

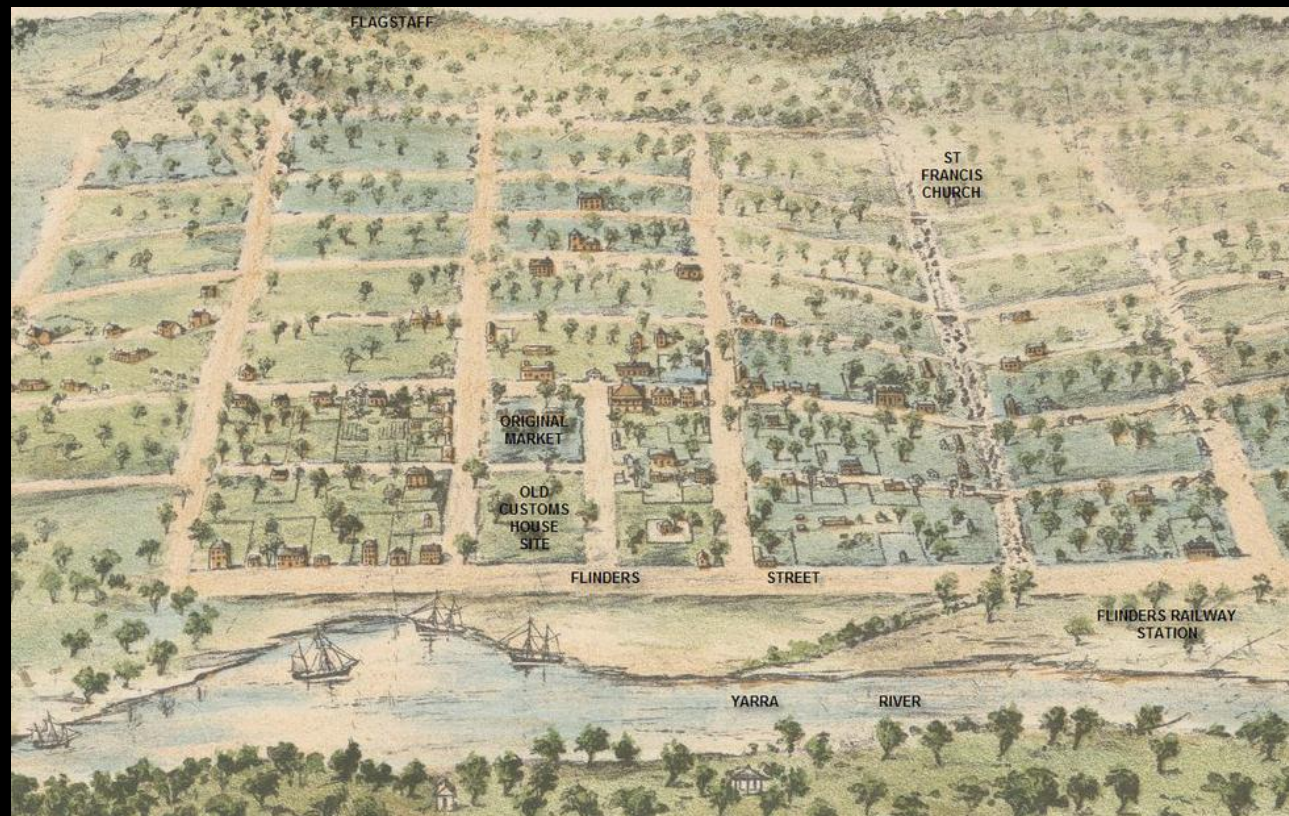
political science

exponential interactions between technology and social justice



Niraj Lal

I acknowledge the traditional scientists, technologists, thinkers, philosophers, engineers, explorers and owners of the land: the Wurundjeri people of the Kulin Nation, and pay my respects to their Elders.



**When there's a huge solar energy spill,
it's just called a "nice day"**

www.votesolar.org

ANU breakthrough: Butterfly effect could boost solar cell efficiency

By Sophie Vorrath on 17 May 2017

A team of Australian National University researchers has taken inspiration from the humble butterfly wing to develop a nano-technology that could greatly improve the efficiency of solar cells.



Sciencey
How Does Sunscreen Work?
7 mins



Top 5 Under 40: Meet ABC RN's newest scientists in residence



Niraj Lal
Friday 16 August 2016 4:30PM



Niraj Lal
Friday 16 August 2016 4:30PM

Photovoltaic systems

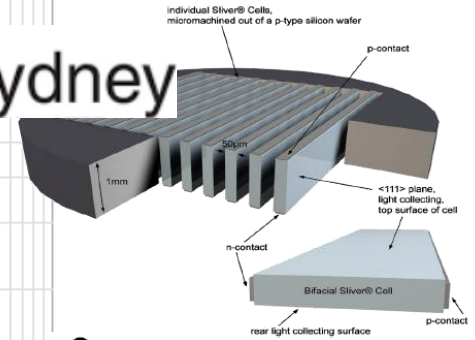
Australian National University, Canberra, ACT 0200, Australia
Engineering and Computer Science, The Australian National University, Canberra, ACT 0200, Australia

SCIENCEY



TEDx Sydney

GATES Cambridge



FOXTEL

ABC

Discovery CHANNEL

ARENA

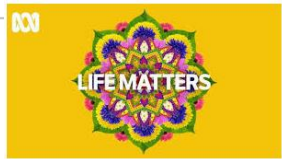
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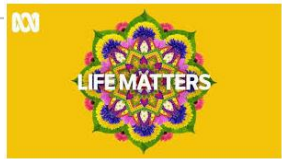
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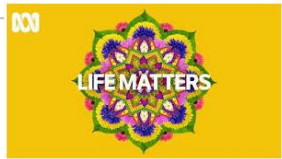
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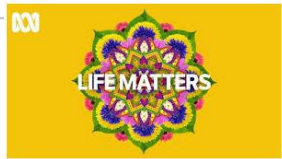
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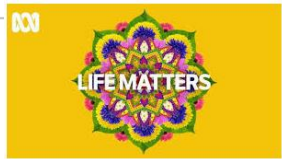
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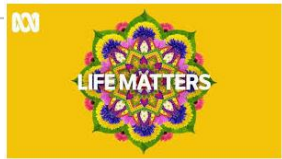
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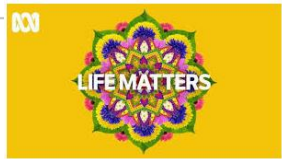
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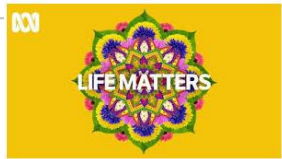
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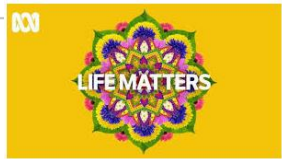
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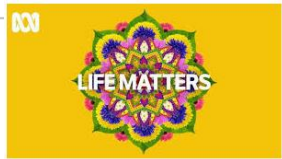
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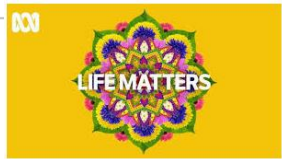
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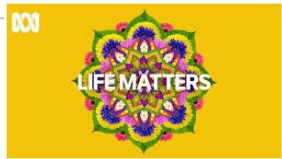
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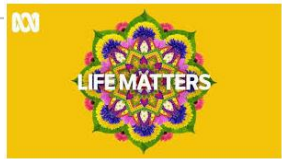
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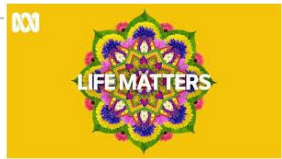
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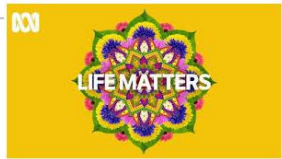
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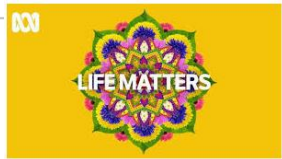
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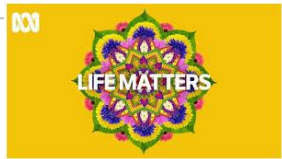
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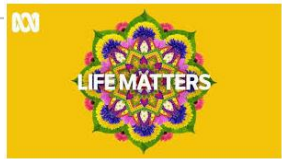
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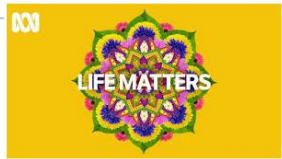
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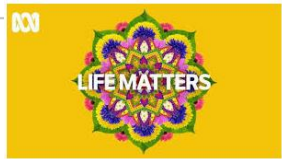
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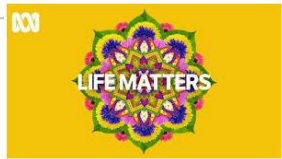
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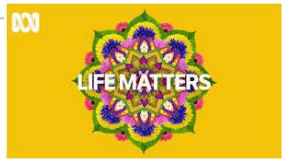
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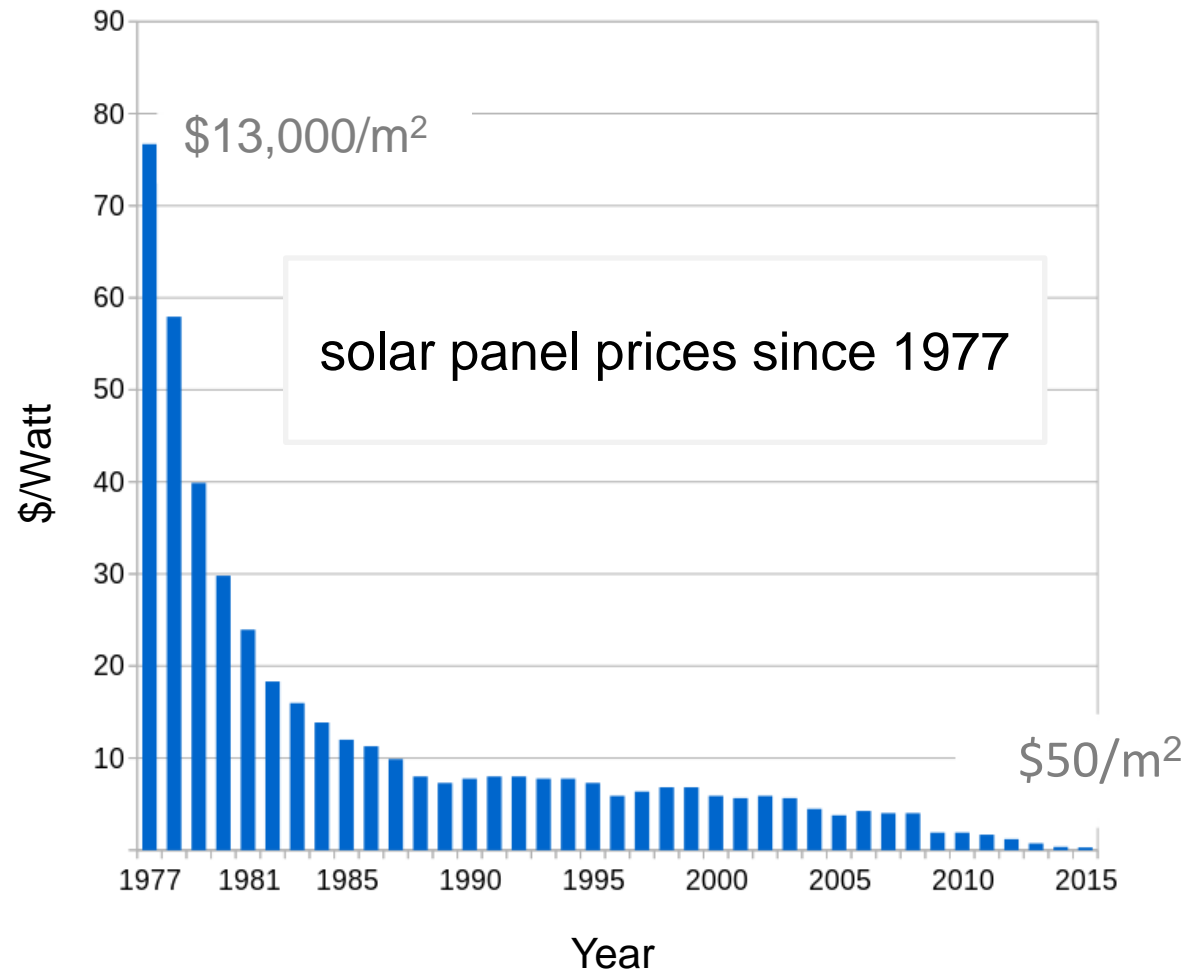


