

Evoking clean energy solutions

Dr. Mike Biddle



Fueling the energy transition

The Evōk story

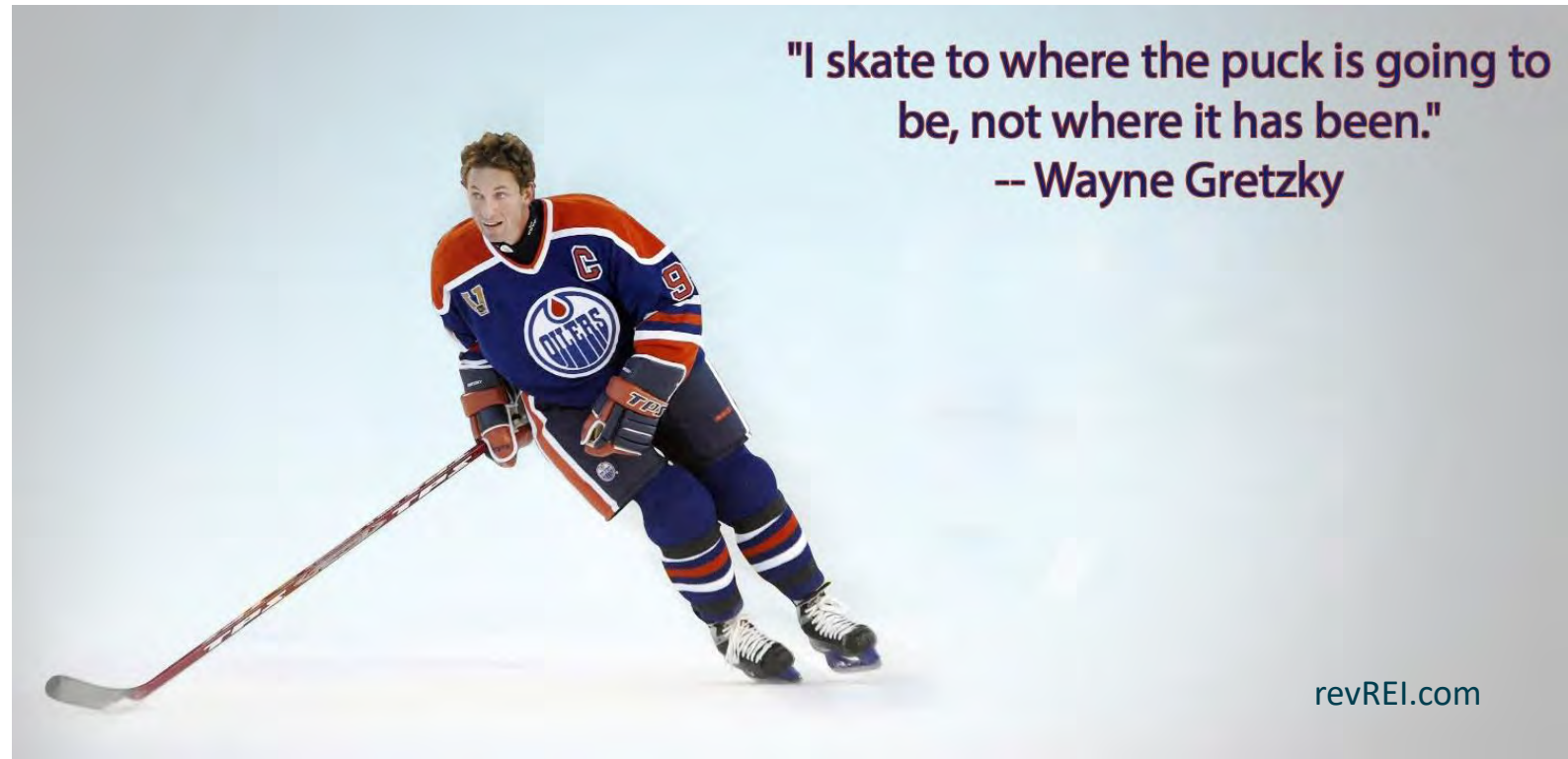
Evok Innovations is a unique partnership between the BC Cleantech CEO Alliance, Cenovus Energy and Suncor Energy.

Founded in 2015 with a \$100M commitment.

Led by experienced entrepreneurs, CleanTech investors, and O&G executives.

We protect the environment and strengthen the economy by investing in the commercialization of clean technology.





"I skate to where the puck is going to be, not where it has been."
-- Wayne Gretzky

revREI.com

My personal pathway to Evok



Navigation

Why are We Here? *purpose*

Where are We? *situational assessment*

Where Do We Want to Go? *vision*

How Do We Get There? *strategy*

Why? For me, it starts with meaningful shapes

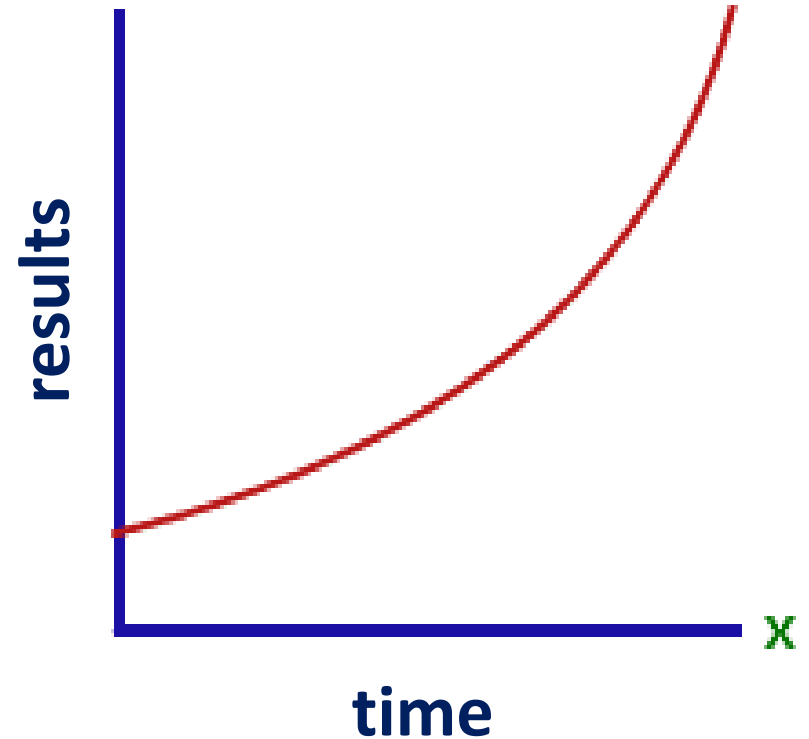
$$x(t) = x_0 \cdot e^{kt} =$$

$$x_0 \cdot e^{t/\tau} =$$

$$x_0 \cdot 2^{t/T} =$$

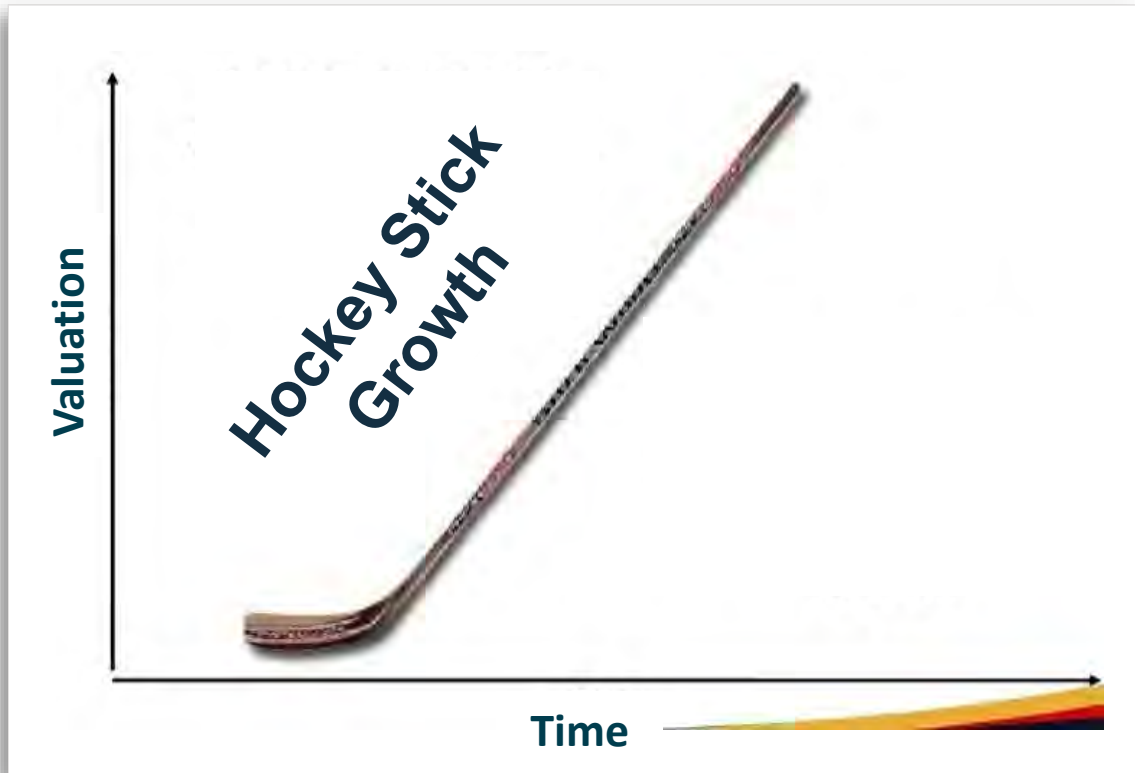
$$x_0 \cdot \left(1 + \frac{r}{100}\right)^{t/p}$$

Exponential Growth



Why are we here?

Investors want to see exponential growth



Venture-backed companies with quick \$1 Billion+ valuations



https://www.slideshare.net/stevekeifer/b2b-emarketplaces-rise-and-fall-by-steve-keifer/9-Hockey_Stick_Revenue_Growth_Investors

https://ichef.bbci.co.uk/news/1024/cpsprodpb/16A94/production/_87602829_unicornphoto.jpg

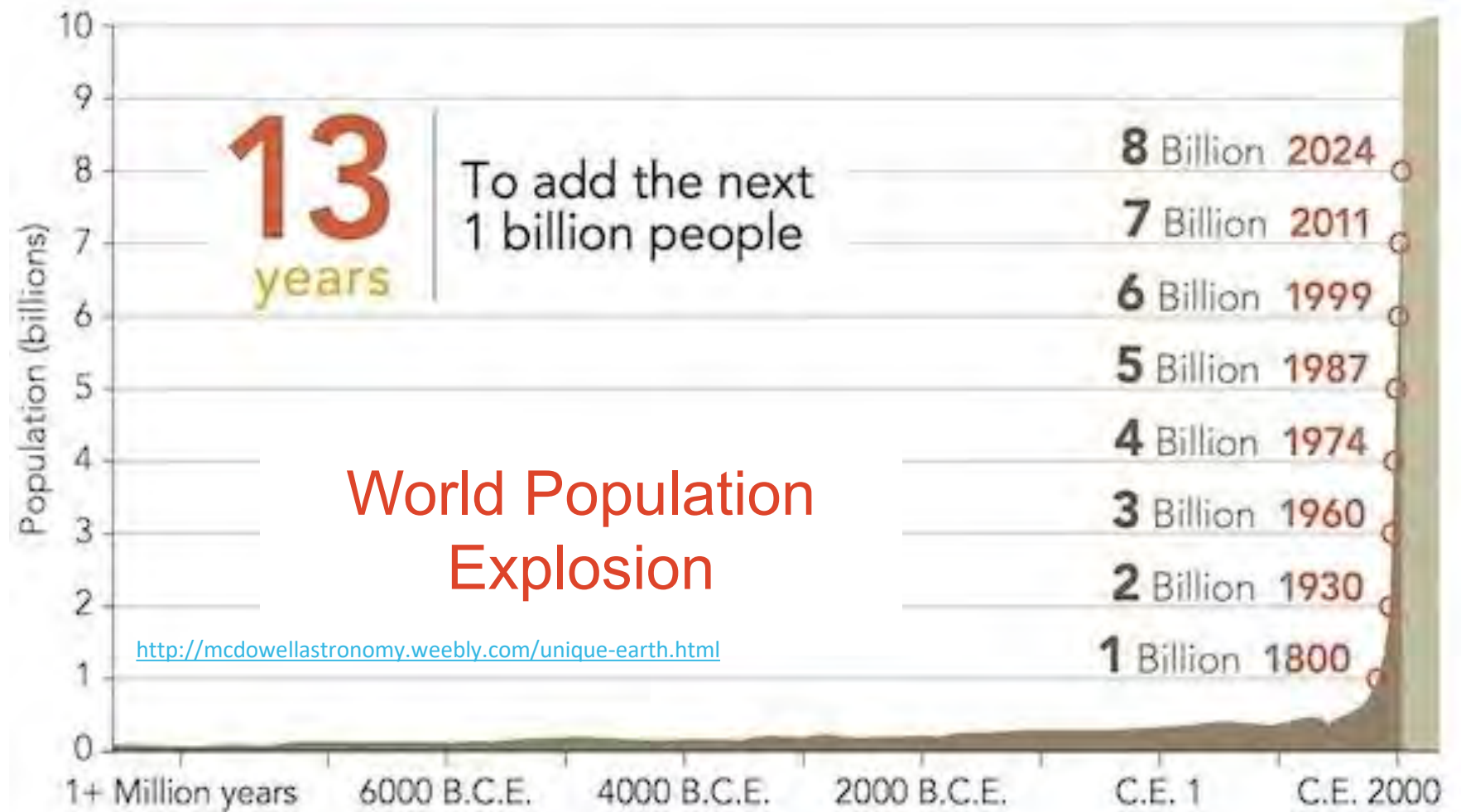
The reality?

is more often like



Why are we here?

