



## 부안주민 "핵폐기장 반대" 한밤 화염병 시위 댐 기계실 불타 2만가구 斷水

전통과 충돌 60여명 부상  
원전 폐기장 건설에 반대하는 전북 부안군 주민 500여명은 19일 오후 10시경 부안군에 있는 한밤댐 제1호 댐 기계실 부근에서 '핵폐기장 반대'를 외치며 한밤댐 제1호 댐 기계실 불타 2만가구 斷水 시위를 벌였다. 주민들은 댐 기계실 부근에 불을 질렀고, 댐 기계실은 불타 2만가구 斷水 되었다. 주민들은 댐 기계실 부근에 불을 질렀고, 댐 기계실은 불타 2만가구 斷水 되었다. 주민들은 댐 기계실 부근에 불을 질렀고, 댐 기계실은 불타 2만가구 斷水 되었다.



# 1990.11.8, 안면도 반핵 항쟁

오마이 뉴스

## '11·8 안면도 반핵항쟁'은 '제2의 광주항쟁'

정부에 대항해 학생까지 동원된 안면주민들의 '핵폭발'

10.11.07 16:04 | 최종 업데이트 10.11.07 16:04 | 김동이(east334) [v]

좋아요 0개

+ 크게 | - 작게 | 인쇄 | URL줄이기 | 스크랩

f 0

4 댓글달기

좋은기사 원료주기



"전남도청을 사수하라."

주간경향 2019 | 04 | 29  
1324호

표지이야기 특집&이슈 정치 경제 사회 문화&과학 세계 스포츠 오피니언

SOCIETY

2006.07.25 | 뉴스메이커 684호

## [秘錄환경운동25년]안면도 반핵항쟁(1) 11·8대첩, 7일간의 드라마

- 작게 + 크게

인쇄 | 목록 | f t

안면도에 '침투'한 공추련 간사 문승식과 주민투쟁 이끈 '건달'들의 활약상

문승식(현 친환경상품진흥원 구매진흥국장)은 흥분을 억누르며 5일 간의 여정을 복기하고 있었다. 안면도와 태안반도를 이어주는 유일한 육로는 안면교였다. 이 다리를 끊으면 안면도는 육지와는 고립된, 말 그대로 '섬'이 된다.

## 안면도 반핵항쟁 기념탑



# 후쿠시마 쓰나미 원전 사고

- ▶ 탈핵에너지전환 국회모임
- ▶ 우원식 공동 위원장과 8인 (2016)
- ▶ 토론회 20여 차례 개최

탈핵에너지전환 국회의원모임, 우수의원연구단체 선정!

Author : 우원식 의원식 Date : 2017.02.24 14:10 Category : 국회 활동/사진보기



탈핵에너지전환 국회의원모임, 우수 국회의원연구단체로 선정!

지난 2월 22일, 경제군 국회의장은 탈핵에너지전환 국회의원모임을 우수 국회의원연구단체로 선정하여 포상하는 행사를 진행했습니다. 탈핵에너지전환 국회의원모임은 지난 2015년 일본 후쿠시마를 직접 방문하여 원자로 멜트 다운(노심 용융)으로 인한 피해를 눈으로 보고 느꼈습니다. 또한 간 나오토 전 일본 총리(후쿠시마 원자력 발전소 사고 당시 총리)를 국회로 초청하여 탈핵의 중요성을 강조하기도 했습니다.

국내의 원전을 운영하고 있는 공기업 '한국수력원자력'으로부터 표플리즘 단체와 정치인으로 탈핵에너지전환 국회의원모임과 우원식 의원이 지목된 걸 생각해보면 일을 정말 잘 한 것이라고 생각되네요. ^^

앞으로도 김영춘 공동대표를 비롯한 탈핵에너지전환 국회의원모임의 위원 분들과 함께 탈핵 달성, 지속가능한 재생에너지로의 전환을 위해 노력하겠습니다.

# 탈핵에너지 교수모임 (2011,11,11)

**탈핵에너지 교수모임**  
calcteam.net/energyprofessor

카테고리 (공개)  
카테고리: 부채종  
회원수: 501  
방문수: 0  
카테고리수: 0

내 정보  
카페 가입하기

탈핵연구소  
탈핵만화  
자료실 웹하드 주소  
인사말 / 전하고 싶은 말  
운영진 메모  
공지사항  
언론보도 및 일반자료  
장정욱교수의 탈핵 칼럼  
[전기중독사회를 넘어서] 시리즈  
전문자료  
우리들의 이야기  
Q&A 게시판  
카페 앨범

**카페에서 알립니다**

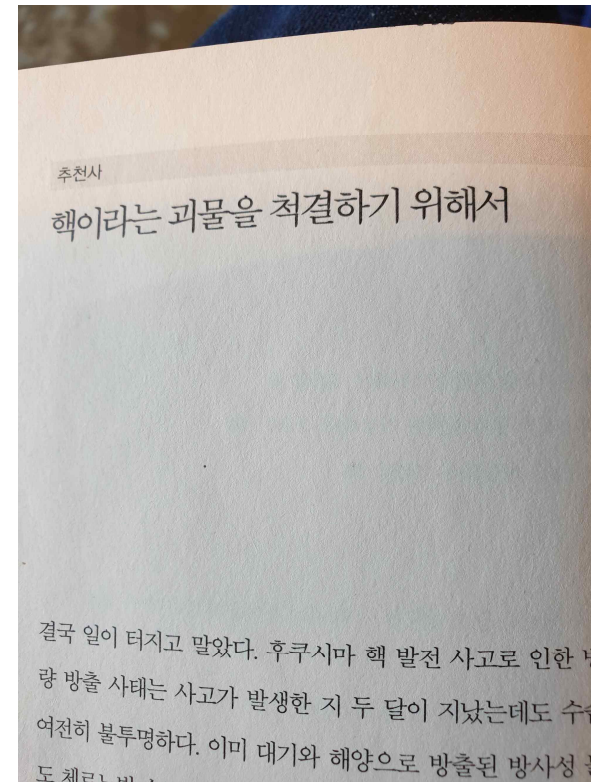
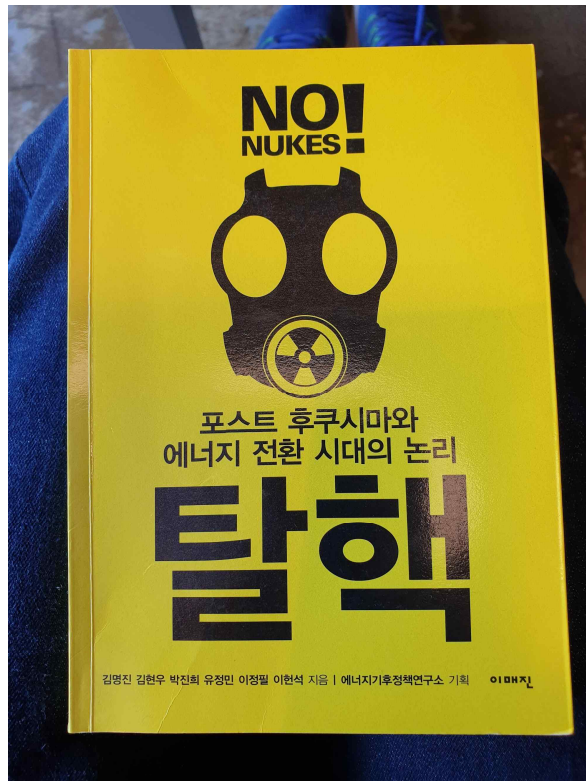
• [생명·탈핵 일크로드] 준비단 출범식, 개요및코스 그리고 해설	16.11.20
• [경향] 이원영 교수 "전 세계 원전 감시하는 '종교계 연합 국제기구' 세울 것"	16.11.17
• [만화] 핵발전소 이제 그만!	16.06.20
• 탈핵생명 국토순례 2016년 여름 서해안	16.06.16
• 평일에 탈핵생명 남도사찰도보순례를	16.02.02

**탈핵연구소**

제목	작성자	조회수	작성일
• 2015.11.14 세미나 발표 동영상	Jongmin...	38	15.11.21
• 탈핵에너지교수모임 4주년 기념세미나 발표자료	Jongmin...	112	15.11.14
• 아파스에 설치한 세모일 태양광 (마이크로 발전소)	수원나그네	318	15.11.13
• NHK멀트다운 시리즈 한글판 [1]	람.	43	15.08.08
• [NHK특별취재팀] "후쿠시마 원전 사고 7년의 수수께끼"	수원나그네	41	15.08.05
• 핵발전소 폐로 자료 [1]	수원나그네	32	15.07.08

- ☘ 탈핵연구소
- ☘ 탈핵만화
- ☘ 자료실 웹하드 주소
- ☘ 인사말 / 전하고 싶은 말
- ☘ 운영진 메모
- ☘ 공지사항
- ☘ 언론보도 및 일반자료
- ☘ 장정욱교수의 탈핵 칼럼
- ☘ [전기중독사회를 넘어서] 시리즈
- ☘ 전문자료
- ☘ 우리들의 이야기
- ☘ Q&A 게시판
- ☘ 카페 앨범

# 충주의 카페에서 만난 책



## 탈원전 2012년에 시도되었을 것이다

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- ▶ 김익중 교수, 2012년 문재인 대선캠프에 참여
- ▶ 2014년 11월 11일 탈핵에너지 교수모임 축사,
- ▶ 문재인 의원 (새정치민주연합 원전대책특별위원회 위원장)
- ▶ 2017년 대선공약 “원전해체기술을 확보하여 경제도 살리고 안전도 챙기겠습니다 ”

# 에너지 민주주의



## 한국사회 에너지민주주의 확대를 위한 쟁점과 과제

일시: 2018년 3월 16일(금) 14:00~16:00

장소: 국회의원회관 제1소회의실

주최: 국회의원 이훈, 국회의원 김경수, 탈핵에너지전환 국회의원모임  
주관: 민주화를 위한 전국교수협의회, 한국사회경제학회, 산업노동학회,  
사회공공연구원, 전국공공운수노동조합, 에너지노동사회네트워크

### 토론회

#### 1부 For Energy Democracy 사회: 김재문 (대구대학교 경제학과)

- 발제 1: 에너지 전환의 정치 (김수진 고려대학교 연구교수)
- 발제 2: 한국 원자력산업의 발전 과정과 향후 전망 (이민석 에너지정의행동 대표)
- 발제 3: 지역에너지시스템 구축과 재생에너지 확대 방안 (이정철 에너지대우정책연구소 연구책임자)
- 발제 4: 에너지 전환의 공적 특성과 가스산업 공적 관리 방향 (전상현 경북대 행정학과 교수)
- 발제 5: 미국의 에너지 NDC 실현과 한국의 시사점 (유승민 한신대 교수)

#### 2부 To Energy Democracy 사회: 서영표 (제주대 사회학과)

- 발제 1: 에너지 산업 재배구조 재구축을 통한 공공성 강화 (안현호 대구대학교 일반사회교육학 교수)
- 발제 2: 분자간 정부 에너지 정책 선진화 과제 (송유나 사회공공연구원)

#### 3부 종합토론

# 에너지를 넘어선 이념 공세



## 복음과 상황

커버스토리 | 교회와 세상 | 말씀의 숨결 | 책과 문화 이야기 | 청년

· 자유게시판 · 독자마당 · 후원하기 · 정기구독신청 · 북상읽기 · 온라인구독신청

홈 > 뉴스 > 책과 문화 | 에디터가 고른 책

뒤로가기

메일보내기 | 오류신고 | 프린트 | + | - | 가 |



### 에너지 민주주의에 관한 근원적 성찰

탄소 민주주의 / 티머시 미첼 지음 / 에너지기후정책연구소 옮김 / 생각비행 펴냄 / 30,000원

[323호] 2017년 09월 25일 (월) 11:38:25

오지은 기자 ohjeun317@goscon.co.kr



출범한 지 얼마 안 된 '신고리 5·6호기 공론화위원회'를 두고 정치권의 공세가 이어진다. 어쨌든 핵발전소를 둘러싸고 우리 사회에도 바야흐로 '에너지 민주주의' 요구가 거세지면서, 향후에도 시민들을 배제한 에너지 의사 결정이 이루어지는 세상은 다시 오기 힘들 것으로 보인다.

그런데 여기, 석탄과 석유의 관점에서 더 근원적으로 민주주의의 가능성에 의문을 던지는 책이 나와, 책은 중동의 세계의 화약고가 된 근원적인 이유를 짚는다. 석탄과 석유라는 '탄소 연료'가 '민주주의 정치'와 어떤 역학 관계를 갖고 있는가를 다루면서(탄소 연료는 대중정치의 출현을 가능케 했으나 뚜렷한 한계도 있었다). 흔히 '석유의 저주'라 불리는 중동의 민주주의 부재 문제를 석유의 역사를 통해 상세하게 보여준다.

# 사회주의 심리학

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- 루트비히 폰 미제스 - 경제적 무지나 지적오류가 아니라 심리적 문제, 노이로제
- 자유주의를 반대하는 그 뿌리는 이성적인 방법으로는 찾을 수 없다. 그 반대는 이성이 아니라 병든 정신 상태에서 기인한다. 프랑스 사회학자의 이름으로, 그 따온 푸리에 콤플렉스라 할 수 있는 분노와 신경질적 상태다.
- 분노와 신경질적 상태로 만들기 위해 사회문제를 끊임없이 과장
- 분노는 가학증을 불러온다. 분노의 나락에 떨어진 사람들은 적대 계급이 그들과 함께 고통 받을 수만 있다면 자신의 성공보다는 실패를 원할 것이다.
- 심리학자 조던 피터슨은 사회주의란 분노를 연료로 삼은 체제



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강한 이념은 강한 확증편  
견과 거짓 선동을 만든다



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# Green is not Green



# Misleading Marketing, Green is not Green

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## Electric Cars Aren't Nearly as Green as People Think

Next time you see an electric car or a charging station, keep in mind the emissions involved in producing the battery and the electricity used to keep it running.

Friday, April 26, 2019



1. Christoph Buchal, Hans-Dieter Karl, and Hans-Werner Sinn, For a Tesla battery of 75 kWh, between 23 thousand and 32 thousand pounds of carbon emissions per battery
2. **Comparative Environmental Life Cycle Assessment of Conventional and Electric Vehicles (Yale University)**
3. It is counterproductive to promote EVs in regions where electricity is produced from oil, coal, and lignite combustion.

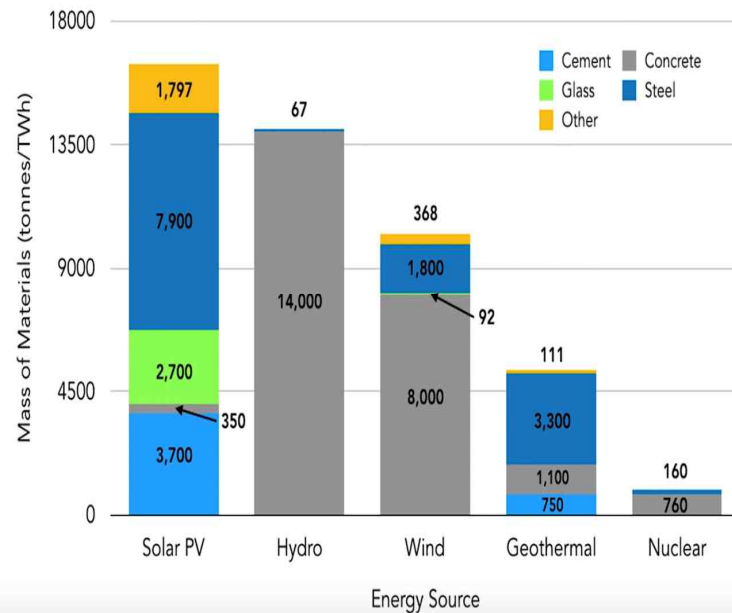
## 숨겨진 비용 (1): 450 배의 토지가 필요

Need 450 times more land for solar than for nuclear



## 숨겨진 비용 (2)

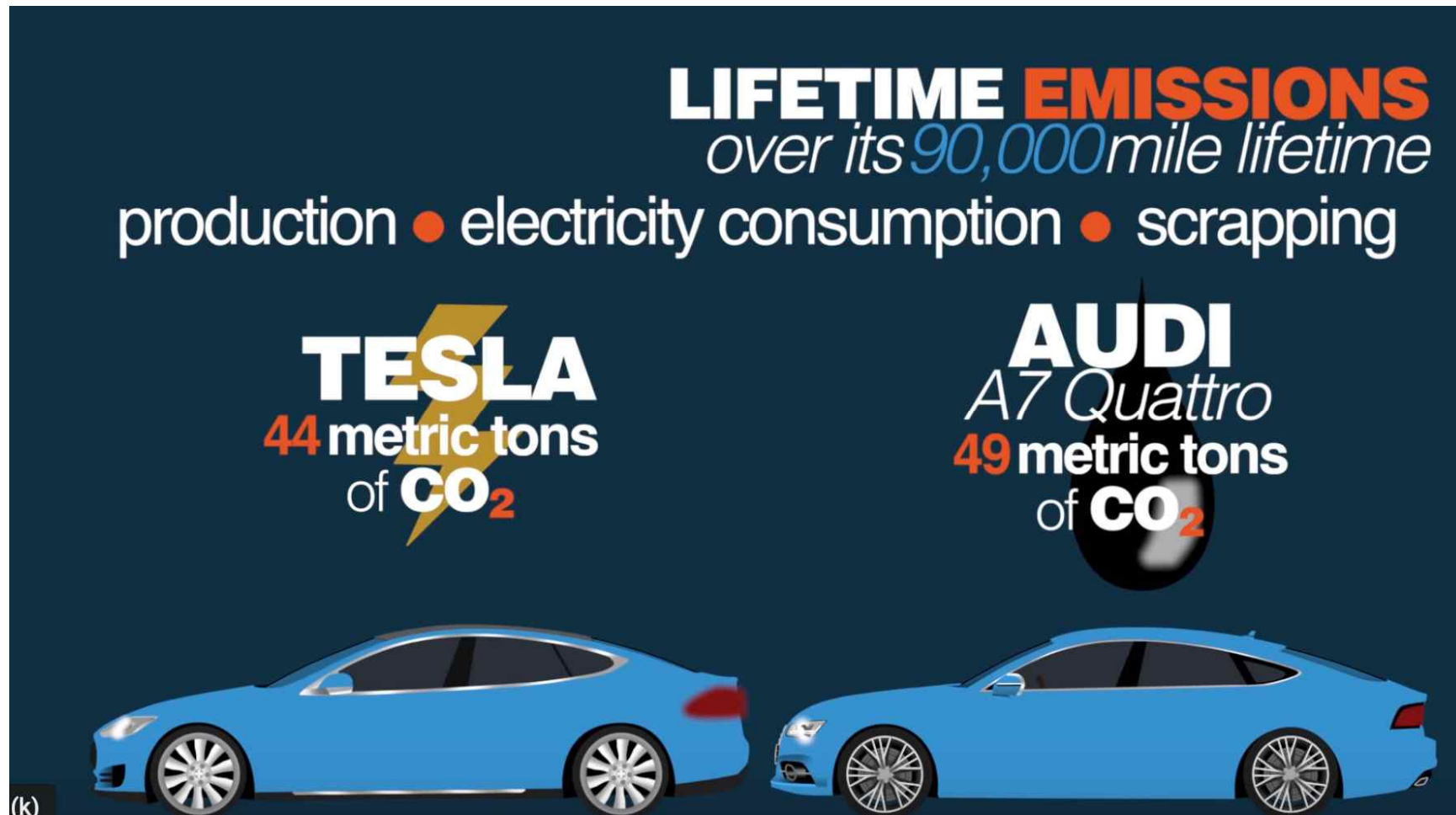
Materials throughput by type of energy source



"Quadrennial Technology Review: An Assessment of Energy Technologies and Research Opportunities," Table 10. September 2015. United States Department of Energy. Nuclear and hydro require 10 tonnes/TWh and 1 tonne/TWh of other materials, respectively, but are unable to be labeled on the graph.

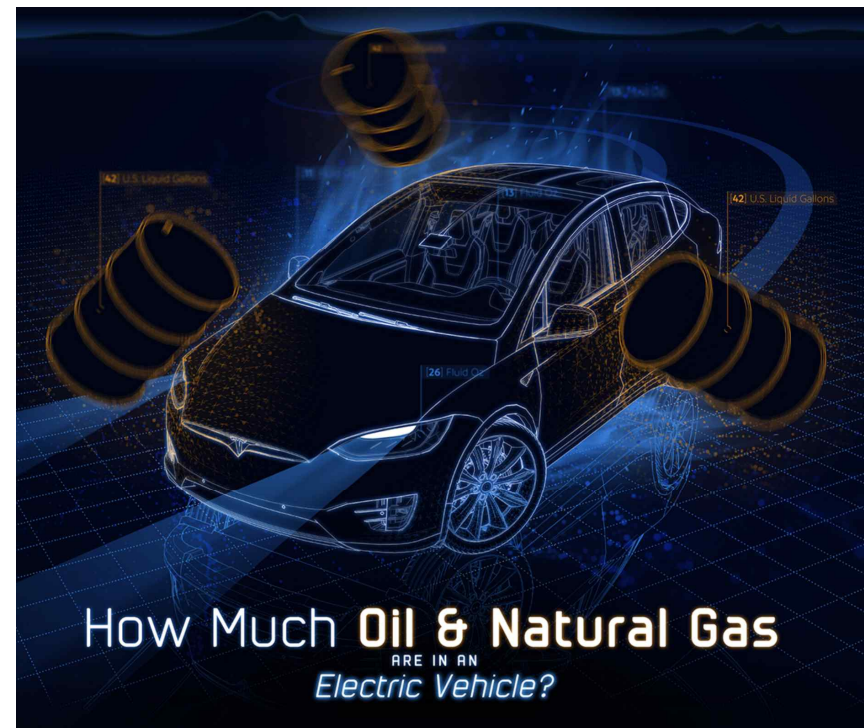


# 온실가스 어떻게 측정하나?



# 어마어마한 세금의 낭비

one ton of CO<sub>2</sub> = \$7  
five tons less CO<sub>2</sub> = \$35  
U.S. government  
electric car subsidy = \$7,500



# 숨겨진 비용(3): Grid 비용과 안전성

9,674 views | Mar 6, 2019, 03:52am

## Google DeepMind's Talks With National Grid Are Over



**Sam Shead** Contributor ⓘ

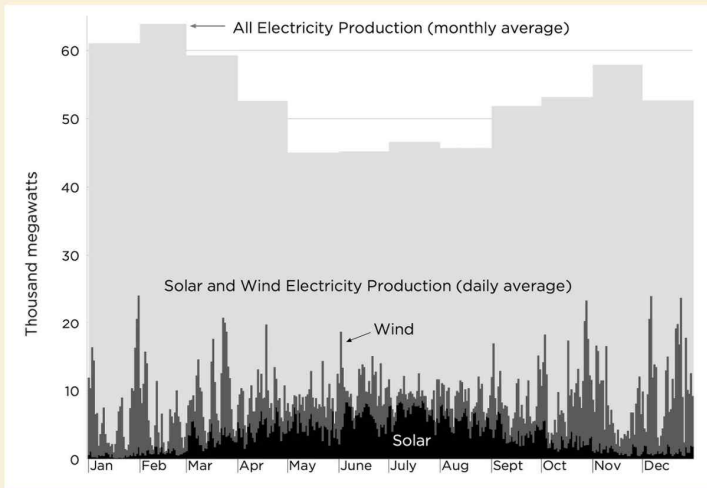
AI & Big Data

*I cover artificial intelligence and Google DeepMind.*

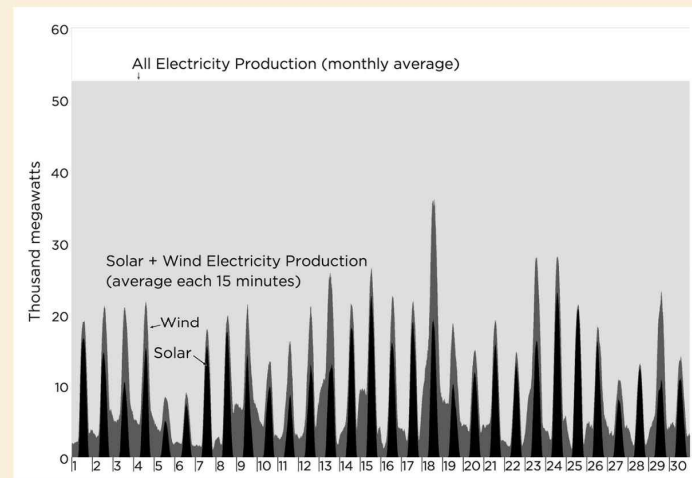


Electricity pylons in England, UK, running through the forest. Taken straight on, perpendicular GETTY

# 재생 에너지의 변동성에 의한 저장 및 배송 비용



Sources: European Energy Exchange Transparency Platform Data (2013); Federal Statistical Office of Germany



Sources: European Energy Exchange Transparency Platform Data (2013); Federal Statistical Office of Germany

# 윈드 터빈의 희생자들



Wind energy is tough on bats  
—but it doesn't have to be  
that way

by [Brandon Keim](#) | Mar 15, 2017

# 태양광의 희생자들



Peter Laufer, "The Tortoise is Collateral Damage in the Mojave," *High Country News*, March 19, 2014

"Everybody knows that translocation [of desert tortoises] doesn't work. When you're walking in front of a bulldozer, crying, and moving animals and cacti out of the way, it's hard to think that the project is a good idea." — Anonymous biologist

Subtitles/closed captions (c)



Bob Maerz  
Destroys Solar Farm in Puerto Rico

# 남에게 전가한 이산화탄소 배출

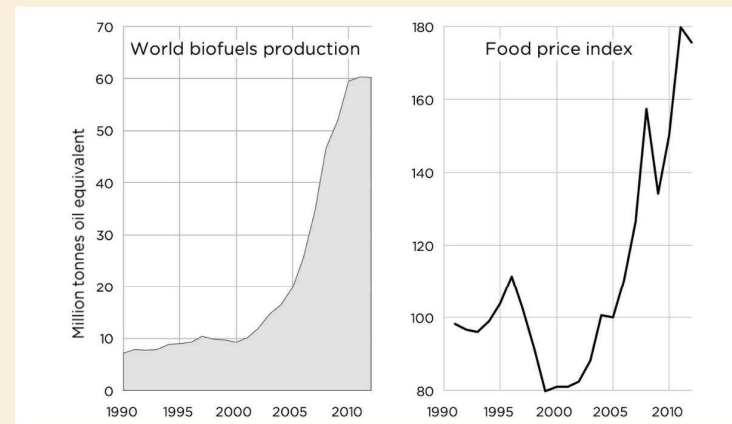


## Europe's renewable energy policy is built on burning American trees

Biomass energy is inadvertently making the climate crisis worse.

By Saul Elbein | Mar 4, 2019, 7:20am EST

Graphics: Javier Zarracina. This story was supported by the Pulitzer Center.

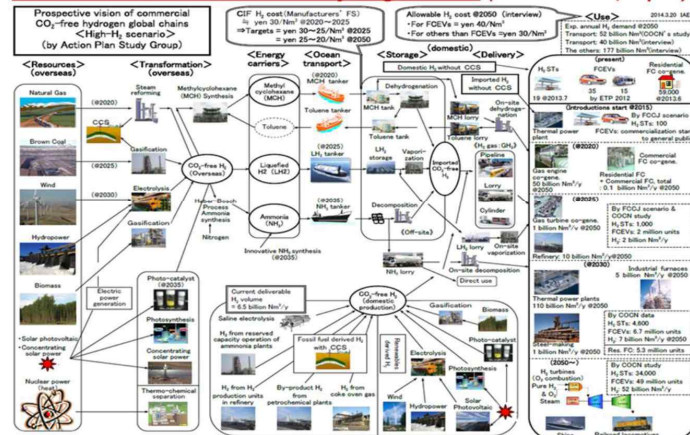


Sources: index mundi Commodity Food Price Index, 2014; BP, Statistical Review of World Energy 2013, Historical data workbook

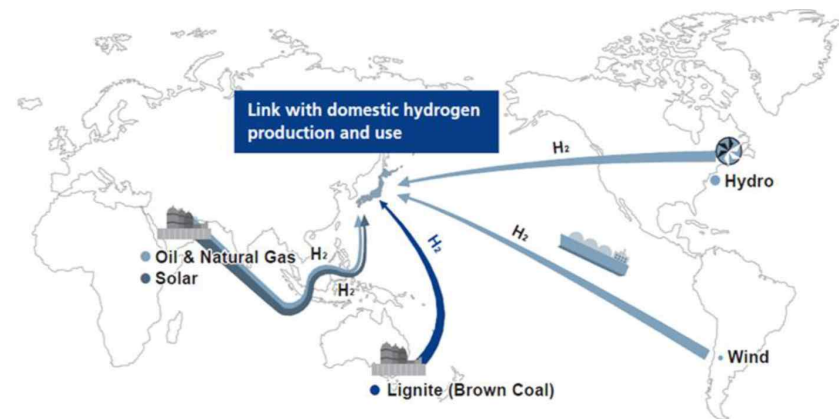
# Co2 배출은 다른 나라가 하라는 일본의 수소경제

Various CO<sub>2</sub>-free Hydrogen Supply Chain  
(global and domestic)

## Evaluation of various CO<sub>2</sub>-free hydrogen chain (2014.3/31 IAE, Japan)



※ 출처: '16년 FISITA Partners Forum 内  
Ken Okazaki 교수 (도쿄공업대학) 발표자료



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세상의 종말은 예언되지  
않았다



# Do We Really Have a Decade Left to Solve Climate Change?

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## Do We Really Have a Decade Left to Solve Climate Change?



53 COMMENTS

TAGS Big Government, The Environment, Interventionism

05/17/2019 • Robert P. Murphy

Wise alecks on social media noted with amusement how Beto O'Rourke recently claimed humans had only *ten years* to act on climate change, thus one-upping Alexandria Ocasio-Cortez who had previously gone out on a limb by putting the *deadline at twelve years*. Snark aside, it's



# UN IPCC는 은 인류 종말을 예언 했나?

- ▶ Beto O'Rourke, humans had only *ten* years to act on climate change.
- ▶ Alexandria Ocasio-Cortez, deadline at *twelve* years
- ▶ There is no such claim in IPCC Report: “If we wait until 2030 to begin mitigation efforts, we will all die.”

Only Cost Increases if delay mitigation efforts

2100 Concentration (ppm CO <sub>2</sub> -eq)	Increase in mid- and long-term mitigation costs due to delayed additional mitigation up to 2030			
	[% increase in mitigation costs relative to immediate mitigation]			
	≤55 GtCO <sub>2</sub> eq		>55 GtCO <sub>2</sub> eq	
	2030-2050	2050-2100	2030-2050	2050-2100
450ppm (430-480)	28%	15%	44%	37%
500ppm (480-530)	(14 – 50) [N: 34]	(5 – 59)	(2 – 78) [N: 29]	(16 – 82)
550ppm (530-580)	3%	4%	15%	16%
580-650ppm	(-5 – 16) [N: 14]	(-4 – 11)	(3 – 32) [N: 10]	(5 – 24)

SOURCE: Adapted from IPCC AR5, Working Group III, Summary for Policymakers, Table SPM.2

# 완전히 엉터리 계산

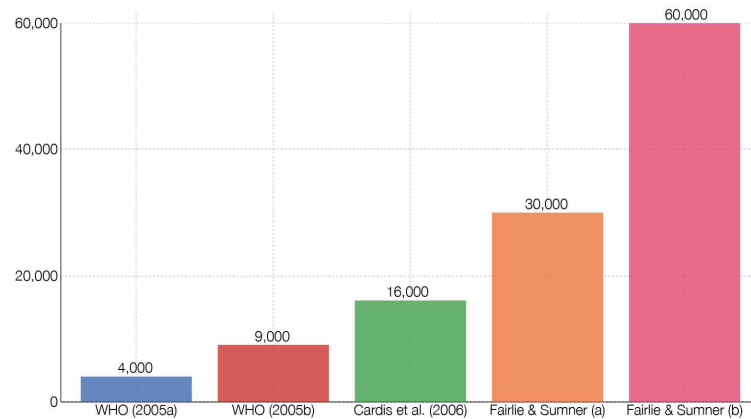
	Consumption losses in cost-effective scenarios <sup>1</sup>			
	[% reduction in consumption relative to baseline]			[percentage point reduction in annualized consumption growth rate]
2100 Concentration (ppm CO <sub>2</sub> eq)	2030	2050	2100	2010-2100
450 (430-480)	1.7 (1.0-3.7) [N: 14]	3.4 (2.1-6.2)	4.8 (2.9-11.4)	0.06 (0.04-0.14)
500 (480-530)	1.7 (0.6-2.1) [N: 32]	2.7 (1.5-4.2)	4.7 (2.4-10.6)	0.06 (0.03-0.13)
550 (530-580)	0.6 (0.2-1.3) [N: 46]	1.7 (1.2-3.3)	3.8 (1.2-7.3)	0.04 (0.01-0.09)
580-650	0.3 (0-0.9) [N: 16]	1.3 (0.5-2.0)	2.3 (1.2-4.4)	0.03 (0.01-0.05)

- 2도 Target is not scientific
- 90년간 0.06% 저성장은 2100년 한해의 4.8% 저성장보다 훨씬 많은 비용
- 2-4% GDP 낙폭은 불경기에서 발생하는 정도

# Chernobyl Nuclear Disaster

## Estimated number of deaths from the Chernobyl nuclear disaster

Estimated total number of deaths as a result of the Chernobyl nuclear incident in Ukraine (1986), reported across a range of published estimates. All estimates, with the exception of WHO (2005a) direct fatalities at the nuclear facility; deaths in proximate areas who died as a result of high radiation exposure; and long-term deaths from low radiation exposure. The estimate of WHO (2005a) does not include potential deaths from low-level exposure in populations further from the nuclear site.