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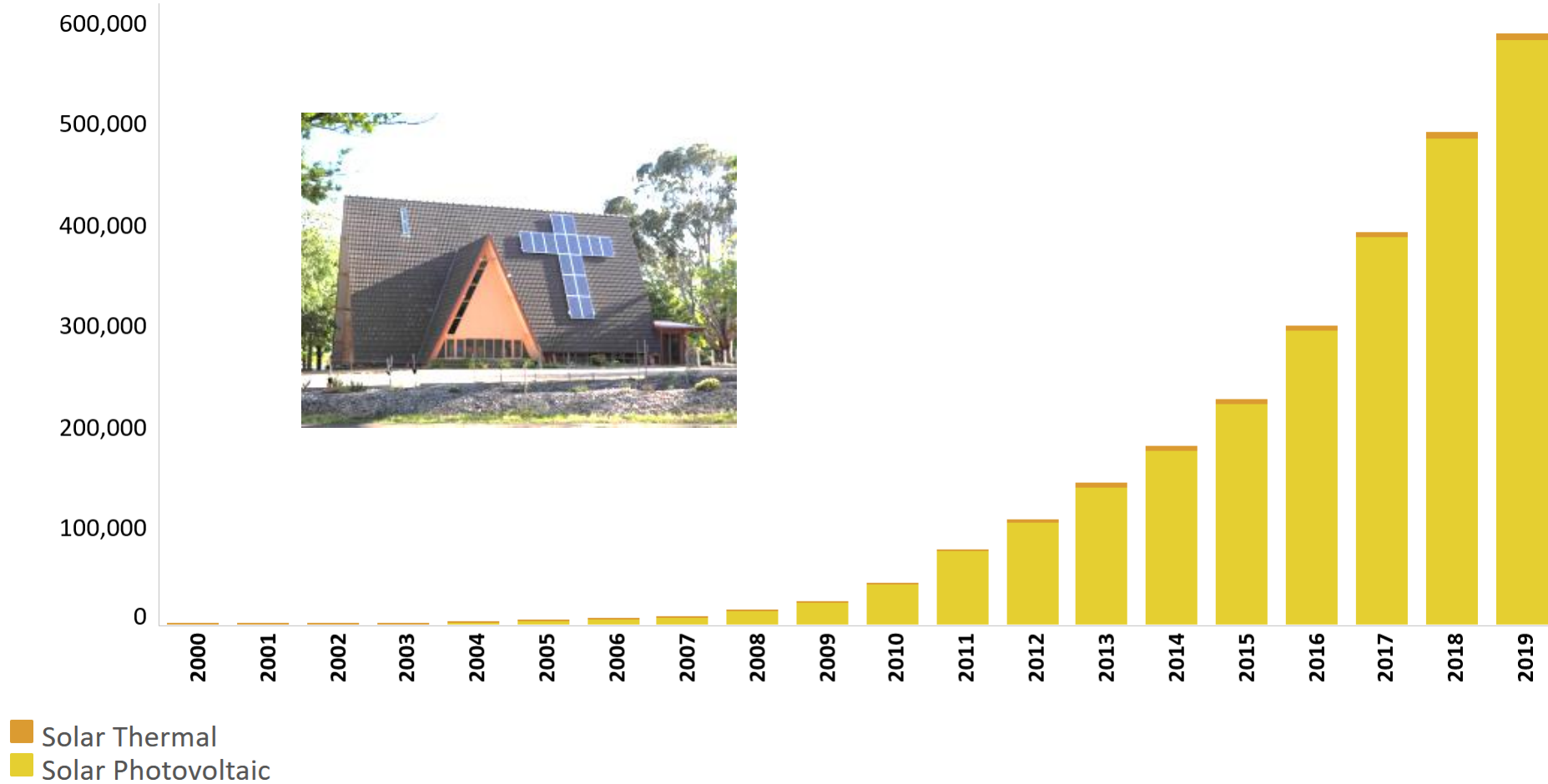
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solar panels will soon be cheaper than plywood



more solar now being installed than anything else

Installed Capacity (MW)