Exponential trends that we believe are both more real and more impactful.



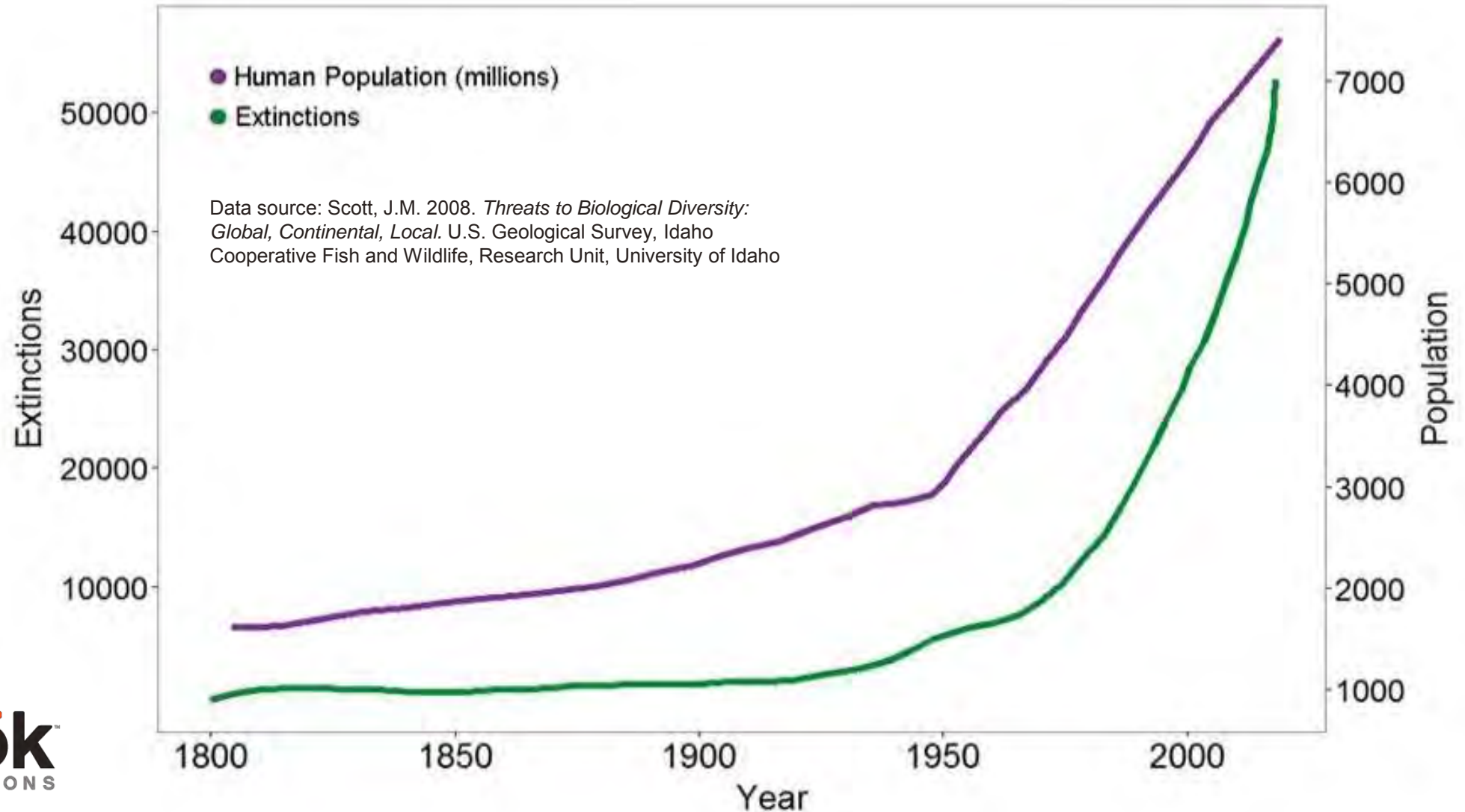
Why are we here?

Exponential LOSS vs Growth



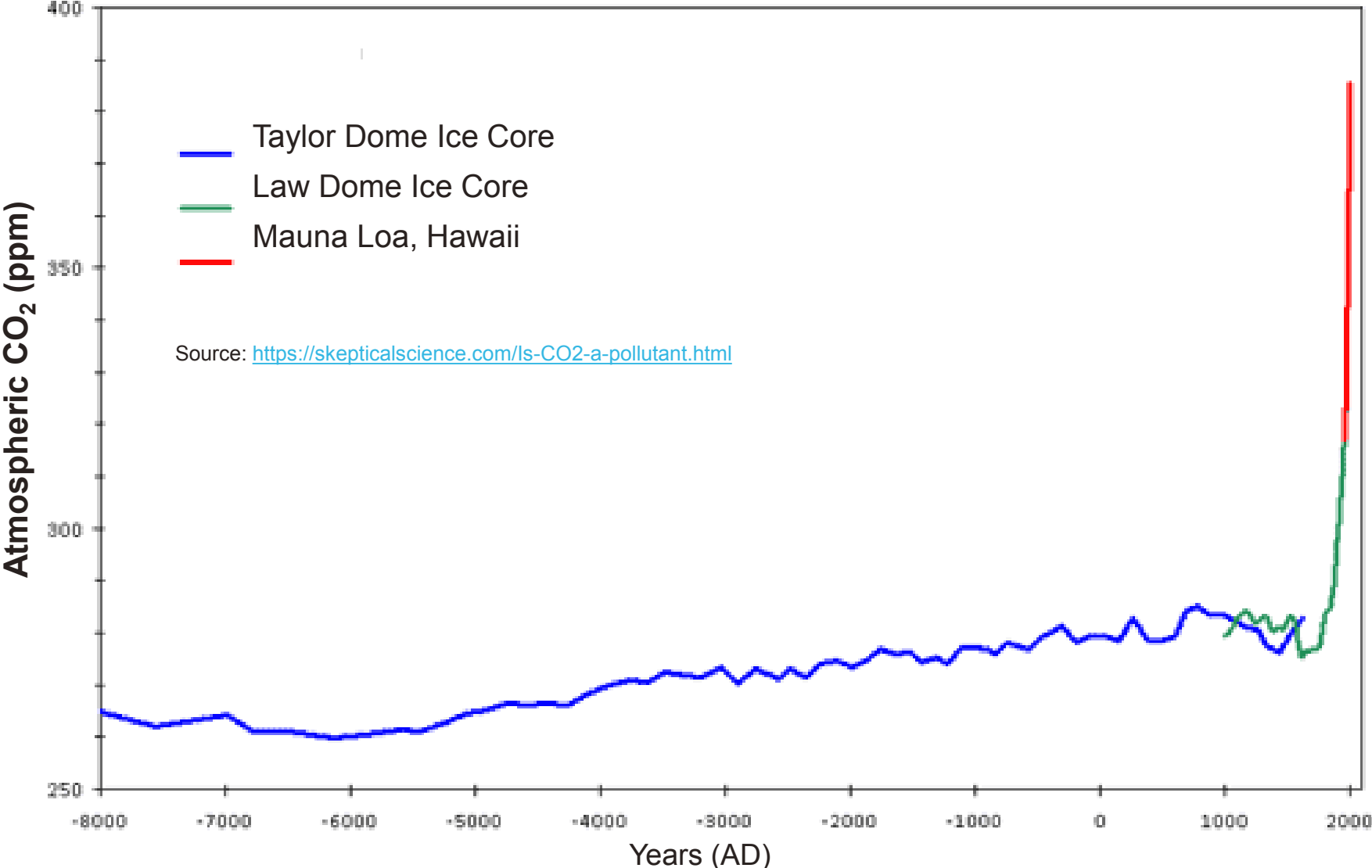
Humans and The Extinction Crisis

Related?