Source: Deaths from Chernobyl (Estimates)  
OurWorldinData.org • CC BY-SA

- ▶ Chernobyl – 500,000명 원자력 노출에 의한 암으로 사망할 것으로 예측. 64명 사망



# 왜 원자력 사고 영화를 만드나?

---

**The Reason They Fictionalize Nuclear Disasters Like Chernobyl Is Because They Kill So Few People, [Michael Shellenberger](#), Forbes, 2019.5.9**

- CBS “Madame Secretary” – Pro-nuclear episode (May 2018)

## Anti-Nuclear Movies

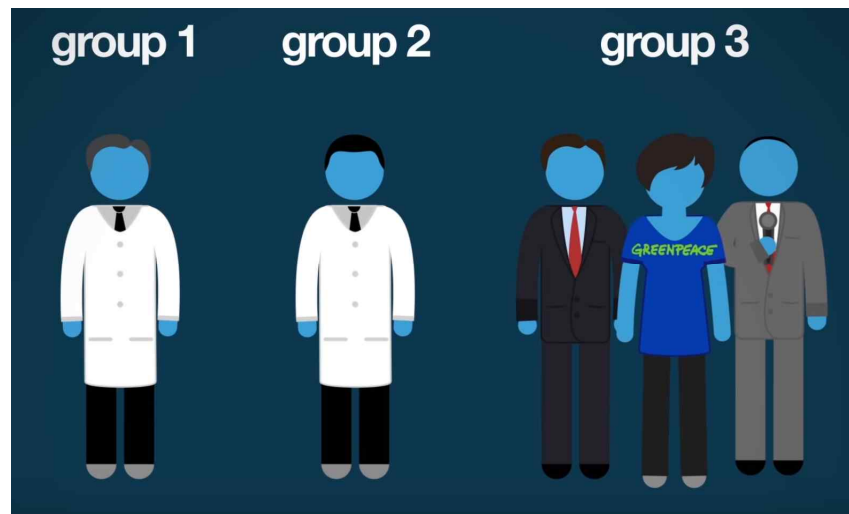
- [“China Syndrome”](#) (US - 1979)
- [“Die Wolke”](#) (Germany - 2006)
- [“Pandora”](#) (South Korea - 2016)
- Why?  
“nuclear accidents remind us of nuclear bombs and our vulnerability to them”
- “With hindsight, we can say the evacuation was a mistake,” [said](#) Philip Thomas, a professor of risk management who led a recent research project on nuclear accidents. “We would have recommended that nobody be evacuated.”

## HBO “Chernobyl” vs Chernobyl

- 폭발직후 방사능과 관련없이 2명 사망, (사고현장 총 3명)
- 31명 사망
- 19명은 화상 등 다른 이유로 사망
- [20,000 documented cases](#) of thyroid cancer in those aged under 18 at the time of the accident, and the UN’s most recent [white paper](#) from 2017 concludes that only 25%, i.e. 5,000, can be attributed to Chernobyl radiation
- Hydroelectric dam in China, killed between [170,000](#) and [230,000 people](#). The Bhopal chemical disaster [killed](#) 15,000.
- Britain’s Grenfell tower caught fire in 2017, [71 people](#) died. During the Twin Towers fires caused by the September 11, 2001 terrorist attacks, 343 firefighters died.

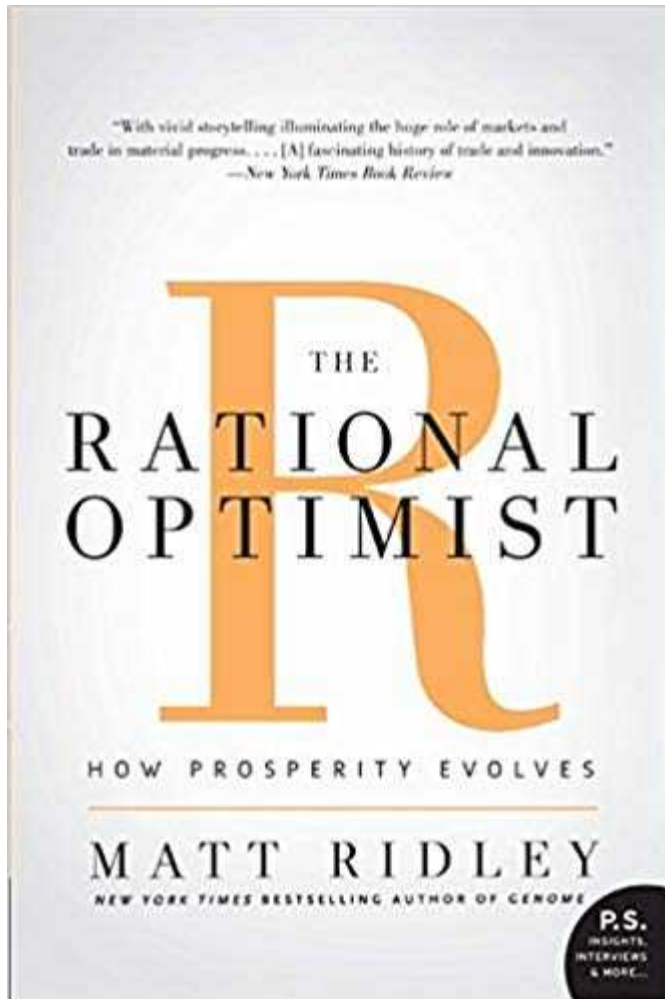
# Politics of Environmental Issues

---



# 인간의 집단지성의 역사에 반하는 주장이다

---



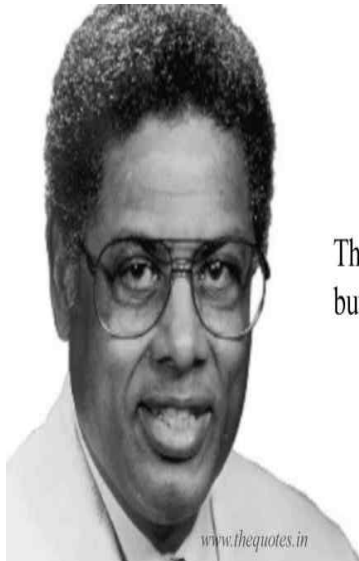
- ▶ Warren Meyer “a poster of John D. Rockefeller should be on the wall of every Greenpeace office”
  - ▶ 석유화학이 고래를 구함
- ▶ 1950년에 런던 거리에는 10 feet (3m)의 말뚝으로 가득찰 것이다
- ▶ Thomas Watson, IBM’s founder – 전세계 컴퓨터 수요는 5대 정도
- ▶ Ken Olson, Digital Equipment Corporation, in 1977 “There is no reason anyone would want a computer in their home”

# Thomas Sowell: Prophets of Doom

---

Global Warming is almost never-  
ending series of Crusades  
Manufactured by Intellectuals.

Talks goes for Money.



The most basic question is not what is best,  
but who shall decide what is best.

*Thomas Sowell*

## Intellectuals and Society

Revised and enlarged edition

**Thomas Sowell**

## 97%의 조작, No “Dangerous”

---

- ▶ John Cook (2013)
- ▶ “97%의 기후과학자들은 지구 온난화의 존재와 인간이 주요한(main) 원인이라는 것에 동의한다”
- ▶ Economist David Friedman 오직 1.6%만 인간이 주요 원인이라고 결론



Barack Obama

@BarackObama

Follow

Ninety-seven percent of scientists agree:  
#climate change is real, man-made and  
dangerous. Read more: [OFA.BO/gJsdFp](http://OFA.BO/gJsdFp)



Reply



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# 인용된 학자들의 항의

---

- “Cook survey included 10 of my 122 eligible papers. 5/10 were rated incorrectly. 4/5 were rated as endorse rather than neutral.”

—Dr. Richard Tol<sup>37</sup>

- “That is not an accurate representation of my paper . . .”

—Dr. Craig Idso<sup>38</sup>

- “Nope . . . it is not an accurate representation.”

—Dr. Nir Shaviv<sup>39</sup>

- “Cook et al. (2013) is based on a strawman argument . . .”

—Dr. Nicola Scafetta<sup>40</sup>

# The Skeptical Environmentalists

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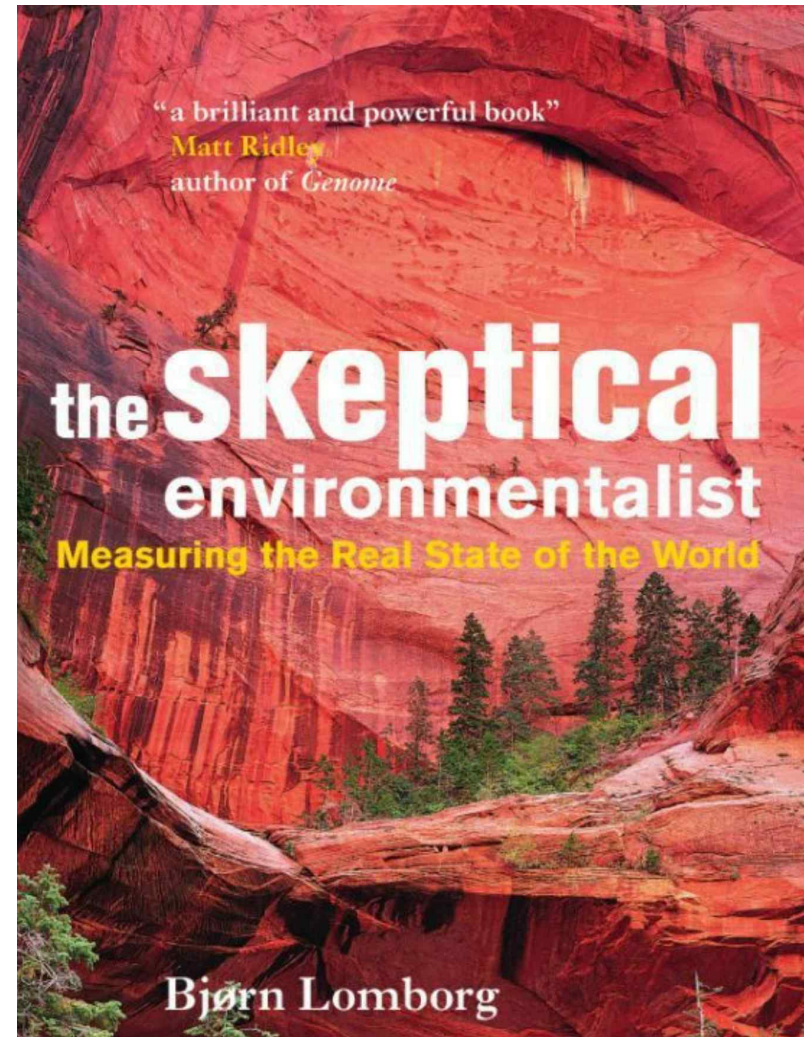
## CLIMATE CHANGE THE FACTS 2017

EDITED BY  
JENNIFER MAROHASY

### CONTRIBUTORS

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Roy Spencer Jaco Vlok Anthony Watts

Institute of Public Affairs



# Renewable energy growth falters as carbon dioxide hits record levels



ERIC C. EVARTS

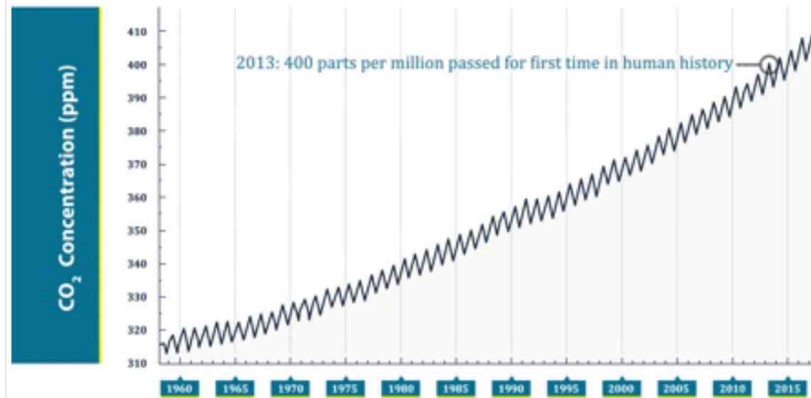
MAY 17, 2019

73 COMMENTS



View Gallery

CARBON DIOXIDE CONCENTRATION AT MAUNA LOA OBSERVATORY



Carbon Dioxide in the Atmosphere Hits Record High Monthly Average

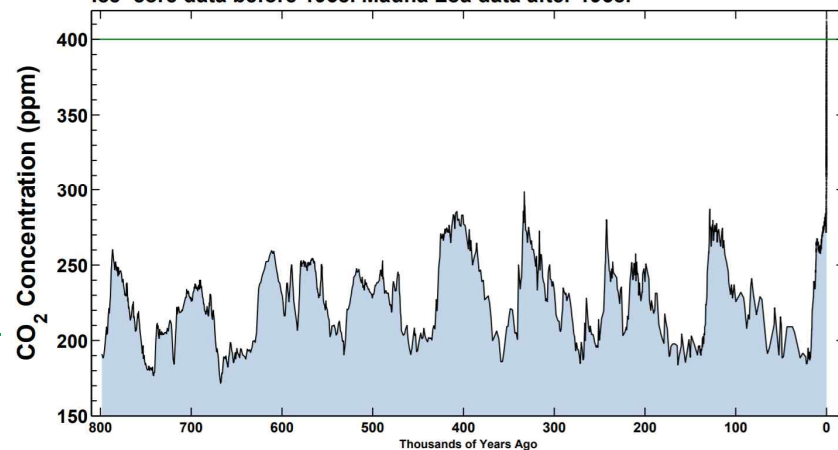
MAY 2, 2018

Latest CO<sub>2</sub> reading

May 17, 2019

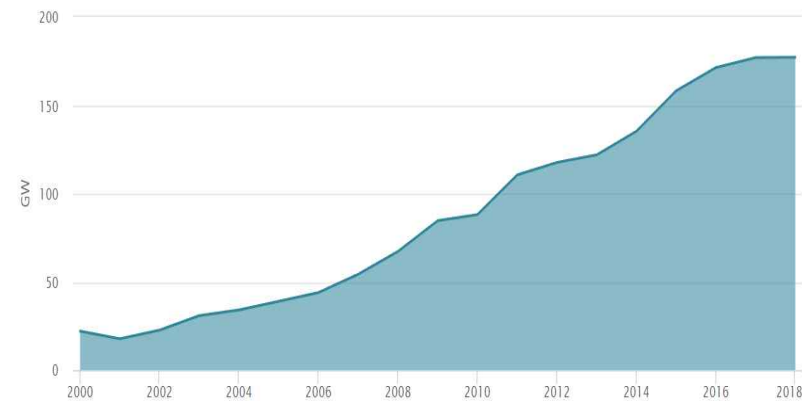
415.19 ppm

Ice-core data before 1958. Mauna Loa data after 1958.



Global renewable net capacity additions

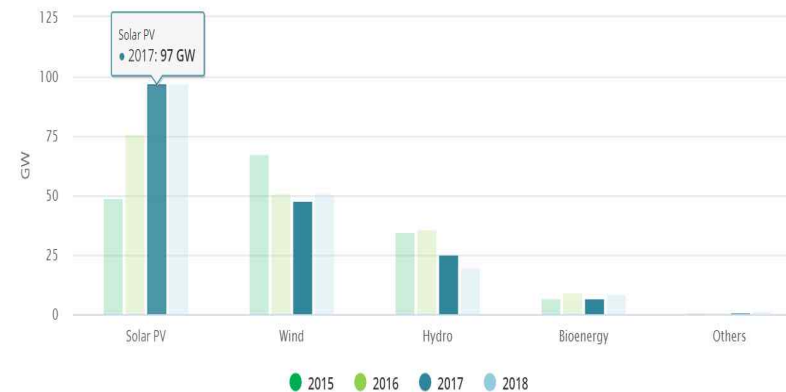
2000-18

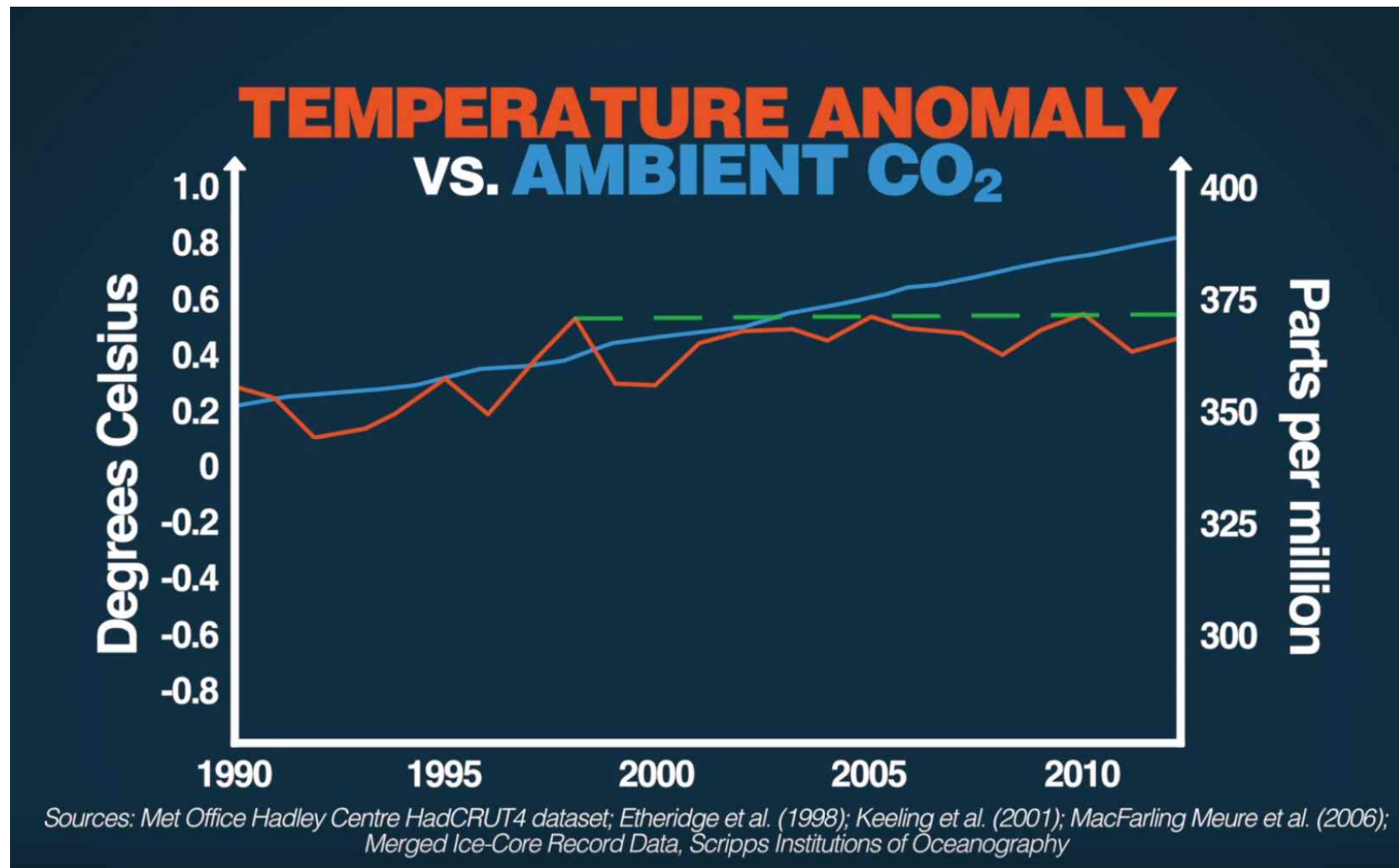


IEA. All rights reserved.

Capacity additions by technology

2015-18





# 모두 숨겨진 아젠다가 있다

- ▶ 독일의 태양광 - 태양광 원천기술과 산업적 이해
- ▶ 독일 클린 디젤의 사기 - 디젤 자동차 산업의 이해
- ▶ 필란드의 반 플라스틱 캠페인 - 목제산업의 이해



재앙의 예언 속에 인류는 어  
떻게 살고 있는가?

*Time We Spent Well*

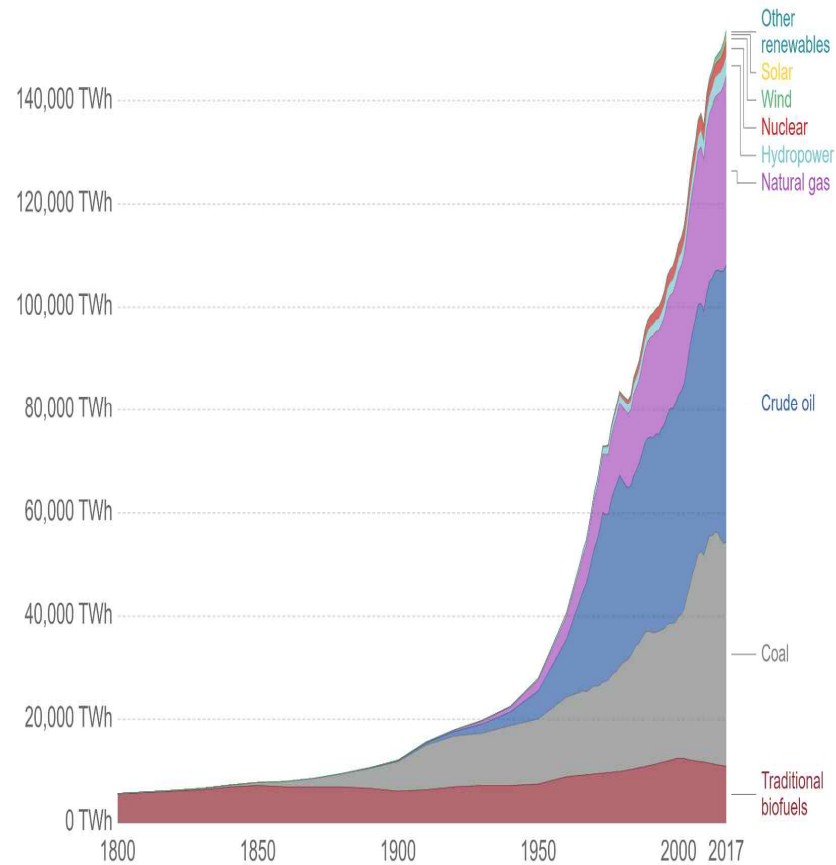


# Global Energy Consumption

## Global primary energy consumption

Global primary energy consumption, measured in terawatt-hours (TWh) per year. Here 'other renewables' are renewable technologies not including solar, wind, hydropower and traditional biofuels.

Our World  
in Data



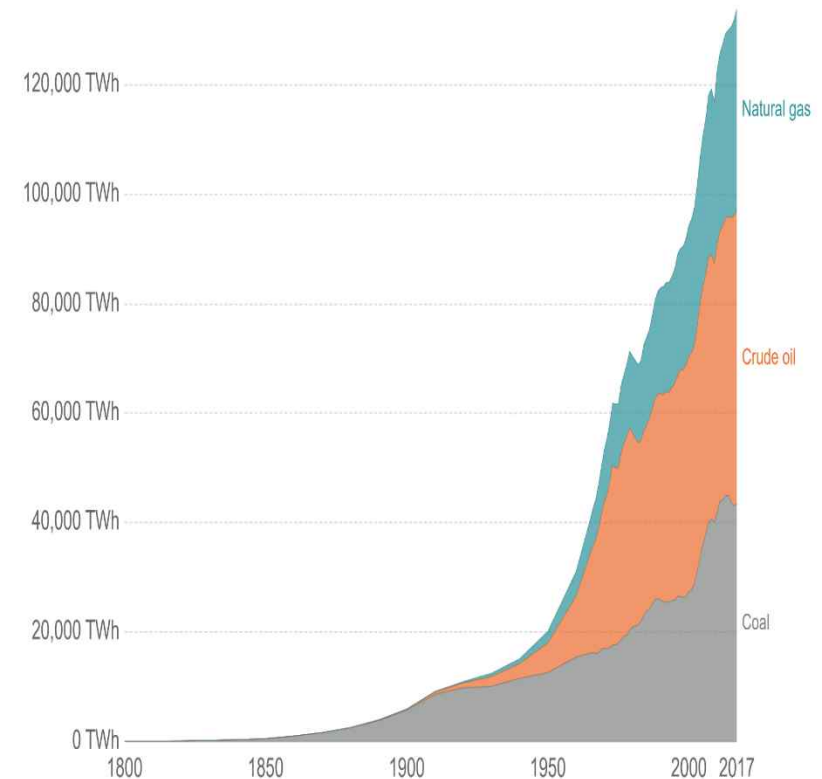
Source: Vaclav Smil (2017) and BP Statistical Review of World Energy

CC BY

## Global fossil fuel consumption

Global primary energy consumption by fossil fuel source, measured in terawatt-hours (TWh).

Our World  
in Data



Source: Vaclav Smil (2017), Energy Transitions: Global and National Perspective & BP Statistical Review of World Energy  
OurWorldInData.org/fossil-fuels/ • CC BY

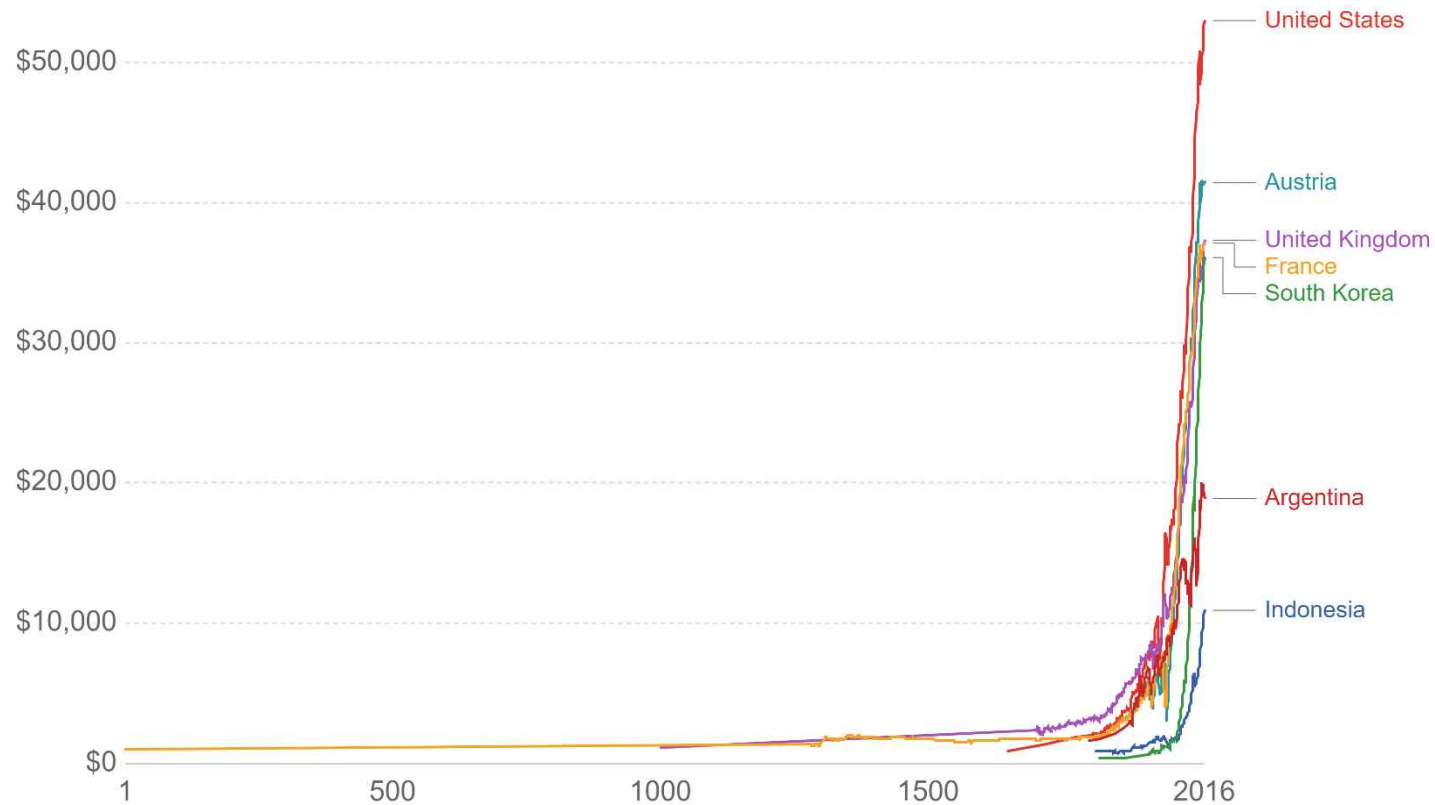


# 상상할 수 없는 부의 증가

## GDP per capita

Real GDP per capita is measured using US\$, inflation adjusted at prices of 2011. A single benchmark in 2011 makes these series suitable for studying the growth of incomes over time (but not for comparing income levels between countries over time).