World Added More Solar, Wind Than Anything Else Last Year

Bloomberg



BBC UK has first coal-free week for a century

Clean Energy Investment Exceeded \$300 Billion Once Again in 2018

theguardian

China Is Set To Become The World's Renewable Energy Superpower

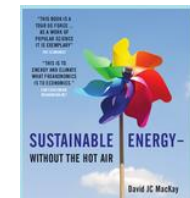
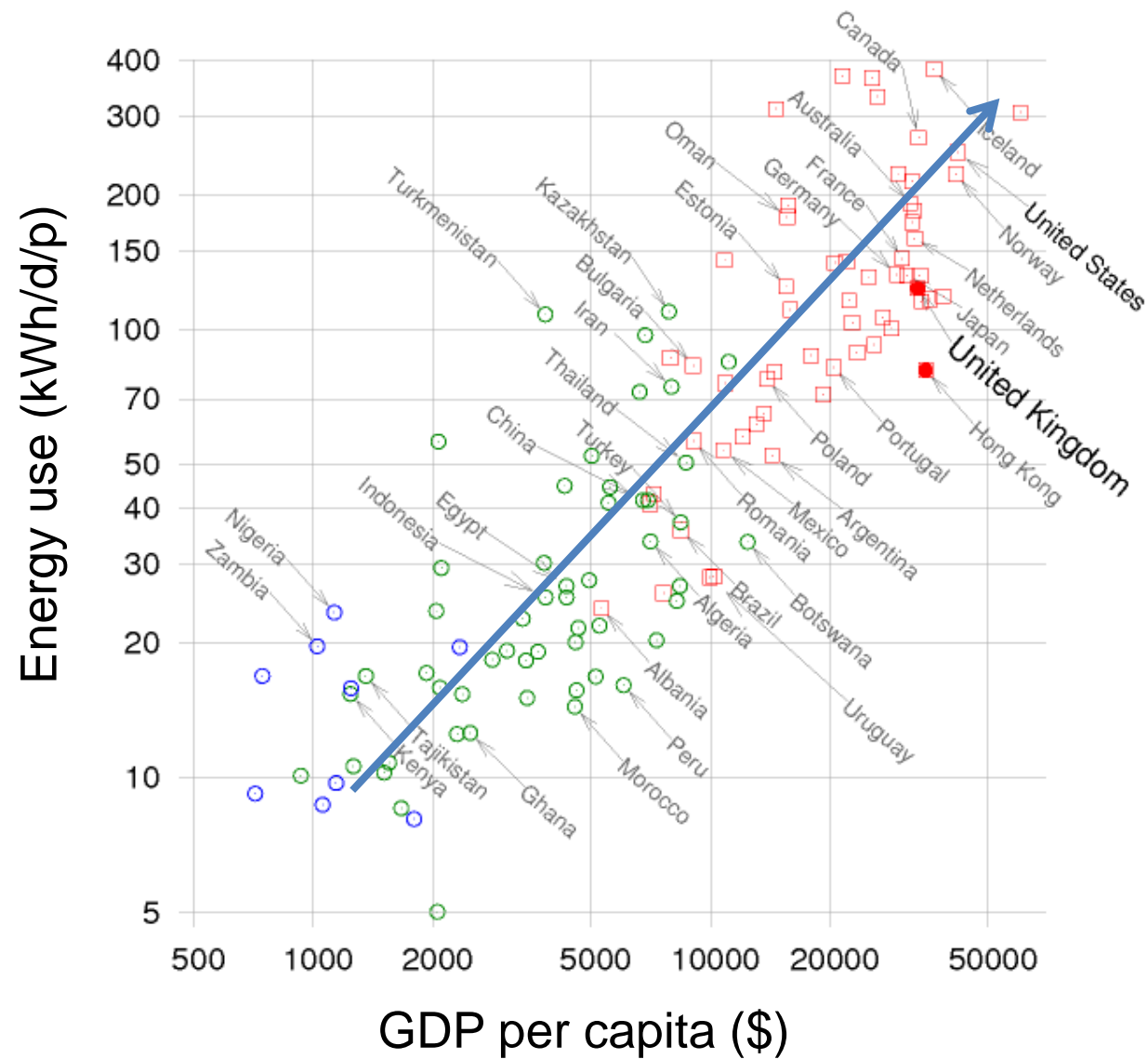
Wind power generates 140% of Denmark's electricity demand

Forbes

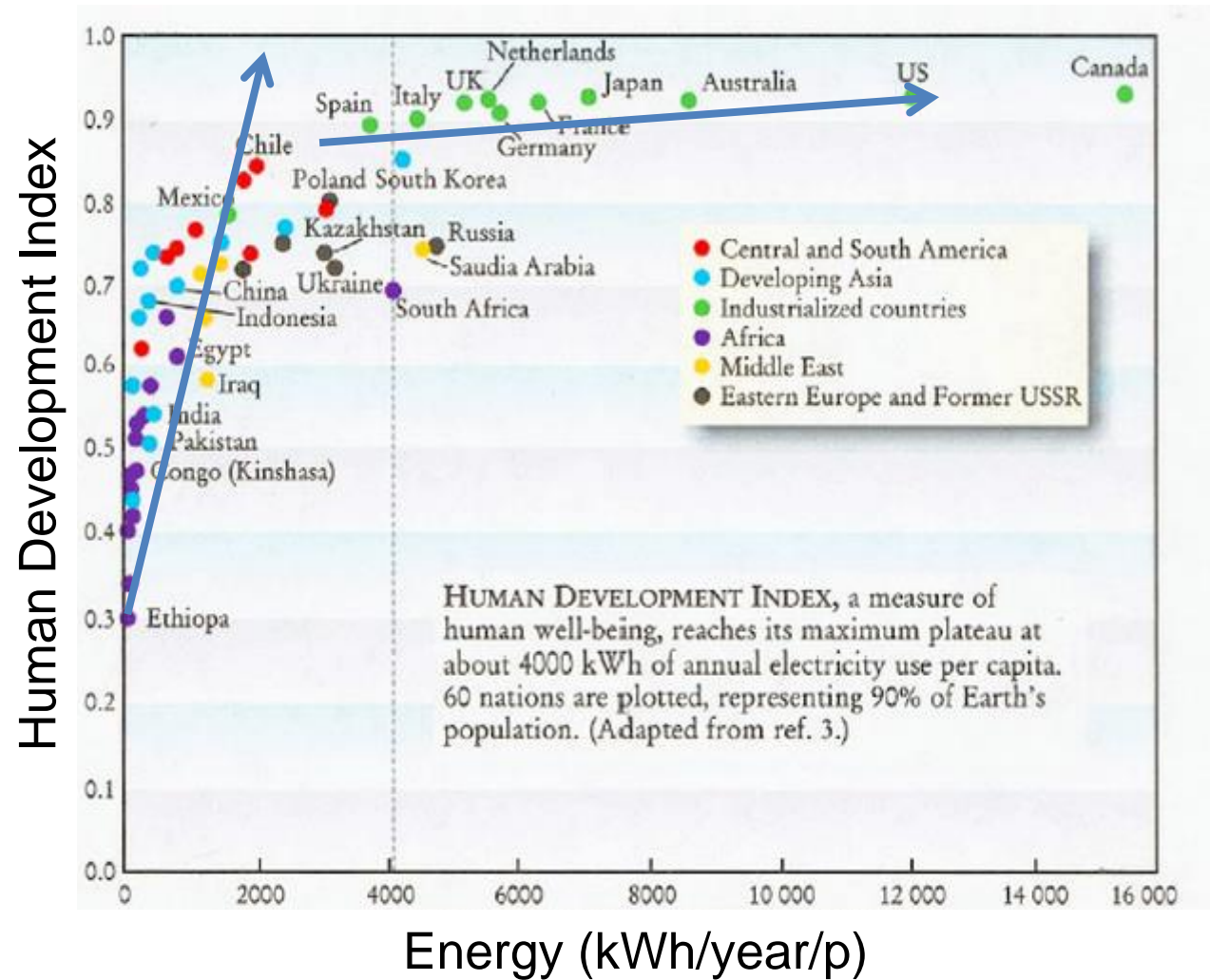
Australia's main grid hits new renewable energy record of 50.4 per cent



Energy correlates with GDP



Energy correlates with HDI



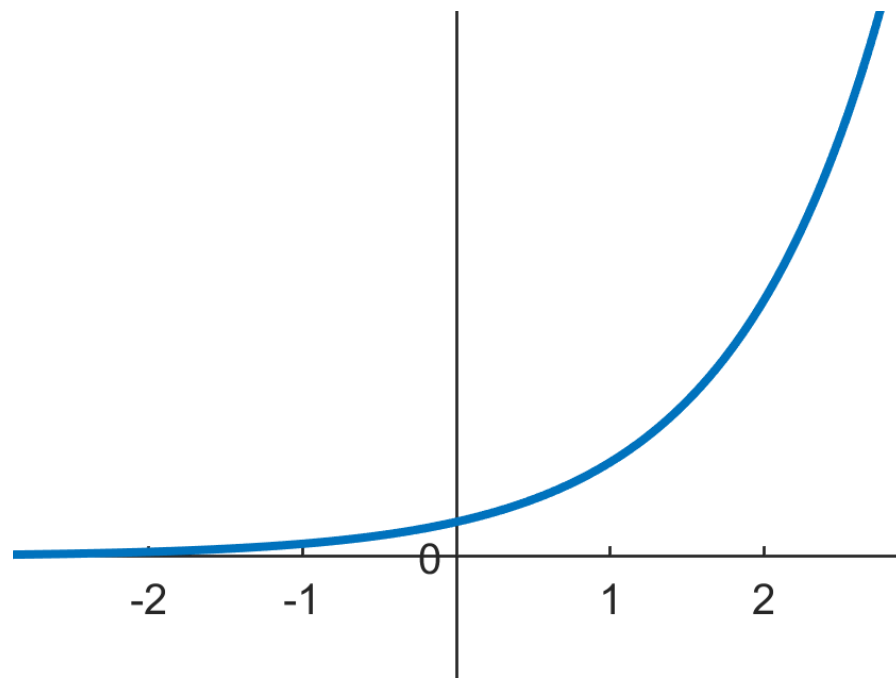
from S. Benka, *Physics Today* (April 2002), pg 39, and adapted from A. Pasternak, Lawrence Livermore National Laboratory rep. no. UCRL-ID-140773.