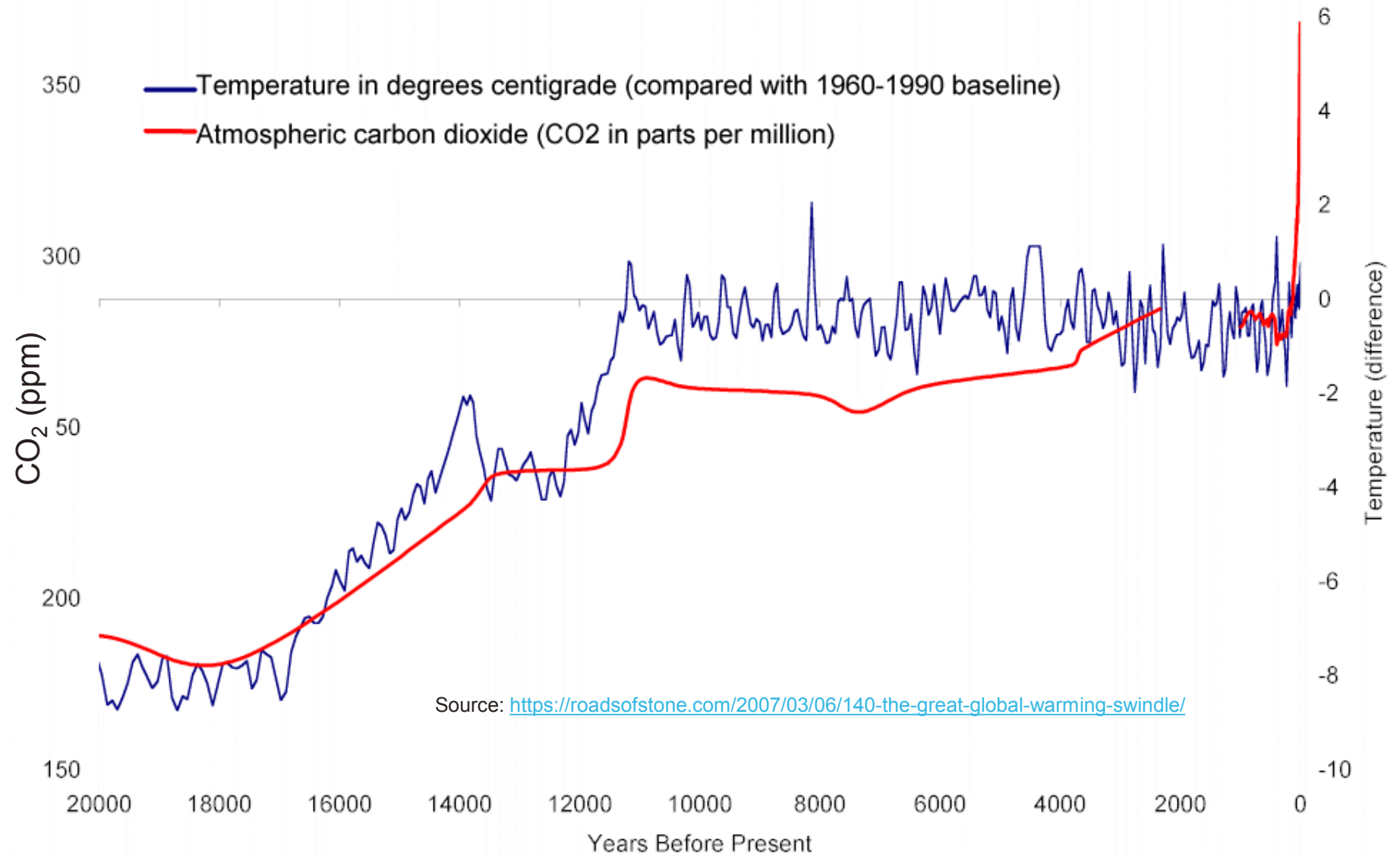


A nearly “invisible” exponential growth

CO₂ levels
over the last
10,000 years

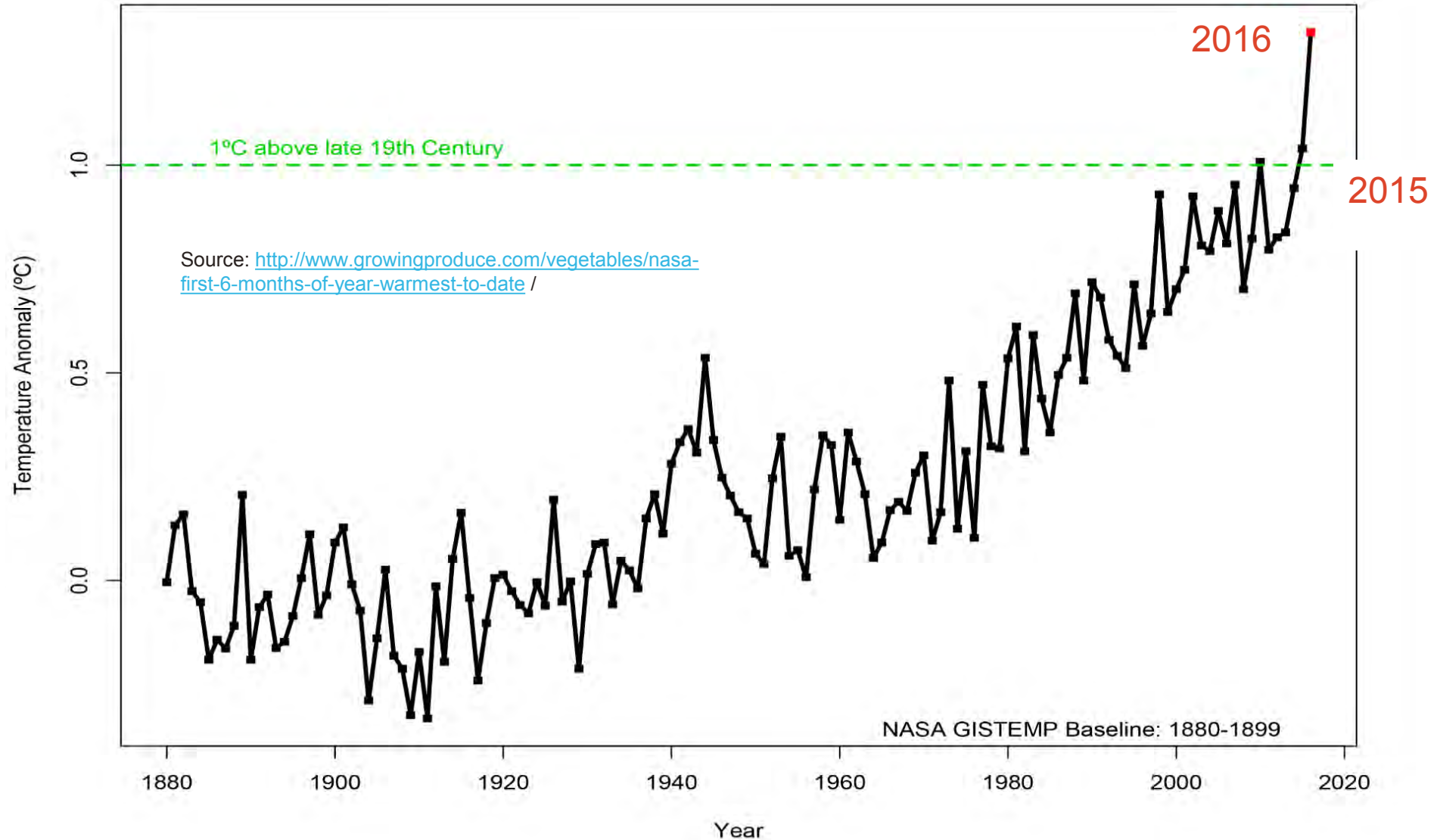


Might CO₂ and global temperature be related?

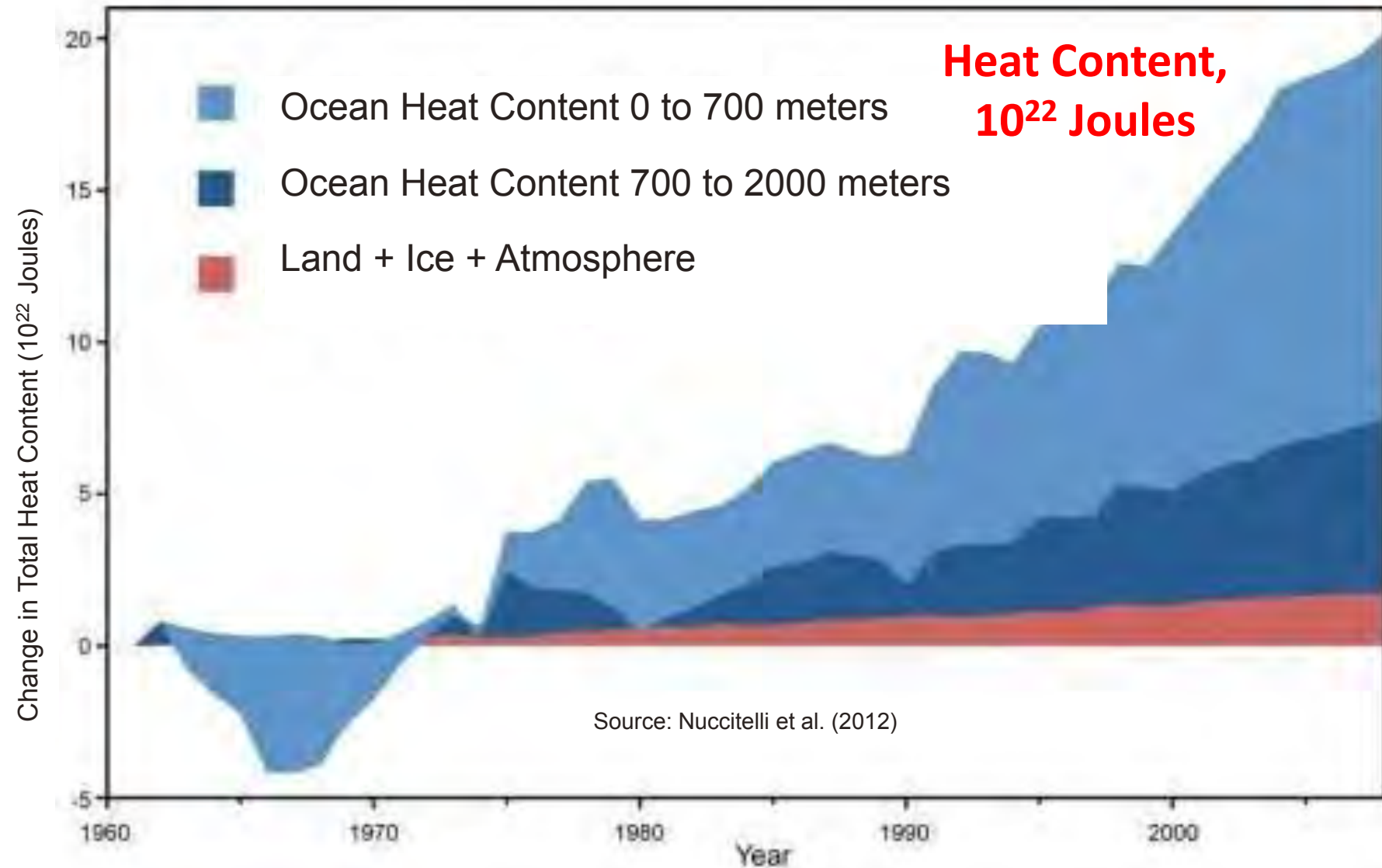


Zoom in on last 125 years

Global Mean Surface Temperature (January-June)



Oceans have been both a CO₂ and heat sink up to now



<https://www.skepticalscience.com/4-Hiroshima-bombs-worth-of-heat-per-second.htm>

Oceans are the primary lungs of the planet

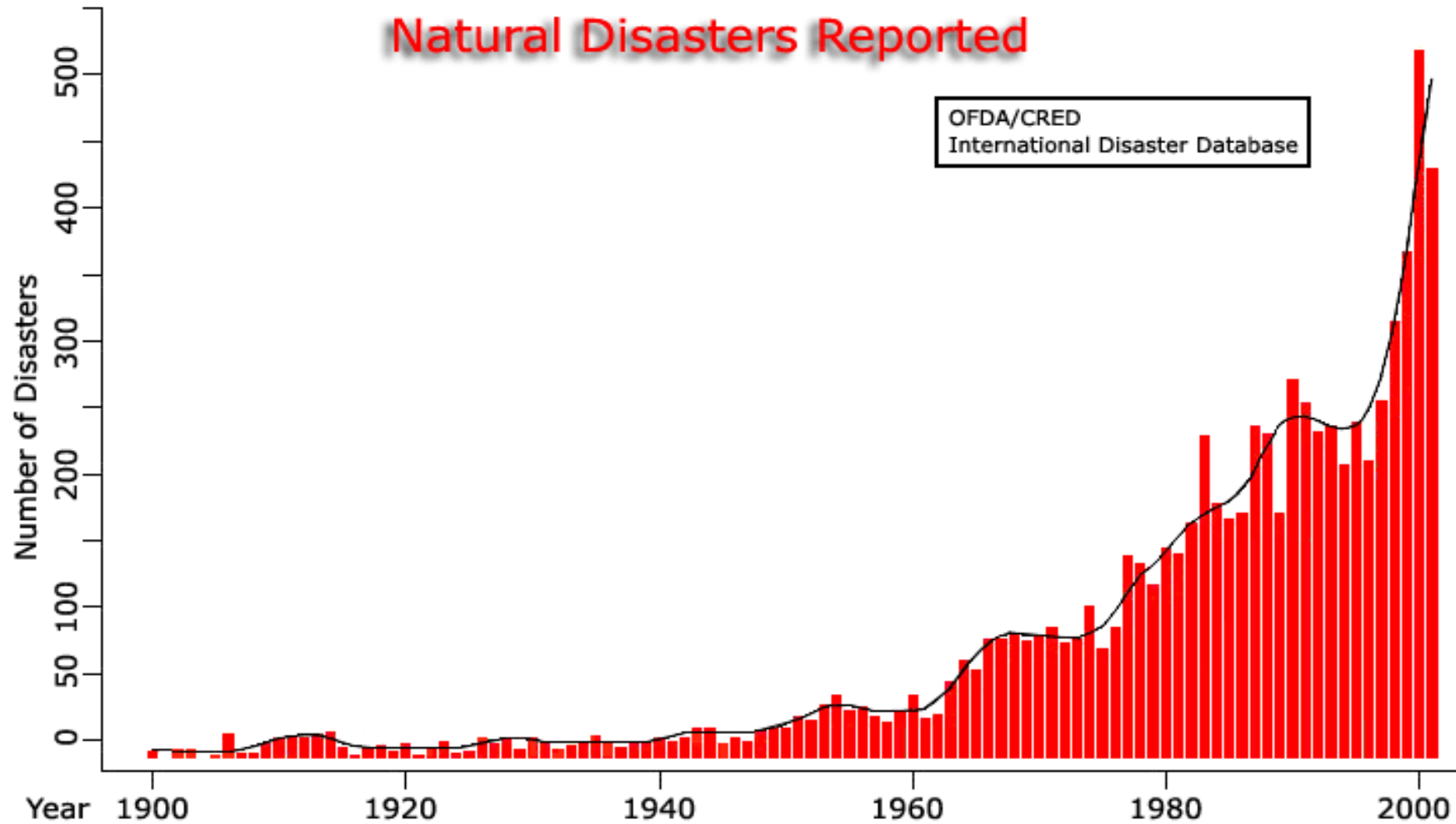
"No water, no life. No blue, no green."

— Sylvia Earle, Oceanographer

**It is estimated that 60% of the World's
Coral Reefs will be lost by 2030**

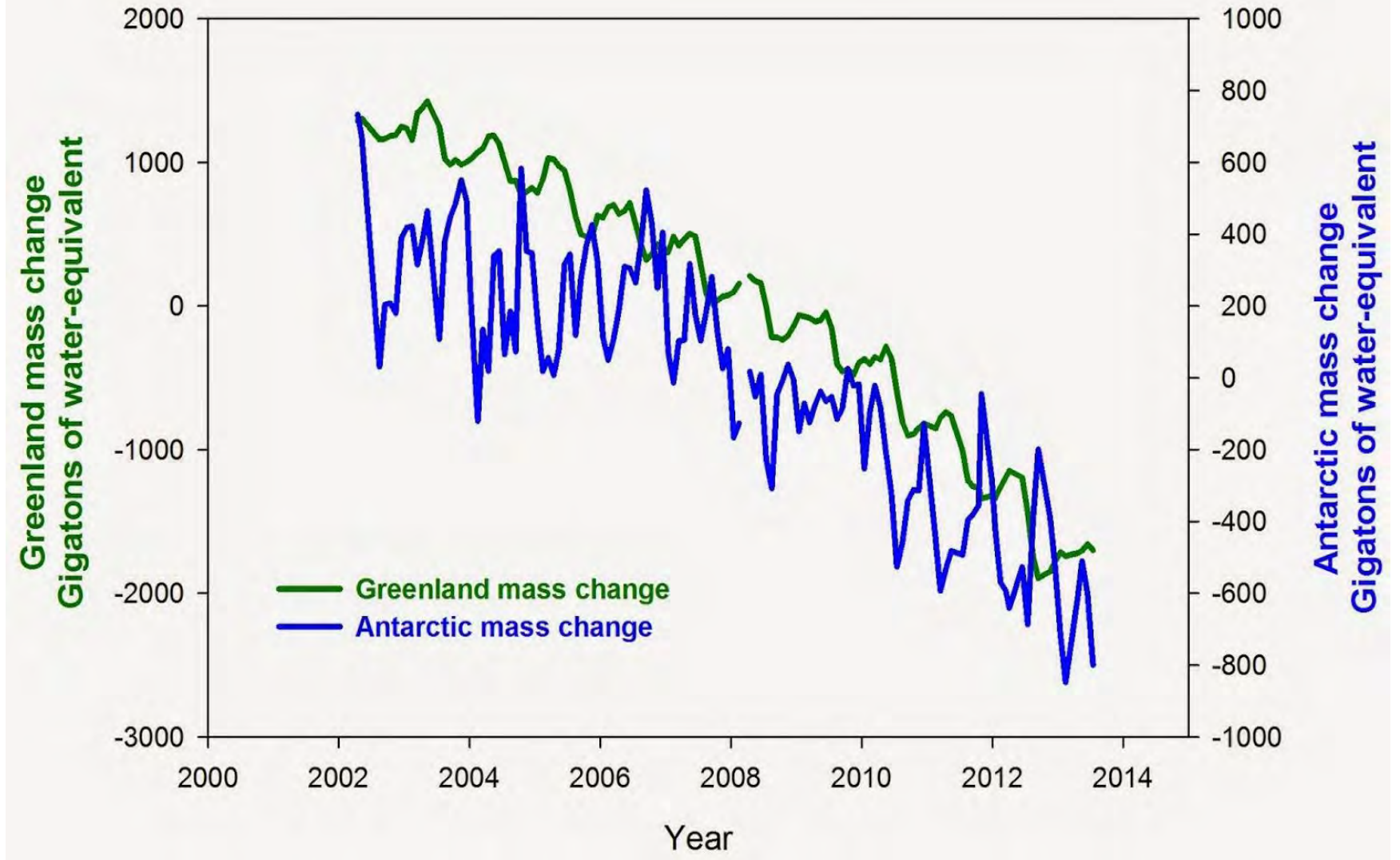
<http://www.greenpeace.org/australia/en/what-we-do/climate/reef-at-risk/>

Warmer Air and Water = Increased Storm Intensity



More Heat = Less Ice = Sea Level Rise, SLR

Mass Change per climate.nasa.gov/key_indicators/



<https://outofthedepths.blogspot.com/2014/08/antarctic-and-greenland-ice-mass-change.html>

SLR + Climate Stress = large scale displacement



Climate change could displace up to 200 million people by 2050

Source: <http://www.csmonitor.com/Environment/2016/0503/First-US-climate-refugees-get-48-million-to-move>



<http://www.globalresearch.ca/what-is-it-really-like-to-be-a-syrian-refugee/5553492>



<http://www.capsweb.org/blog/world-population-growth-speeding-not-slowing-down-no-peak-sight-and-consequences-will-be>

Why? In Summary

I believe that we can mitigate these impacts to a large extent by more INTELLIGENT and more EFFICIENT production and consumption of resources and delivery of services.