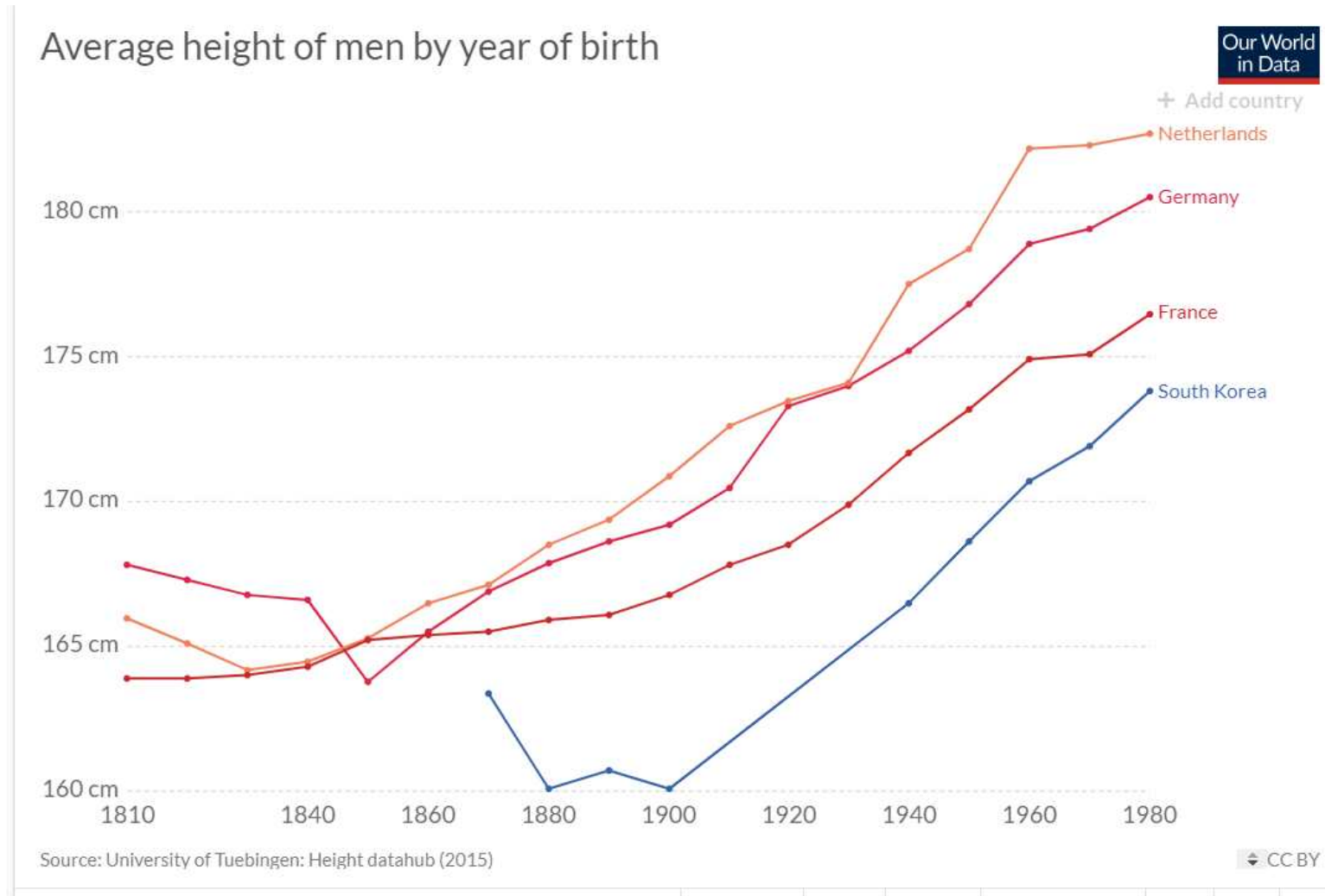
Our World  
in Data



Source: Maddison Project Database (2018)

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# 인류의 신장 변화



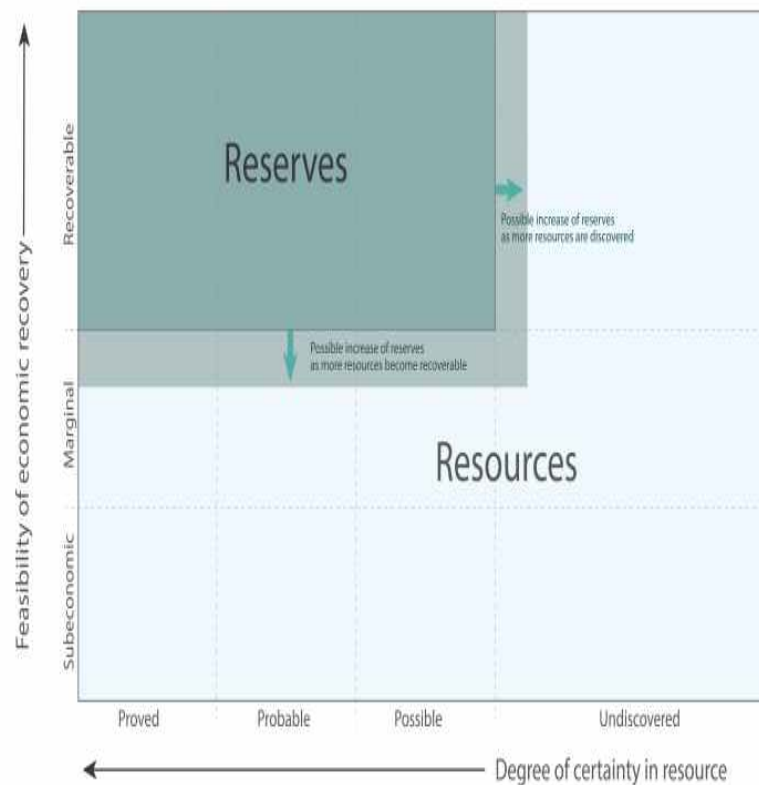
# Energy resource is determined by technology

## Reserves vs. resources: What turns resources into reserves?



Once discovered, natural 'resources' are defined as 'reserves' if they are determined to be economically recoverable.

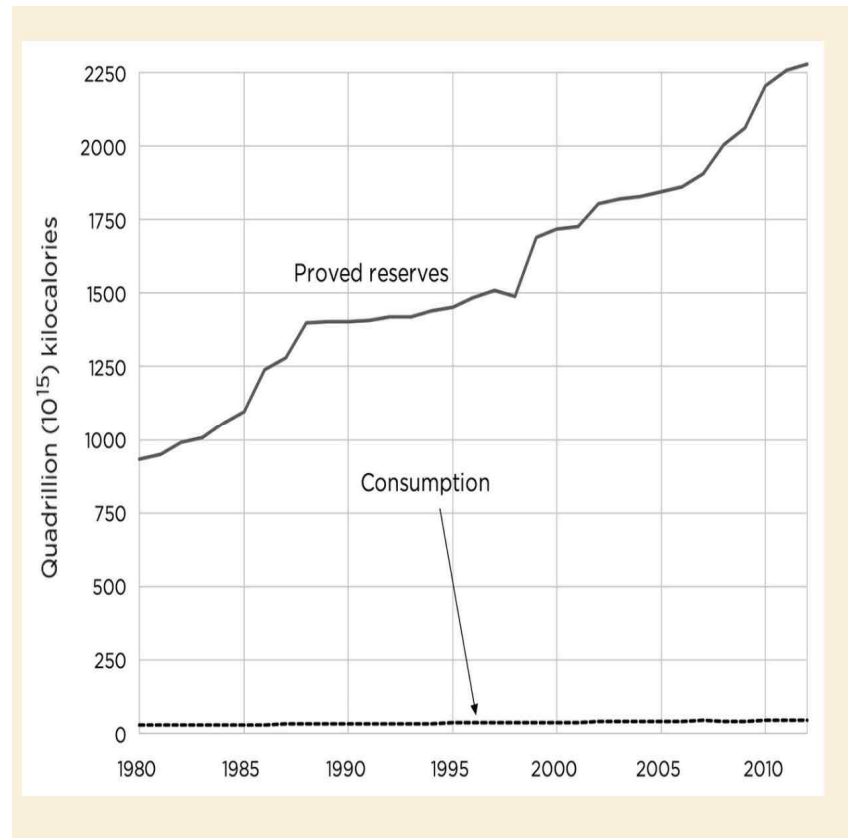
The potential expansion of the 'reserves' category is shown to represent the dynamic nature of mineral resource extraction; economic and technological developments may allow for previously unknown or economically unviable resources to be extracted.



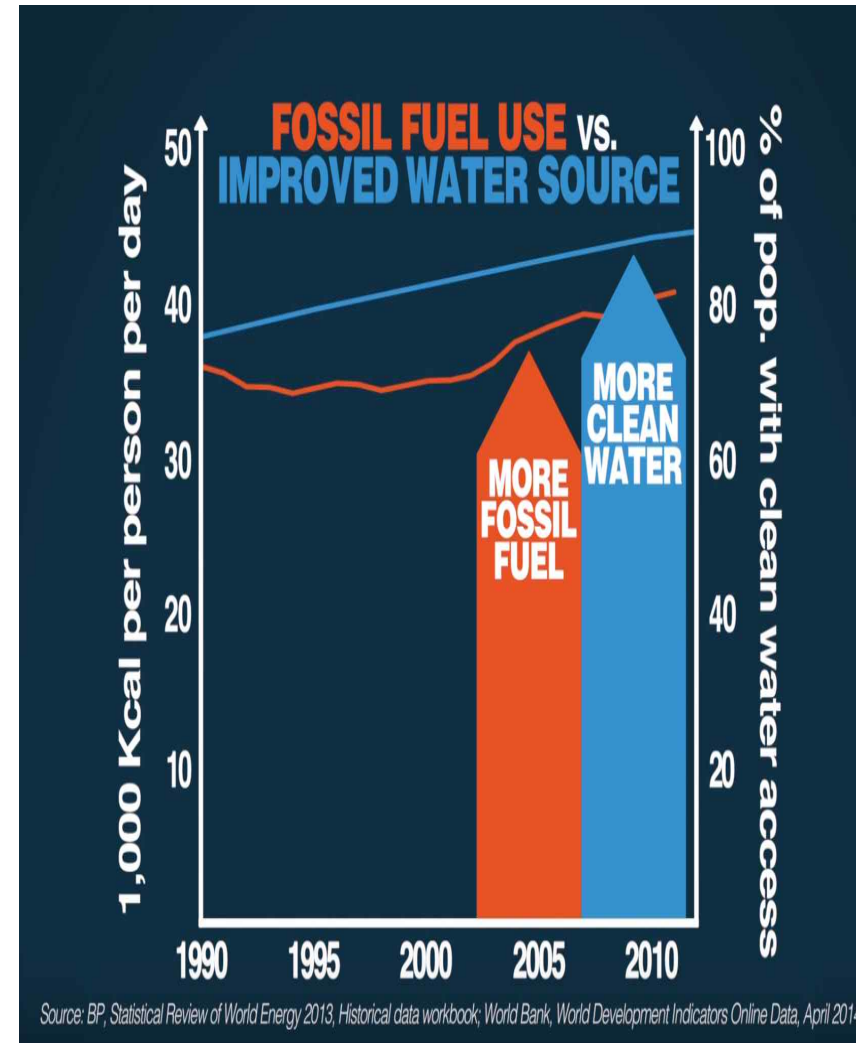
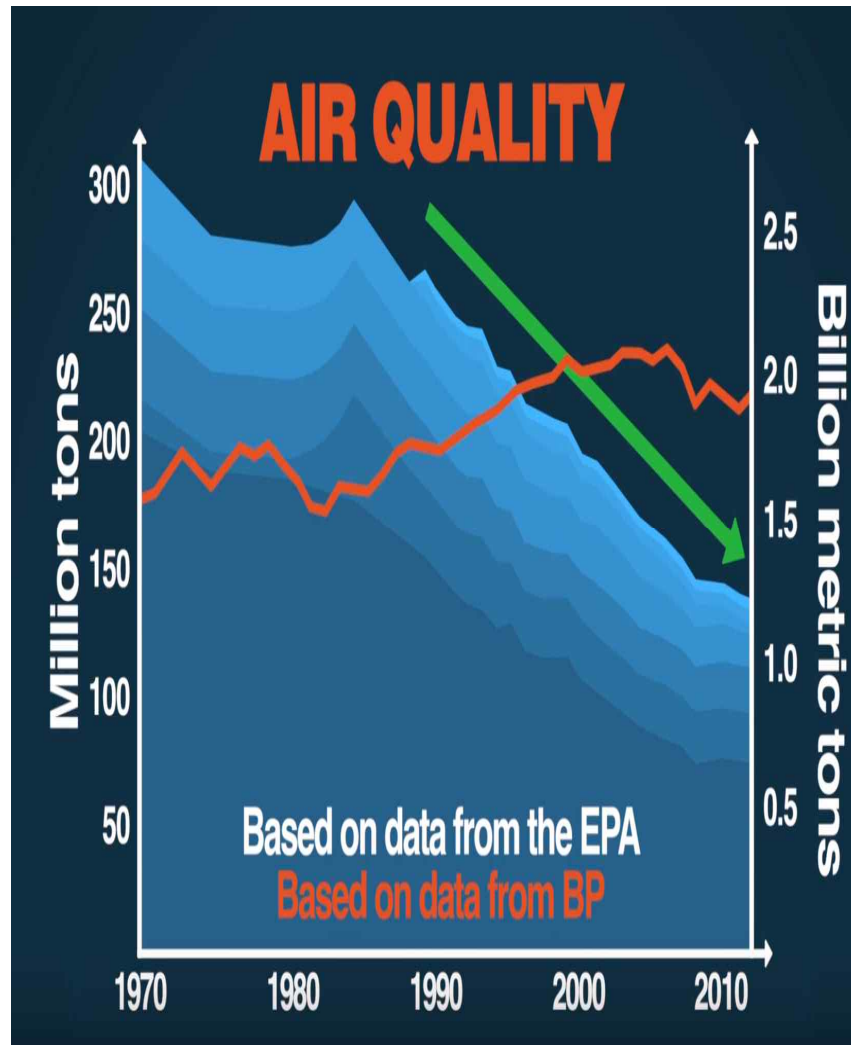
This is a version of 'McKelvey's Box' as suggested by American geologist Vincent Ellis McKelvey (1973).  
The data visualization is available at [OurWorldInData.org](https://ourworldindata.org). There you find research and more visualizations on this topic.

Licensed under CC-BY-SA by the author Hannah Ritchie and Max Roser.

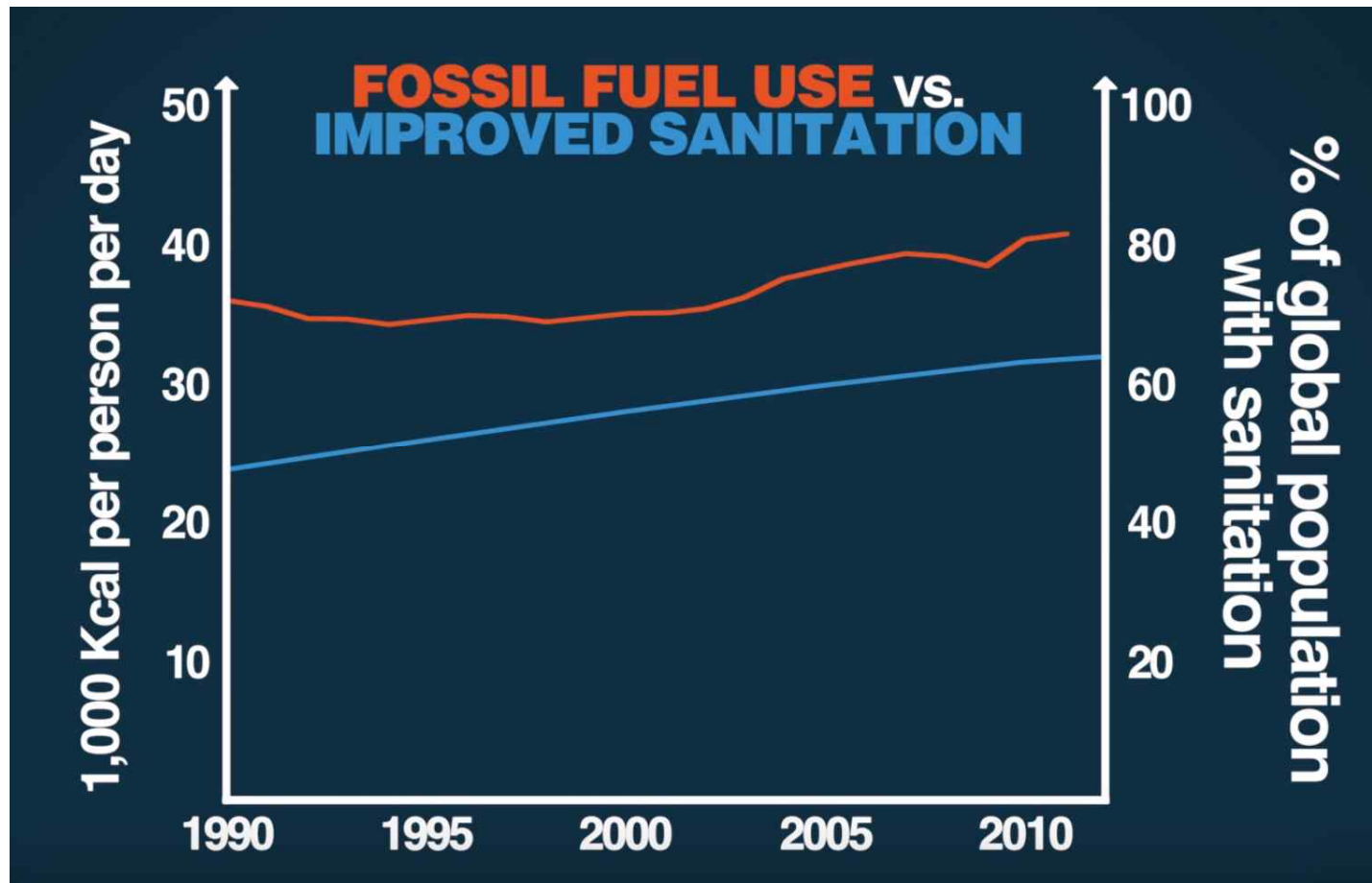
## Oil Reserves



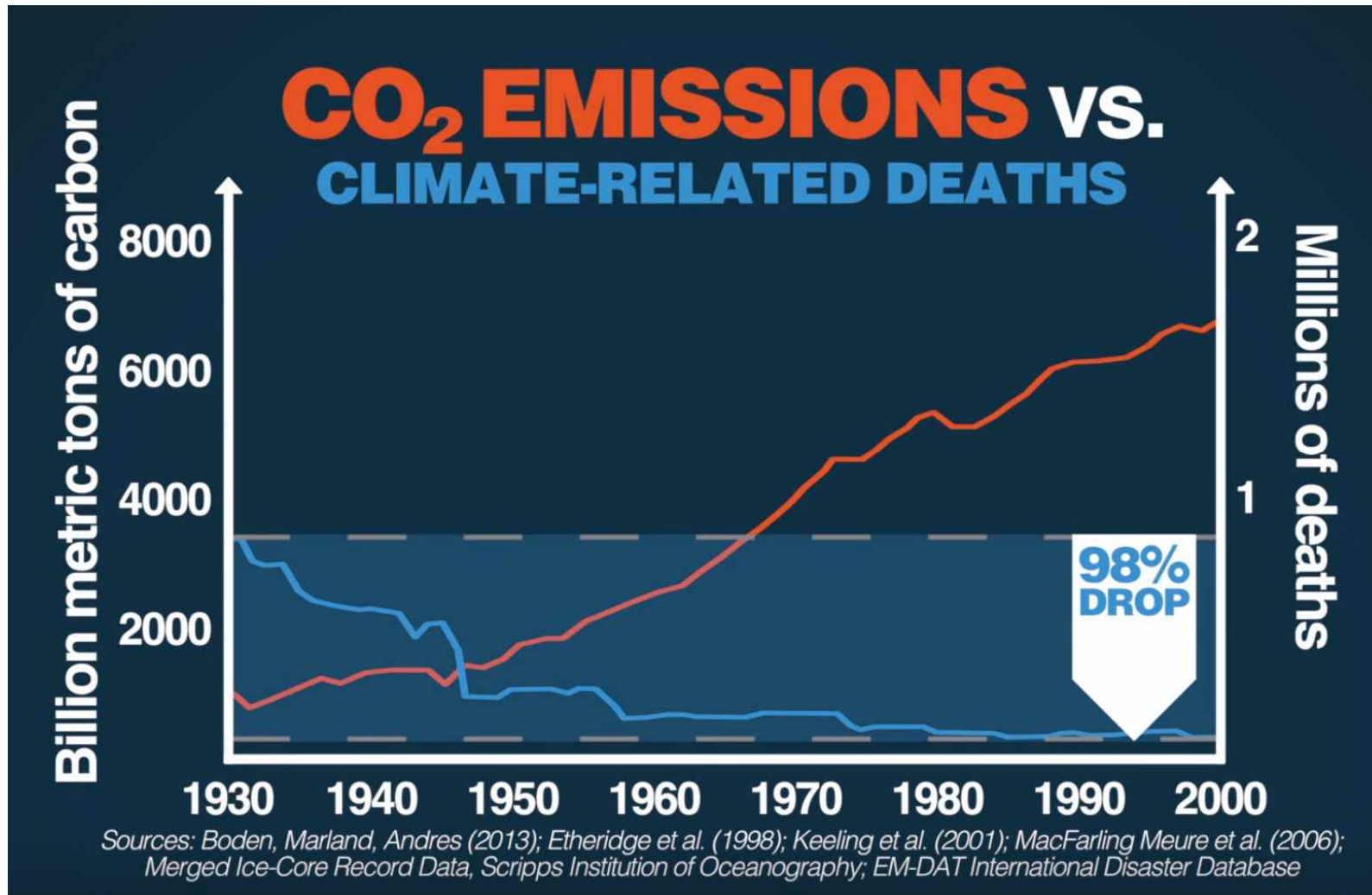
# Cleaner Air and Water



# 위생수준



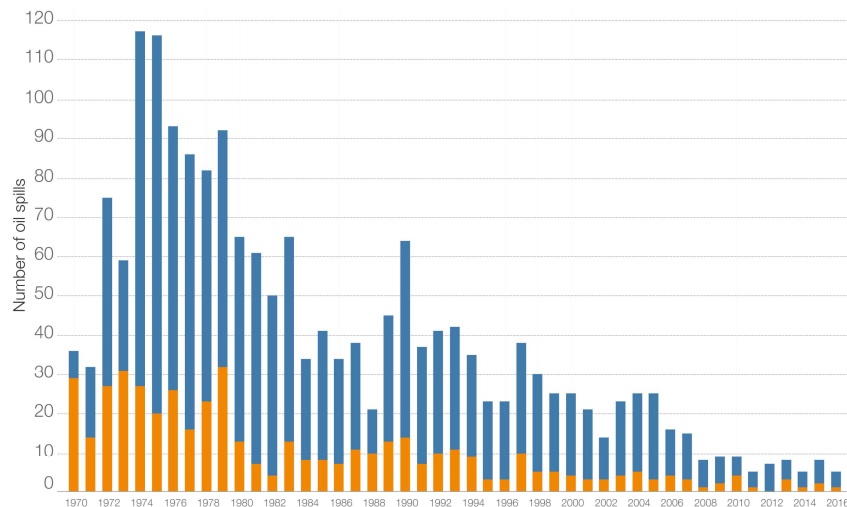
# More Fossil Fuels, Fewer Climate-Related Deaths



# Cleaner Environment - Oil Spills

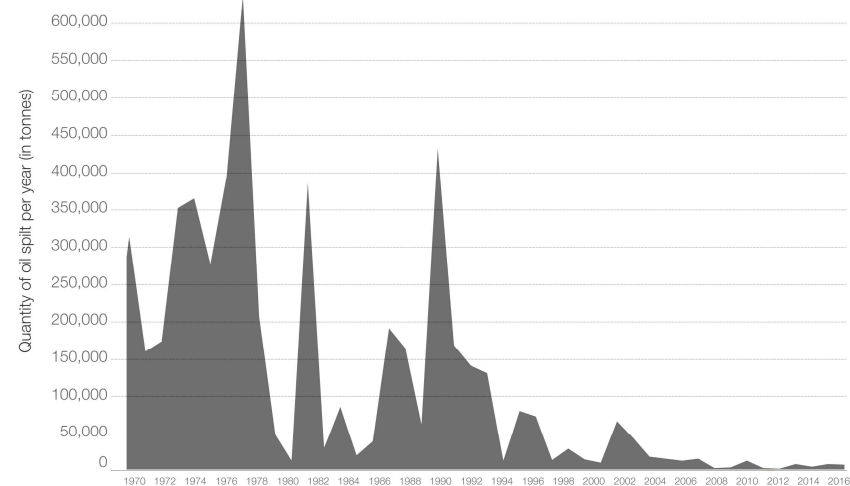
Number of oil spills from tankers worldwide, 1970–2016

The bars show the number of oil spills per year. Smaller oil spills (7-700 Tonnes) in blue and large oil spills (>700 Tonnes) in orange



Data source: International Tanker Owners Pollution Federation (ITOPF) for the number of oil spills, United Nations Conference on Trade and Development (UNCTAD) for trade data. The interactive data visualization is available at OurWorldInData.org. There you find the raw data and more visualizations on this topic. Licensed under CC-BY-SA by the author Max Roser.

Quantity of oil spilled from tankers worldwide, 1970–2016

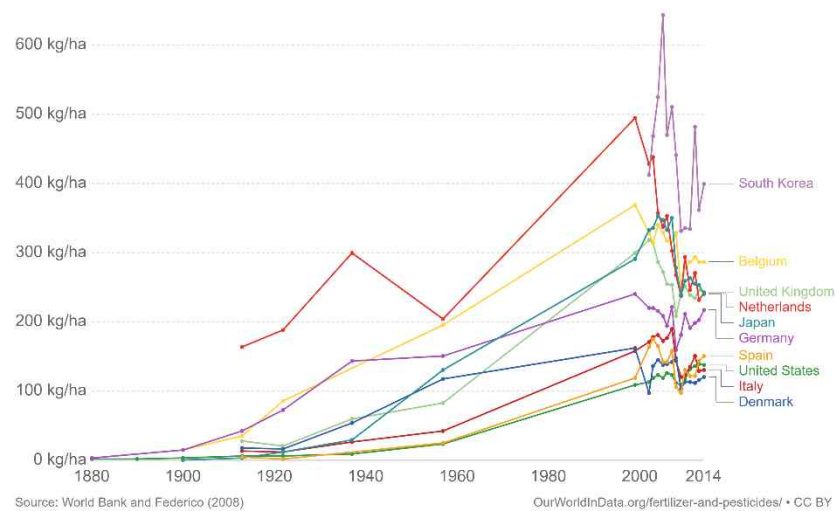


Data source: International Tanker Owners Pollution Federation (ITOPF) for the number of oil spills, United Nations Conference on Trade and Development (UNCTAD) for trade data. The interactive data visualization is available at OurWorldInData.org. There you find the raw data and more visualizations on this topic. Licensed under CC-BY-SA by the author Max Roser.

# Less Fertilizers

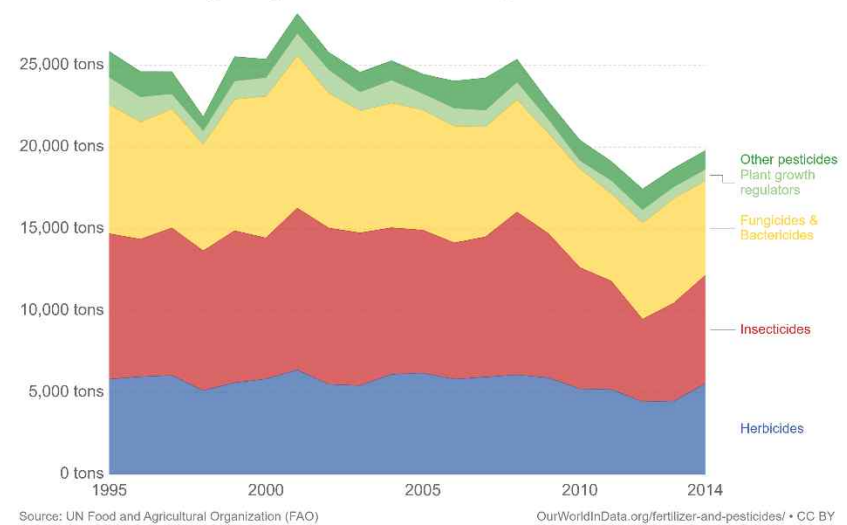
## Fertilizer application rates over the long-run

Average fertilizer application rates for select countries over the long-run, measured in kilograms of nutrient per hectare of arable land.



## Pesticide breakdown by type, South Korea

Pesticide use, broken down by product type, measured in tonnes of active ingredient.

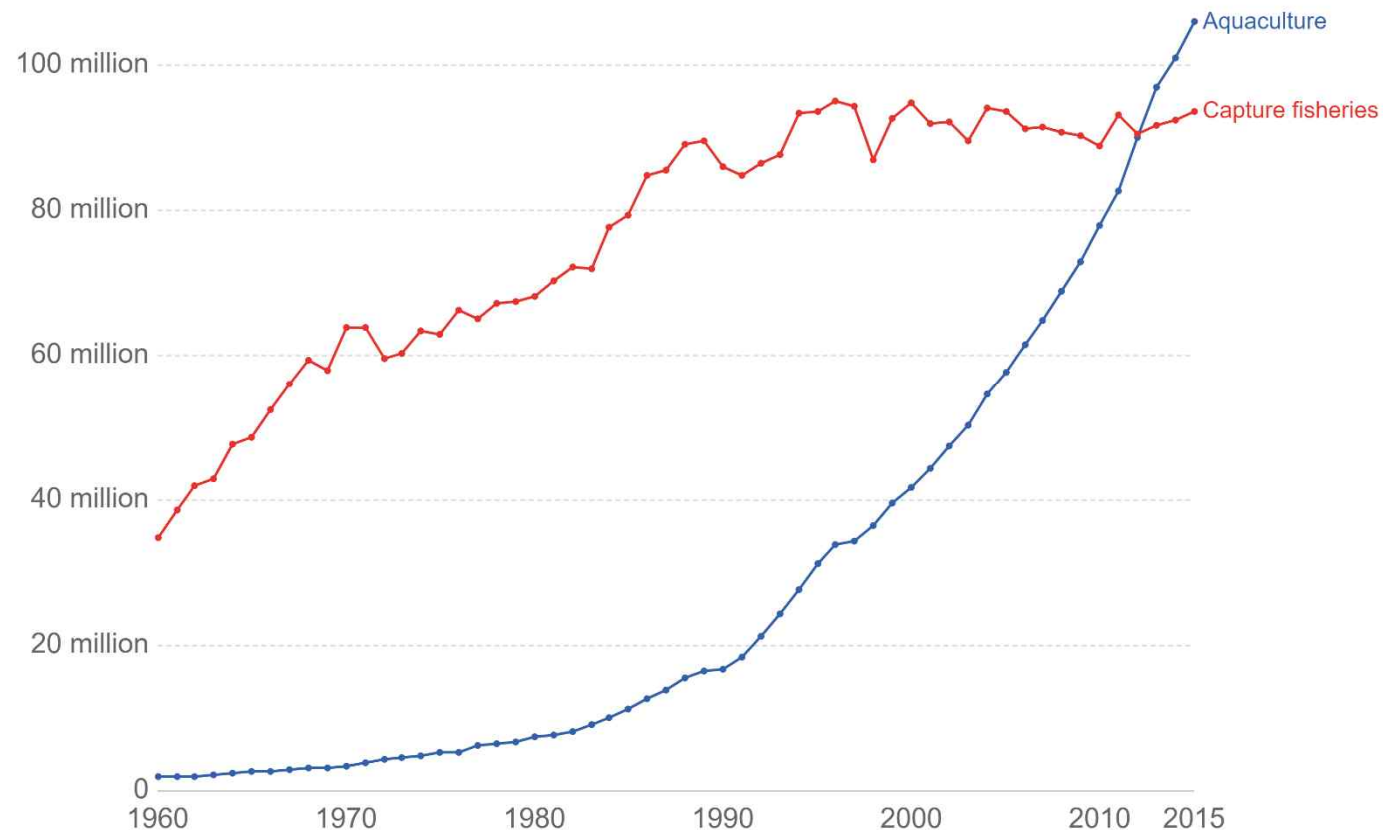


# No fish are not endangered

## Capture fisheries vs. aquaculture (farmed fish) production, World

Annual production of seafood from wild-catch fisheries and aquaculture (farmed seafood) practices, measured in metric tonnes per year. Data is inclusive of all aquatic species, including aquatic animals and plants.

Our World  
in Data



Source: World Bank- World Development Indicators

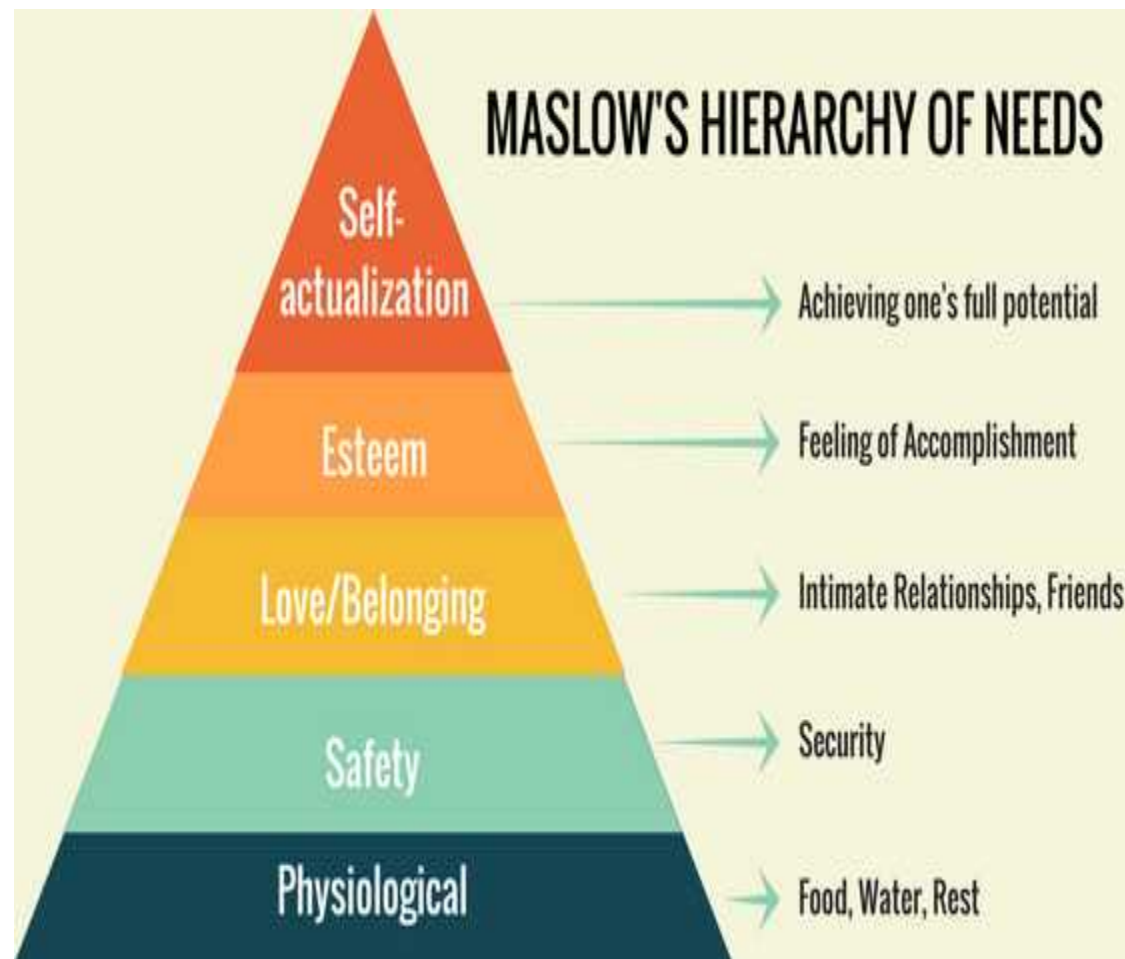
OurWorldInData.org/meat-and-seafood-production-consumption/ • CC BY

Climate Change가 사실이라고  
해도 왜 환경론자들의 해법은  
실패할 수 밖에 없는가?