$$\frac{dy}{dx} = y$$

Exponentials

$$y = e^x$$

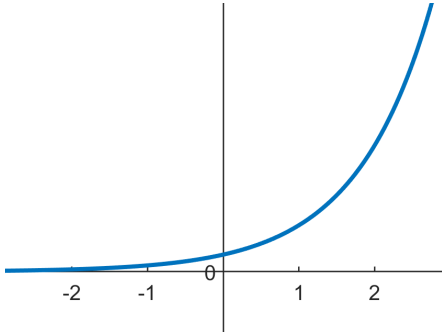
$$e^x = 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \dots \sum_k^{\infty} \frac{x^k}{k!}$$



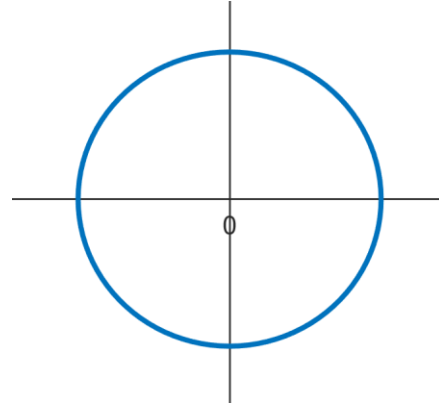
how fast you grow depends on how big you are...

Exponentials

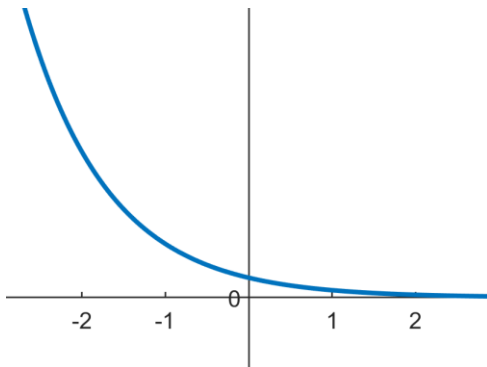
$$y = e^x$$



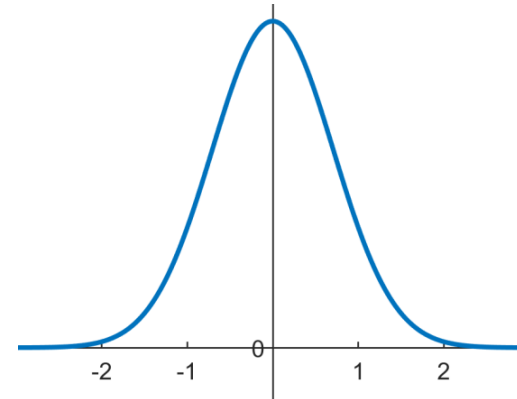
$$y = e^{ix} = \cos x + i \sin x$$



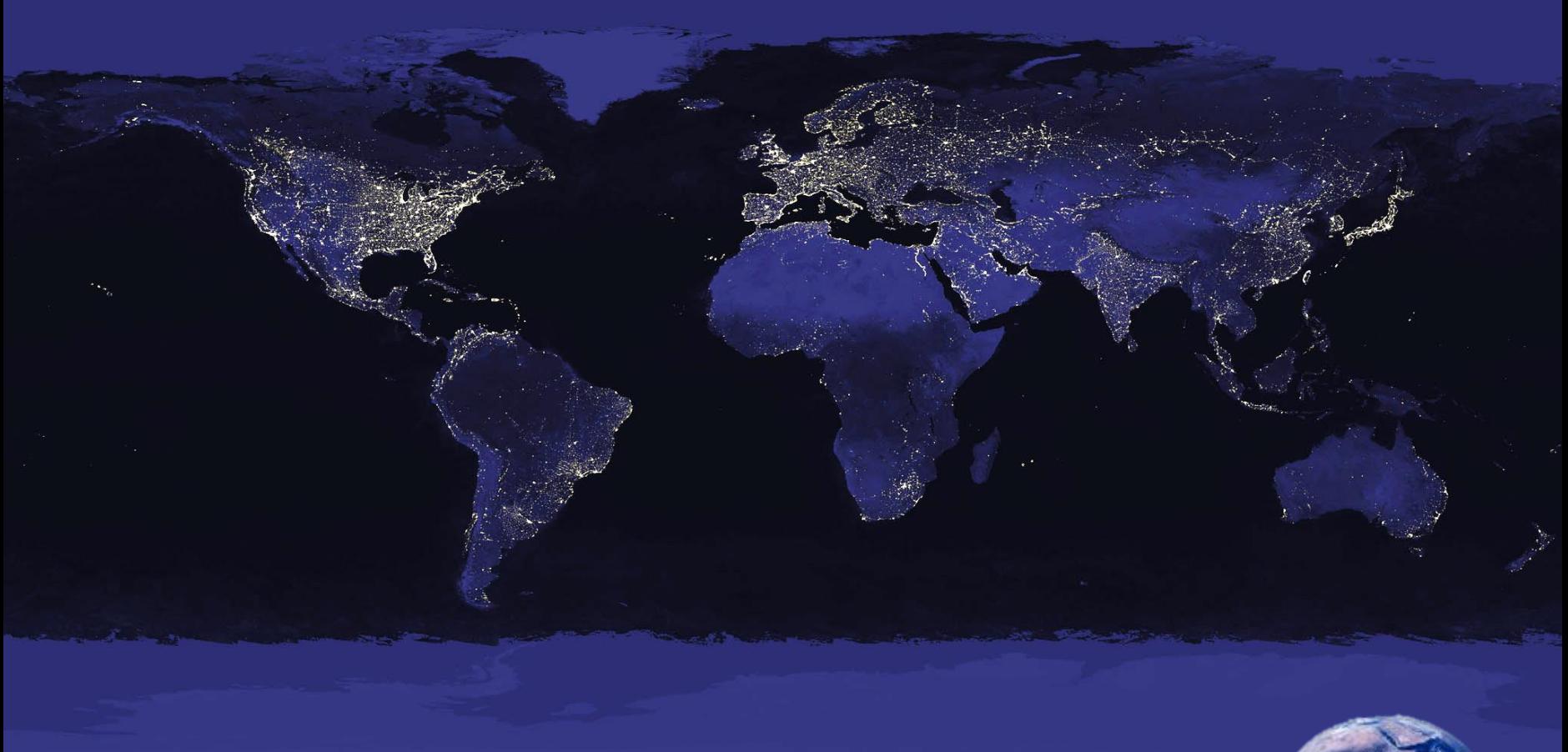
$$y = e^{-x}$$



$$y = e^{-x^2}$$



“The future is already here, it’s just not very evenly distributed”
- William Gibson, 1993