We can do better.

This is NOT the future I want to leave to my 2 children

– or any other future generations

Uncharted Territory – except for million years ago

The last time CO₂ was nearly 400 ppm:

- Global average surface temperature was up to 6°C warmer
- Very little ice present anywhere on the planet
- Sea level was around 30 meters higher than today

Where are we? Resources

Increasing risk of resource scarcity

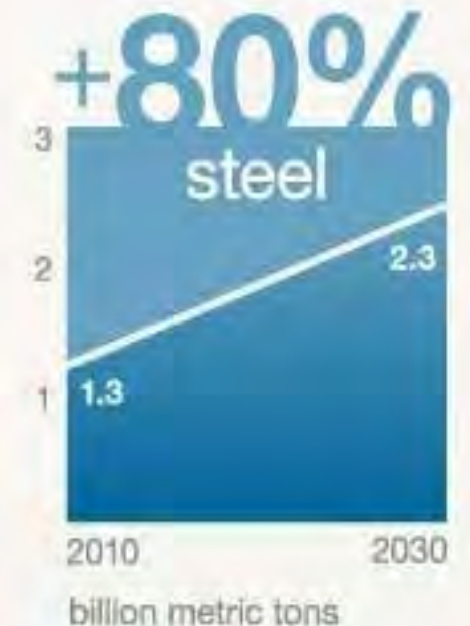
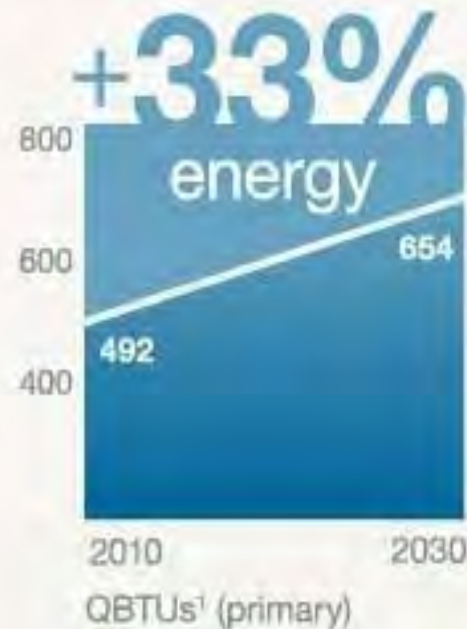
McKinsey
& Company

3 BILLION more
middle-class
consumers by
2030



Economic growth in emerging markets is fueling **dramatic increases in demand for resources...**

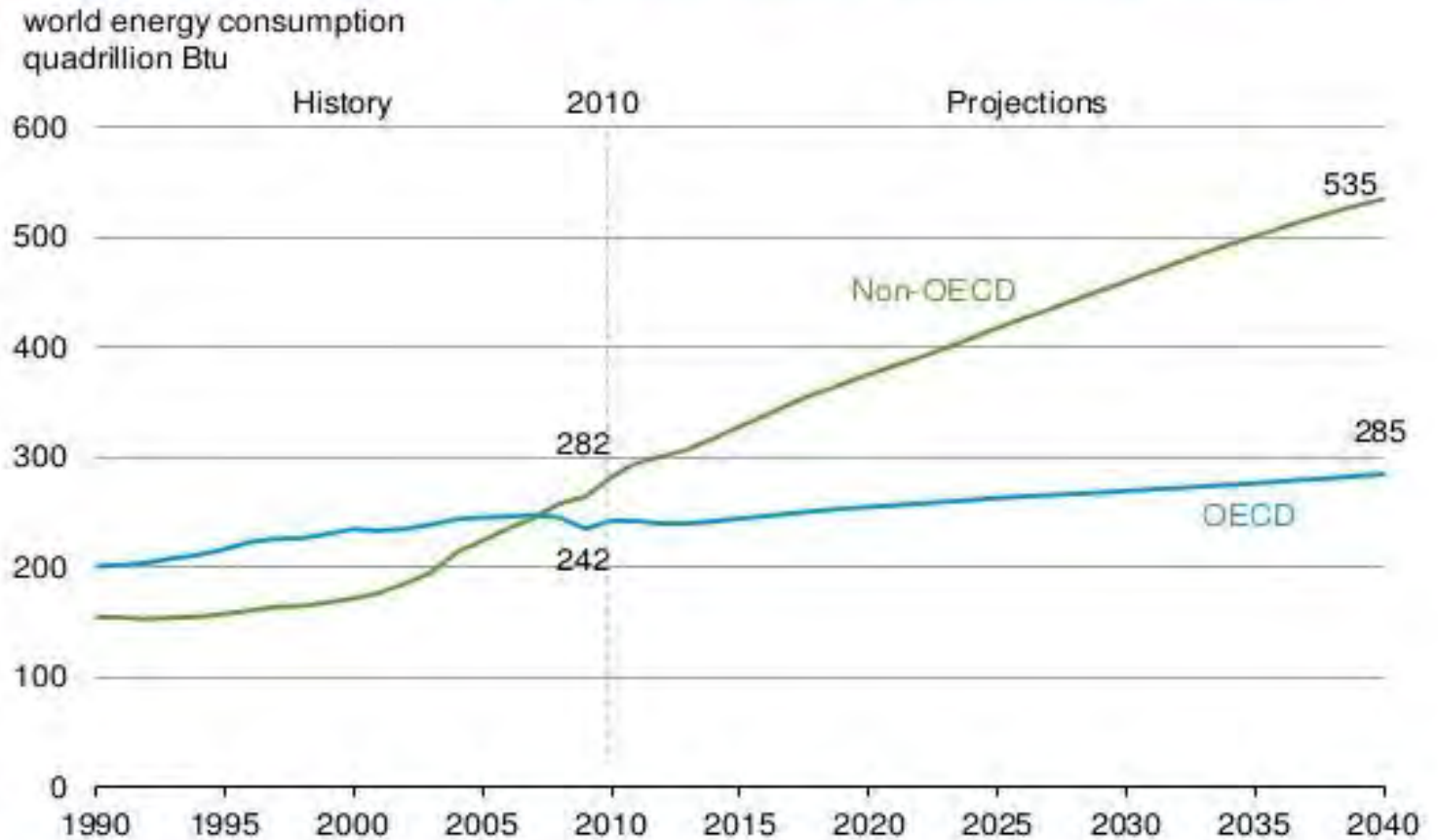
Projected growth, 2010–30¹



Where are we? Energy

The Growing Number of Affluent Consumers will Demand More Energy

Non-OECD nations drive the increase in energy demand

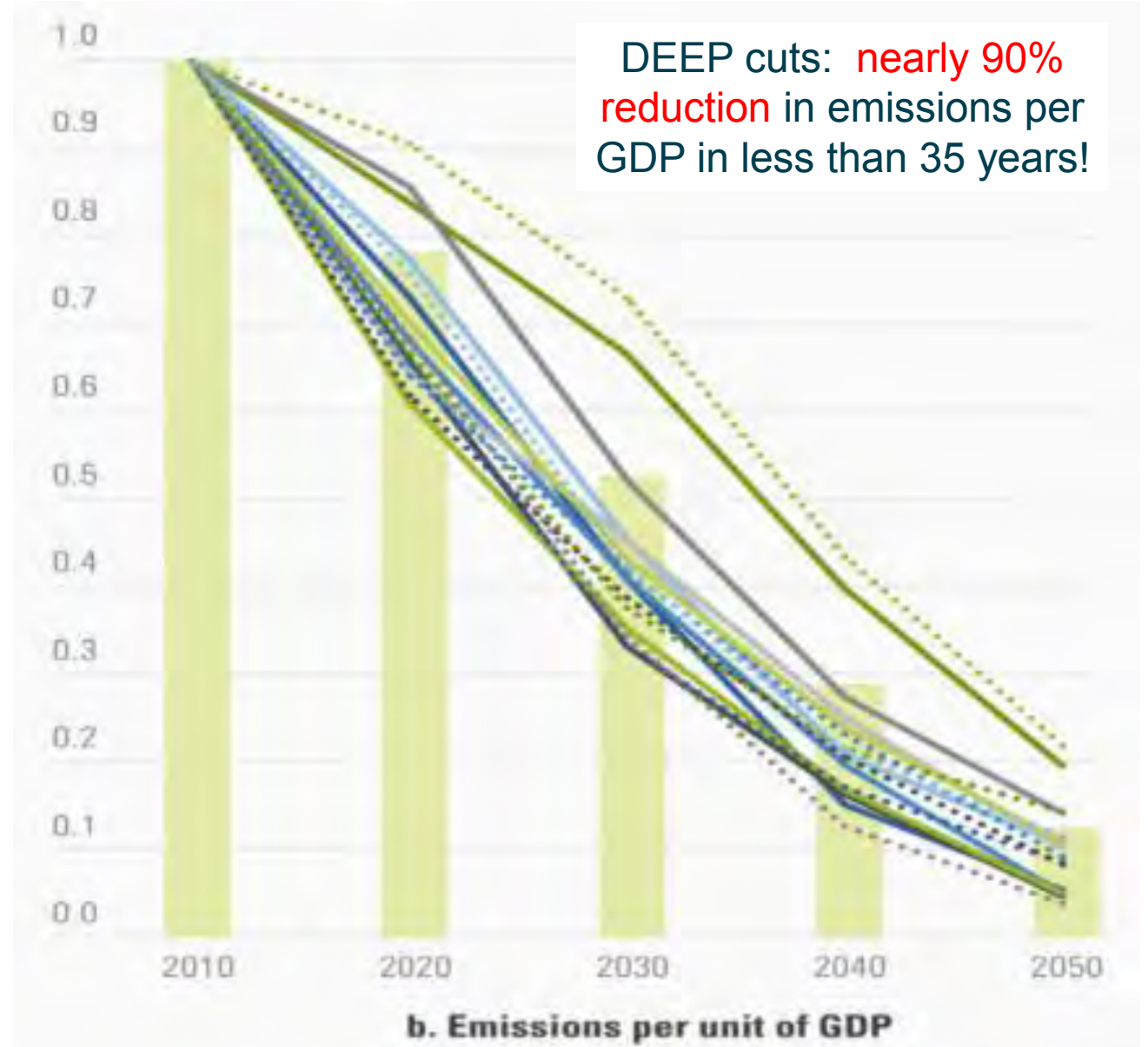


Source: EIA, International Energy Outlook 2013

Where are we?

Governance

Dissonance



Where do we want to go?

NOT:



Find Another Planet?



I would like to die on Mars. Just not on impact.

Elon Musk



"Fk Earth! Who cares about Earth?"** Musk said. "If we can establish a Mars colony, we can almost certainly colonize the whole solar system" Elon Musk

<http://www.recode.net/2014/10/1/11631474/codered-the-best-elon-musk-quote-ever>

Shelter in Place?