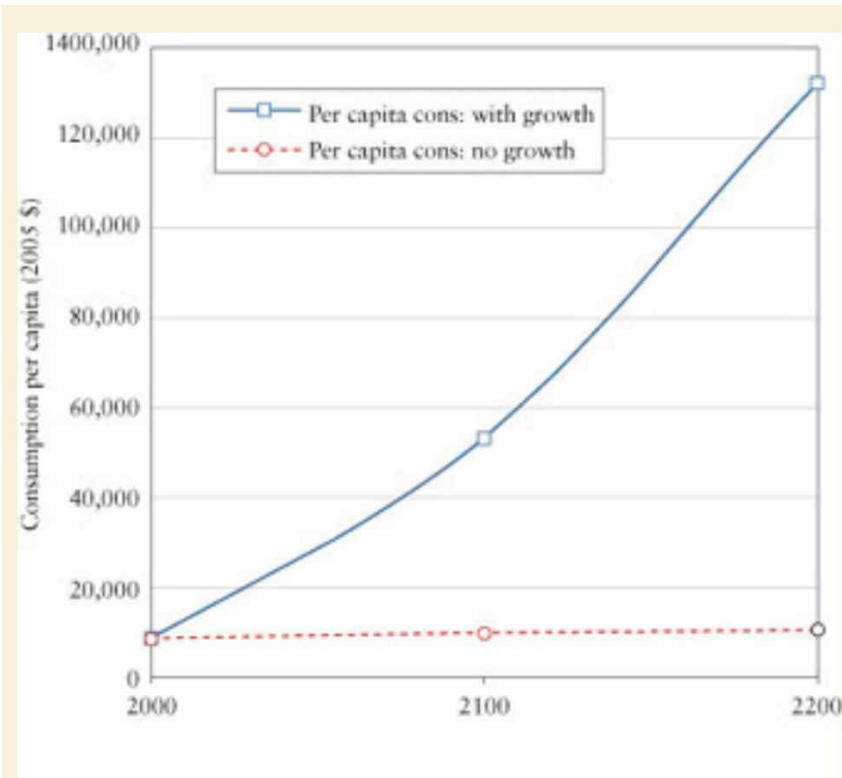
# (1) 삶의 질의 욕구와 충돌

---

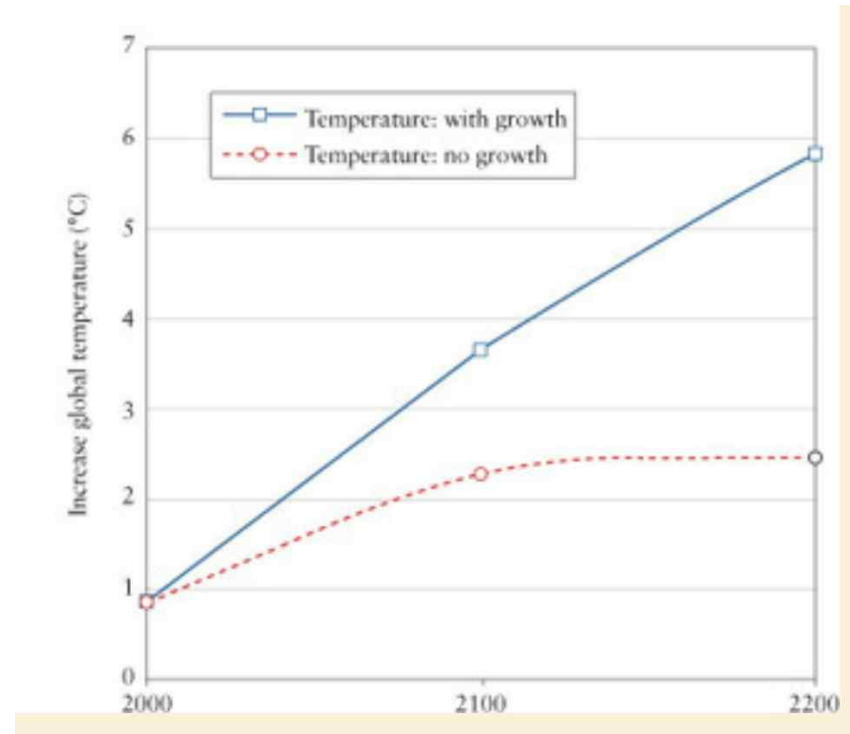


# 환경론자들의 자연주의 해법의 충돌

경제성장과 소득



경제성장과 기온



---

# \$5 trillion

estimated cost to major US public pension  
funds of divesting shares in fossil fuel  
companies over 50 years

Source: Compass Lexecon

CAP**X**

---

## Impact of Divestment on NYC Pension Funds



# Costs and Benefits to Whom?

---

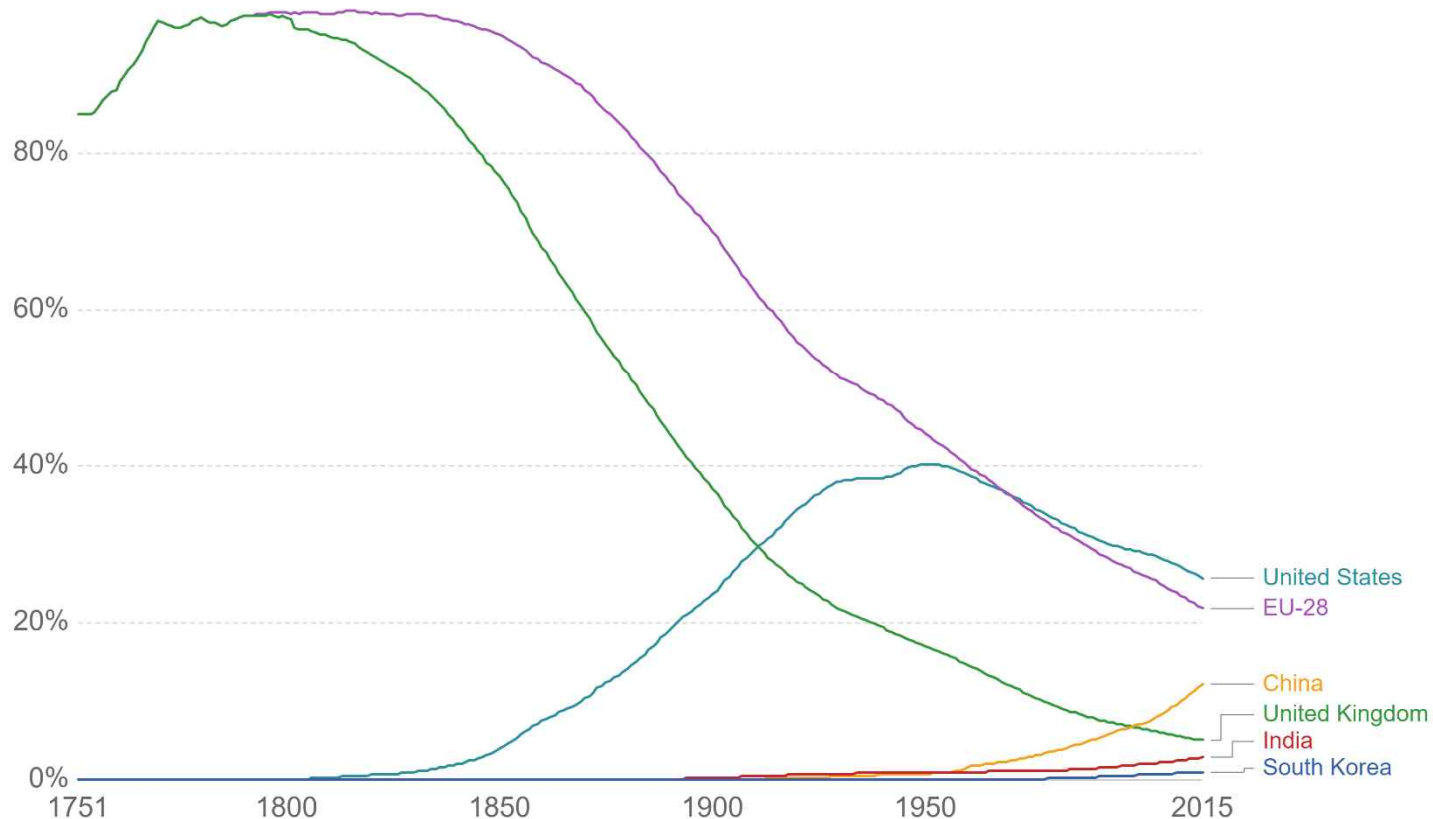
- ▶ 대상 (현재 x 미래)
  - ▶ 인간
    - ▶ 개인
    - ▶ 지역사회
    - ▶ 국가
  - ▶ 모든 생명

## (2) 비용과 혜택의 주체가 불일치 Prisoner's Dilemma

### Share of global cumulative CO<sub>2</sub> emissions

Each country or region's share of cumulative global carbon dioxide (CO<sub>2</sub>) emissions. Cumulative emissions are calculated as the sum of annual emissions from 1751 to a given year.

Our World  
in Data

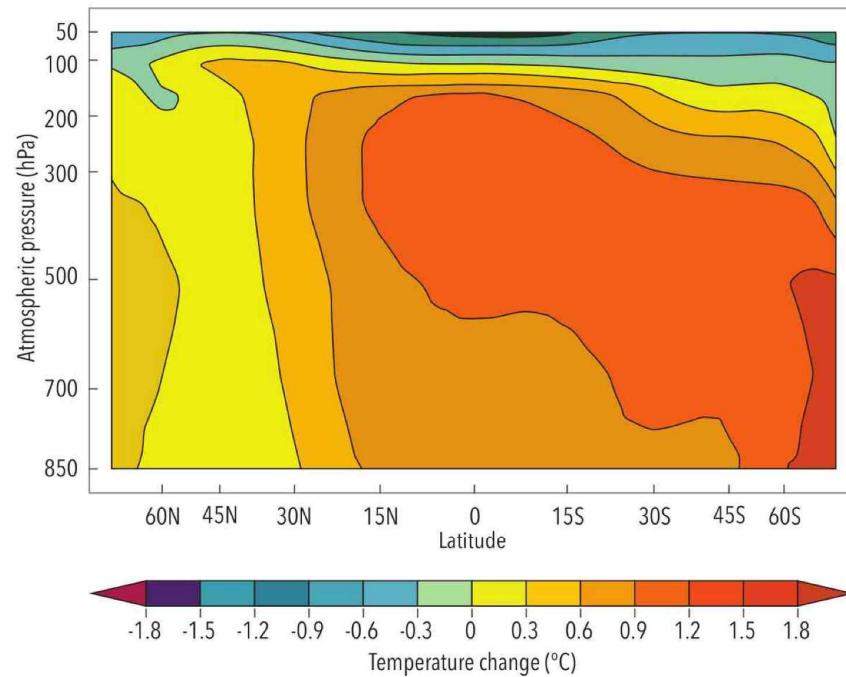


Source: Our World in Data based on Global Carbon Project (GCP)

CC BY

# 비용과 혜택의 지역이 다르다

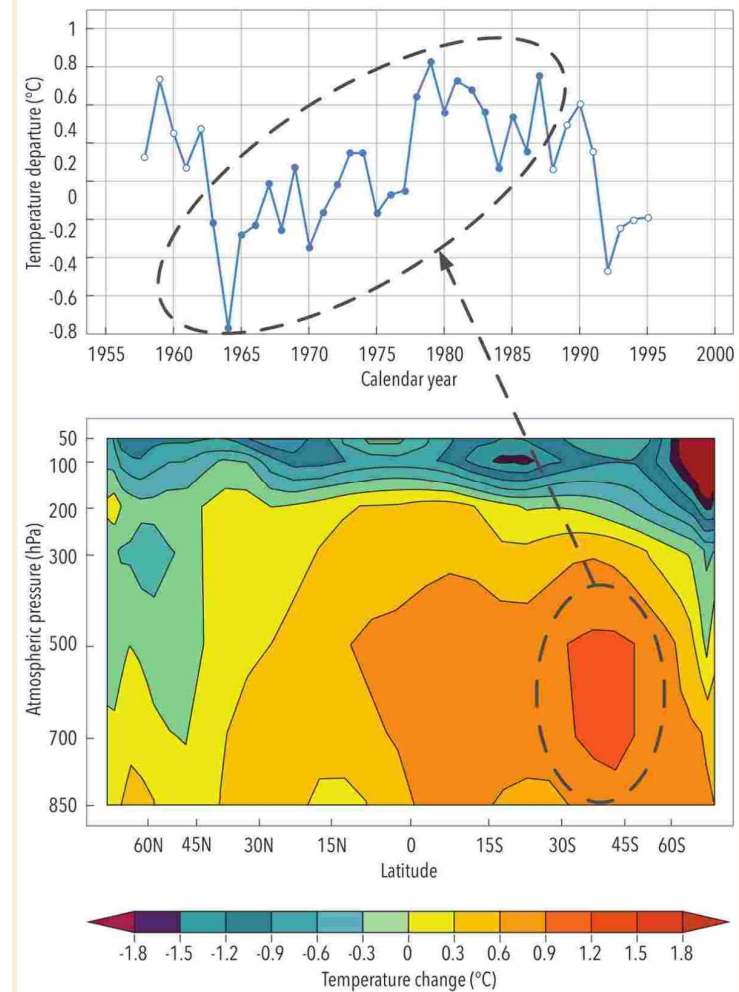
**Figure 18.2** Climate-model projections of atmospheric temperature change



Projections for different atmospheric heights and latitudes as depicted in Santer et al. (1996).

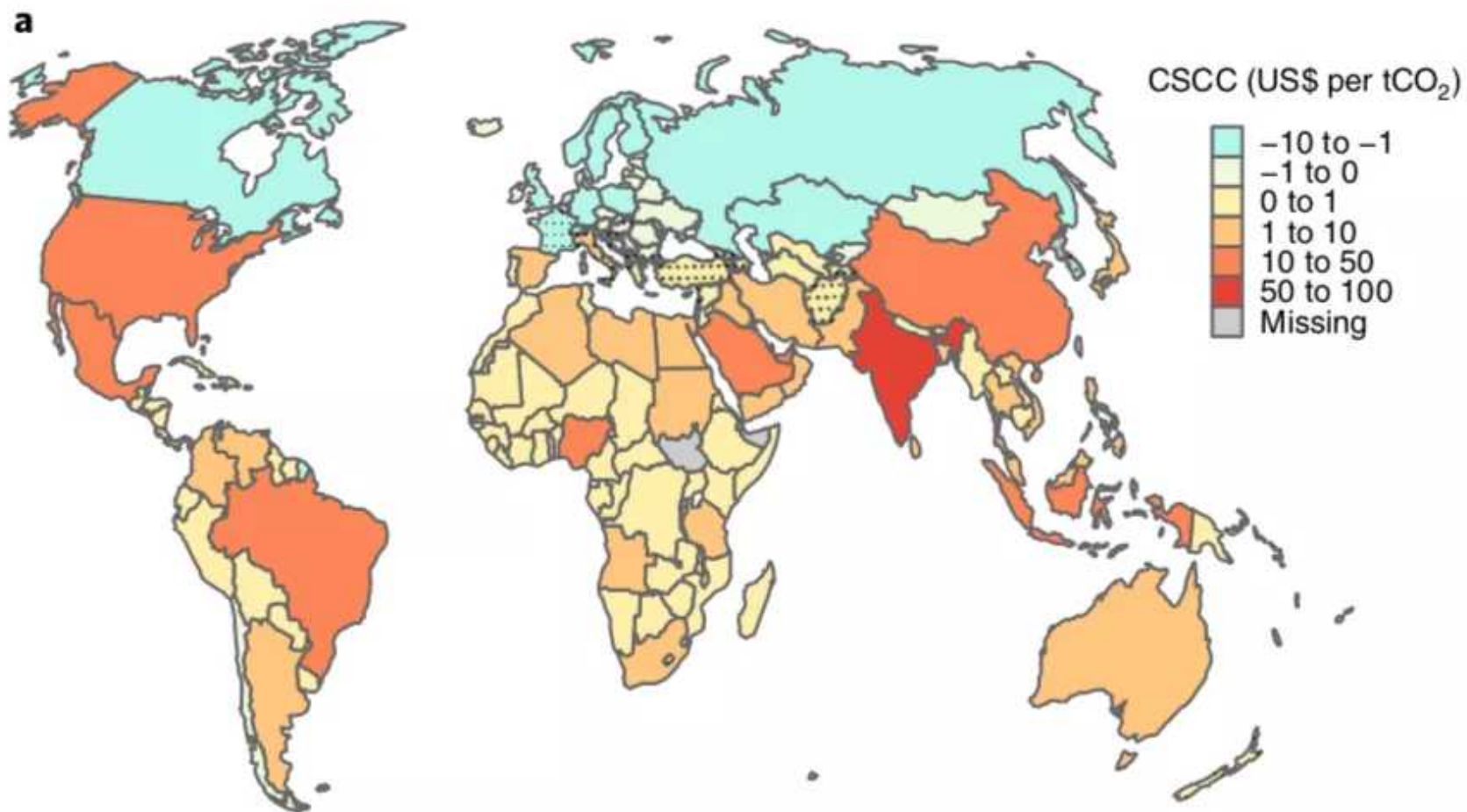
Source: reprinted by permission from Nature Publishing Group – Santer, BD et al., 'A search for human influences on the thermal structure of the atmosphere', *Nature*, vol. 382, pp. 39-46, copyright 1996.

**Figure 18.3** Observed atmospheric temperature trends

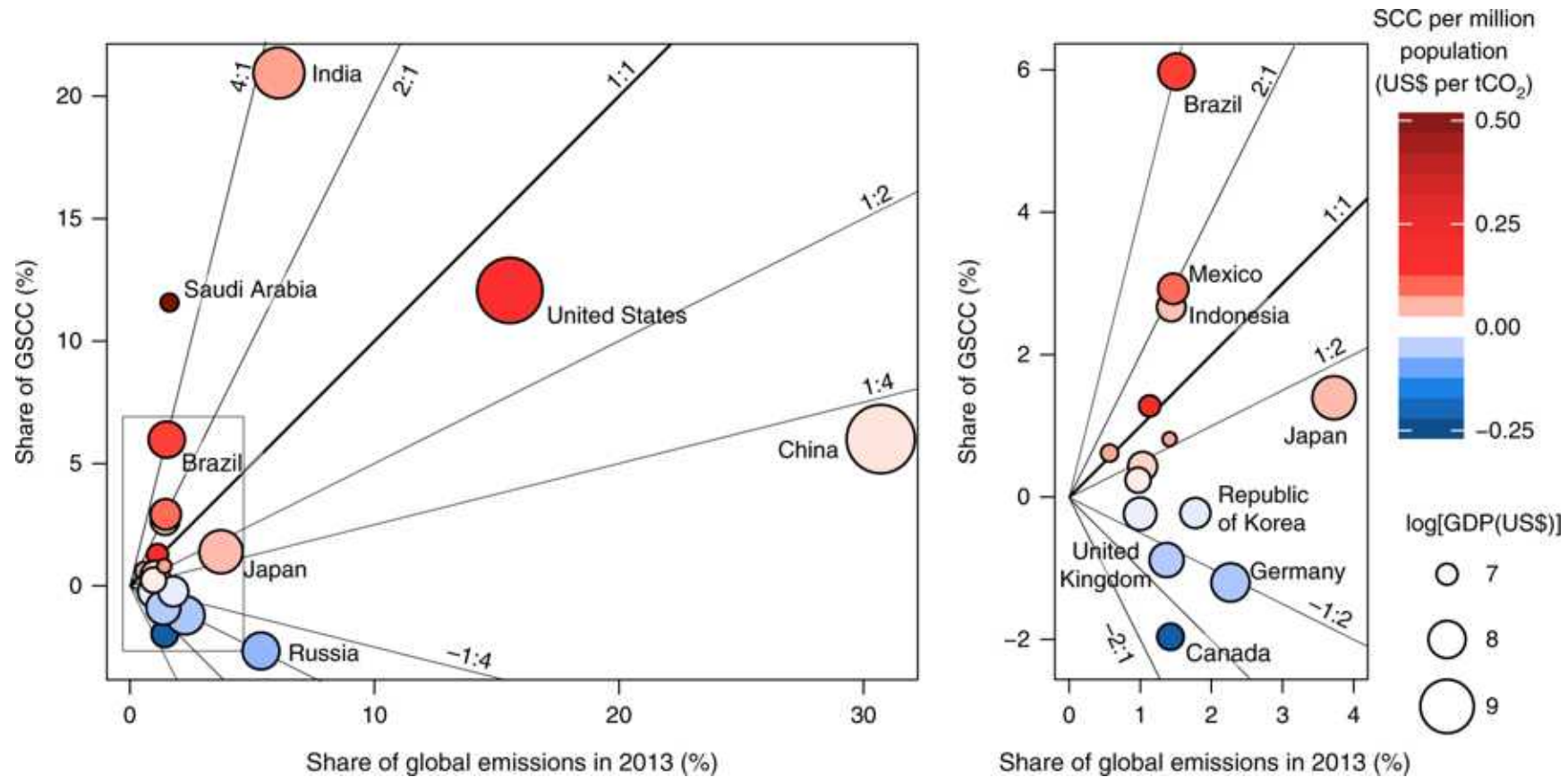


# social cost of carbon

---



# 한국은 지구 온난화 혜택 국가다



Country-level social cost of carbon (nature Climate Change, September 24<sup>th</sup>, 2018)

## 먼 훗날을 위해 당장을 희생하기는 쉽지 않다

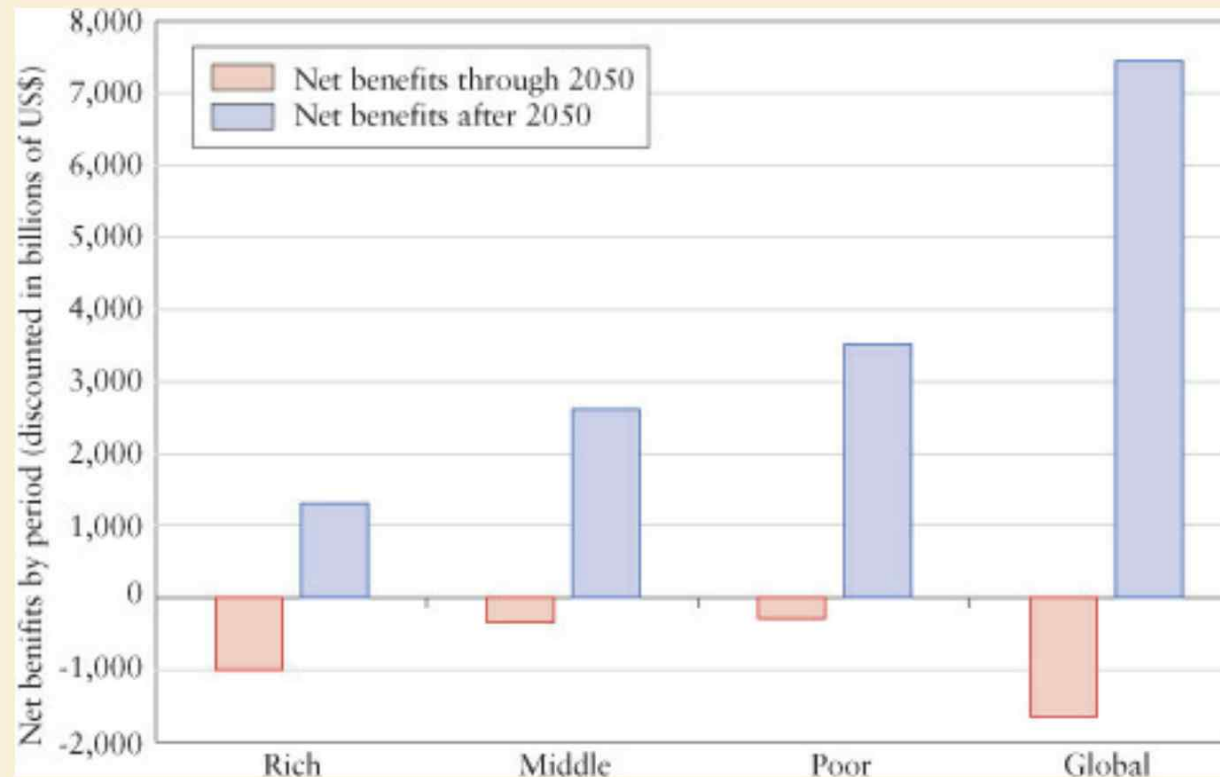
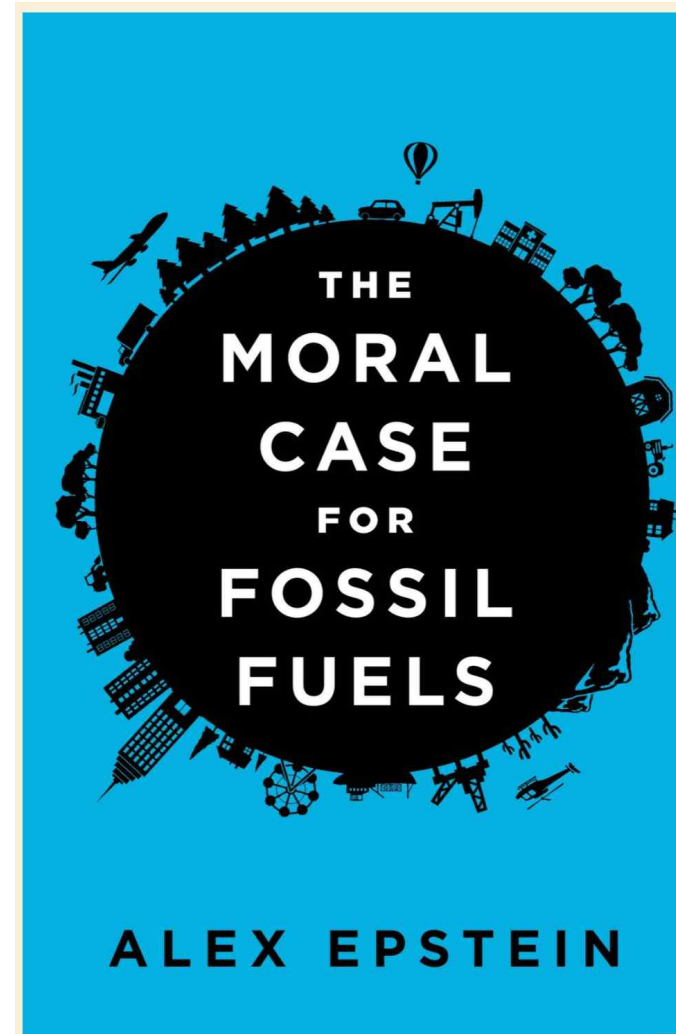


Figure 44. The temporal trade-off in climate-change policies. The bars show net benefits (equal to damages plus abatement costs, all discounted at market interest rates) for country groups for two time periods. The left solid bars are the net benefits for the first half century, while the light shaded bars are the net benefits for the balance of the period through 2200.

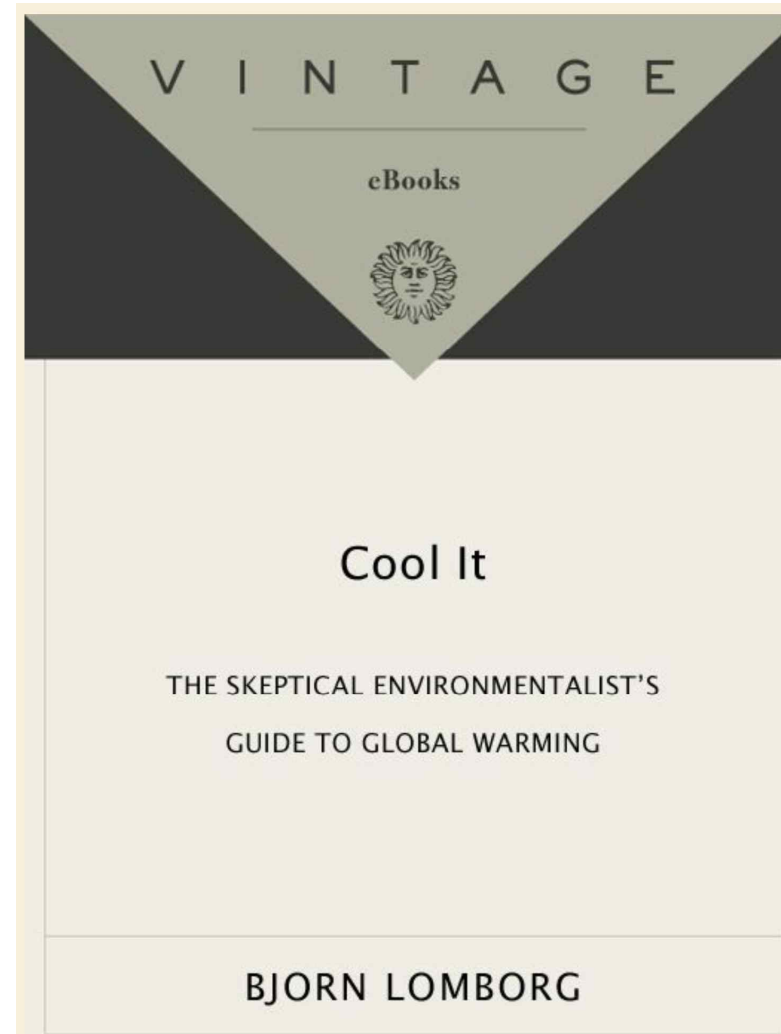
### (3) 에너지 손익분석

- 화석연료가 기후 변화를 만든다?
  - 인간의 천제성과 기술이 기후변화를 점점 통제가능하게 한다
- 화석 연료는 재생되지 않는다
  - 화석연료는 부족하지 않다. 기술만큼 생산된다.
  - 더 싸고 좋은 에너지(원자력)를 발전시킬 시간이 있다
- 화석연료는 태양광, 풍력으로 대체 가능하다.
  - 아니다. 화석연료만이 현재는 80억명을 지탱할 경제성 있고 안정된 에너지원.