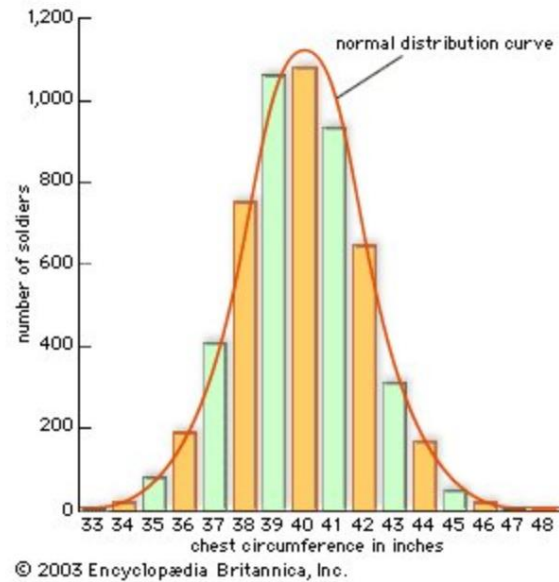


1 billion people don't have access to electricity

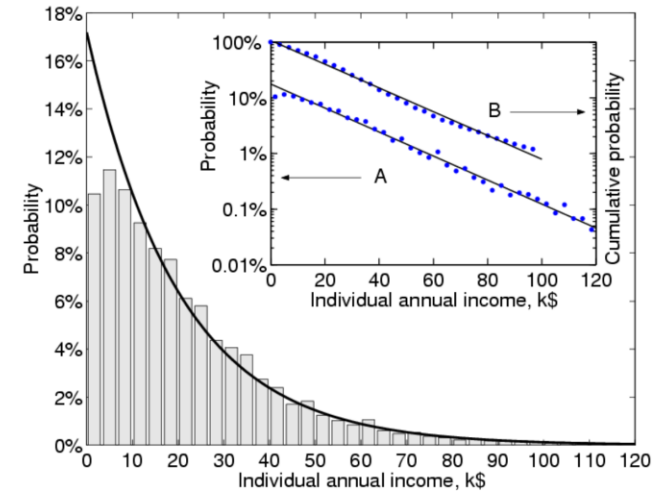


Distributions

Chest circumferences of 5,732 Scottish soldiers,
Quetelet 1817

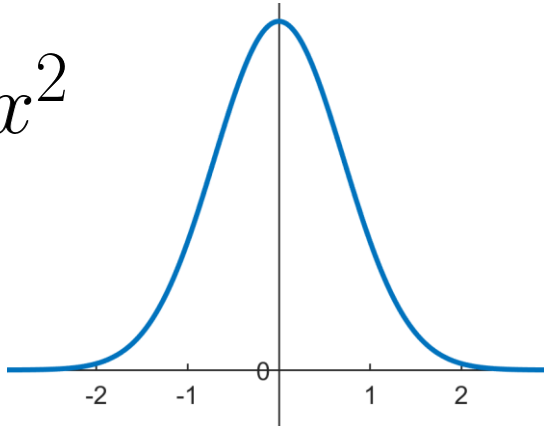


US Income
Yakovenko, et al. 2009

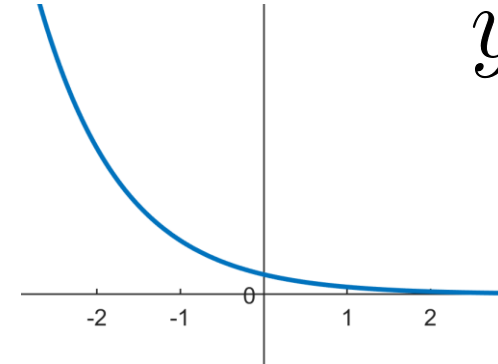


Yakovenko et al. Classical Econophysics, Routledge 2009

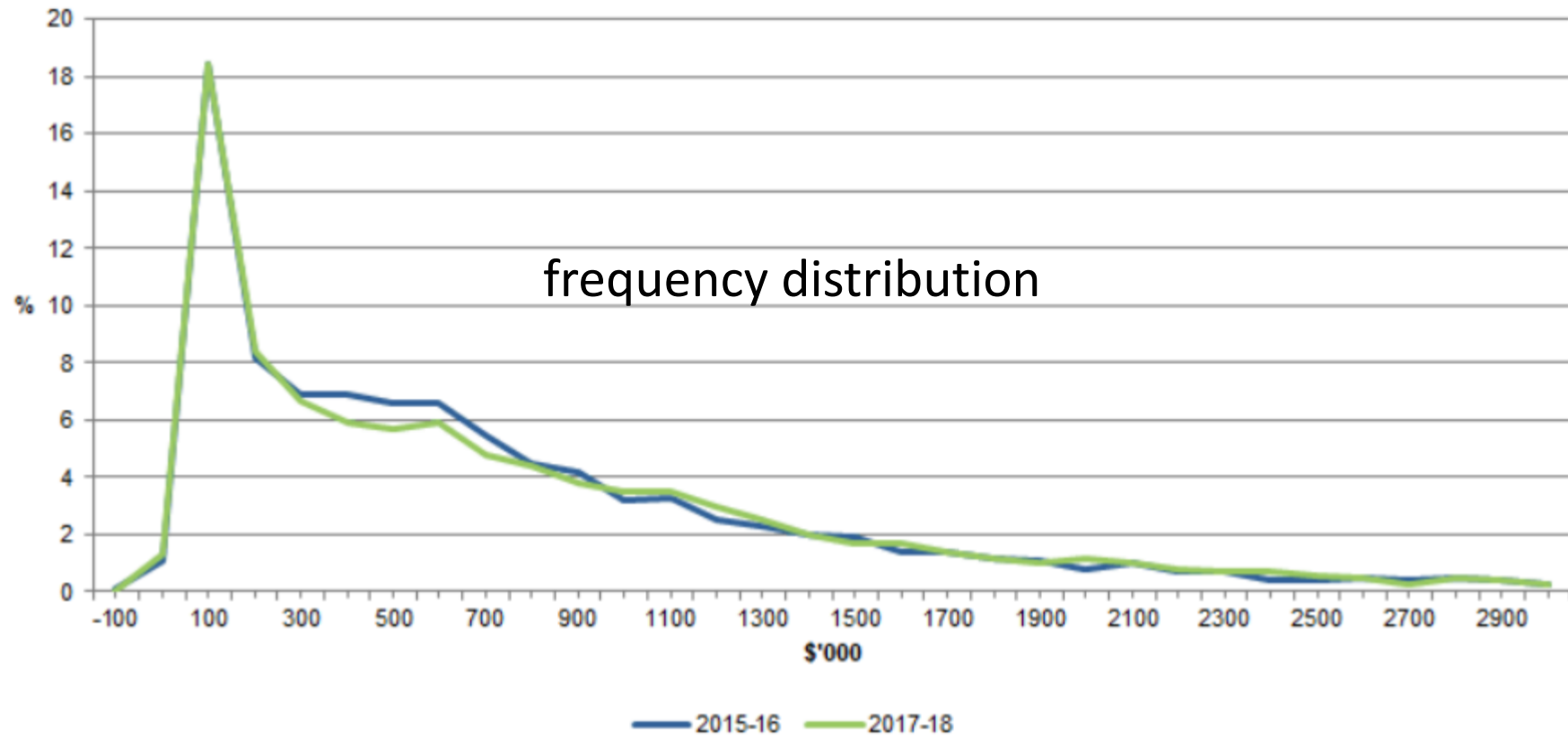
$$y = e^{-x^2}$$



$$y = e^{-x}$$

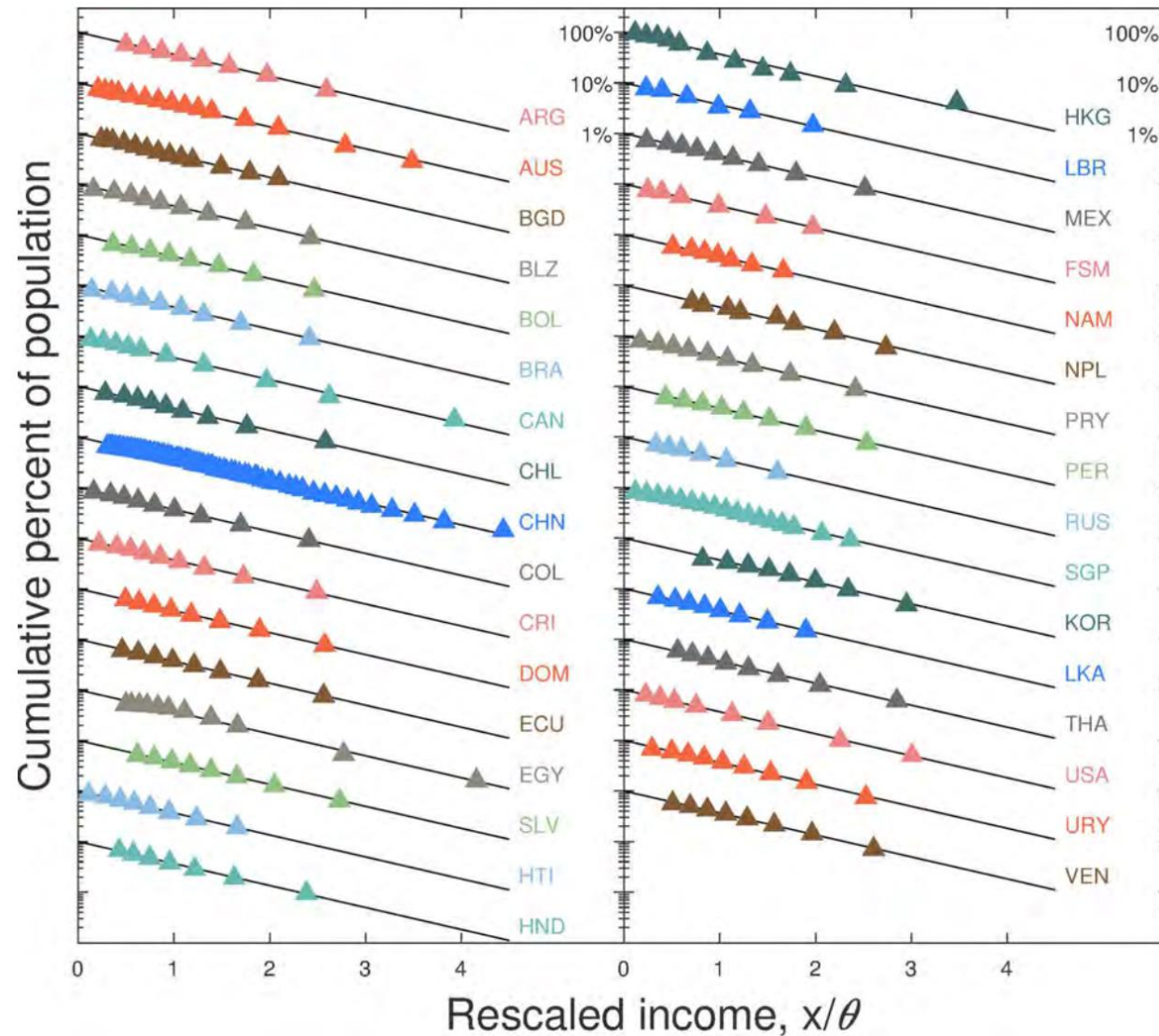


Net Worth of Australians

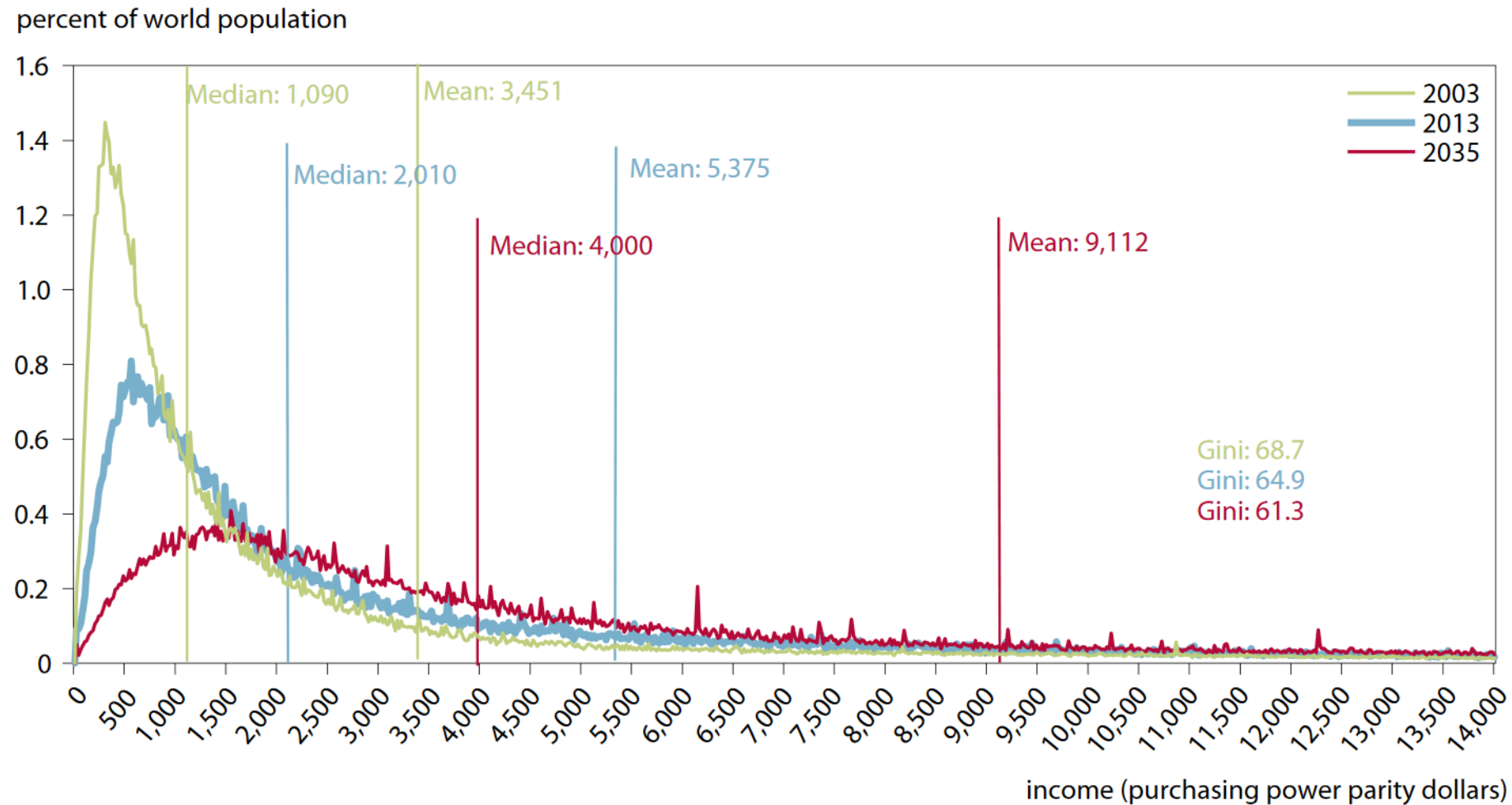


Source: ABS 2018

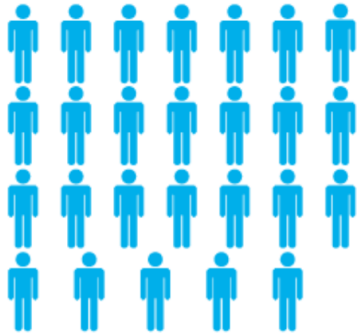
Exponential income inequality across 67 countries



Global income distribution

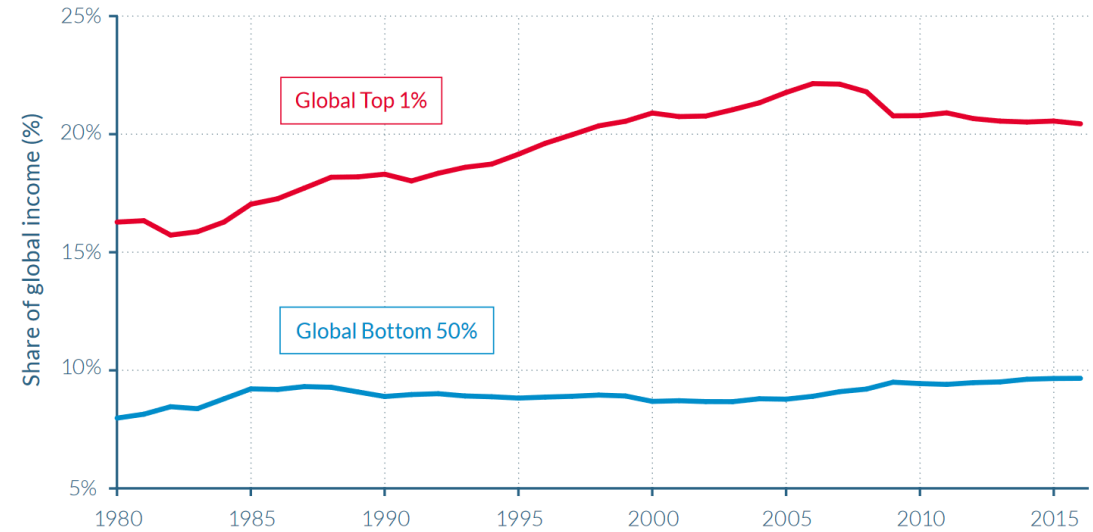


Global distribution of wealth



Global wealth report 2019

CREDIT SUISSE 