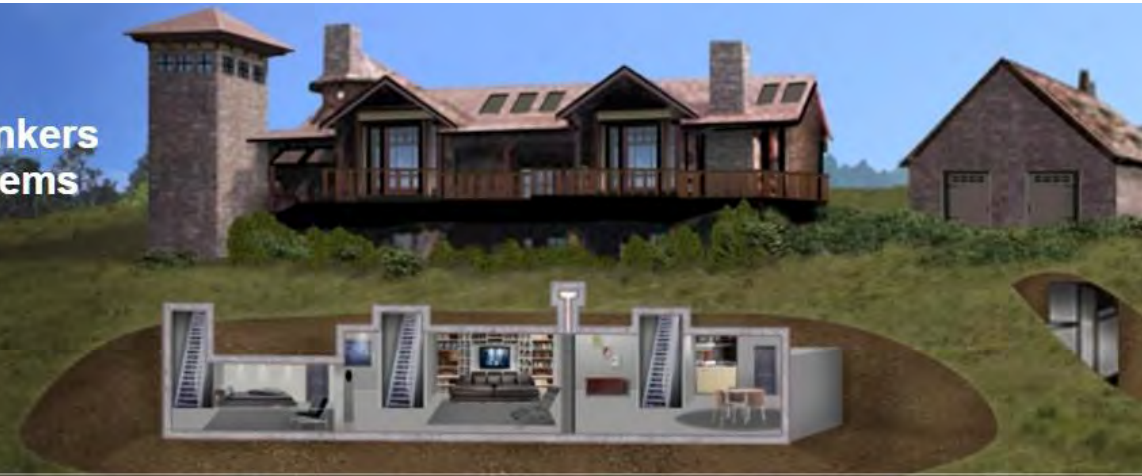
Luxury Survival Condo

PEACE OF MIND COMES WITH BEING PREPARED FOR ANYTHING



Fortified Homes

Fortified "Hardened" Homes with Bunkers
"Genesis" Underground Shelter Systems
2012 Structures



Fortified Homes



Commercial



Military



Special Projects

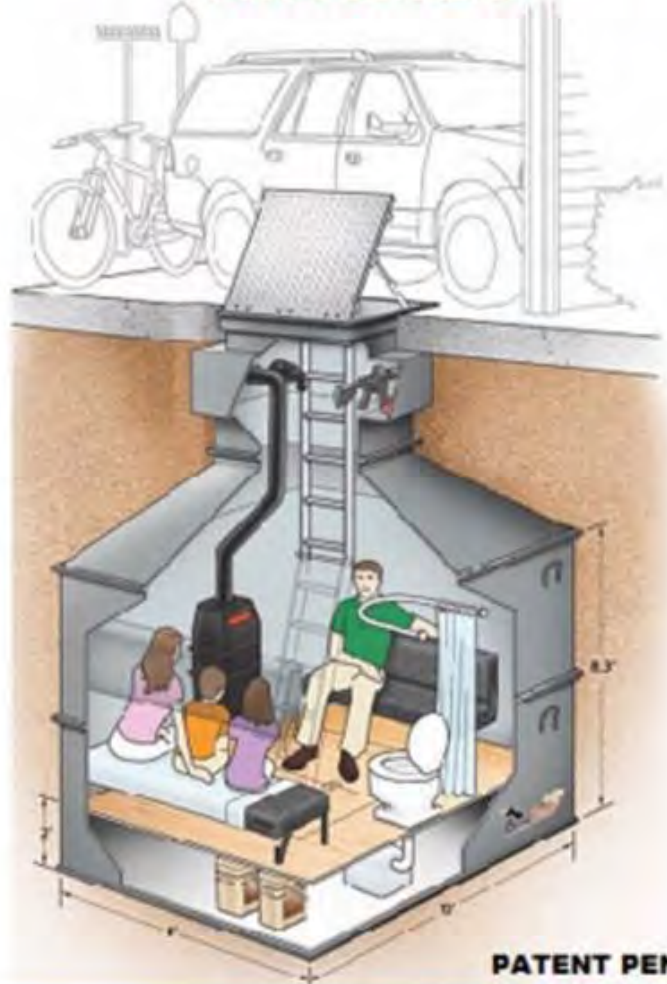
Shelter in Place?



\$12,000

2 views/hr!

BOMB NADO
DISASTER SHELTERS
Starting at \$18,999 with up to 100% financing!
1-855-4-BUNKERS



Shelter in Luxury?

Maybe a way for Congress to Balance the Budget?



5 Star
Amenities and
Protection For
Your Family



Five kilometers of continuous tunnels form individual chambers, which Vivos packages as separate living quarters.

Where do we want to go?



Where do we want to go with Resources?

McKinsey & Company

**Are You Ready for the
Resource Revolution?**

At least \$1 trillion

more investment in the resource system needed
each year to meet future resource demands

THE WALL STREET JOURNAL.

MINING THE

Investors are clamoring for natural resource plays. Here's how to get in without getting burned.

21 Sc	27 Co	47 Ag	45 Rh	6 C	77 Ir	22 Ti	70 Yb
56 Ba	8 O	76 Os	25 Mn				



Junk Dealer



OCTOBER 31, 2005 WWW.FORBES.COM
Forbes

Junk Into Money

Here's one fellow who has no objection to \$65 oil: a plastics recycler | By Kerry A. Dolan

CACOPHONY REIGNS INSIDE Michael Biddle's 45,000-square-foot recycling plant in Richmond, Calif. Pieces of fax machines, telephones, keyboards and cell phones are fed into green hoppers atop 20-foot-tall chutes. Pipes and conveyor belts run everywhere. Amid the whirring fans and clanging grinders, you can pluck out the sounds of metal clinking as it gets sucked out by ejectors, plastic pinging as it is pulled away from foil and paper, air jets whooshing as they separate light-color plastic from dark. Out the end come gray pellets, sorted into six or more grades of reusable plastic.

To Biddle it's a symphony, the result of nearly two decades of hard work. He claims to be the first to figure out how to take nearly any kind of plastic trash, which is usually a mongrel blend of up to 20 different plastics, and separate it by chemical

type. Biddle's factories make the three important plastics used in durable goods and electronics: polypropylene, acrylonitrile butadiene styrene (alias ABS) and polystyrene. "We're changing the way plastic is made, just like minimills changed the way steel was made," he says.

Every year 40 million tons of plastic—in cars, refrigerators, personal computers, fax machines, coffeemakers, food bins, bottles and so on—are dumped in landfills in the U.S. Landfill space happens to be plentiful at the moment, but it might not be for long, and in any event many Americans are wracked with guilt at the notion of all this compressed garbage sitting around. Pressure to recycle is building. In Europe it is mandatory for producers of electronic goods to take back their products and recycle them.

The swelling waste stream is the fuel for Biddle's MBA Polymers. "They're clearly pioneers. If anybody's in a position to suc-

"THE GARBAGE MAN"



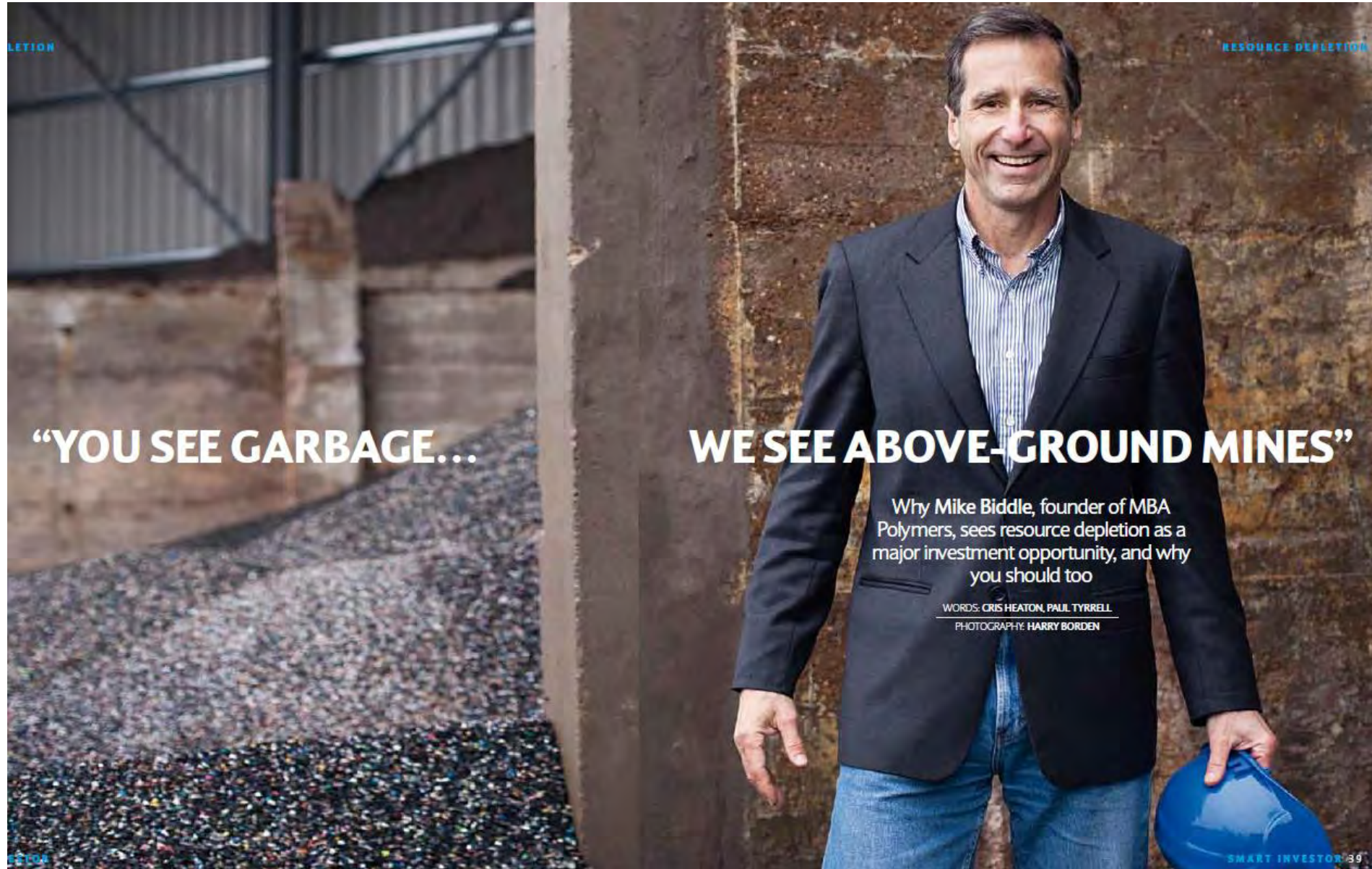
A Miner



BARCLAYS

SMART
INVESTOR

*Resource
Depletion*



“YOU SEE GARBAGE...”

WE SEE ABOVE-GROUND MINES”

Why Mike Biddle, founder of MBA Polymers, sees resource depletion as a major investment opportunity, and why you should too

WORDS: CRIS HEATON, PAUL TYRRELL
PHOTOGRAPHY: HARRY BORDEN

RESOURCE DEPLETION

LETION

ETON

SMART INVESTOR 39

Where do we want to go?

Depends on your Mindset

Is this the **CRISIS** of our time?

Or the OPPORTUNITY of our Time?

The Atlantic

The Planet-Saving, Capitalism-Subverting, Surprisingly Lucrative Investment Secrets of Al Gore

According to Mercer, the average return for Generation's global-equity fund, in which nearly all its assets are invested, was 12.1 percent a year, or more than 500 basis points above the MSCI index's growth rate. Of the more than 200 global-equity managers in the survey, **Generation's 10-year average ranked as No. 2. In addition to being nearly the highest-returning fund, Generation's global-equity fund was among the least volatile.**



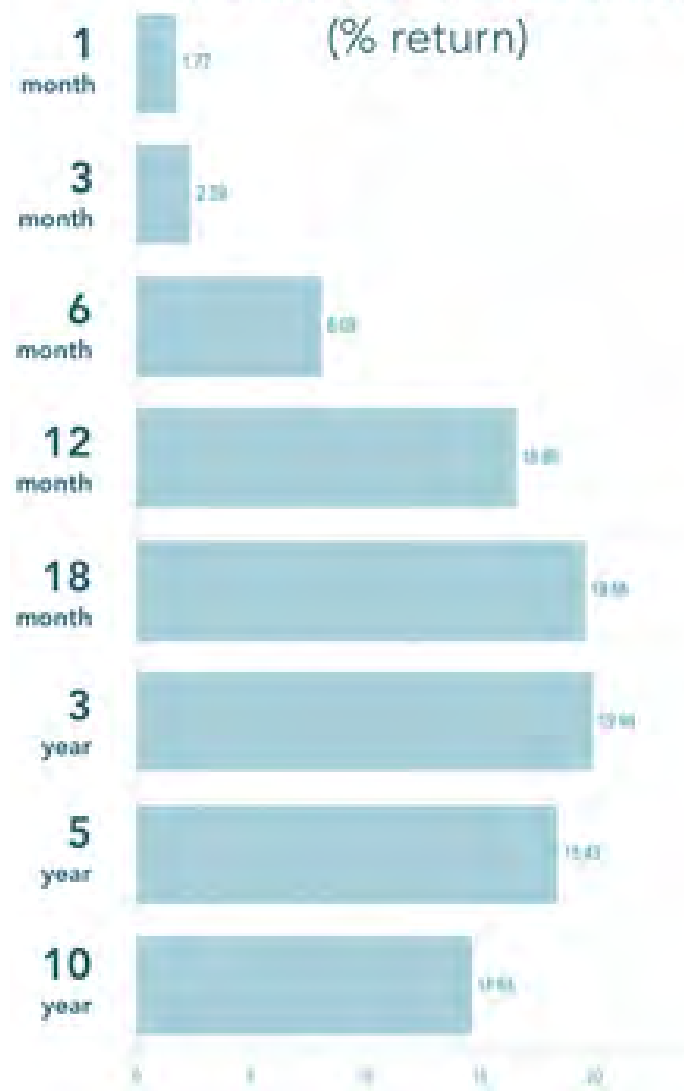
Where do we want to go?