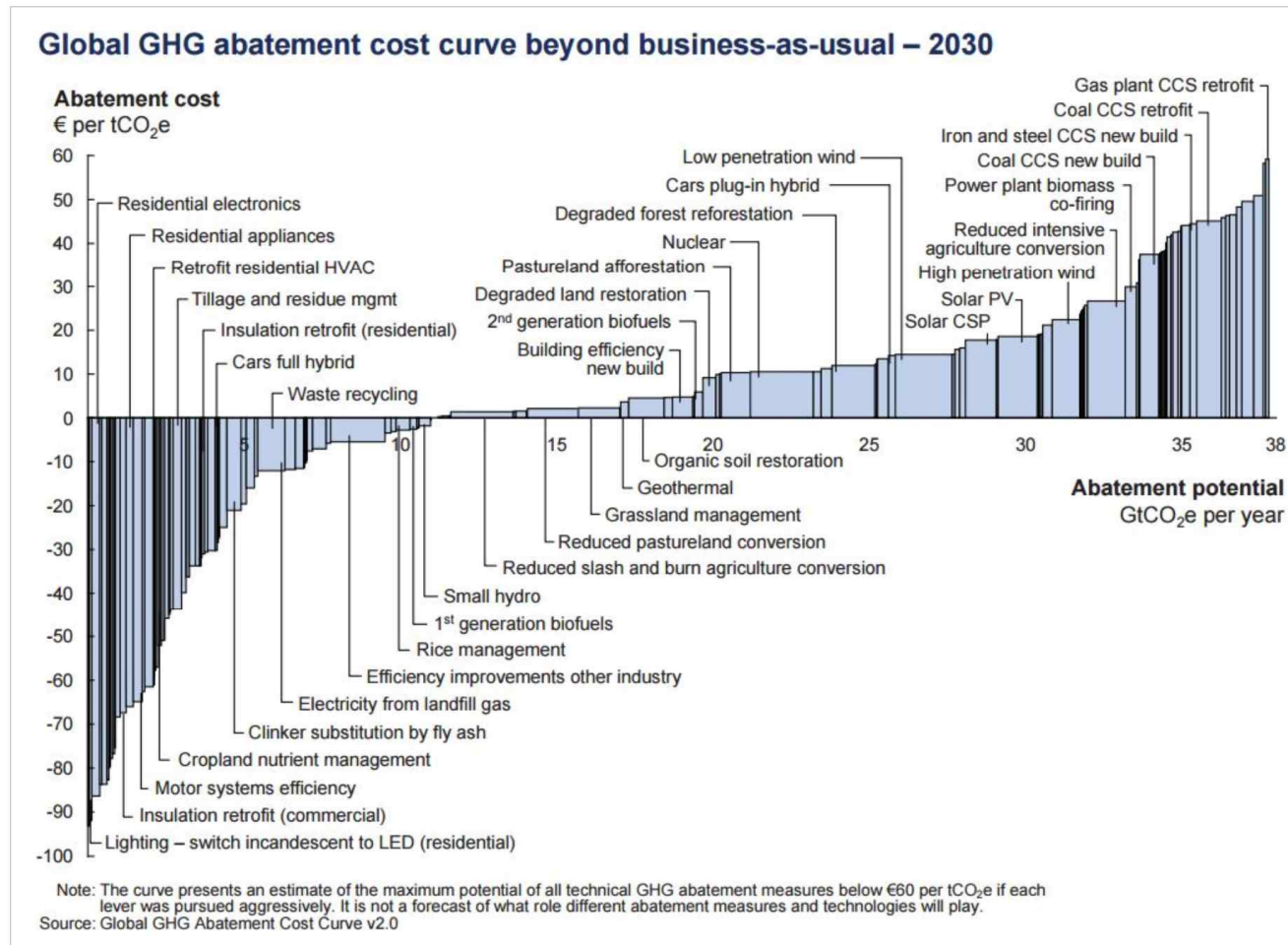
# 과장된 손익분석

- ▶ 2006년 Sir Nicholas Stern
  - ▶ 기후 변화에 의한 GDP 손실은 현재 GDP의 5%~20%. 이는 20세기의 경제 공황이나 전쟁에 의한 피해 수준.
  - ▶ 기후변화에 대한 비용은 1%
- ▶ 비판
  - ▶ 최악의 시나리오에 기반
  - ▶ 피해를 엄청나게 과장
  - ▶ 비용의 과소 계상

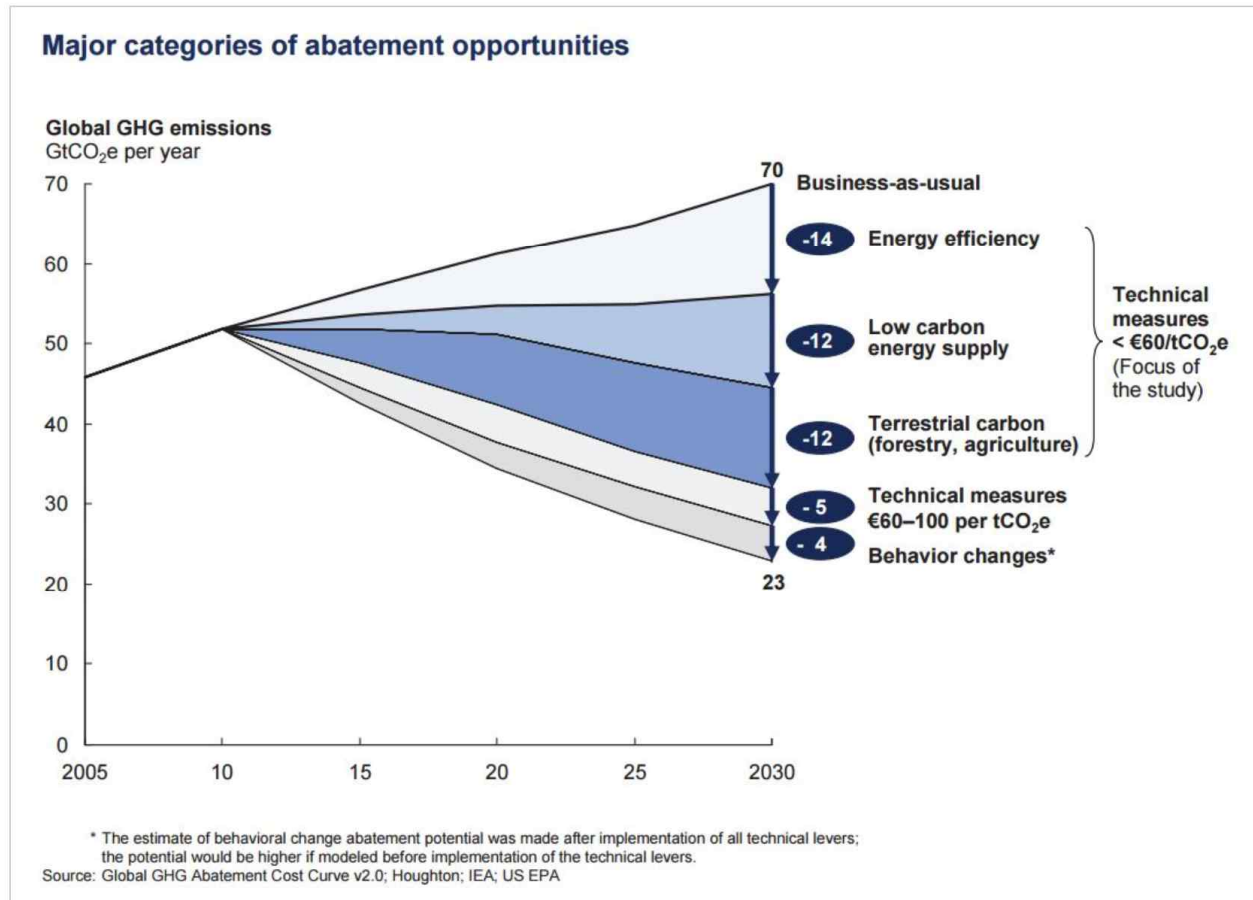


# Can we predict these precisely?

Global greenhouse gas abatement cost curve<sup>6</sup>



Global greenhouse gas abatement potential<sup>7</sup>



# How big US\$20 trillion?



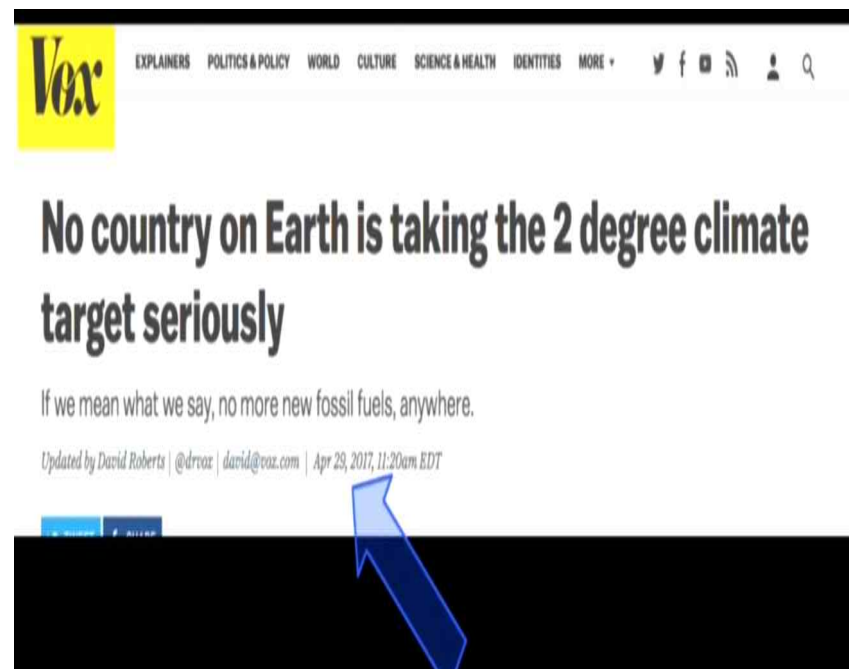
1. World GDP US\$80 trillion (2017)
2. GDP Growth on average 3%
3. GDP up to 2030 =  $15 \times 80$  trillion = 1200 trillion
4. 1.6 % of 11 years of World GDP
5. 2030 World GDP= 120 trillion
6. Mitigation Cost, 16.6% of 2030 World GDP

## “All we can do is speculate”

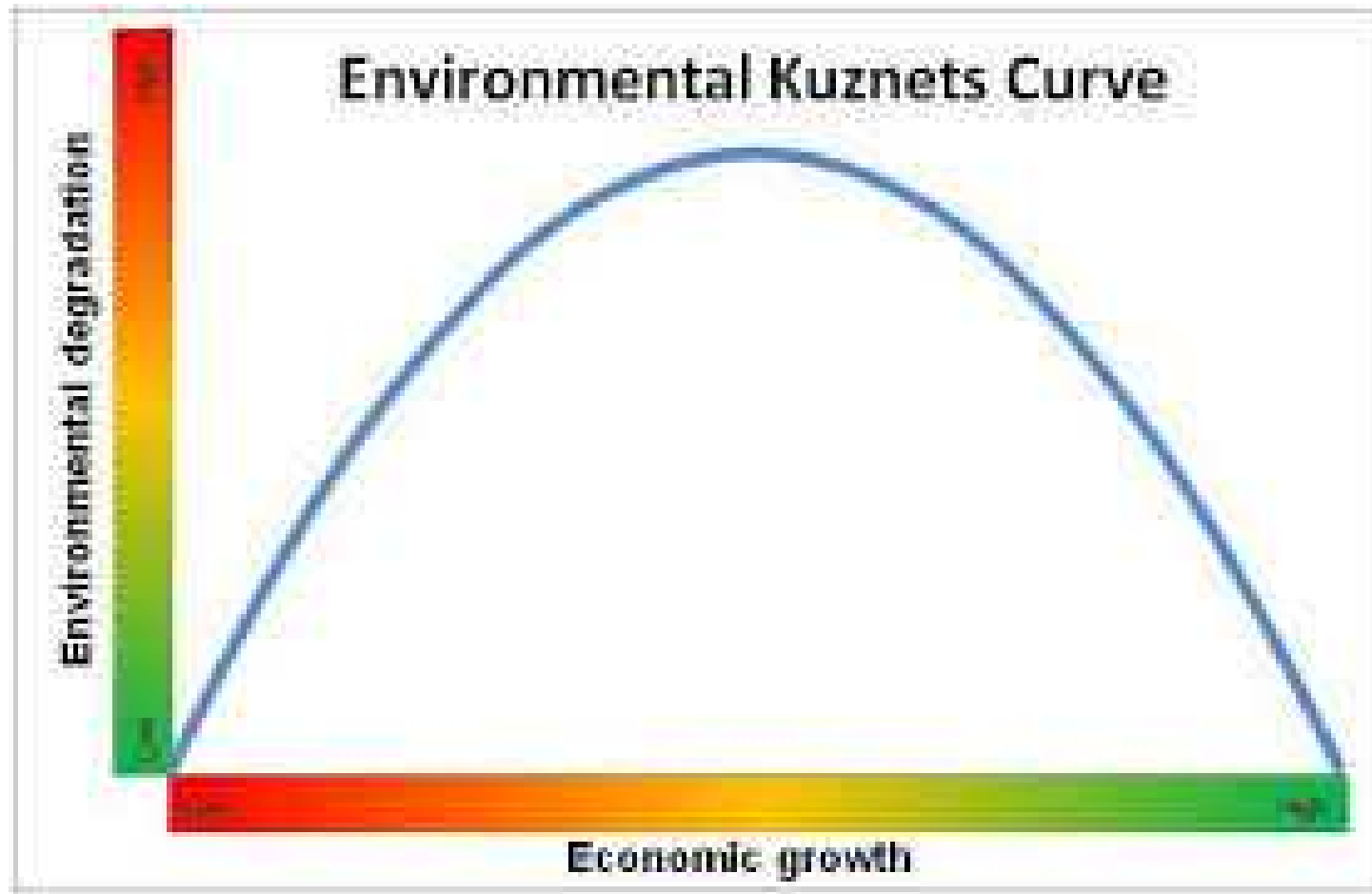
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Robert Pindyck, a professor of economics and finance at MIT, says that attempts to make decisions about climate change based on a cost-benefit analysis are doomed to fail because both costs and benefits are uncertain. “All we can do is speculate,” he says. “We don’t really know the costs. We don’t really know the benefits.”

## (4) The Climate Change is not only problem we have



## (5) 경제개발= 환경 파괴의 공식은 틀렸다

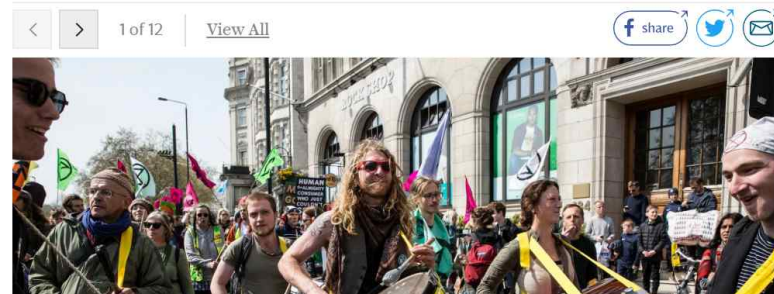


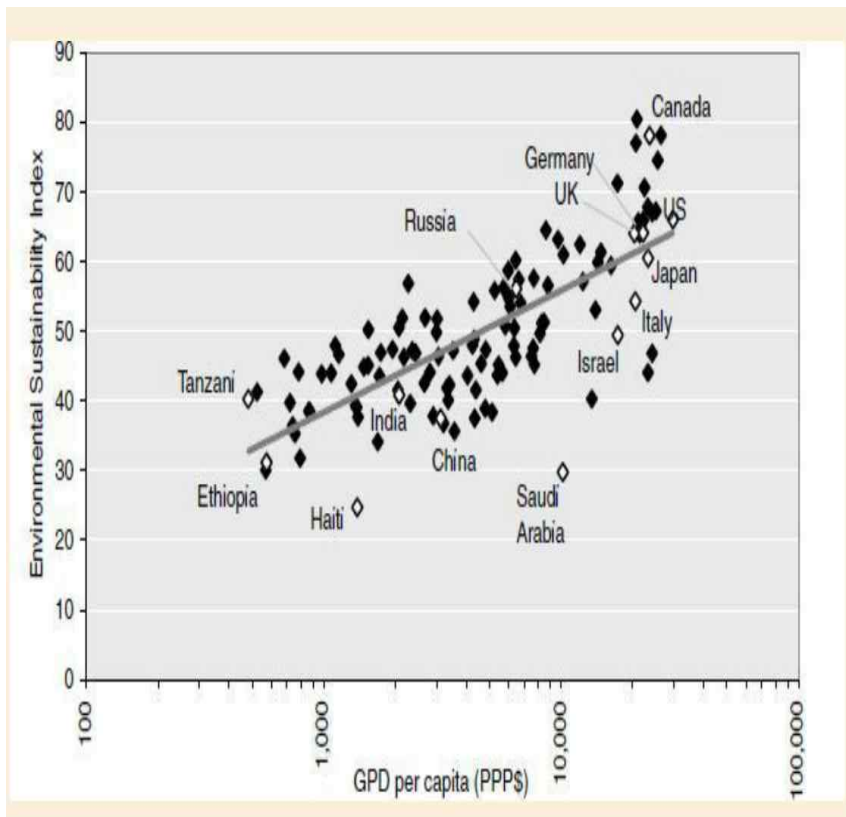
# What Environmentalist do not know

- The relationship between population growth and abundance is a positive one
- A populous world is a rich world and a rich world is better for the environment



Extinction Rebellion block London roads in climate protest, pictures

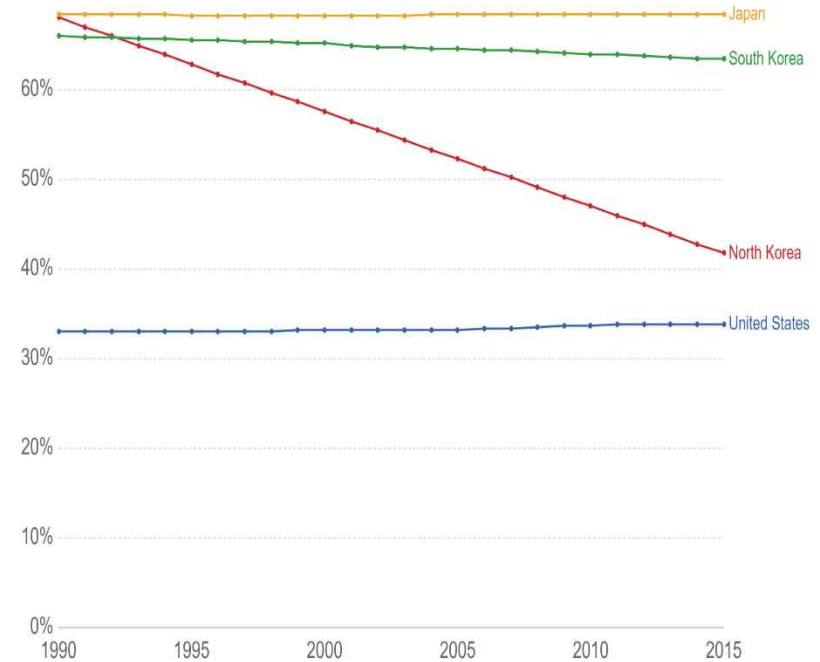




## Forest area (% of land area)

Forest area is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens.

Our World  
in Data



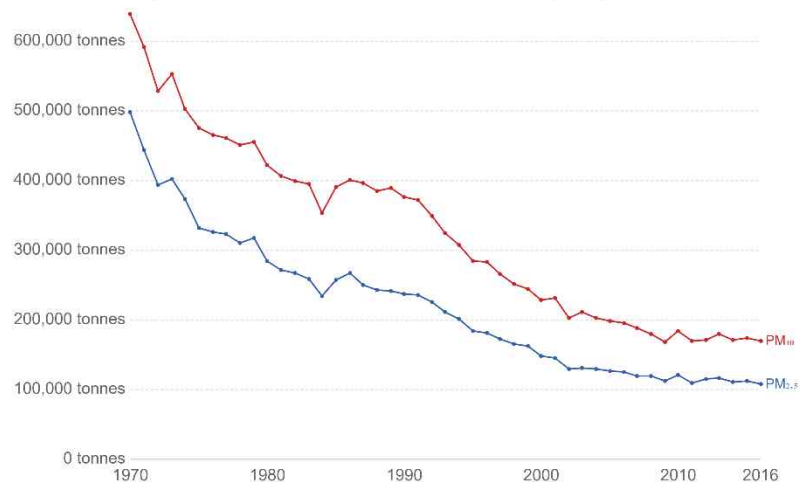
CC BY

# Air Pollution

## Emissions of particulate matter, United Kingdom

Annual emissions of particulate matter from all human-induced sources. This is measured in terms of  $PM_{10}$  and  $PM_{2.5}$ , which denotes particulate matter less than 10 and 2.5 microns in diameter, respectively.

Our World  
in Data



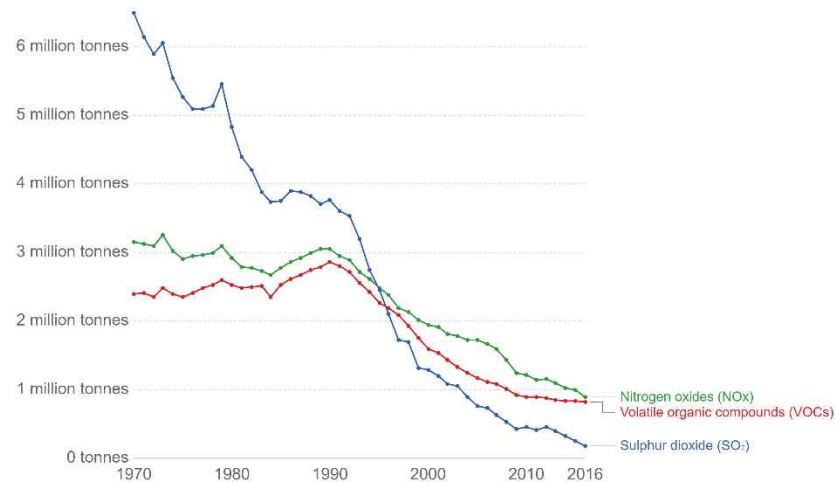
Source: UK DEFRA; US EPA

CC BY

## Air pollutant emissions, United Kingdom

Annual emissions of nitrogen oxides ( $NO_x$ ), non-methane volatile organic compounds (VOCs) and sulphur dioxide ( $SO_2$ ) measured in tonnes per year. This is measured across all human-induced sources.

Our World  
in Data



Source: UK DEFRA; US EPA

CC BY

# The Politics of Possibility

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## The Politics of Possibility

We have it in our power to begin the world over again. A situation, similar to the present, hath not happened since the days of Noah until now. The birth-day of a new world is at hand.

—THOMAS PAINE, *Common Sense*

# Solutions

---

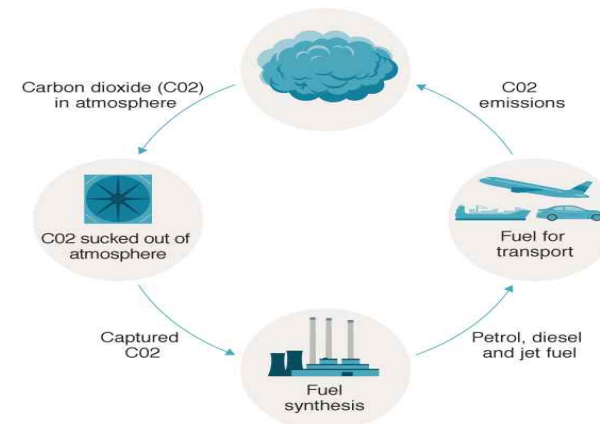
1. Mitigation
  1. Prohibition
  2. Technological Solutions
2. Adaptation



# Carbon Engineering



## How to turn CO<sub>2</sub> into fuel



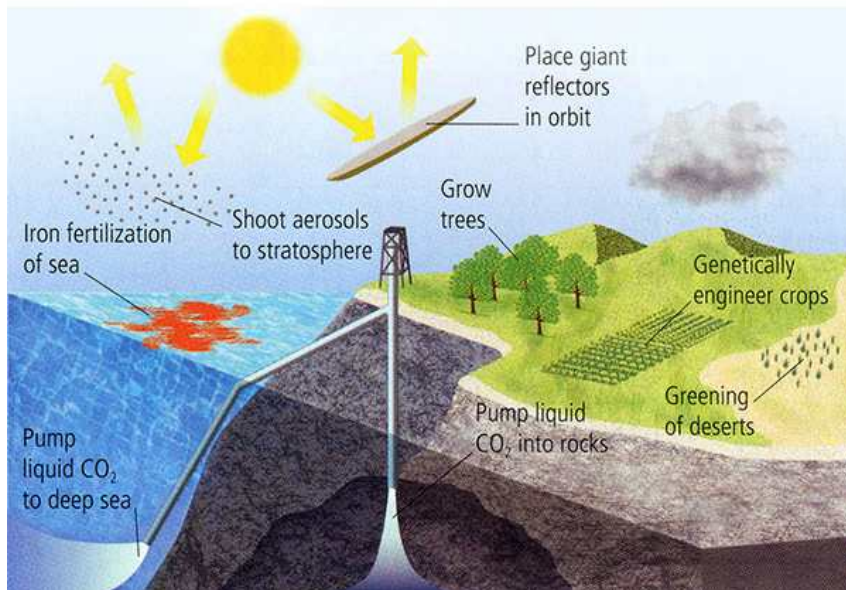
Source: Carbon Engineering

BBC



# Geoengineering?

## GEOENGINEERING SOLUTIONS TO CLIMATE CHANGE





SPECIAL SERIES  
Environment And Energy Collaborative



3:56

+ PLAYLIST

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EMBED

TRANSCRIPT

# This Company Says The Future Of Nuclear Energy Is Smaller, Cheaper And Safer

May 8, 2019 - 6:02 AM ET  
Heard on Weekend Edition Sunday

JEFF BRADY [f](#) [t](#) [i](#) [o](#) [g](#)



Artist rendering of NuScale Power's nuclear power plant design, which would use small modular reactors.  
*NuScale Power*

## Advanced Small Modular Reactors (SMRs)

[Home](#) » [Reactor Technologies](#) » Advanced Small Modular Reactors (SMRs)



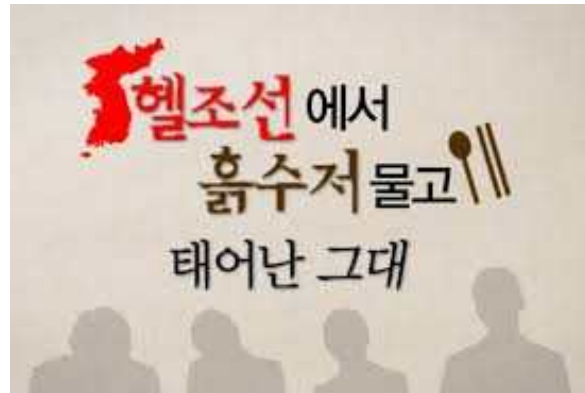
NuScale Power Reactor Building

- 
- ▶ [https://www.salon.com/2019/04/21/report-going-100-percent-renewable-power-means-a-lot-of-dirty-mining\\_partner/](https://www.salon.com/2019/04/21/report-going-100-percent-renewable-power-means-a-lot-of-dirty-mining_partner/)
  - ▶ CBS News: Capturing carbon, once a fringe idea, may be key to fighting climate change.  
<https://www.cbsnews.com/news/capturing-carbon-once-a-fringe-idea-may-be-key-to-fighting-climate-change/?ftag=CNM-00-10aag7e>
  - ▶ Engadget: Researchers suggest 100 percent renewable energy isn't very green.  
<https://www.engadget.com/2019/04/19/earthworks-renewable-energy-metal-demand/>

# 대한민국의 에너지 정책의 방향과 현실은 무엇인가?

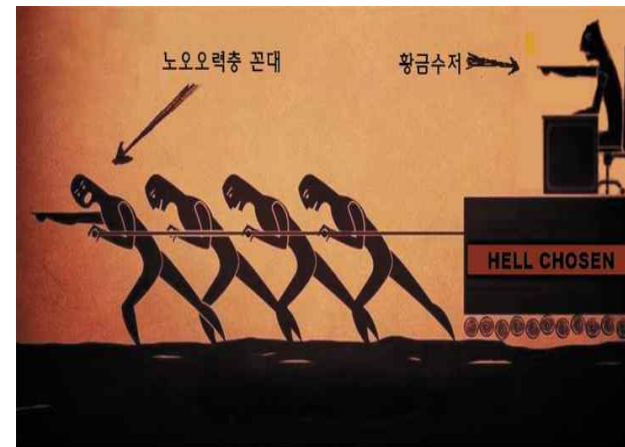


# 젊은이들에게 인식되는 대한민국



Hell Korea  
아프면 안 되는 청춘  
우주의 기운  
지옥불반도 헬반도  
노오력  
증후군  
N포세대

**헬조선**



# 선진국의 파티는 오래 전에 끝났다

## 2차 대전 직후 미국의 독점적 지위

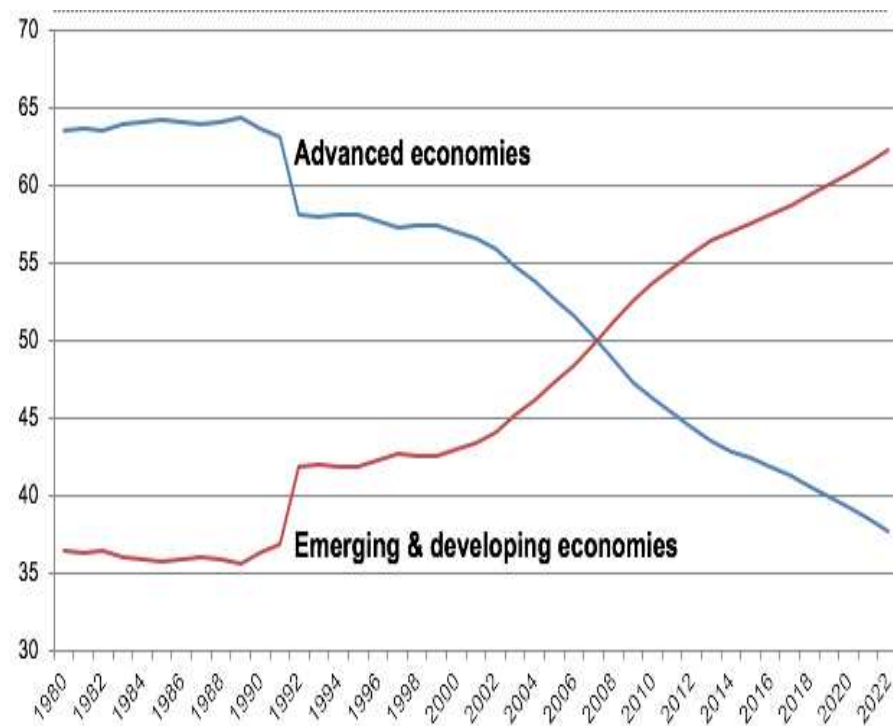
America after the Second World War accounted for...

<b>7%</b> of the world's population	<b>42%</b> of manufactured goods
<b>43%</b> of electricity	<b>62%</b> of oil

Source: Greenspan and Wooldridge, 'Capitalism in America'

CAPX

## 선진국 개도국 GDP 비중 변화



# 아주 크고 쎈 놈들이 왔다

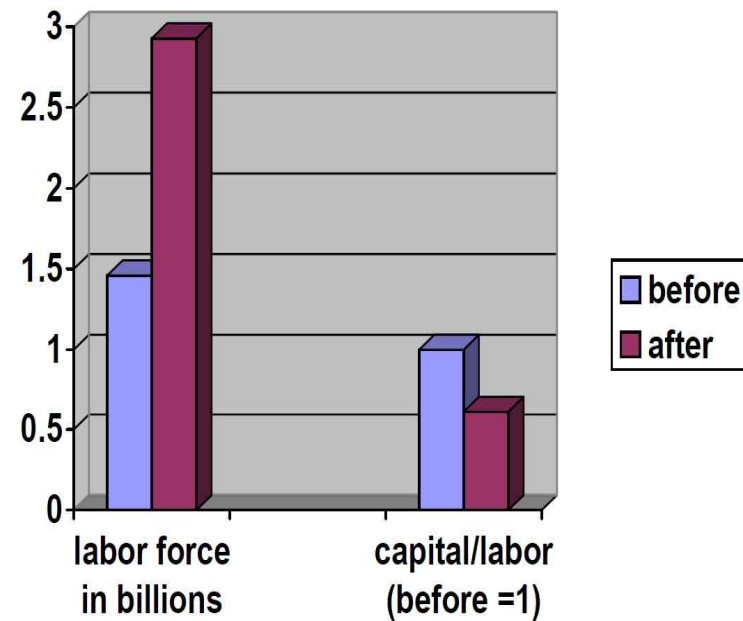
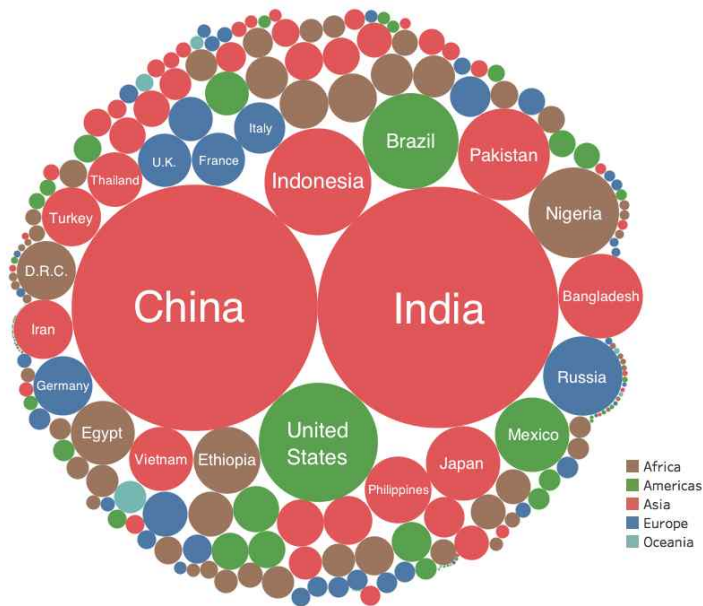


The Great Doubling, Richard Freeman

2000-2005년 글로벌 경제인구 15억에서 30억으로 급증

- *The Great Doubling: The Challenge of the New Global Labor Market*, August 2006 (Harvard University)

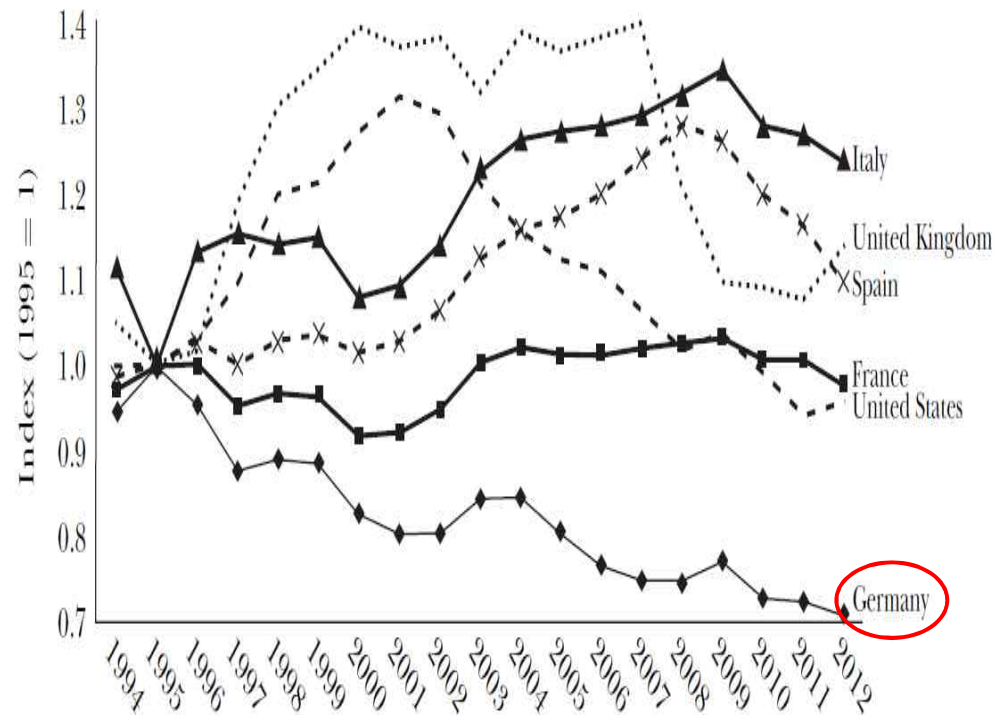
Countries by Population Size



Source: Employment from ILO data, [laborsta.ilo.org/](http://laborsta.ilo.org/) Millions of Economically Active Persons, 2000 Capital-labor ratio, calculated from Penn World Tables as described in Freeman 2005, scaled so before is 1.00.