WORLD INEQUALITY REPORT **2018**

World's wealthiest 10%
(those who own \$100,000 in assets)
own >80% of global wealth

theguardian

Limited resources

Energy



Time



Matter



Space

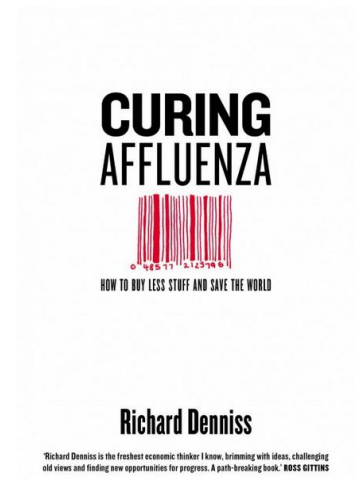


World's 10 biggest companies by revenue



FORTUNE GLOBAL 500

Rank ↕	Name ↕	Industry ↕	Revenue ↕
			USD mil
1			▲ \$523,964
2			▼ \$407,009
3			▼ \$383,906
4			▼ \$379,130
5			▼ \$352,106
6			▼ \$329,784
7			▲ \$282,760
8			▼ \$282,610
9			▲ \$280,522
10			▲ \$275,288



Coal Exports by Country (CIA World Factbook 2019)

- Australia: US\$47 billion (36.9% of total coal exports)
- Indonesia: \$20.6 billion (16.2%)
- Russia: \$17 billion (13.4%)
- United States: \$12 billion (9.4%)
- Colombia: \$6.6 billion (5.2%)
- South Africa: \$6.2 billion (4.9%)
- Canada: \$5.8 billion (4.5%)
- Netherlands: \$3.9 billion (3%)