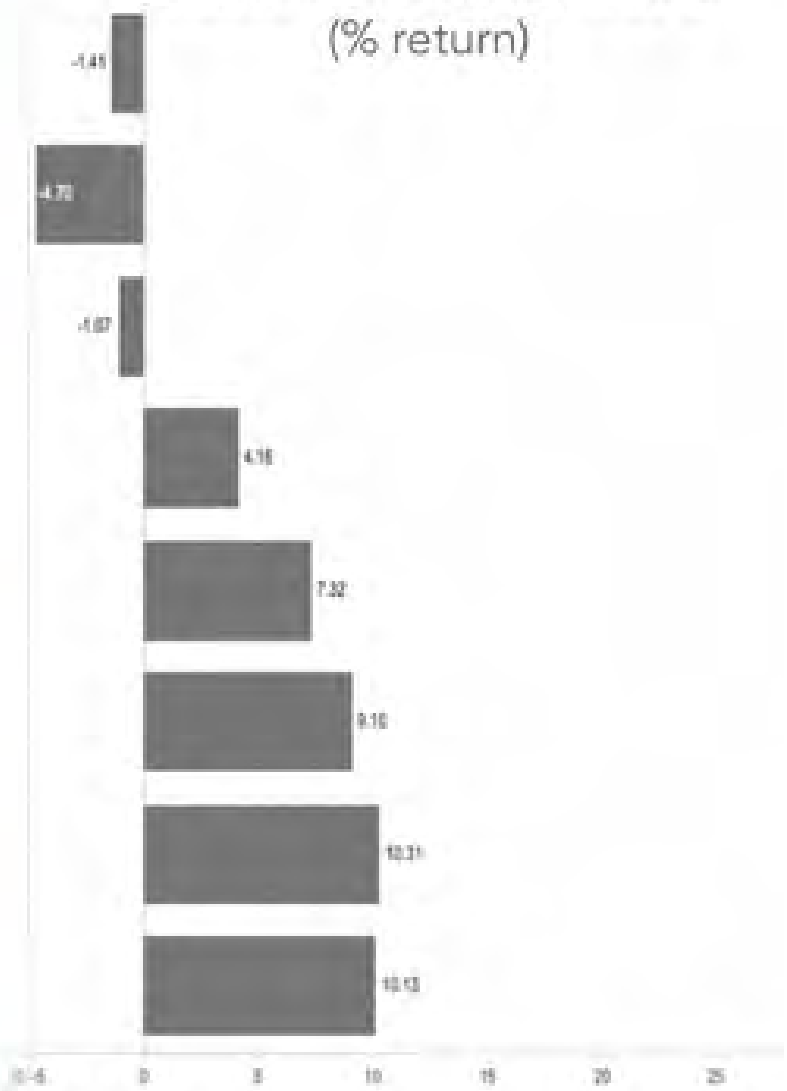
Climate Leadership
comes from
efficient
companies



CLIMATE LEADERS



CLIMATE LAGGARDS



Where do we want to go?



FINANCIAL RETURNS

Since Inception (11/19/2015) through 9/30/2017

■ Etho Climate Leadership Index - US (+28.04%) ■ S&P 500 Index (+ 20.91%) Performance based on daily price returns of each index.

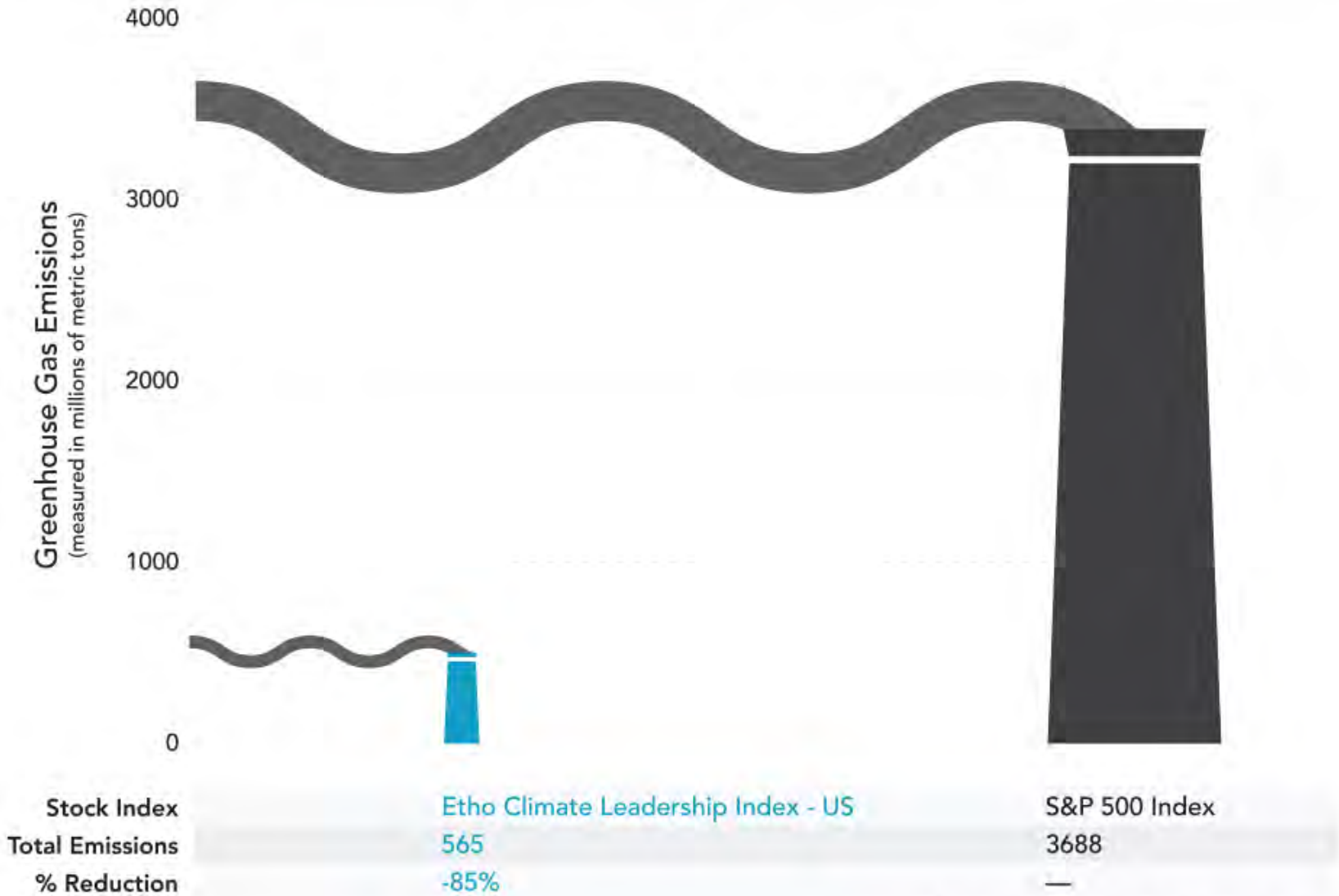


Where?



CARBON FOOTPRINT (2017)

Total Greenhouse Gas Emissions Per Index Using Scopes 1, 2, 3



How Do We Get There?

We have great ideas & technologies that can change the world

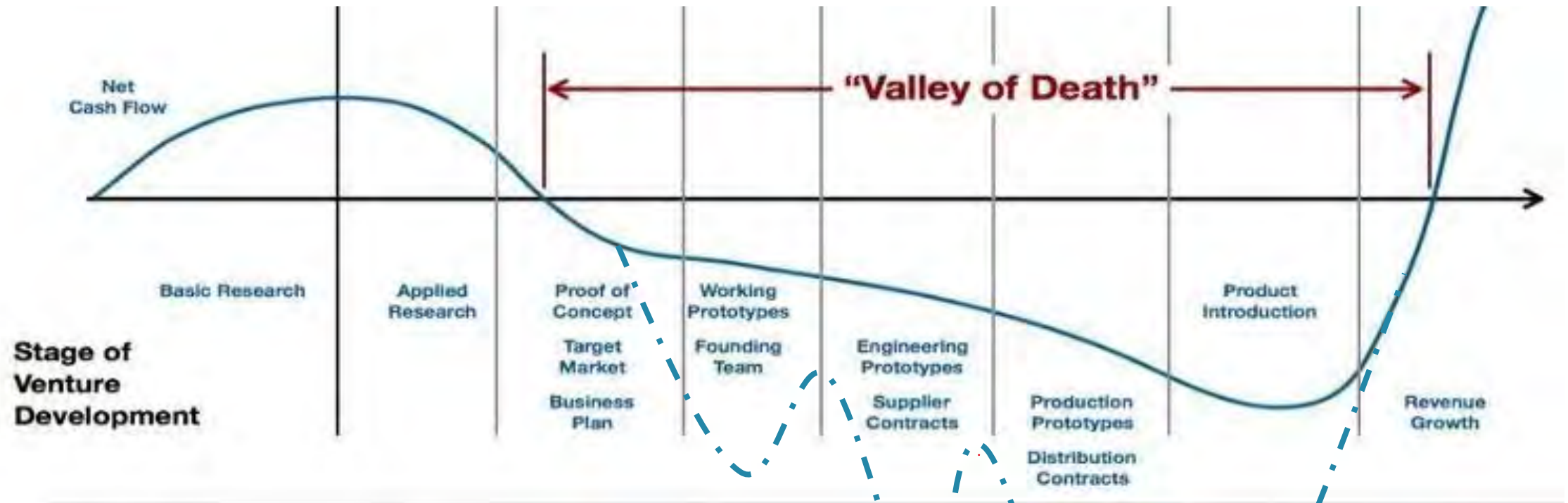
Both new and seasoned entrepreneurs are ready to turn them into great business

We need **Faster and Better** delivery of solutions - out of the labs and garages more quickly and further developed

So What's in Our Way?

The Valley of Death





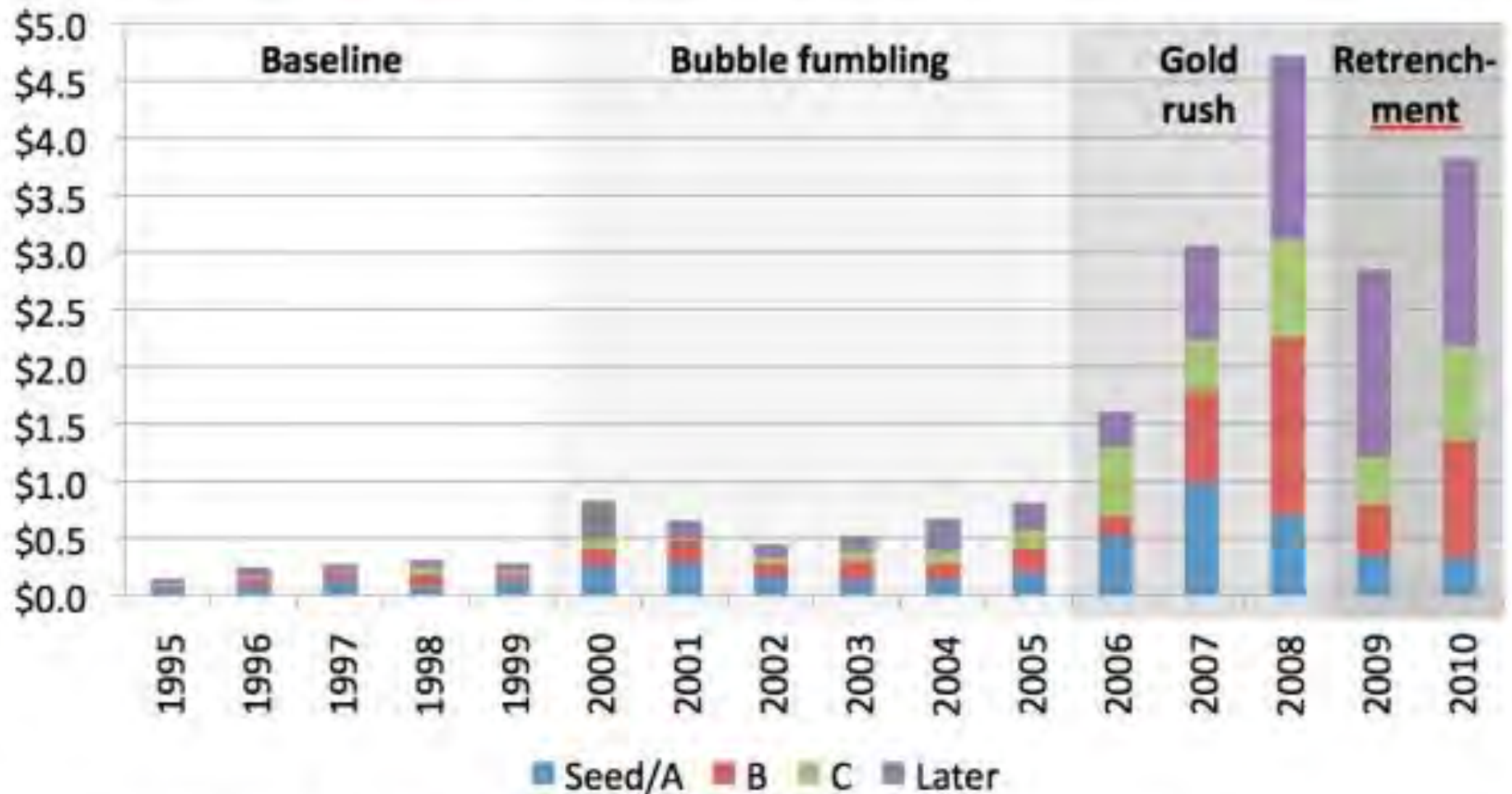
UC DAVIS
 CENTER FOR ENTREPRENEURSHIP



<https://www.greentechmedia.com/articles/read/into-the-valley-of-death>

The CleanTech Gold Rush

Cleantech start-up investment (\$B), 1995 to 2010



mnordan.com | Source: Dow Jones VentureSource, Lux Research, personal communications.