# 독일과 일본 경제가 살아난 이유

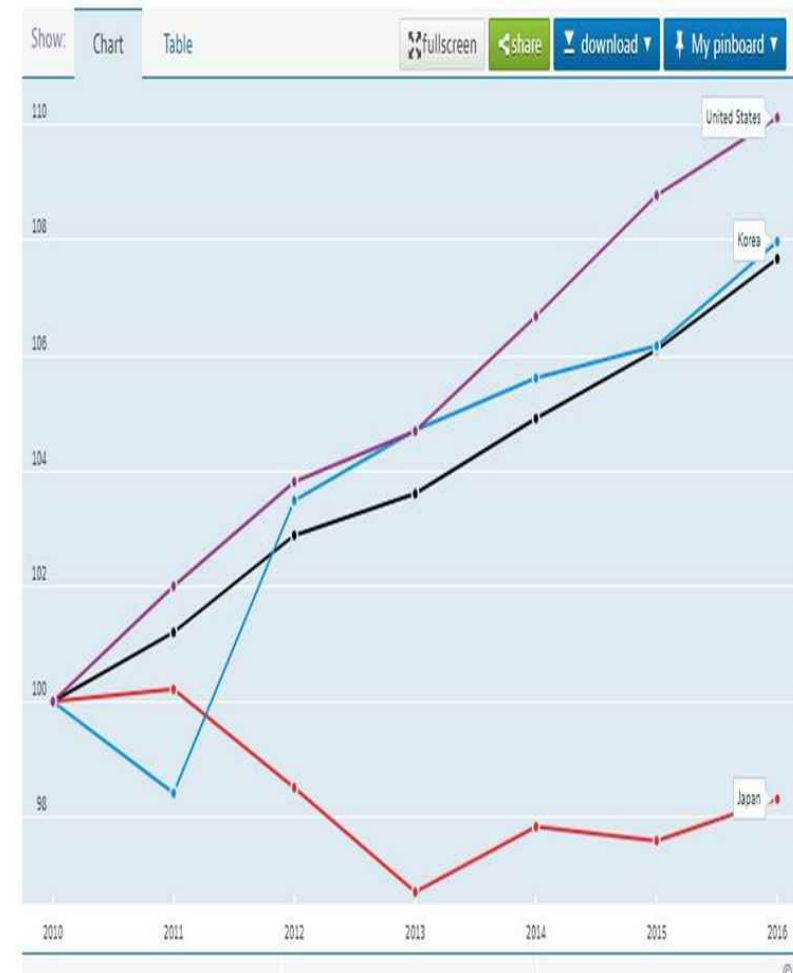
Evolution of Competition-Weighted Relative Unit Labor Costs, Selected Countries, 1994-2012



Dustmann, C., Fitzenberger, B., Schönberg, U., & Spitz-Oener, A. (2014). From Sick Man of Europe to Economic Superstar: Germany's Resurgent Economy. *Journal of Economic Perspectives*, 28(1), 167-188.

Unit labour costs By persons employed, 2010=100, 2010 - 2016

Source: Labour: Unit labour cost - quarterly indicators - early estimates



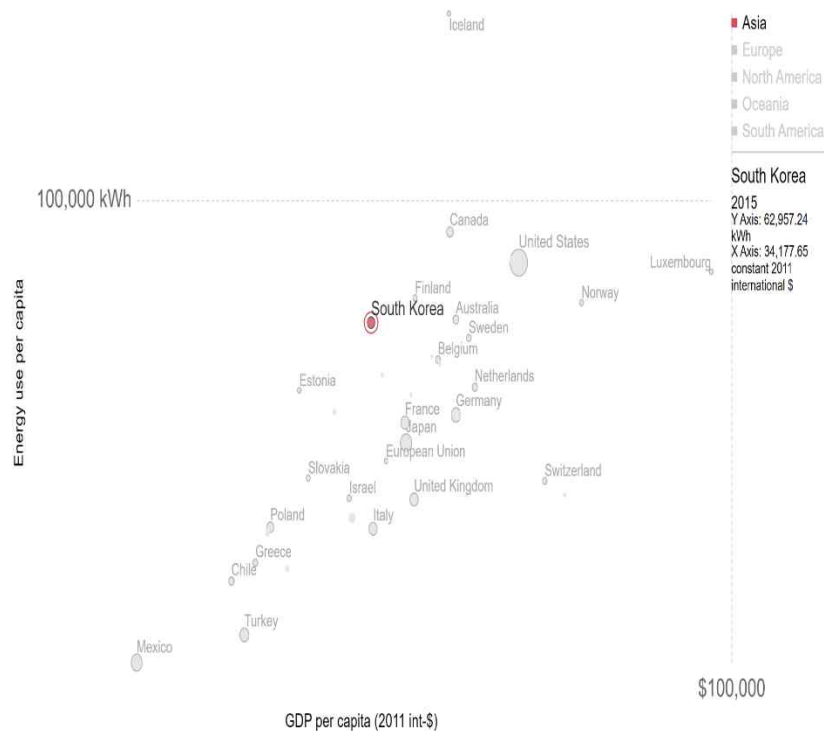
# 에너지 수요의 불확실성 (1)

## 경제구조 X 급격한 인구 변화와 가족 구성의 변화

### Energy use per capita vs. GDP per capita, 2015

Annual energy use per capita, measured in kilowatt-hours per person vs. gross domestic product (GDP) per capita, measured as 2011 international-\$

Our World  
in Data

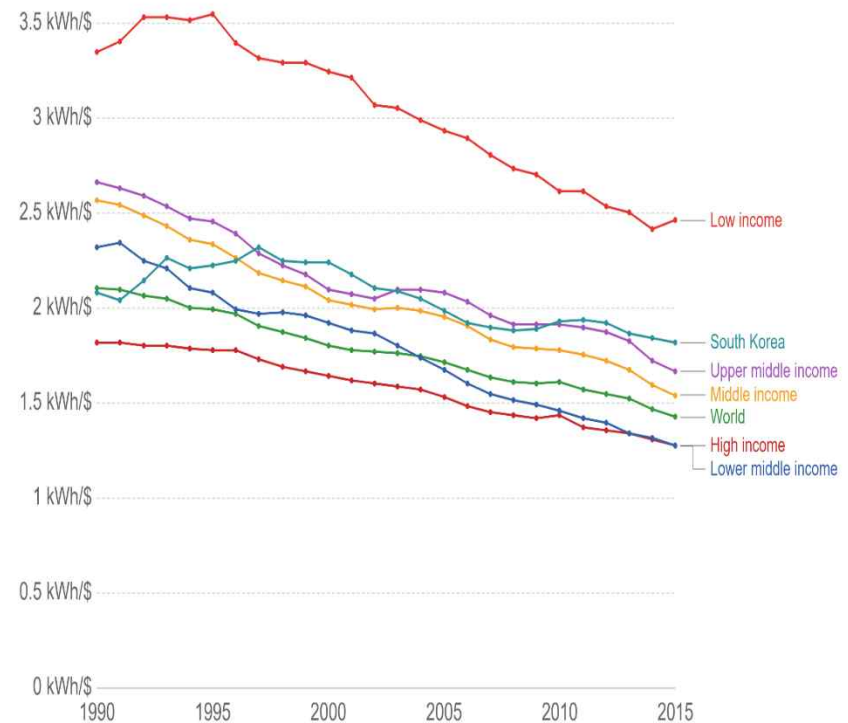


Source: International Energy Agency (IEA) via The World Bank OurWorldInData.org/energy-production-and-changing-energy-sources/ • CC BY

### Energy intensity of economies

Energy intensity of production, measured in kilowatt-hours per 2011 international-\$ of gross domestic product (kWh per 2011 int-\$ GDP).

Our World  
in Data



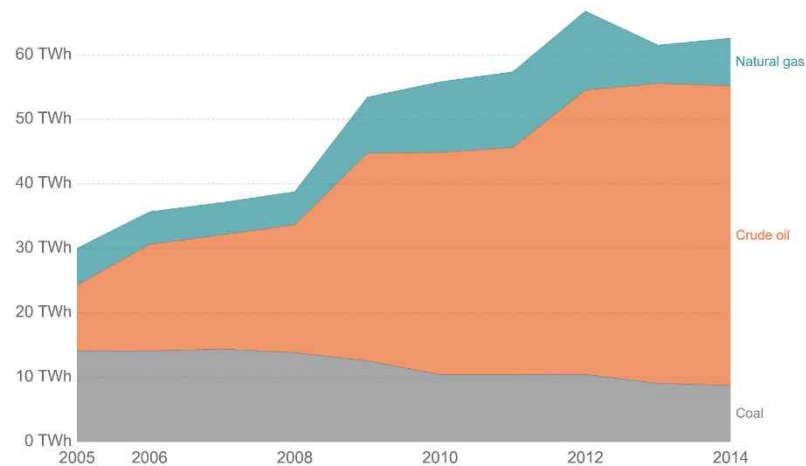
Source: World Bank, Sustainable Energy for All (SE4ALL) OurWorldInData.org/energy-production-and-changing-energy-sources/ • CC BY



## 에너지 수요의 불확실성 (2)북한의 에너지는?

Fossil fuel production over the long-term, South Korea

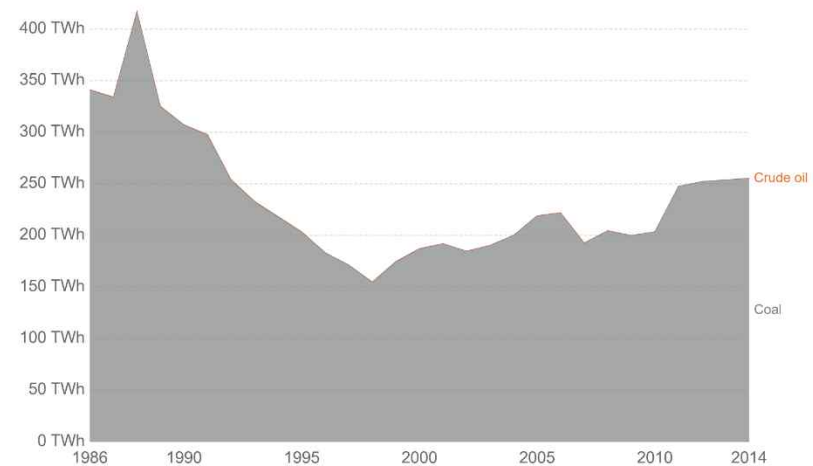
Total fossil fuel production - differentiated by coal, oil and natural gas - by country over the long-run, measured in terawatt-hour (TWh) equivalents per year.



Source: Coal production - The SHIFT Project, Oil production - Etemad & Luciana, Gas production - Etemad & Luciana  
OurWorldInData.org/fossil-fuels/ • CC BY

Fossil fuel production over the long-term, North Korea

Total fossil fuel production - differentiated by coal, oil and natural gas - by country over the long-run, measured in terawatt-hour (TWh) equivalents per year.



Source: Coal production - The SHIFT Project, Oil production - Etemad & Luciana, Gas production - Etemad & Luciana  
OurWorldInData.org/fossil-fuels/ • CC BY

## 4차 산업혁명과 에너지 변화

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이세돌 에너지 효율에서 알파고  
에 5만배 우위

### Another Way Of Looking At Lee Sedol vs AlphaGo – Jacques Matteij

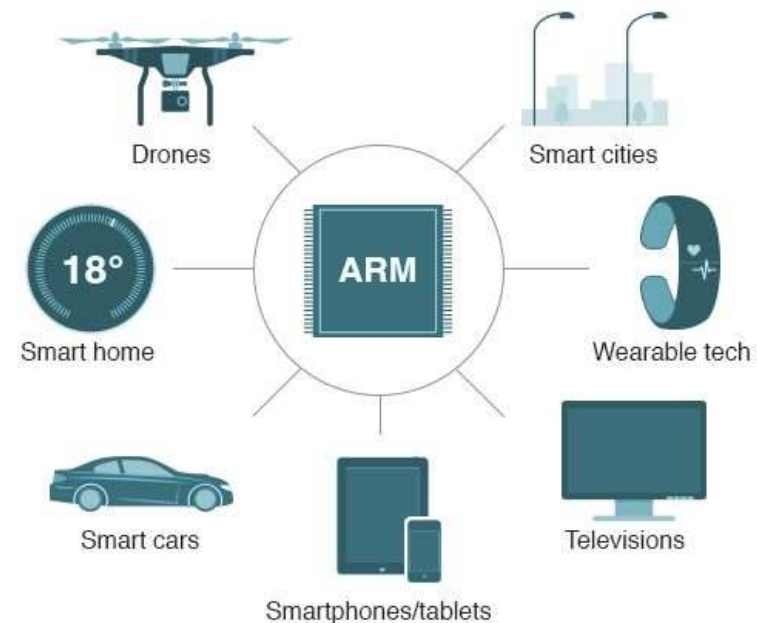
- 현재의 전기차 기술로 Fully Connected Car를 구현하면 20분마다 배터리 재충전이 필요
- Lee Sedol **20 Watts** of power
- AlphaGo runs on a whopping 1920 CPUs and another 280 GPUs for an estimated power consumption of approximately **1 MW** (200 W per CPU and 200 W per GPU).
- That's **50,000 times** as much power as the amount of power that Lee Sedol's brain uses

# 간절한 새로운 먹거리 산업

- Tesla
- Toyota
- 35 조에 인수된 ARM
- 삼성전자, SK 하니닉스의 성공



## ▶ 원자력 산업



# 4IR Energy Company, Tesla



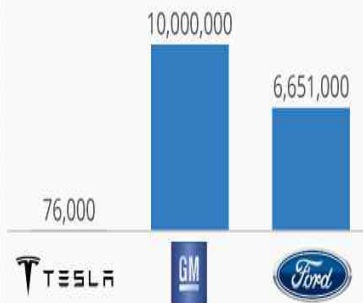
# Tesla Mystery

## The Numbers Behind the 'New Big Three'

Market cap (as of April 10, 2017)



Vehicle deliveries in 2016



Revenue in 2016

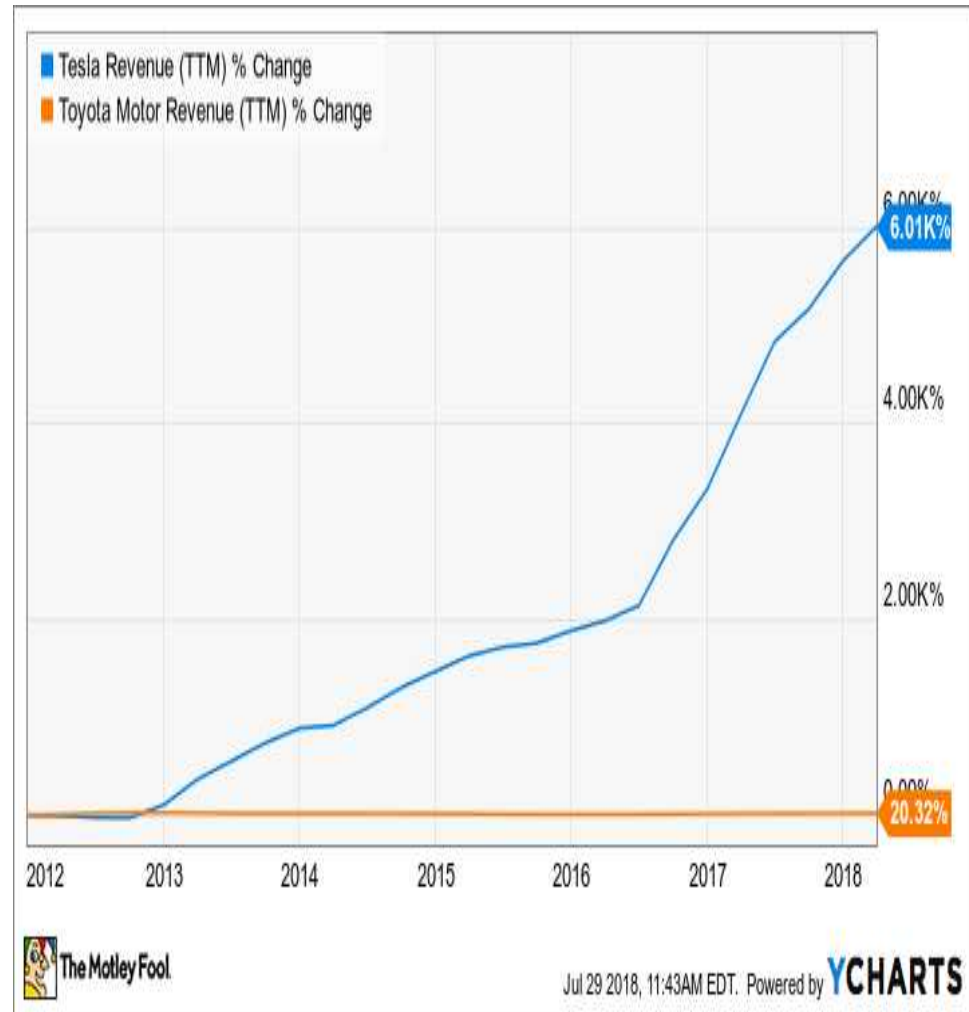


Net income/loss in 2016



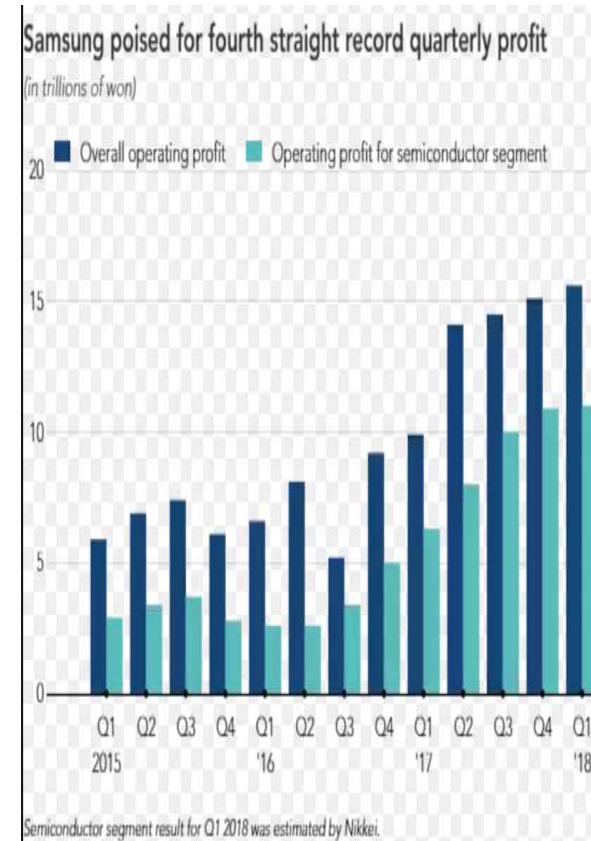
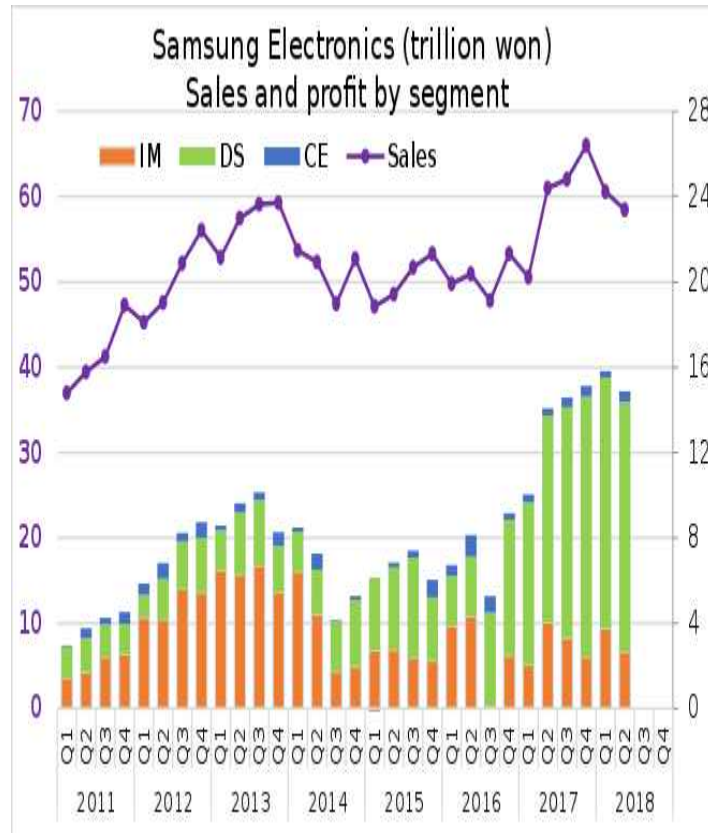
@StatistaCharts Sources: Ycharts, Company reports

statista



# Why so SSE's DS business profitable?

Gross Margin %: 46.52% (As of Jun. 2018)



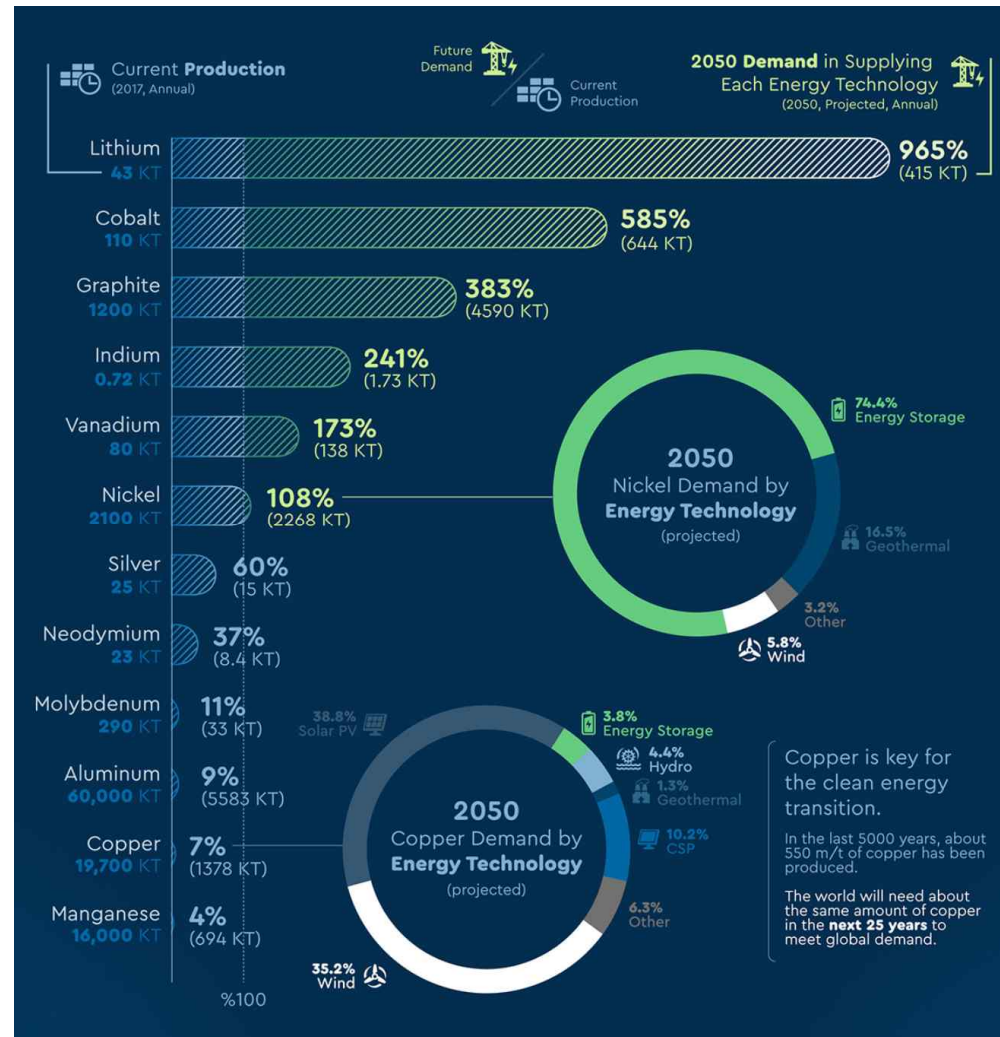
# 원유는 최대 수입 품목: 외환관리의 주요 항목



# Old Price over 70 Years: Can Anyone Predict This?



# 신생 에너지에 의한 광물 수요 급증

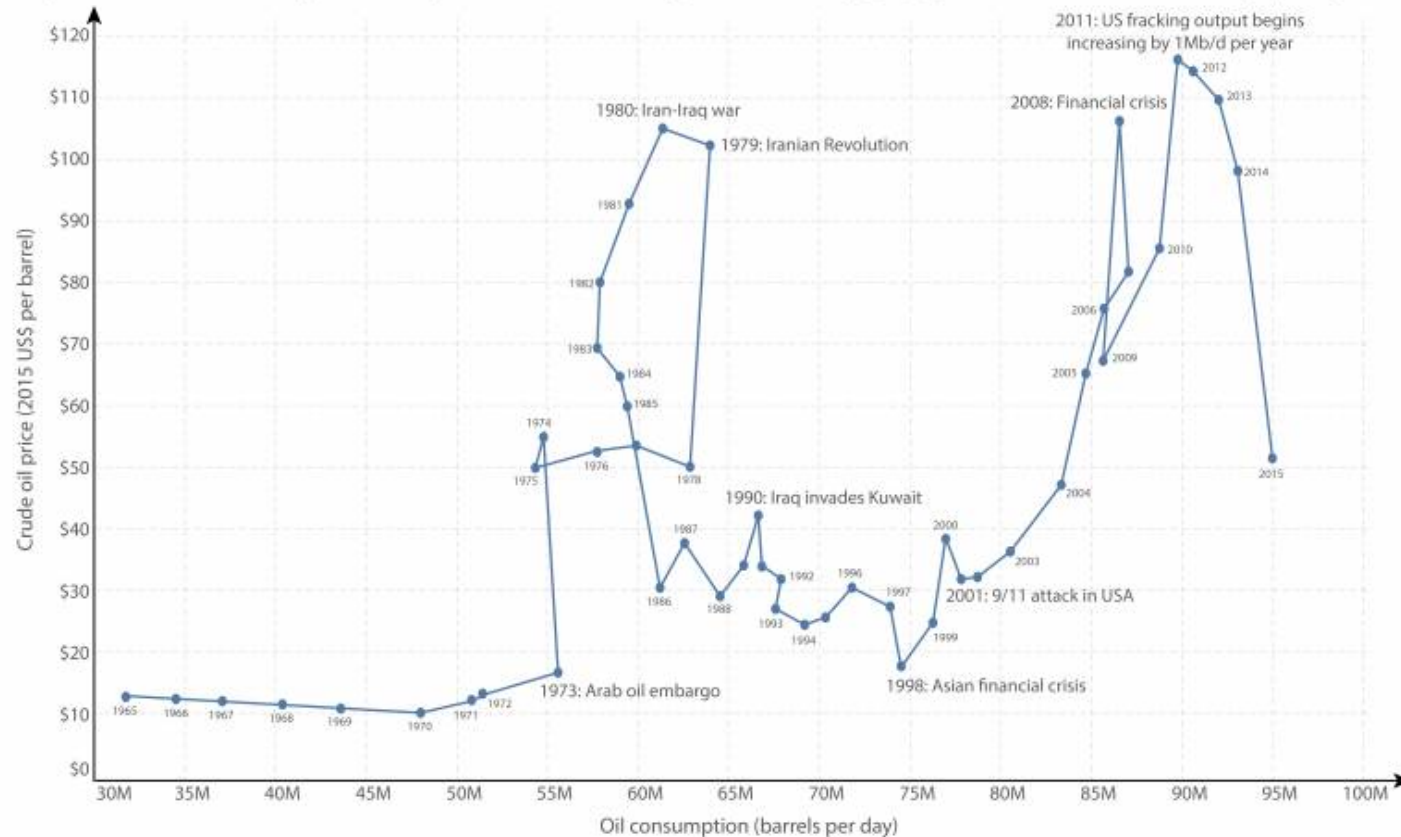


# 누구도 예측 못한 셰일가스 혁명

## World crude oil price vs. oil consumption (1965 to 2015)

Global crude oil price, measured in 2015 US\$ per barrel, versus total oil consumption, measured in barrels consumed per day. Oil prices are based on average crude oil prices as the Arabian Light series from 1965-1983 and Brent dated series from 1984-2015.

Our World  
in Data

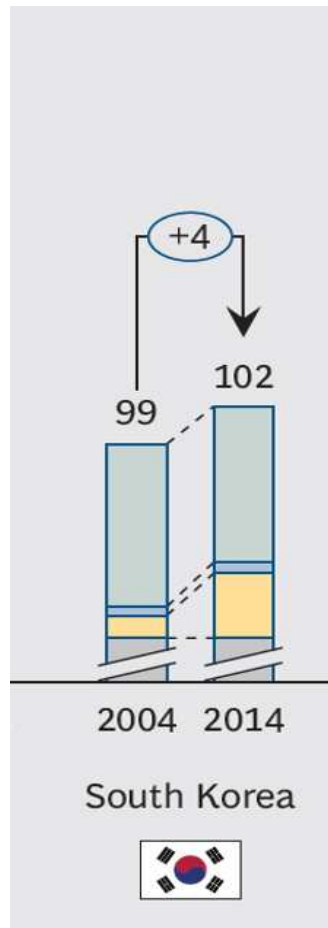


Data source: BP Statistical Review of World Energy 2016  
The data visualization is available at [OurWorldinData.org](http://OurWorldinData.org). There you find research and more visualizations on this topic.