Australia grabs world's biggest LNG exporter crown from Qatar in Nov



Coal lobby ads biggest third-party political expenditure in Australia



Australia's mining exports hit \$278bn



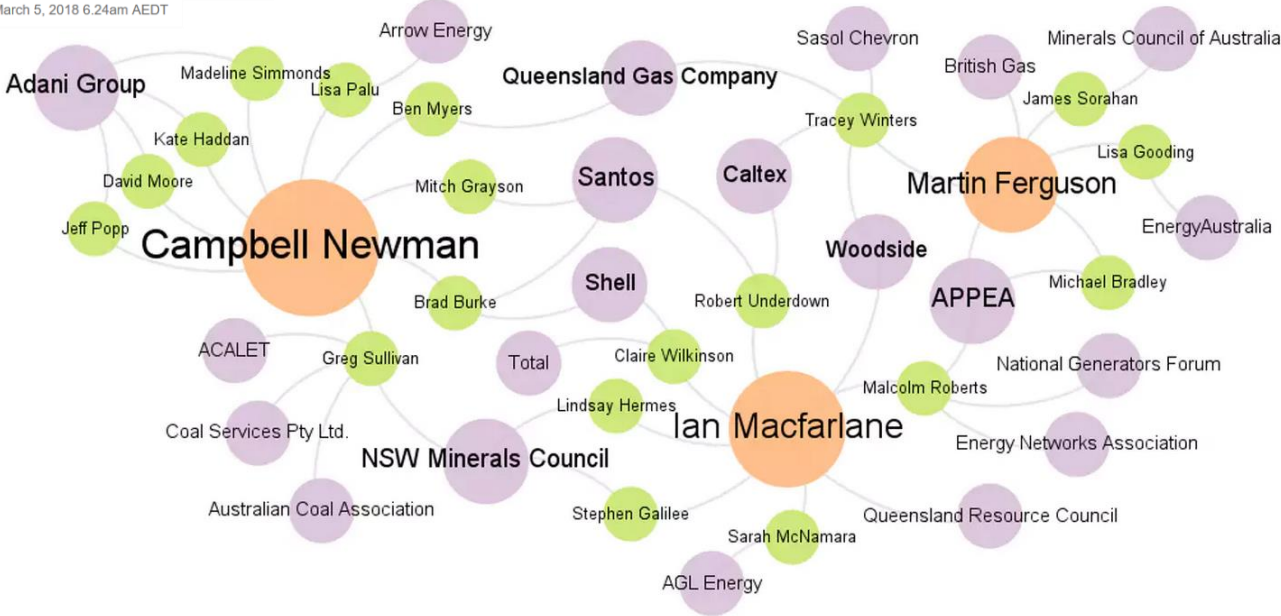
Top 10 fossil fuel donors 2017-18

COMPANY	ALP	LIB	NAT	TOTAL
Woodside	\$117,700	\$118,500	\$1,100	\$237,300
Santos	\$85,610	\$71,973	\$24,500	\$182,083
Chevron Australia	\$59,000	\$51,219	\$11,660	\$121,879
Alinta Energy	\$68,500	\$25,000	\$25,250	\$118,750
Origin Energy	\$54,500	\$39,670	\$16,425	\$110,595
Caltex	\$44,138	\$52,769	\$0	\$96,907
Minerals Council of Australia	\$41,200	\$43,250	\$10,450	\$94,900
Cartwheel Resources	\$0	\$52,864	\$0	\$52,864
Senex Energy	\$36,500	\$15,400	\$0	\$51,900
The Trustee for St Baker Family Trust	\$0	\$50,000	\$0	\$50,000

Market Forces

Revealed: the extent of job-swapping between public servants and fossil fuel lobbyists

March 5, 2018 6.24am AEDT



A. Lucas, The Conversation, 2018

No longer a government by free opinion, no longer a government by conviction and the vote of the majority, but a government by the opinion and the duress of small groups of dominant men.

– Woodrow Wilson, 28th President of the United States of America, The New Freedom, 1913

A lack of transparency results in distrust and a deep sense of insecurity.

– The 14th Dalai Lama

The truth shall set you free.

– John 8:32

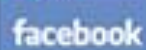


“in a time of universal deceit, telling the truth is a revolutionary act”

“The further a society drifts from truth, the more it will hate those who speak it”

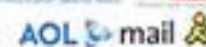
- George Orwell

TOP SECRET//SI//ORCON//NOFORN

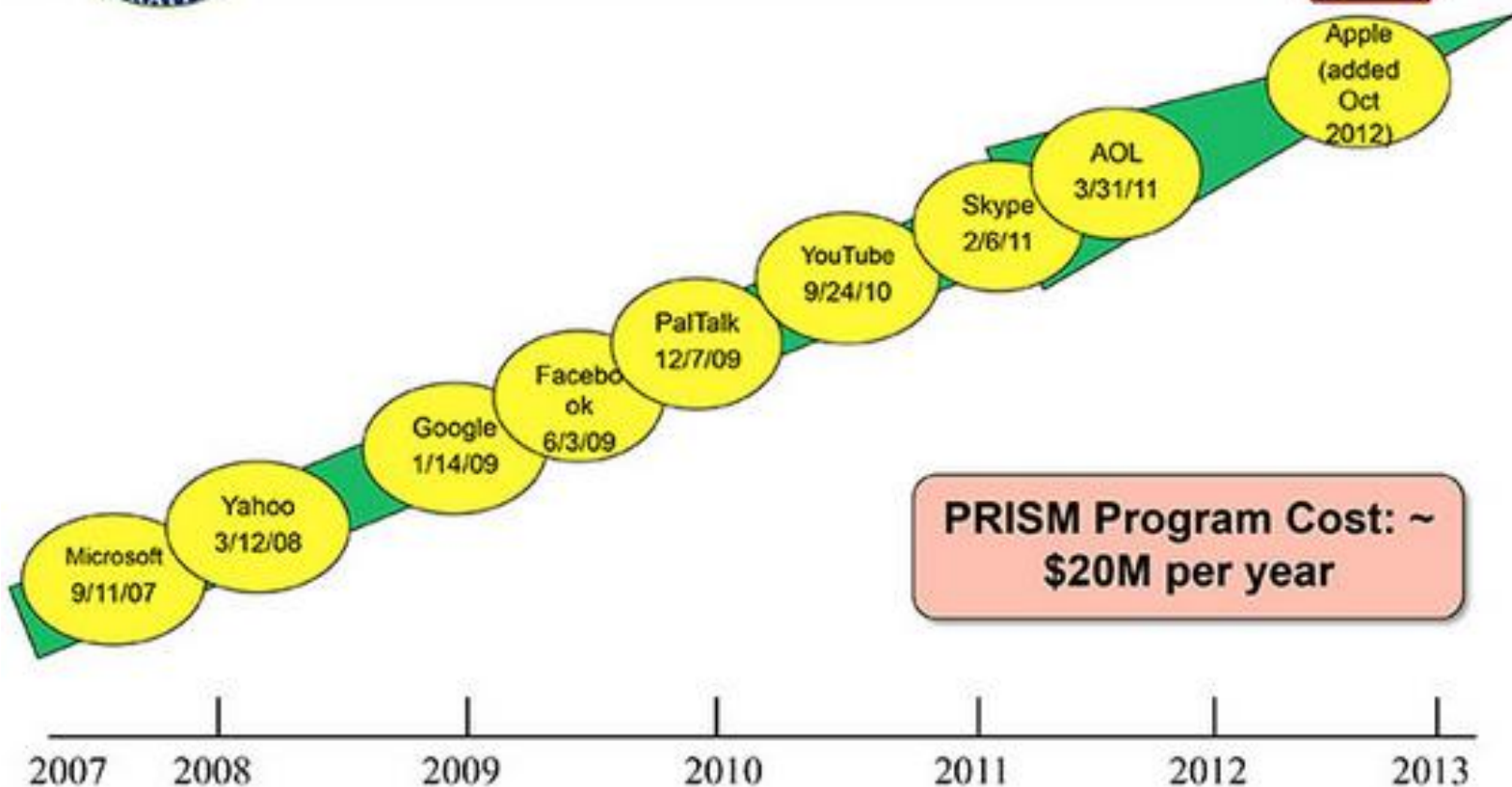


Hotmail

YAHOO!



(TS//SI//NF) Dates When PRISM Collection
Began For Each Provider



**PRISM Program Cost: ~
\$20M per year**

TOP SECRET//SI//ORCON//NOFORN

Source: NSA (courtesy Edward Snowden and The Guardian)



banksy

Noise vs Signal

Resisting mass surveillance with targeted noise

$$\text{NSR} = \frac{P_{\text{noise}}}{P_{\text{signal}}}$$

we homeland opposed They are able Most vaccine United response
we Gulf shut month, #NvS

Generate a string of catch-words and surveillance search terms (above) that might be picked up by a bulk-surveillance system and include them in your digital communications. Send to those who have agreed to receive them or noise.vs.signal@gmail.com.

NoiseVsSignal.org

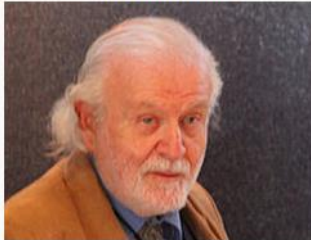
Who do we trust?