60
MINUTES



the **Cleantech** Crash

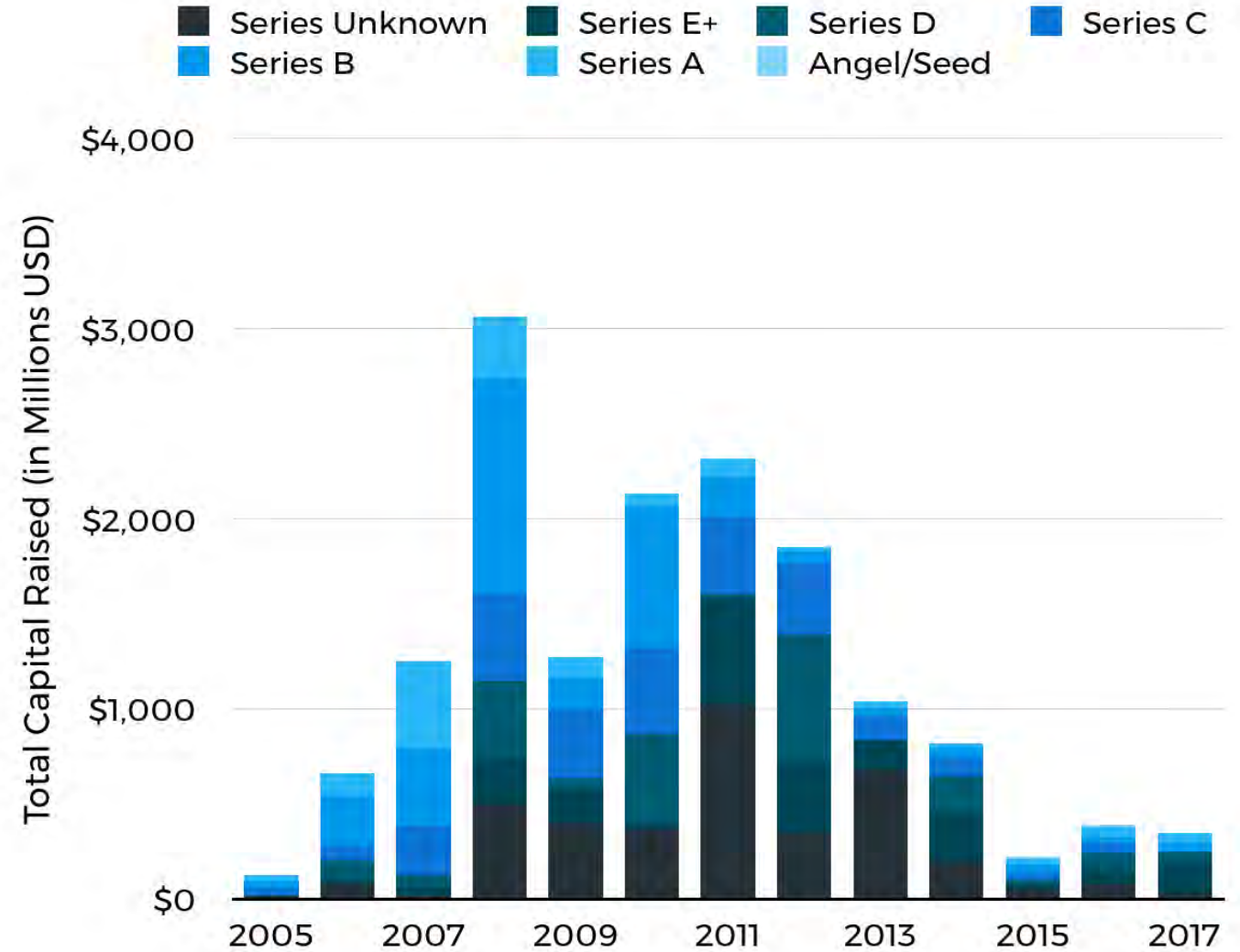
Produced By
Shachar Bar-On





VC Funding Into U.S. Cleantech Startups

By Funding Type



<https://news.crunchbase.com/news/pipeline-u-s-cleantech-startups-dries-vcs-withhold-dollars/>

crunchbase news

Bridging the Gap with Money, Network & Battle Scars



Investing in the future



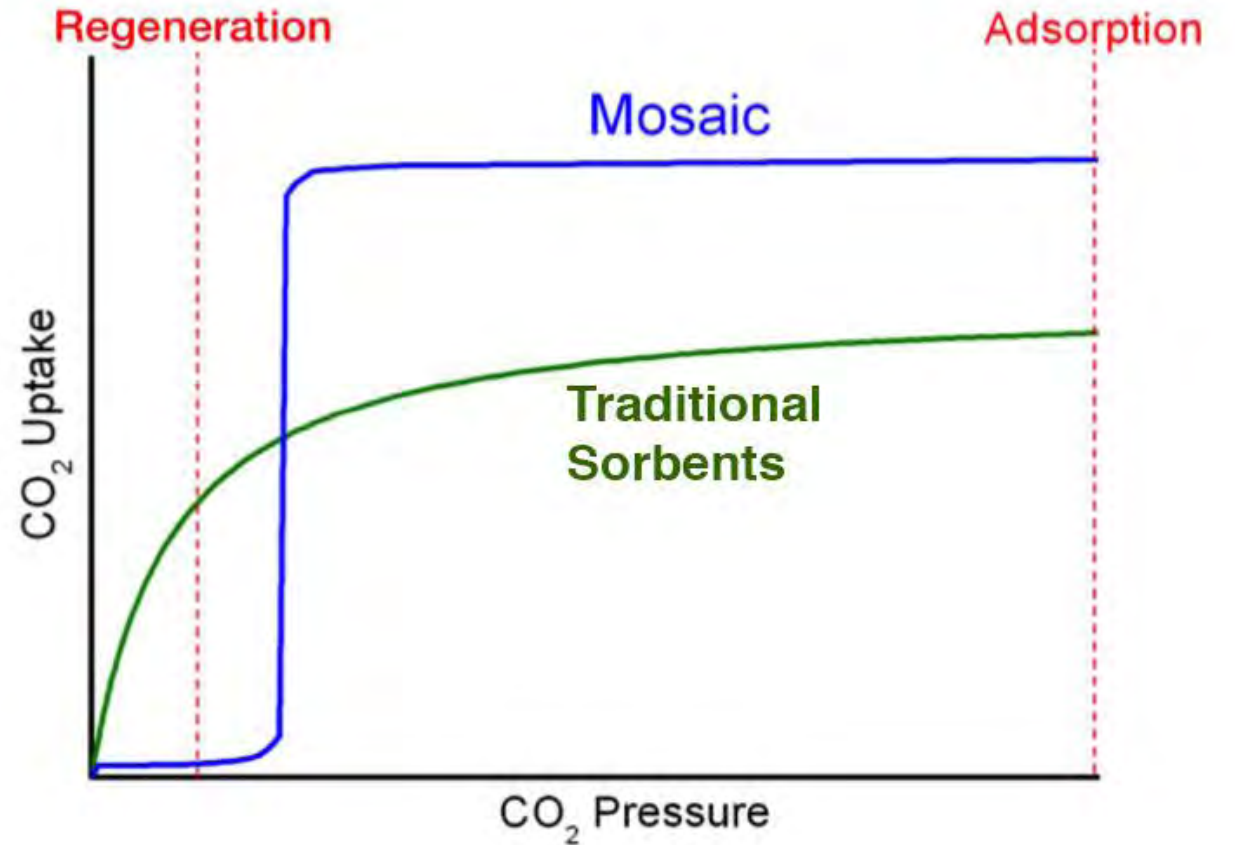
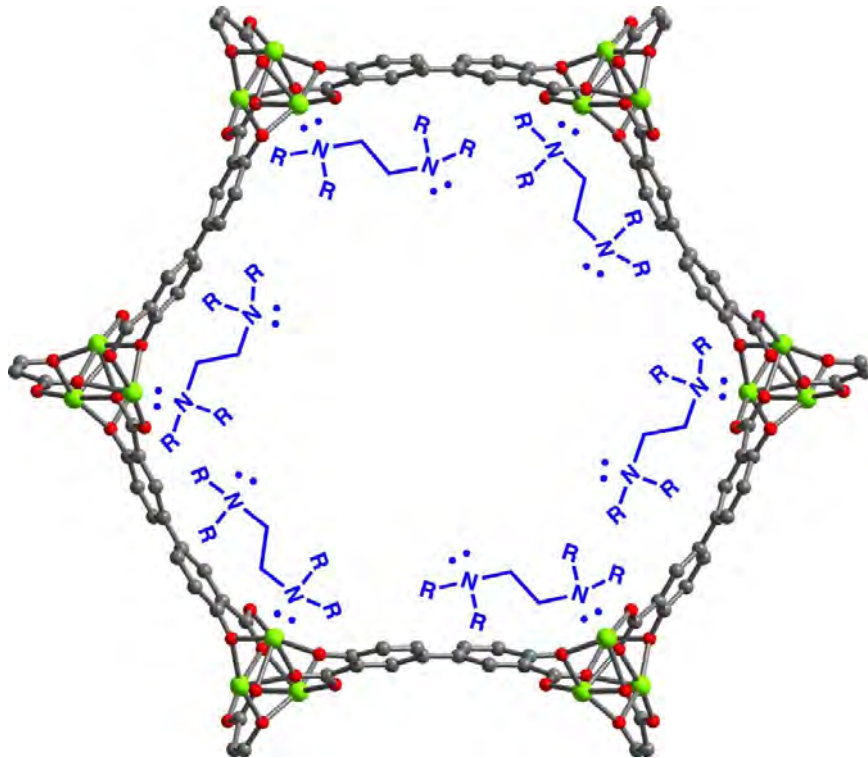
Carbon capture/
gas separations

OPUS¹²

Carbon to
value



Intersection of Industrial IoT, Machine
Learning and Artificial Intelligence



- ✦ Very large CO₂ adsorption capacities under nearly all T,P conditions
- ✦ Mild regeneration conditions for TSA, PSA, or VSA



Potential for Lower Cost CO₂ Adsorption



Coal flue gas
0.15 bar



Natural gas flue gas
0.05 bar

Natural gas production
>1 bar



Cryogenic air distillation
400 ppm



Enhanced Oil Recovery



Hydrogen Production
2-10 bar



Biogas upgrading
0.5 bar



Air recycling
1-3 bar

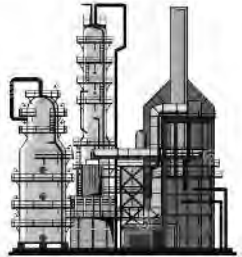
OPUS¹²

REVERSE COMBUSTION

A platform technology that recycles CO₂ back into chemicals and fuels

1

**INPUTS: CO₂,
WATER,
ELECTRICITY**



CO₂

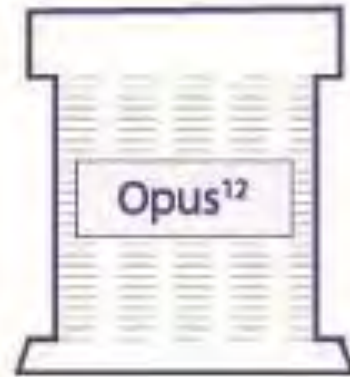
H₂O

ELECTRICITY

2

**ELECTROCHEMICAL
REDUCTION OF CO₂**

OPUS¹²



**75% ENERGY
EFFICIENCY**

3

**OUTPUTS: PRODUCTS THAT
DROP INTO EXISTING
SUPPLY CHAINS**

CHEMICALS
& FUELS



PURE
O₂





37,000 trees



...in a suitcase

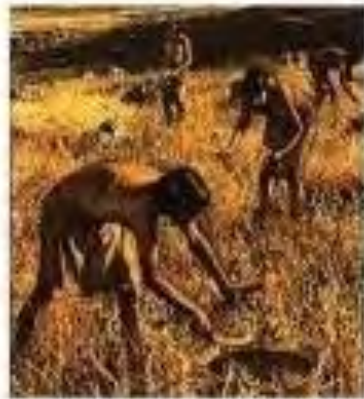
How will We Work in the Future?

Informed by the past



Hunter
Gatherer

MILLIONS OF
YEARS



Early Tools:
Agriculture

THOUSANDS
OF YEARS



Industrial
Revolution

A FEW
CENTURIES



Information
Revolution

DECADES



Human
Augmentation

?

Digital Innovation is Creating New Reality for Many Industries



25bn enterprise-owned connected things across globe by 2020 will generate a \$2 TRILLION economic benefit

The McKinsey & Company logo, consisting of the text "McKinsey & Company" in a white, serif font on a dark blue rectangular background.