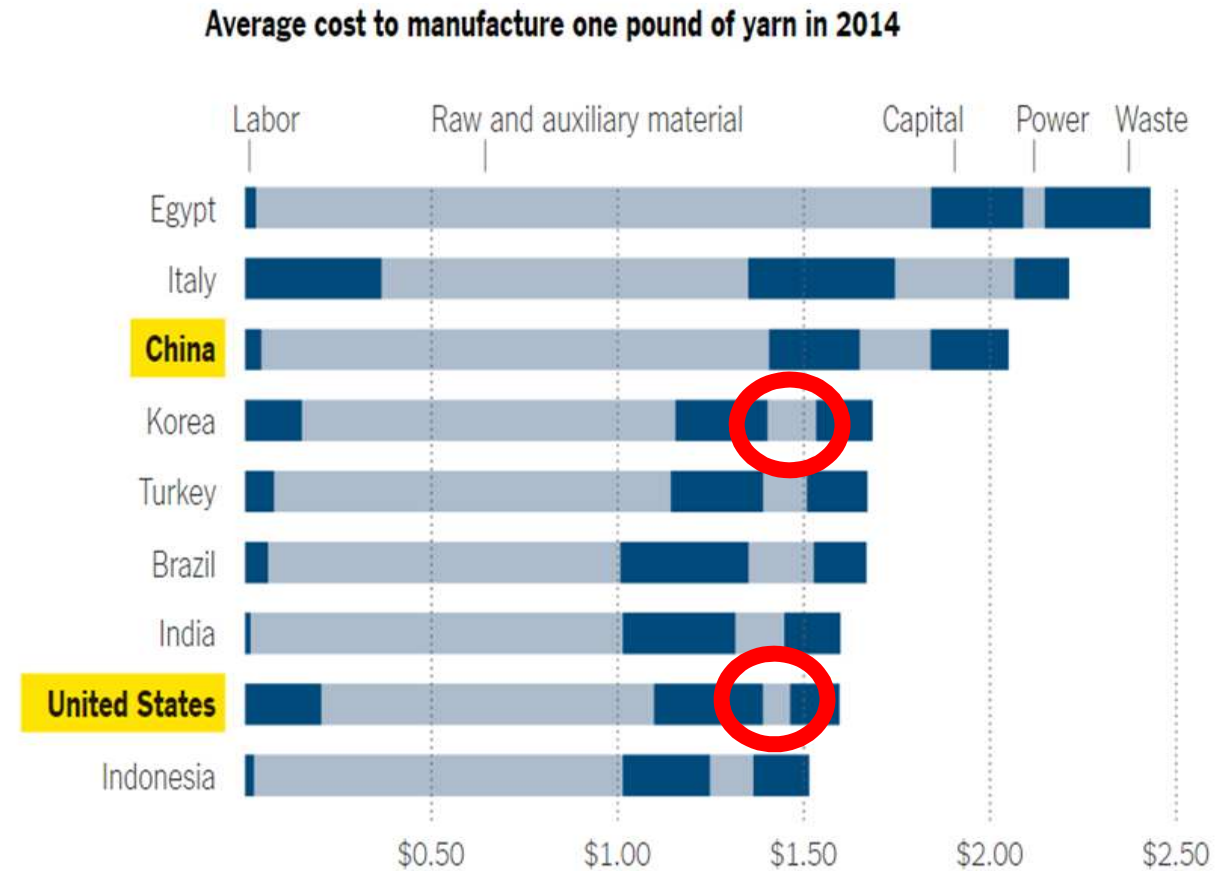
Licensed under CC-BY-SA by the authors Hannah Ritchie and Max Roser.



# 한국 제조원가에서 미국에 밀려



(US=100)



The New York Times | Source: International Textile Manufacturers Federation

# 전기가 경쟁력인 나라 (전기 2위)

## ▶ Ease of Doing Business Ranking 5위

TABLE 1.1 Ease of doing business ranking

Rank	Economy	EODB score	EODB score change
1	New Zealand	86.59	0.00
2	Singapore	85.24	+0.27
3	Denmark	84.64	+0.59
4	Hong Kong SAR, China	84.22	+0.04
5	Korea, Rep.	84.14	-0.01
6	Georgia	83.28	+0.48
7	Norway	82.95	+0.25
8	United States	82.75	-0.01
9	United Kingdom	82.65	+0.33
10	Macedonia, FYR	81.55	+0.32

KOREA, REP.		OECD high income		GNI per capita (US\$)	
Ease of doing business rank (1-190)		5	Ease of doing business score (0-100)	84.14	Population
					51,466,201
Starting a business (rank)		11	Getting credit (rank)		60
Score for starting a business (0-100)		95.83	Score for getting credit (0-100)		65.00
Procedures (number)		2	Strength of legal rights index (0-12)		5
Time (days)		4	Depth of credit information index (0-8)		8
Cost (% of income per capita)		14.6	Credit bureau coverage (% of adults)		100.0
Minimum capital (% of income per capita)		0.0	Credit registry coverage (% of adults)		65.7
Dealing with construction permits (rank)		10	Protecting minority investors (rank)		23
Score for dealing with construction permits (0-100)		84.43	Score for protecting minority investors (0-100)		73.33
Procedures (number)		10	Extent of disclosure index (0-10)		8
Time (days)		27.5	Extent of director liability index (0-10)		6
Cost (% of warehouse value)		4.4	Ease of shareholder suits index (0-10)		8
Building quality control index (0-15)		12.0	Extent of shareholder rights index (0-10)		7
Getting electricity (rank)		2	Extent of ownership and control index (0-10)		6
Score for getting electricity (0-100)		99.89	Extent of corporate transparency index (0-10)		9
Procedures (number)		3	Paying taxes (rank)		24
Time (days)		13	Score for paying taxes (0-100)		86.91
Cost (% of income per capita)		35.2	Payments (number per year)		12
Reliability of supply and transparency of tariffs index (0-8)		8	Time (hours per year)		188
Registering property (rank)		40	Total tax and contribution rate (% of profit)		33.1
Score for registering property (0-100)		76.34	Postfiling index (0-100)		93.93
Procedures (number)		7	Enforcing contracts (rank)		2
Time (days)		5.5	Score for enforcing contracts (0-100)		84.15
Cost (% of property value)		5.1	Time (days)		290
Quality of land administration index (0-30)		27.5	Cost (% of claim value)		12.7
			Quality of judicial processes index (0-18)		14.5
			Resolving insolvency (rank)		11
			Score for resolving insolvency (0-100)		83.01
			Time (years)		1.5
			Cost (% of estate)		3.5
			Recovery rate (cents on the dollar)		84.6
			Strength of insolvency framework index (0-16)		12.0

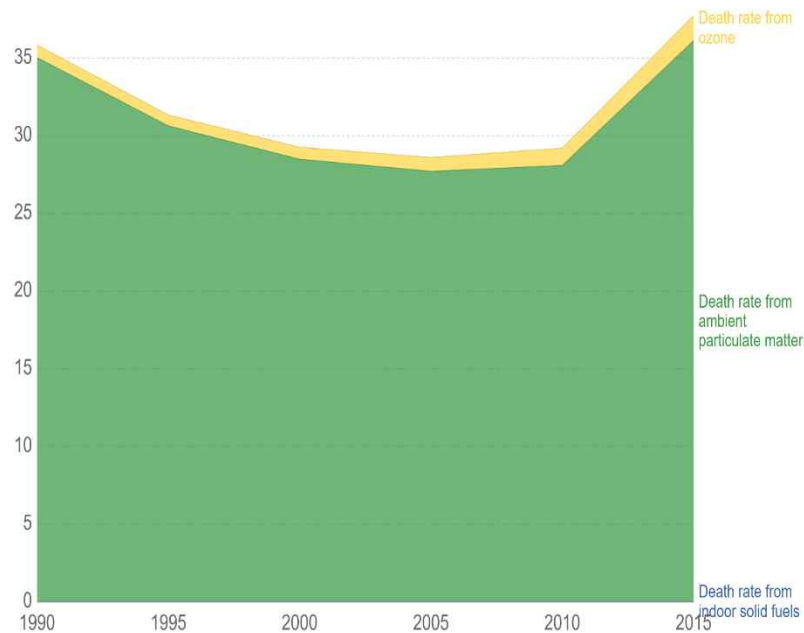
왜 한동안 원자력인가?



# 높아진 환경의 질에 대한 기대 공해로 인한 사망자가 늘고 있다

Death rate from air pollution per 100,000, South Korea

Age-standardized death rates (differentiated by attribution to ozone, particulates, or indoor fuel pollution) per 100,000 individuals.

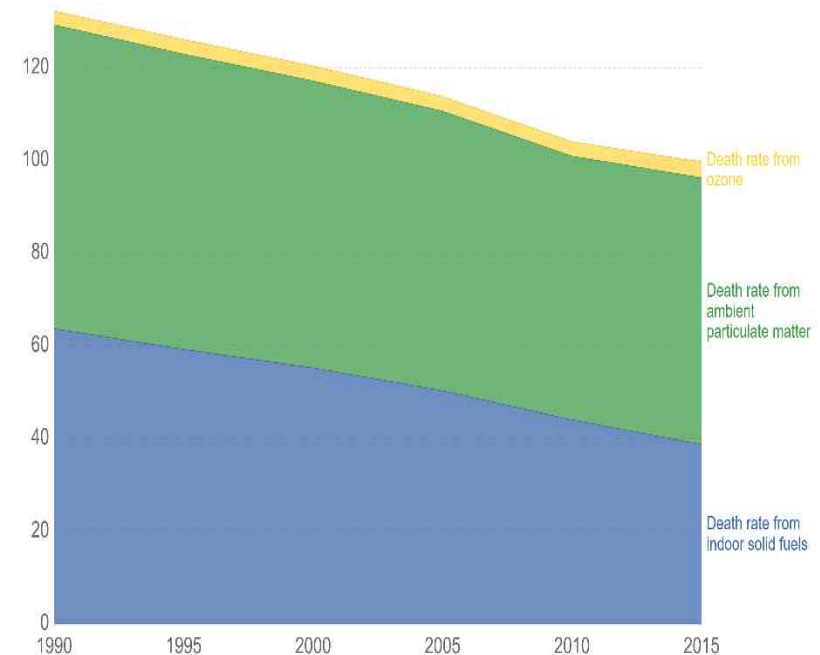


Source: IHME, GBD 2016

OurWorldInData.org/air-pollution/ • CC BY

Death rate from air pollution per 100,000, World

Age-standardized death rates (differentiated by attribution to ozone, particulates, or indoor fuel pollution) per 100,000 individuals.

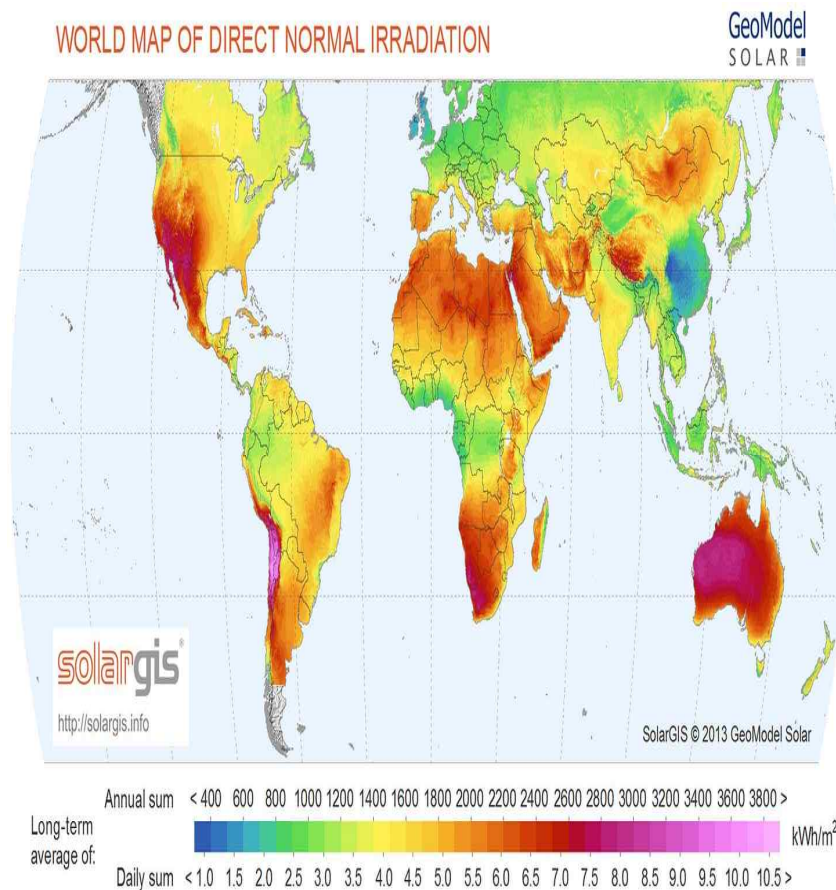


Source: IHME, GBD 2016

OurWorldInData.org/air-pollution/ • CC BY



# 재생 에너지 생산과 소비에 불리한 지리



Country	CO <sub>2</sub> emission, million tonnes	Electricity consumption, TWh	Potential wind energy, TWh	
			Onshore	Offshore
U.S.	5,956.98	3,815.9	74,000	14,000
China	5,607.09	2,398.5	39,000	4,600
Russia	1,696.00	779.6	120,000	23,000
Japan	1,230.36	974.1	570	2,700
India	1,165.72	488.8	2,900	1,100
Germany	844.17	545.7	3,200	940
Canada	631.26	540.5	78,000	21,000
U.K.	577.17	348.6	4,400	6,200
S. Korea	499.63	352.2	130	990
Italy	466.64	307.5	250	160

CO<sub>2</sub> emission and electricity consumption are for 2005; data are from the Energy Information Administration (<http://tonto.eia.doe.gov/country/index.cfm>).

# Economics of Energy Shift

---

**Matter-dense fuels**

**Energy-dense fuels**



**Renewables**  
(wood, solar,  
biofuels, wind)

**Coal**

**Oil**

**Natural Gas**

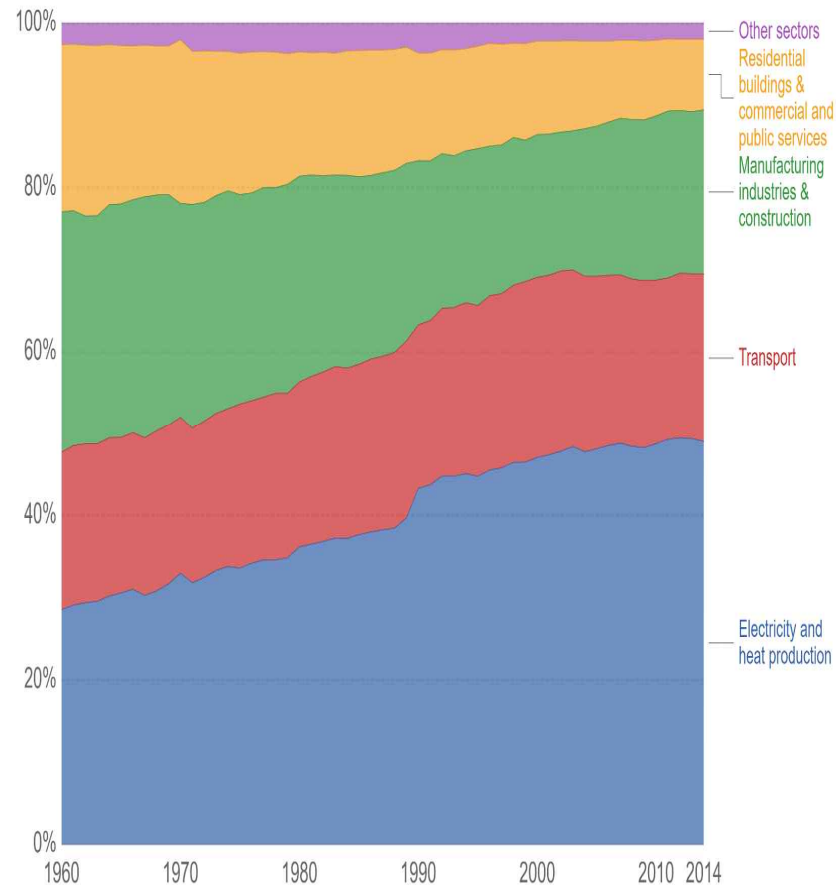
**Uranium**

# Co2 배출을 줄일려면 발전부문에 주목해야

## Carbon dioxide (CO<sub>2</sub>) emissions by sector or source, World

Share of carbon dioxide (CO<sub>2</sub>) emissions from fuel combustion by sector or source.

Our World  
in Data



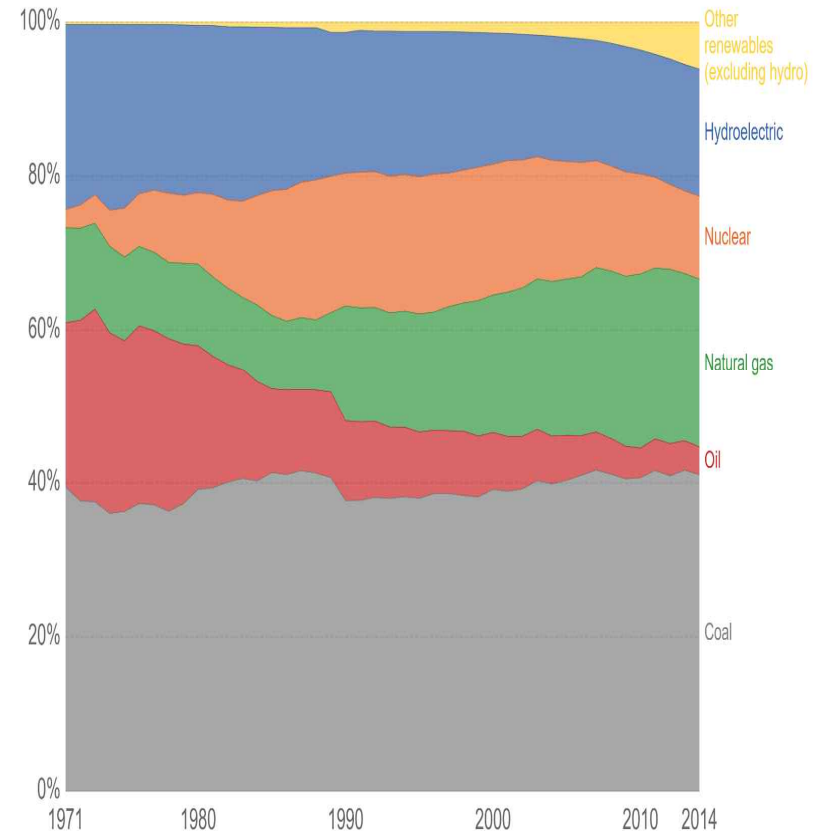
Source: International Energy Agency (IEA) via The World Bank

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY

## Electricity share by fuel source, World

Electricity production (measured as the percentage of total electricity production) by source (coal, oil, gas, nuclear, hydroelectric power and other renewables). Other renewables in this definition includes biomass, wind, solar, geothermal, and marine power.

Our World  
in Data



Source: International Energy Agency (IEA) via The World Bank

OurWorldInData.org • CC BY

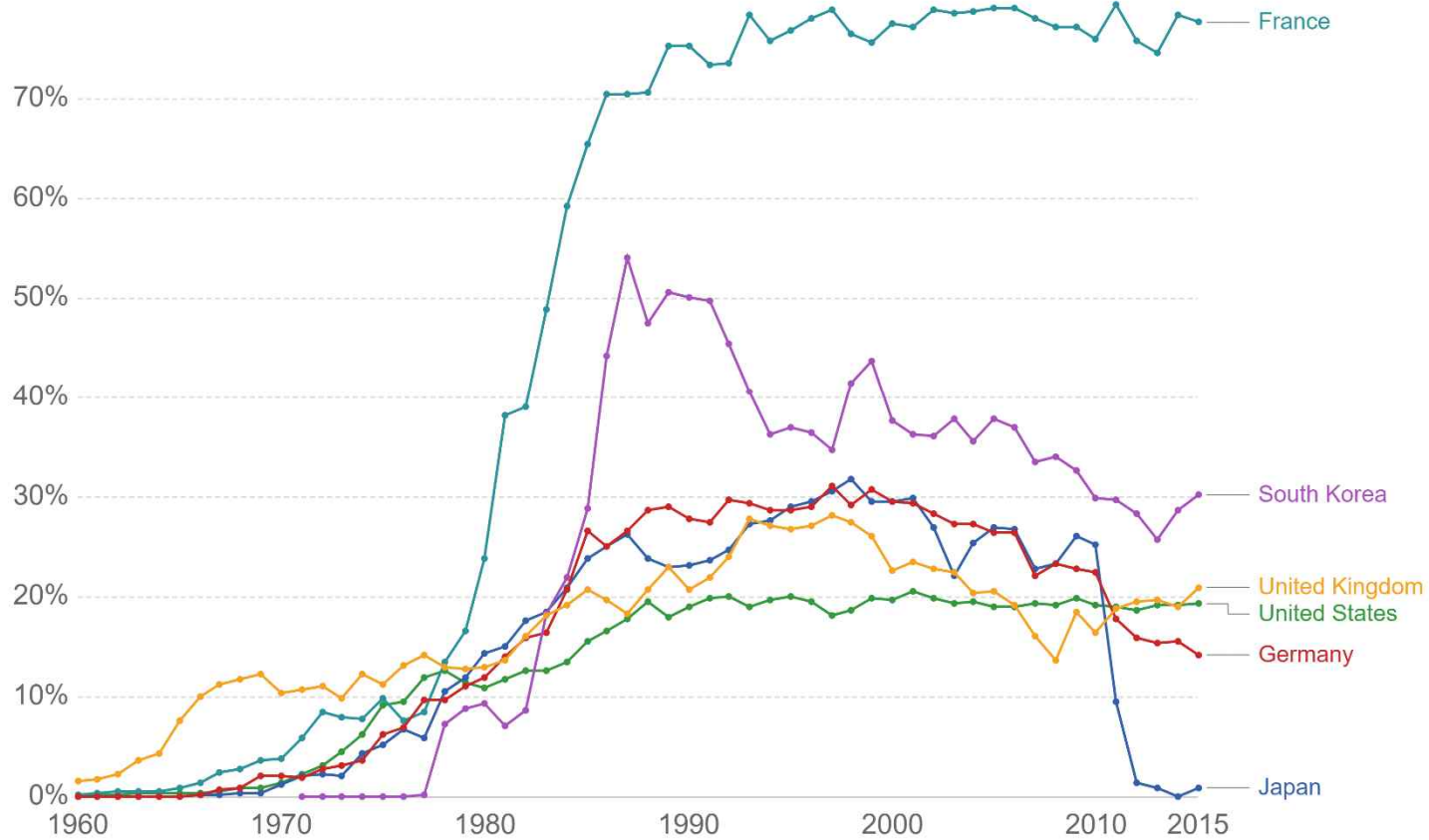


# 프랑스와 독일의 역사적 실험

## Nuclear energy, share of electricity production

The share of nuclear energy in the electricity mix, measured as a percentage of total electricity production.

Our World  
in Data

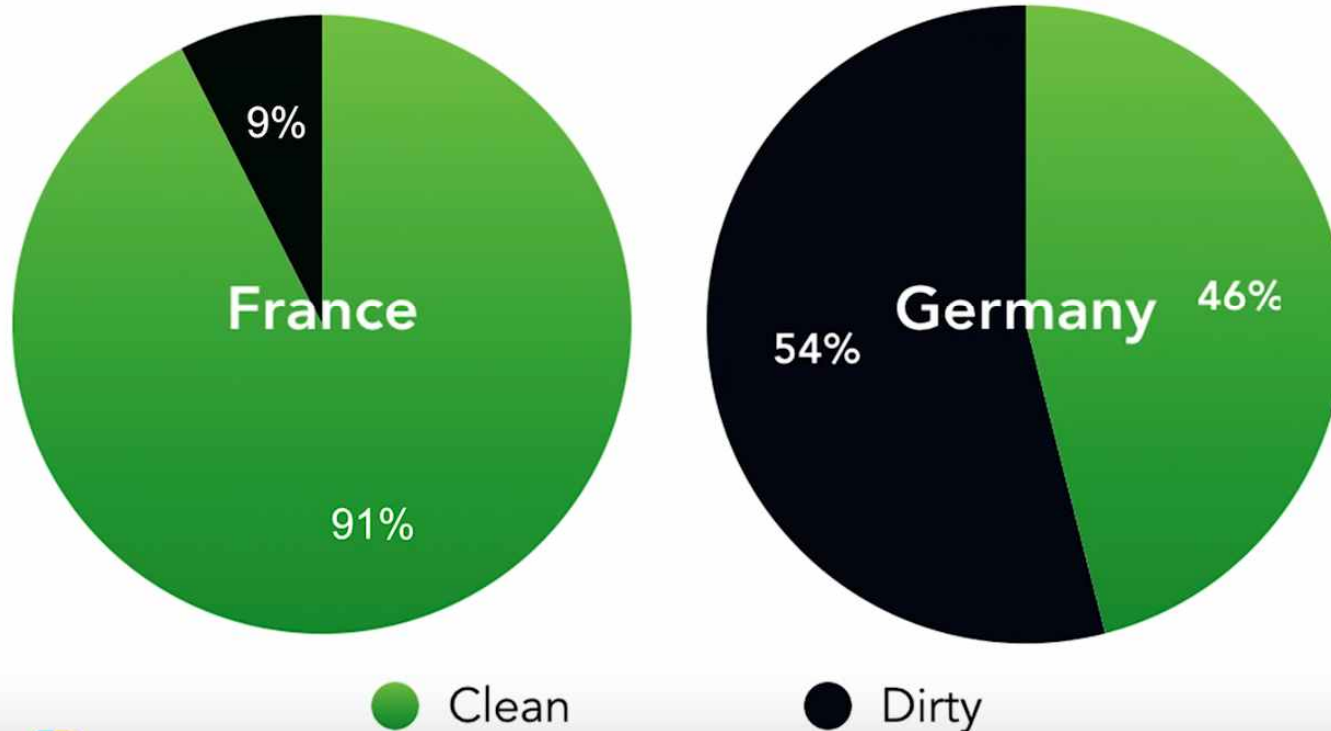


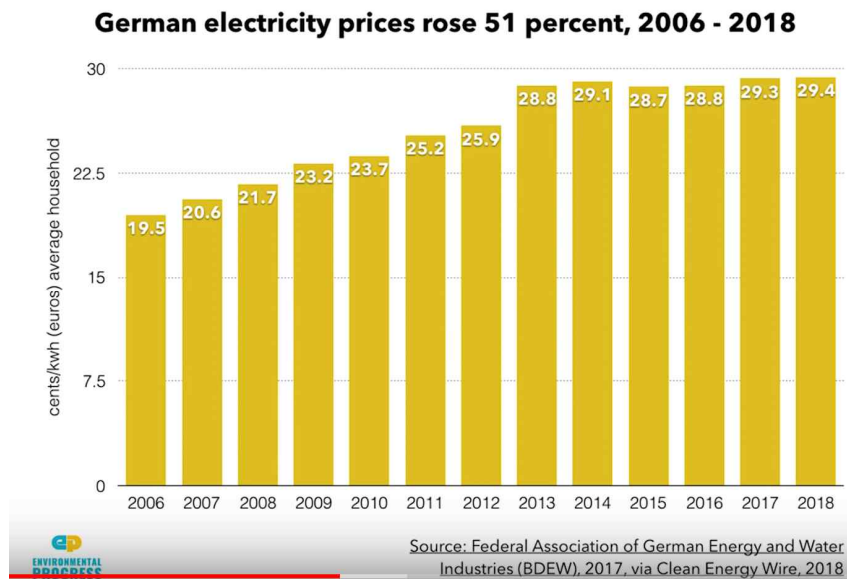
Source: International Energy Agency (IEA) via The World Bank

CC BY

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

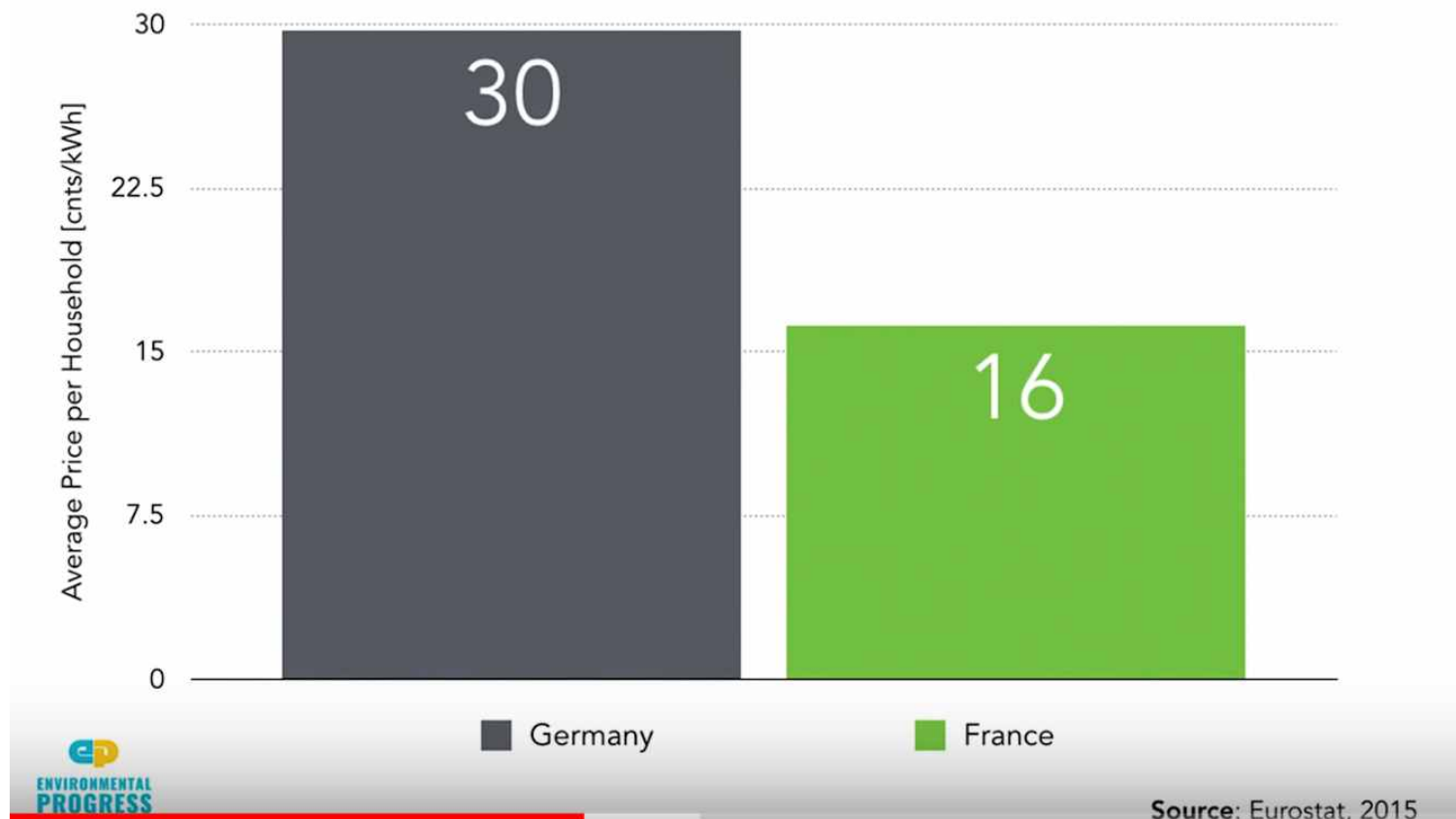




- ▶ 만약 독일이 원자력에 5800억불을 사용했다면 이미 독일의 전력과 교통에 필요한 100%의 에너지를 배출가스 없는 청정 에너지에서 얻을 수 있었다.