Frederick Seitz



President, US National Academy of Science, PhD Princeton
NASA Distinguished Public Service Award

S. Fred Singer



PhD Princeton
Gold Medal Award for Distinguished Federal Service



William A. Nierenberg

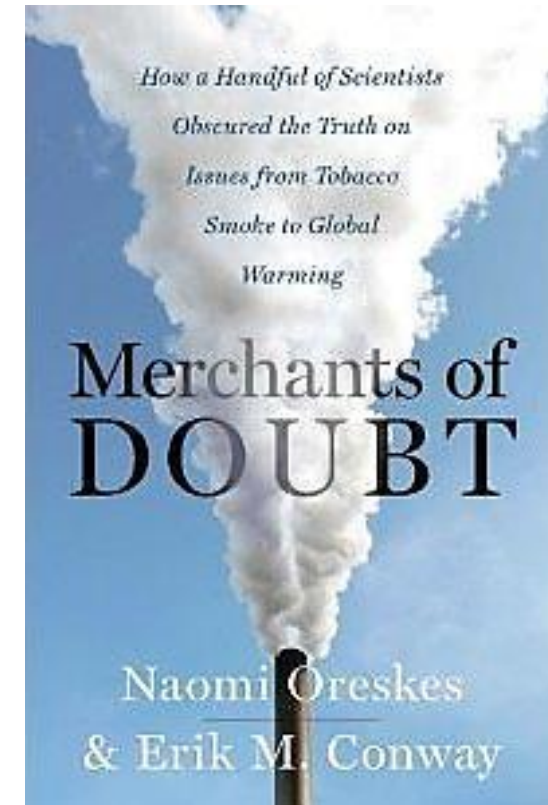
PhD Columbia
Fellow National Academy of Science

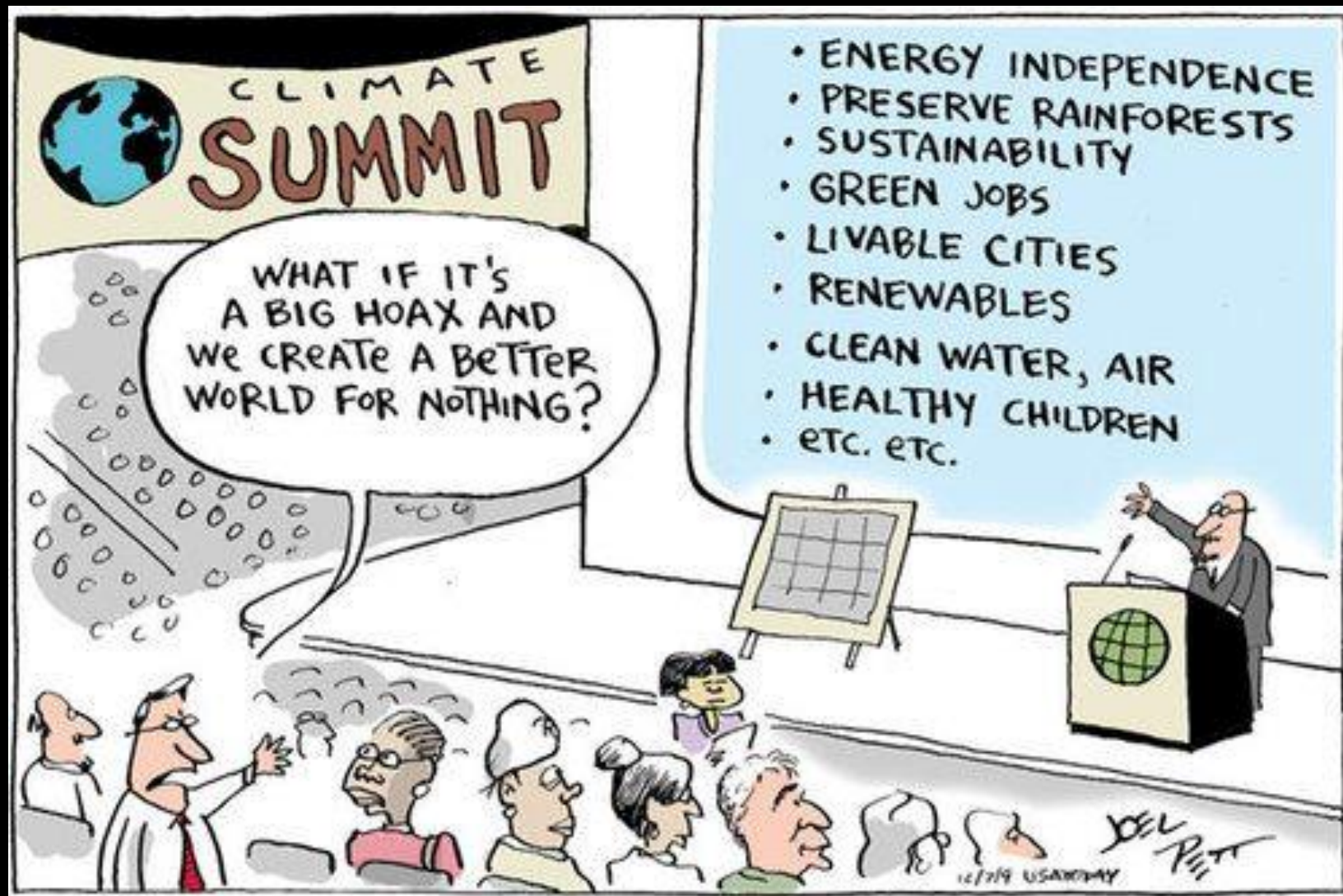


'Keep controversy alive'

*'Spread doubt and confusion after
scientific consensus has been
reached'*

- Tobacco
- Acid Rain
- Pesticides
- Chlorofluorocarbons
- Climate Change...





Education

Questions are the creative acts of intelligence.
- Confucius

You can tell whether a man is clever by his answers. You can tell whether a man is wise by his questions.
- Naquib Mahfouz

He who asks a question is a fool for five minutes; He who does not remains a fool forever.
- Seneca the Younger, 60AD



THE HUFFINGTON POST

Dark Chocolate May Help Prevent Some Types Of Cancer

Posted: 08/08/2016 9:05 am EDT | Updated: 08/08/2016 4:59 pm EDT



Cocoa and dark chocolate contain compounds that may help prevent cancer by many ways, including preventing DNA damage, lowering inflammation, and inhibiting cell proliferation. Experimental [evidence](#) shows that cocoa can lower the risk of some types of cancer. Most importantly, some human trials show that cocoa can reduce activation of molecules that are involved in the development and progression of cancer.



Alcohol: Cancer risk 'increased' by drinking more than one glass of wine or pint of beer per day, experts warn

Jess Staufenberg | Friday 8 January 2016 |



5 'unhealthy' foods that are actually good for you

Woman's Day



Kinder cancer: 'Possible carcinogen' found in beloved chocolates

Published time: 5 Jul, 2016 03:03



The Knews (beta)

In support of distilled knowledge and persistent wisdom.
not for profit.

Search

Contribute

Eg. Eat food, mostly plants, not too much #health #diet # life
@michaelpollan

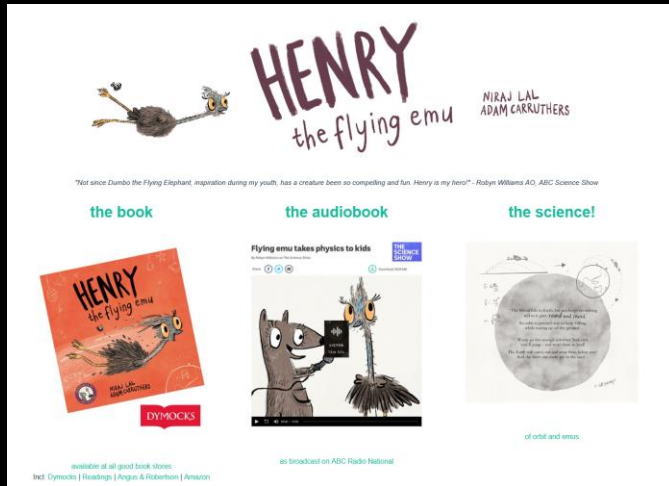
#health

the knews

1. Eat food, mostly plants, not too much @MichaelPollan 1092313 ↑↓
2. Exercise 899764 ↑↓
3. Laugh often, wonder more, spend time with loved ones 732448 ↑↓
4. Practice meditation 732229 ↑↓
5. Stay hydrated 438270 ↑↓
6. Seek awe-inspiring experiences 105405 ↑↓
7. Listen to your body 93882 ↑↓
8. Invest time in family and friends 74770 ↑↓
9. More roots 68889 ↑↓
10. Make time for yourself 56113 ↑↓

new

1. Practice meditation
2. Stay hydrated
3. Try yoga/pilates/tai-chi
4. Seek awe-inspiring experiences
5. Make time for yourself
6. Laugh often, wonder more, spend time with loved ones
7. Listen to your body
8. Invest time in family and friends
9. Exercise
10. Eat food, mostly plants, not too much - Michael Pollan



nirajlal.org
henrytheflyingemu.org

Acknowledgements

Mentors

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Mr Glenne Drover
Prof Udo Bach
Prof Jeremy Baumberg FRS

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Nicole Blinco
Bennett Schneider
James Liu
Daniel Shen
Dorota Bacal