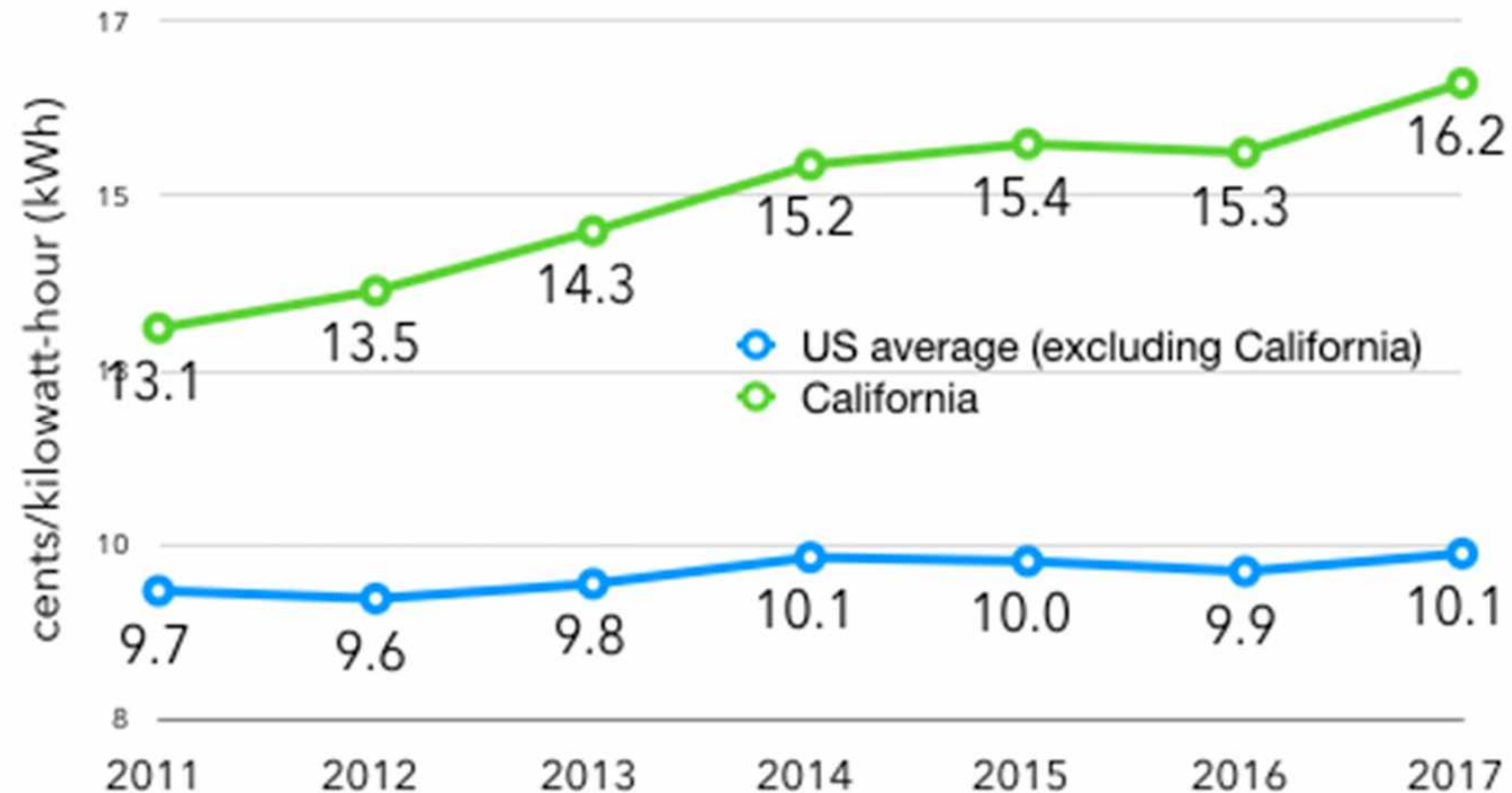
# 독일과 프랑스 가계 전력 가격

German electricity is 2x more expensive than French electricity.



# 캘리포니아의 재생에너지와 전기료

**Electricity prices in California rose 5x more than in rest of U.S.**



Source: US Energy Information Administration, 2017.

# Why not because not economical

MIT  
Technology  
Review



AMERICAN PUBLIC POWER ASSOCIATION

Climate Change / Clean Energy

## Global renewables growth has stalled—and that's terrible news

Additions of wind, solar, hydro, and other clean energy sources have unexpectedly flattened after two decades of reliable gains.

by James Temple

May 7, 2019

## Bloom Energy Maintains Momentum in Fuel Cell Revenue but Losses Persist

The long-awaited takeoff of the microgrid market offers big potential for Bloom, as it struggles to break away from the loss-making fuel cell industry.

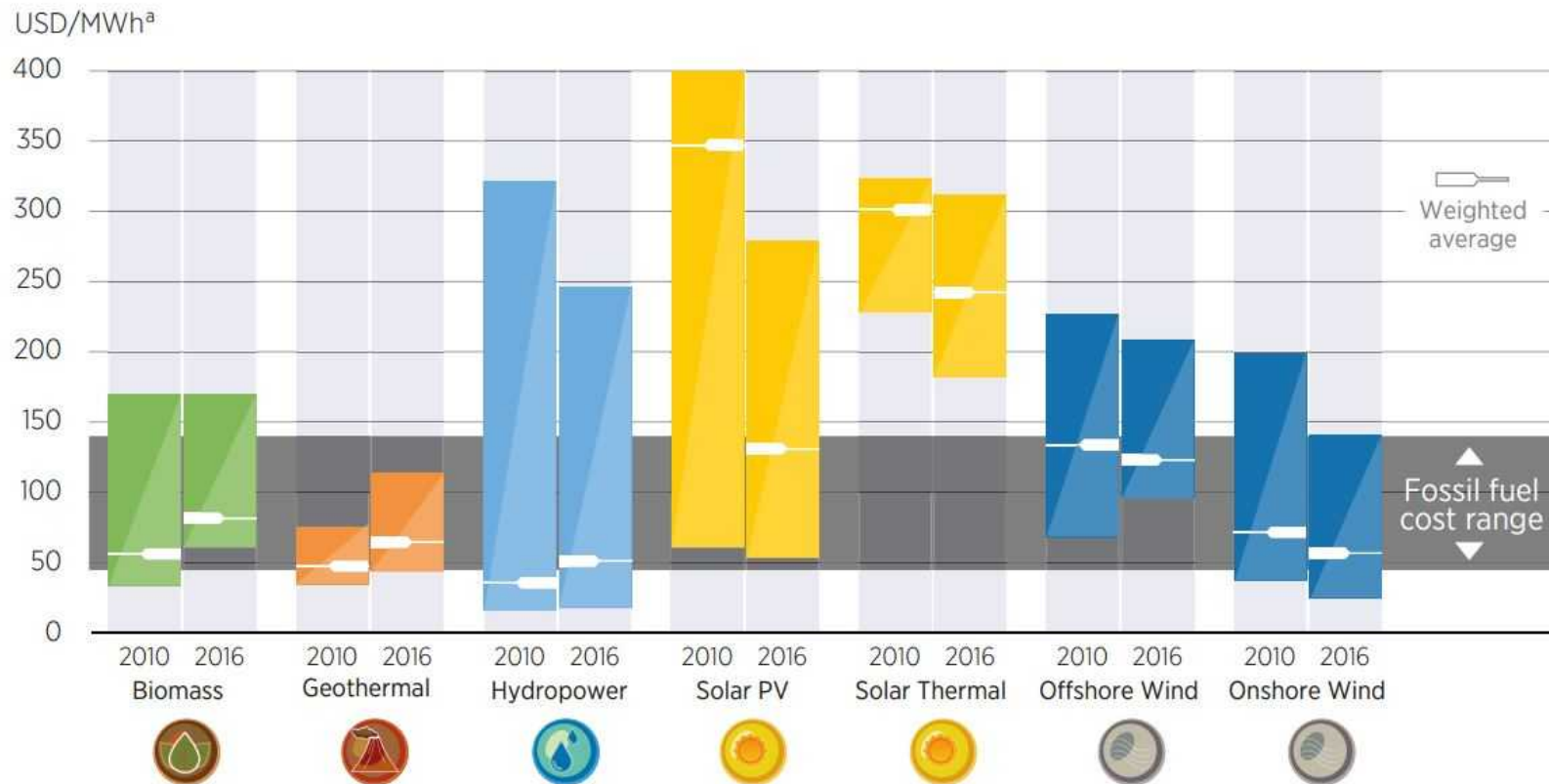
ERIC WESOFF | MAY 07, 2019



Bloom's revenue story distinguishes it from the rest of the fuel cell pack.



# 신재생 에너지의 가격은 아직 다 비싸다

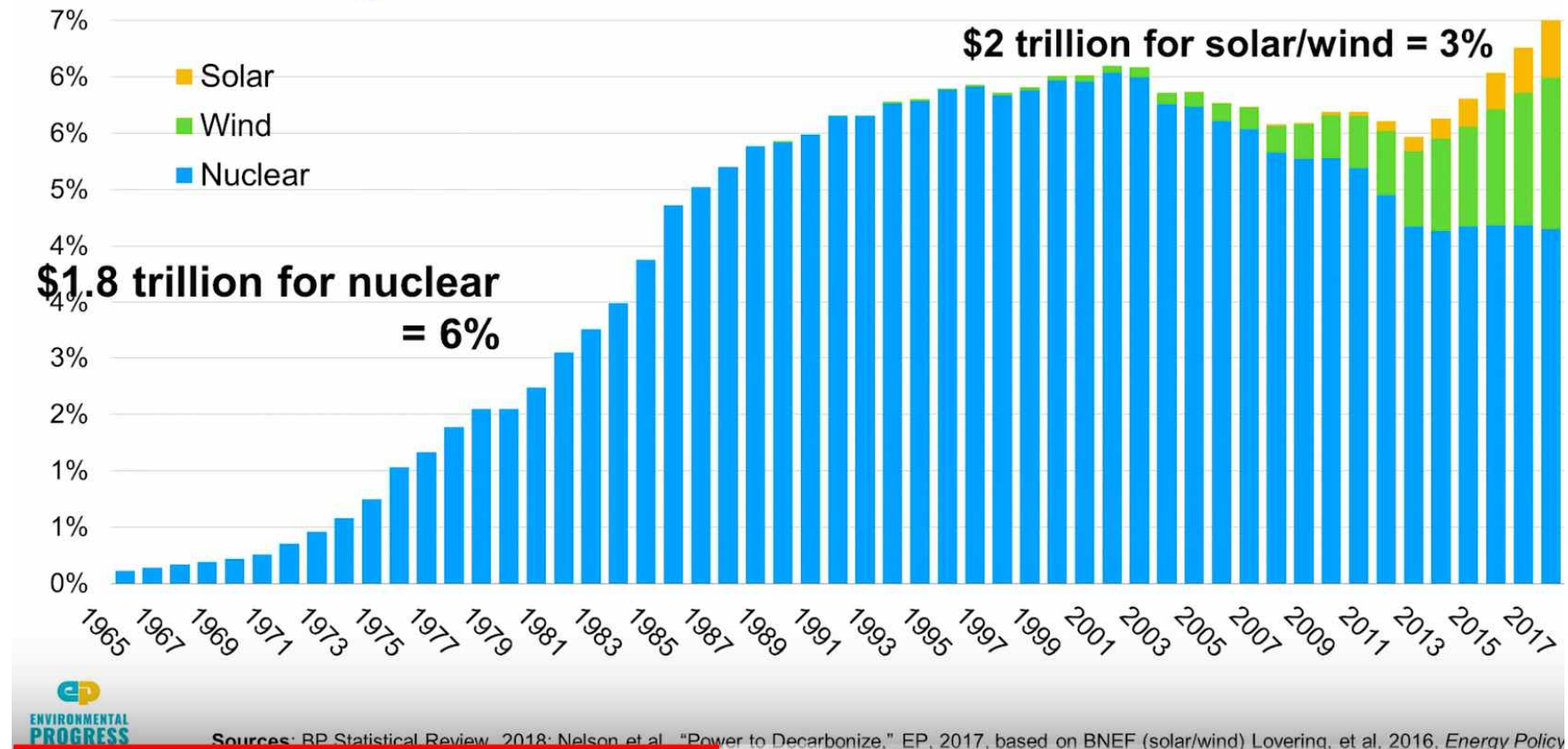


Note: a) MWh: megawatt-hour

b) All costs are in 2016 USD. Weighted Average Cost of Capital is 7.5% for OECD and China and 10% for Rest of World

## 재생에너지 생산가격은 원자력 발전의 2배 이상

### Nuclear produced twice as much for less

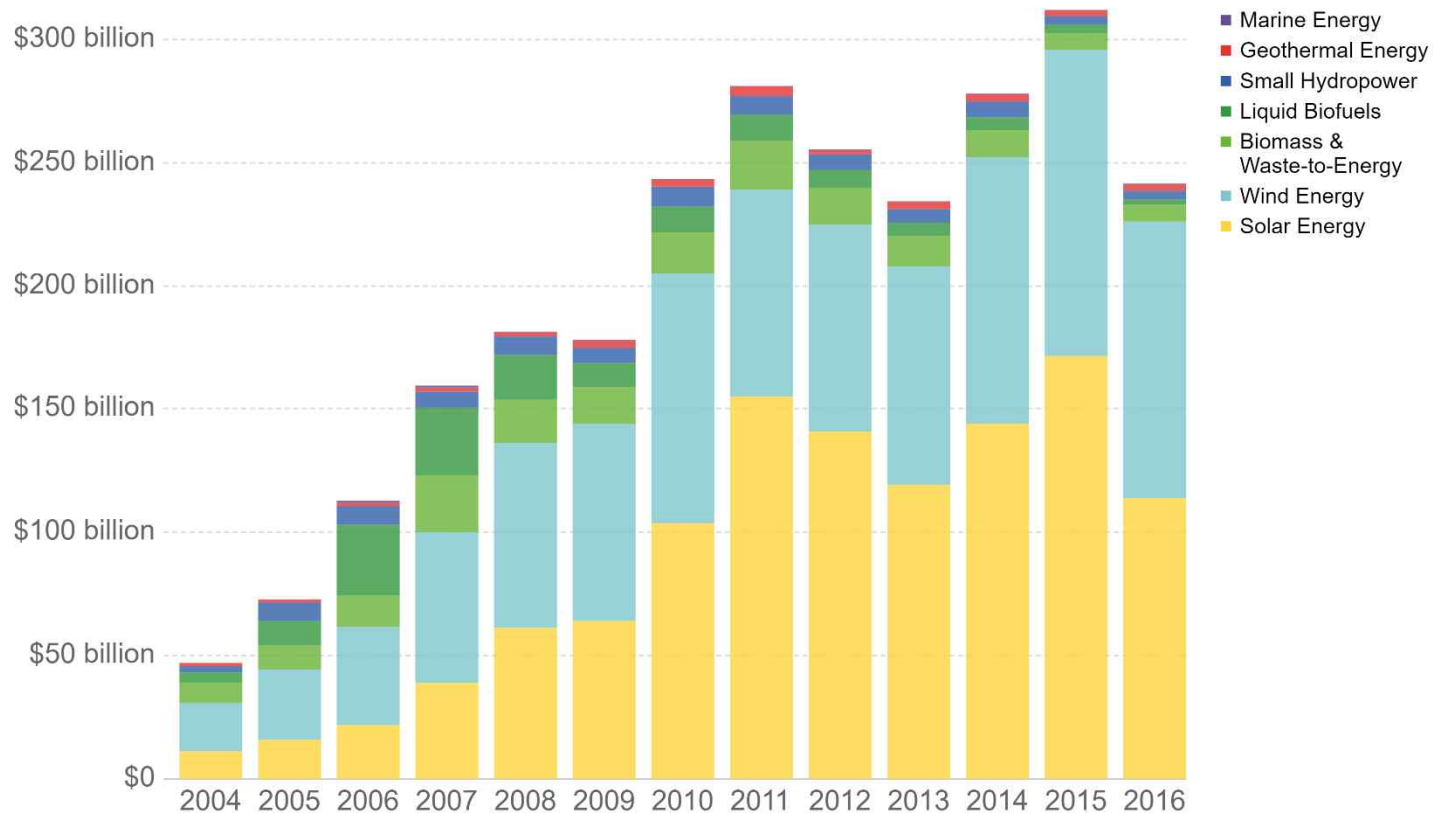


# 신재생 에너지 R&D로 가격인하 기대

## Investment in renewable energy, by technology

Global investment in renewable energy technologies, measured in USD per year. Note investment figures exclude large-scale hydropower schemes.

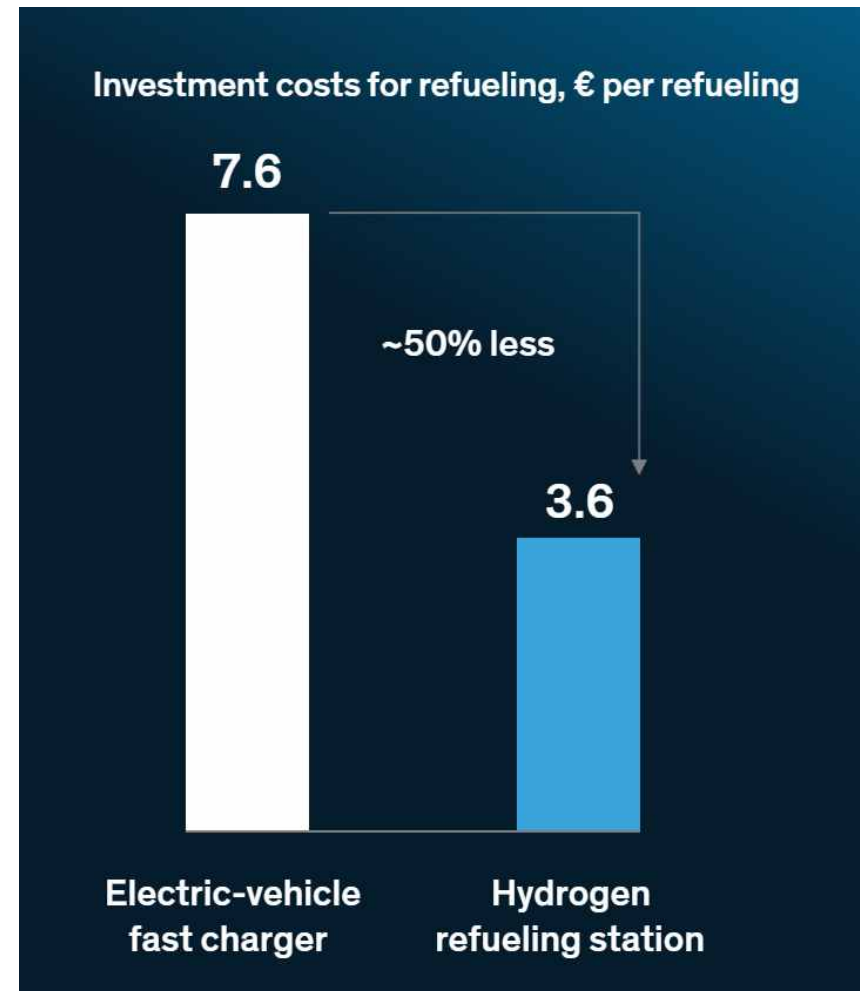
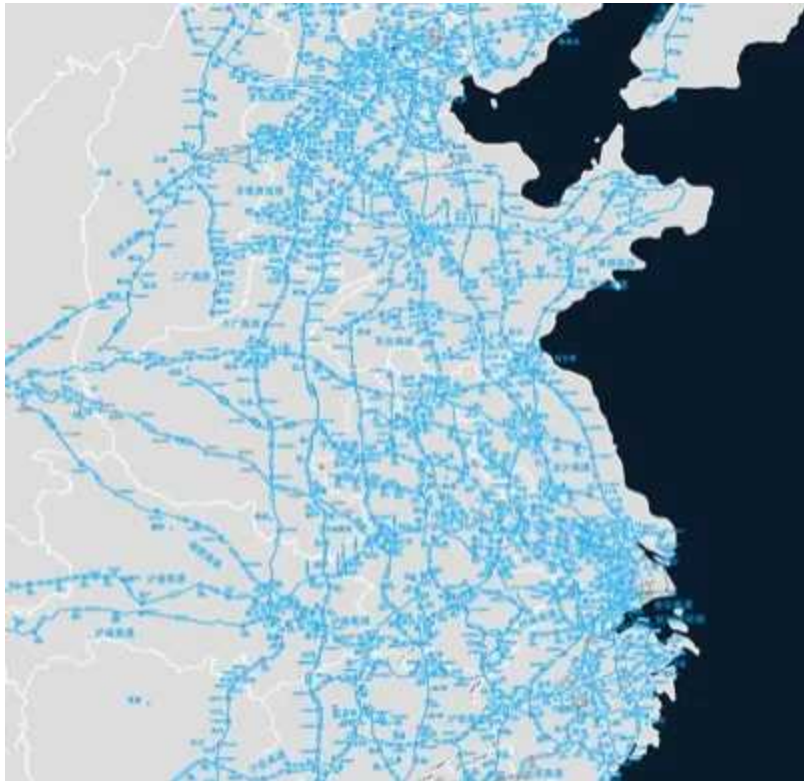
Our World  
in Data



Source: International Renewable Energy Agency (IRENA)

OurWorldInData.org/energy-production-and-changing-energy-sources/ • CC BY

# EV or FCEV or Carpoolcalypse

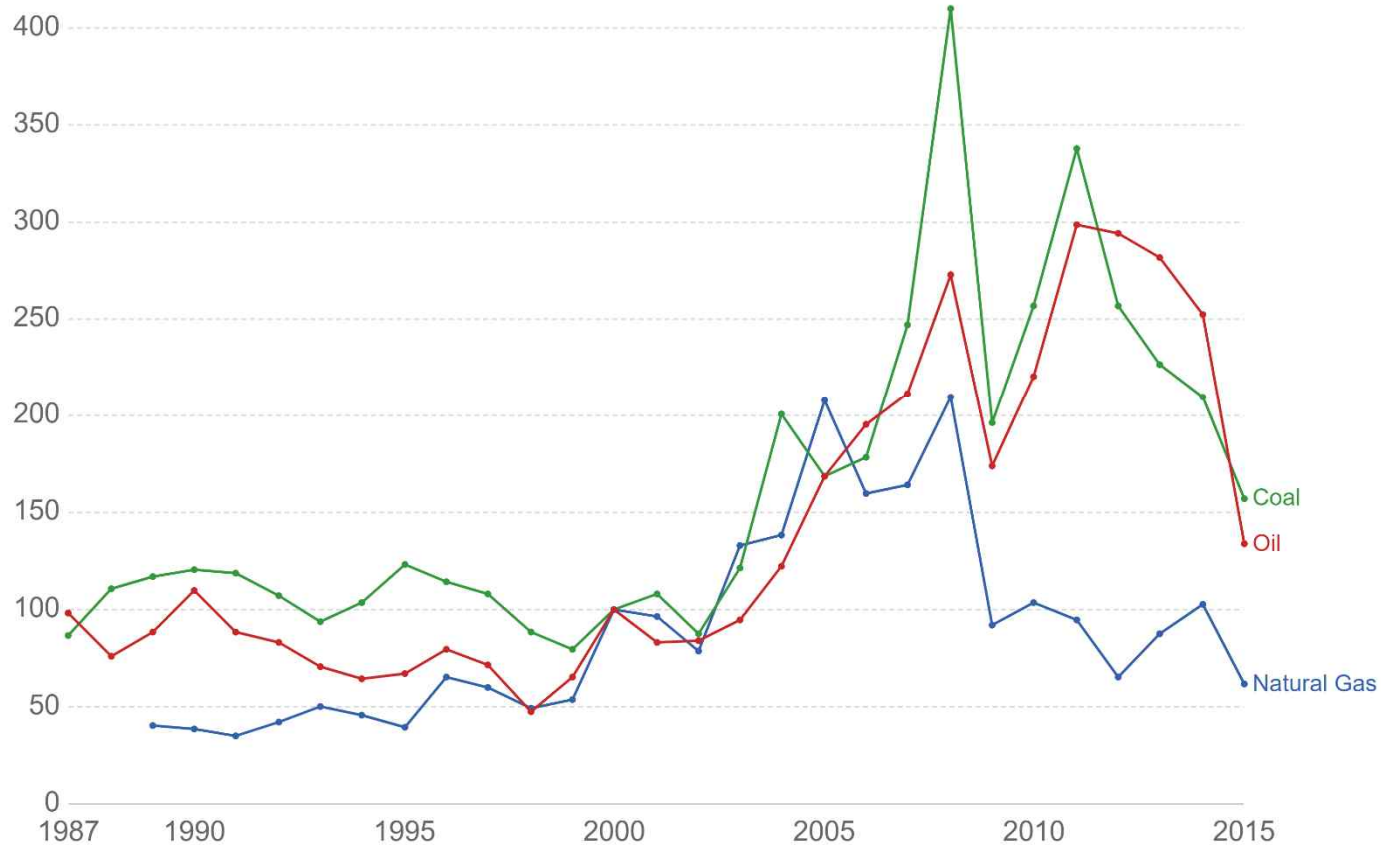


# 화석연료 가격도 내려간다

## Fossil fuel price index

Average global prices of oil, natural gas and coal, measured as an energy index where prices in 2000=100.

Our World  
in Data



Source: BP Statistical Review 2016

OurWorldInData.org/fossil-fuels • CC BY

# 유망하던 많은 기술이 실패한다

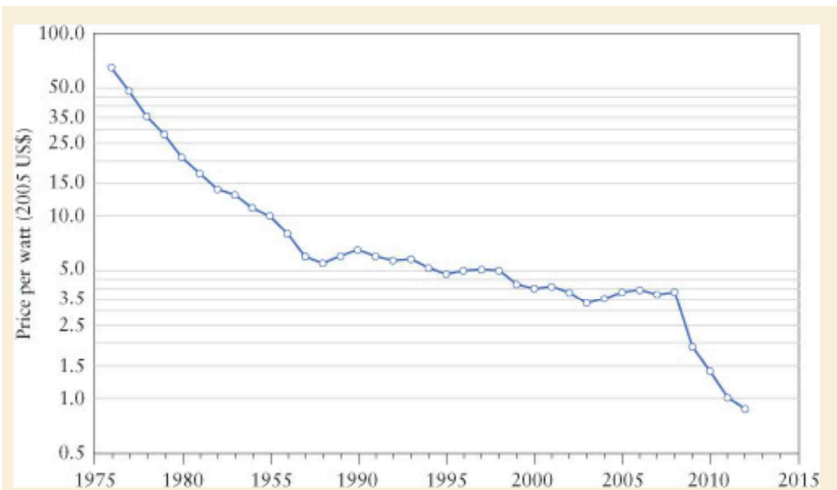
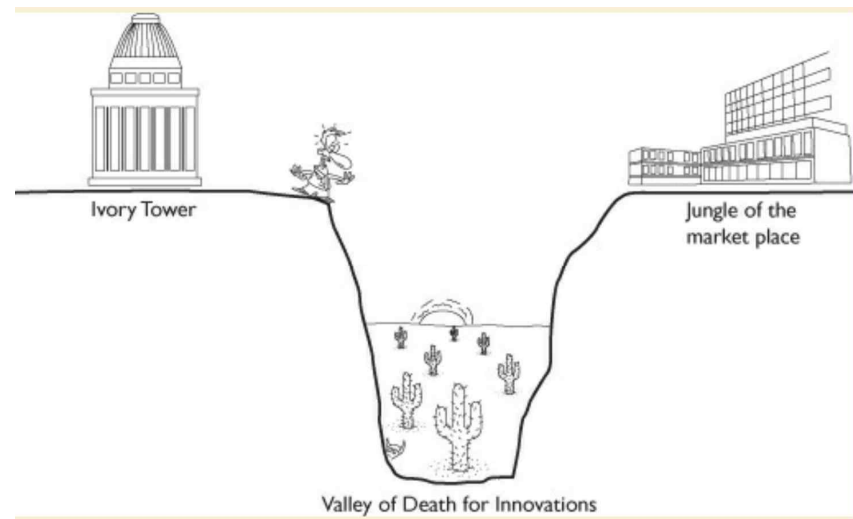
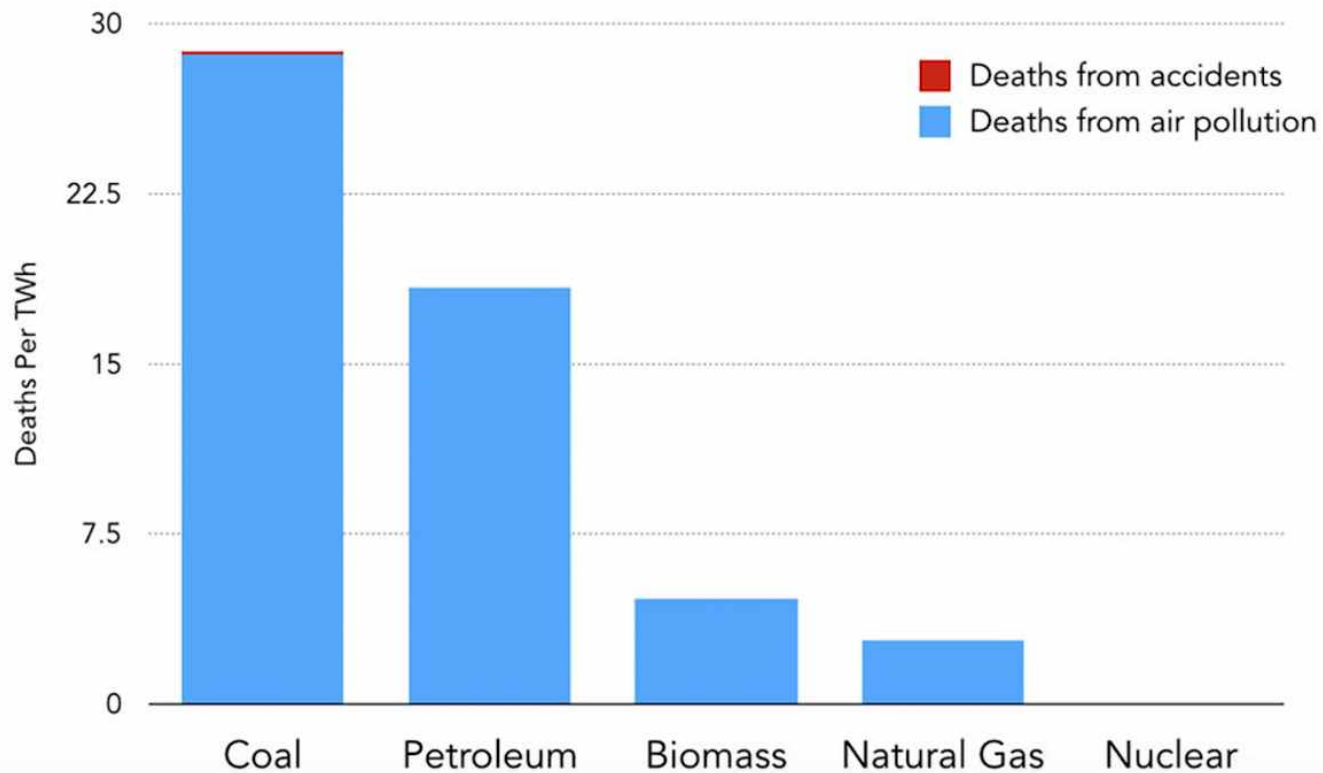


Figure 39. Decline in price of solar power. Prices declined sharply in the early era, reached a plateau, and then dropped again when China entered the market with large governmental subsidies.



# 가장 안전한 에너지

Nuclear is already the safest way to make reliable electricity.



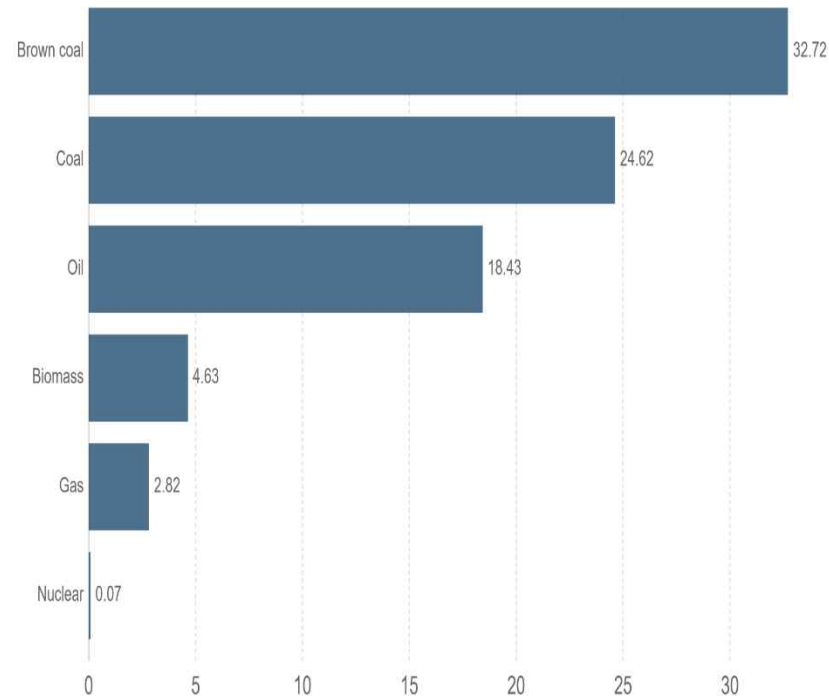
Source: Markandya, A., & Wilkinson, P. 2007. Electricity generation and health. *The Lancet*, 370(9591), 979-990.

# 안전한 에너지

## Death rates from energy production per TWh

Death rates from air pollution and accidents related to energy production, measured in deaths per terawatt hours (TWh)

Our World  
in Data



Source: Markandya and Wilkinson (2007)

OurWorldInData.org/energy-production-and-changing-energy-sources/ • CC BY

Note: Figures include deaths resulting from accidents in energy production and deaths related to air pollution impacts. Deaths related to air pollution are dominant, typically accounting for greater than 99% of the total.

- ▶ 700 million dies from air pollution
- ▶ 원자력은 이미 180만명의 생명을 구했음 - James Hansen

# 45 Years of Swiss Nuclear Waste

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# 원자력의 재인식

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- ▶ 한국
- ▶ 애리조나 탈원전 거부
- ▶ 네덜란드 원전 증설 결정



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# 질문하는 이성의 회복 없이는 미래가 없다

고맙습니다

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KAIST 경영대학  
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