The Internet of Things has a total potential economic impact of \$3.9 trillion to \$11.1 trillion per year in 2025



GE estimates that the industrial internet will bring productivity gains of \$8.6 trillion for industrial companies in next 10 years



Digital disruption will displace 40% of incumbent companies in the next 5 years



Optimal Control
Complexity simplified

Measure
Learn
Act

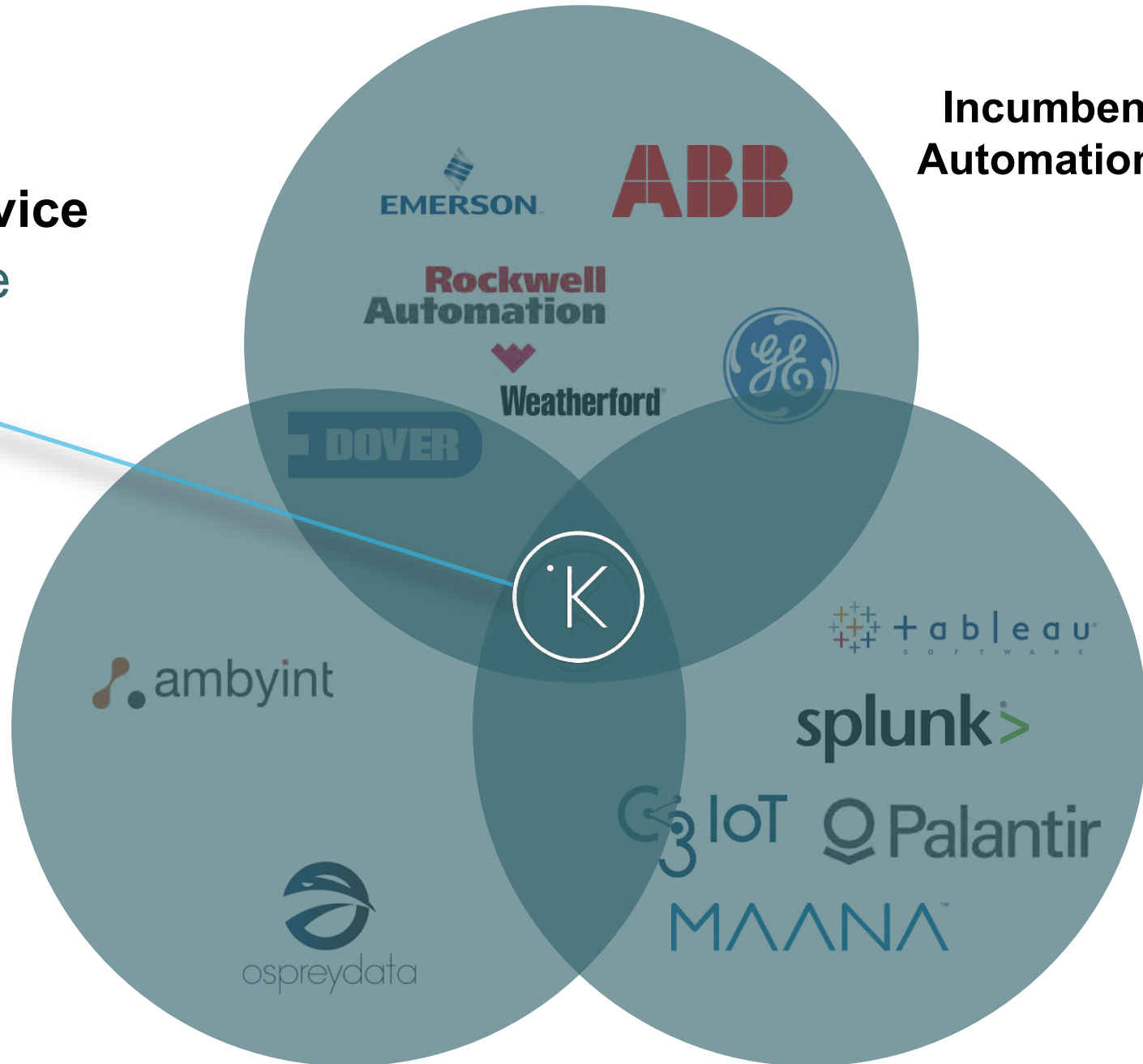
 Kelvin

Ⓚ Kelvin

Control as a Service

We fit at a unique intersection of capabilities

Incumbent Process Automation Hardware



Emerging Point Solutions

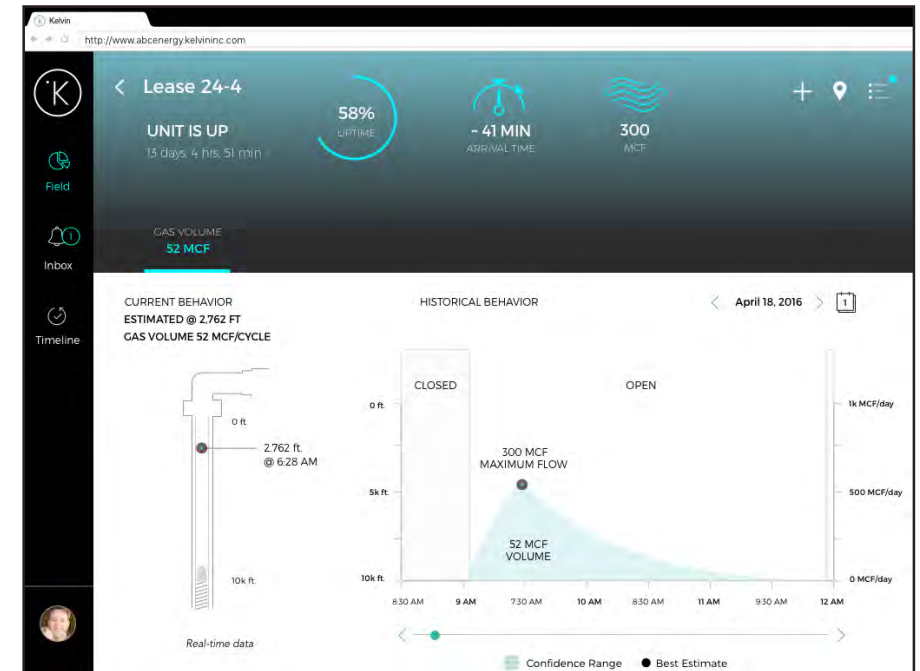
Big Data Analytics



Kelvin

Autonomous production

Improving production operations performance through sensor fusion, analytics & new control models.

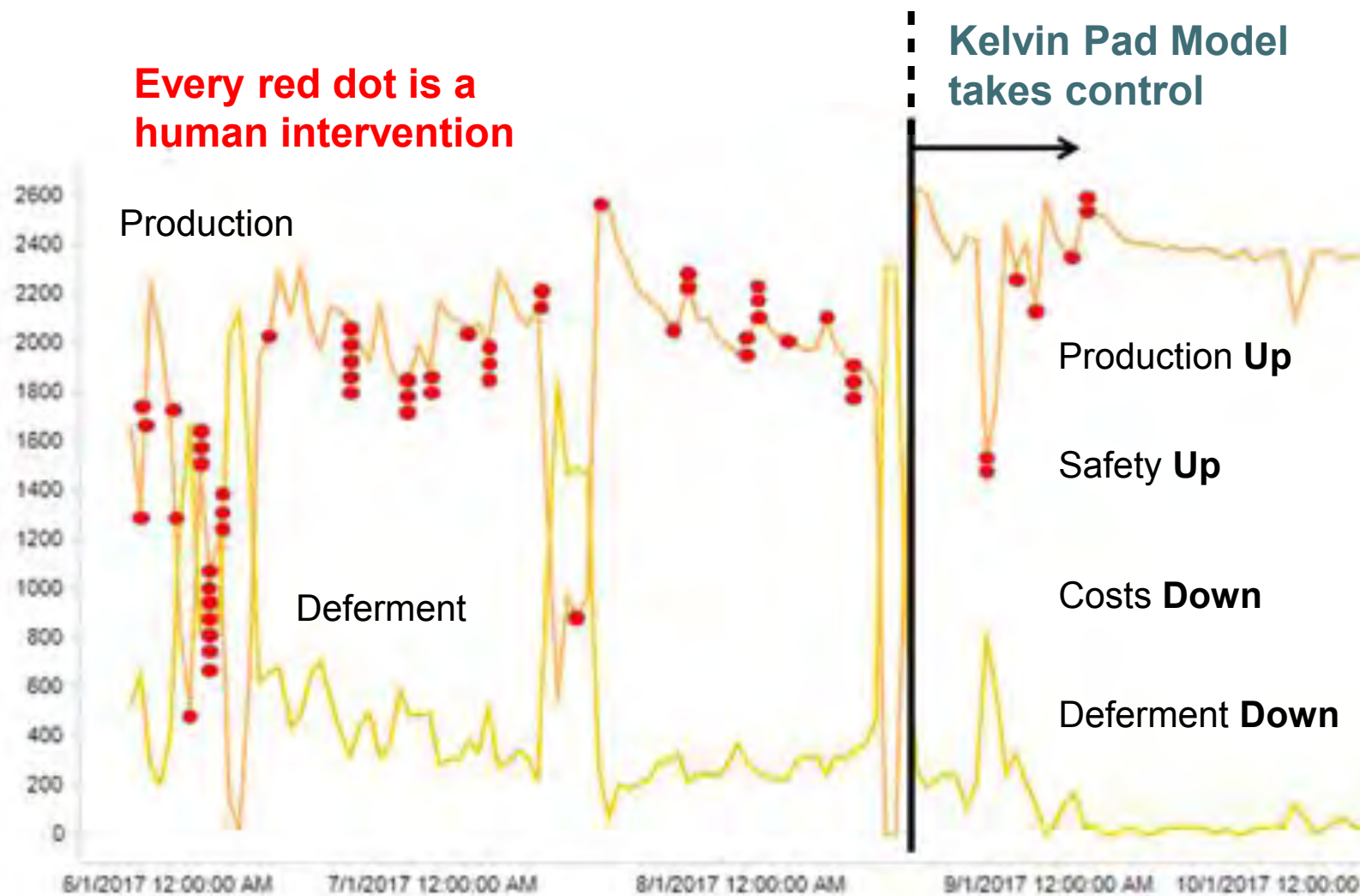


Kelvin never stops listening, so your business continuously improves.

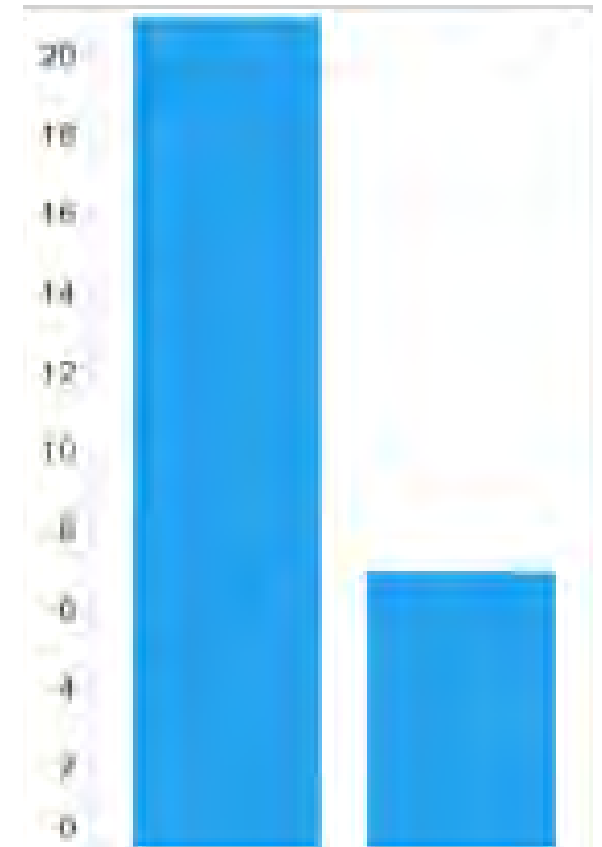


Kelvin

Kelvin's Multi-level Impact on Pad Performance



Vents on Pad
(45 Days Pre & Post Kelvin)



Before Kelvin

After Kelvin



Value from modernisation and transformation



9,000 trillion
calculations per second

Supercomputing power
doubled in 2017

Finding a field in a field
in the Gulf of Mexico

200mmboe
new barrels identified
in Atlantis using BP
proprietary imaging
algorithms

Reliability monitoring

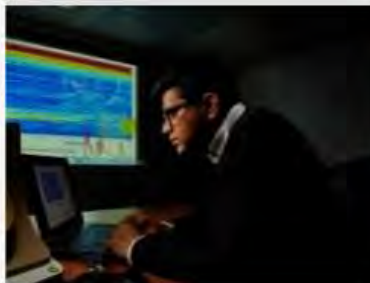
40 million

calculations per day on
400 pieces of Atlantis
equipment using Plant
Operations Advisor

Acoustic sensing

30

wells in Azerbaijan with
fibre optic sensing
capability to detect sand



Applying big data analytics in Lower 48

74%
reduction in venting

20%
increase in production

22%
reduced costs



Optimising production

30mboed
from APEX production
system digital twin

Rapid field development in Oman

12x
productivity gains using
Siraj optimisation tool

Machine intelligence informing business decisions

40 years
of data helping predict
corrosion to drive more
effective inspection
programmes

Global operations continuous improvement

2,700 individual projects

\$330m value created

55mboed production

Multi-Level Improvements



Q4 2017
Investor
Slides

Feb. 6, 2018

Applying **big data analytics** in Lower 48

74%
reduction in venting

20%
increase in production

22%
reduced costs



What's Next?

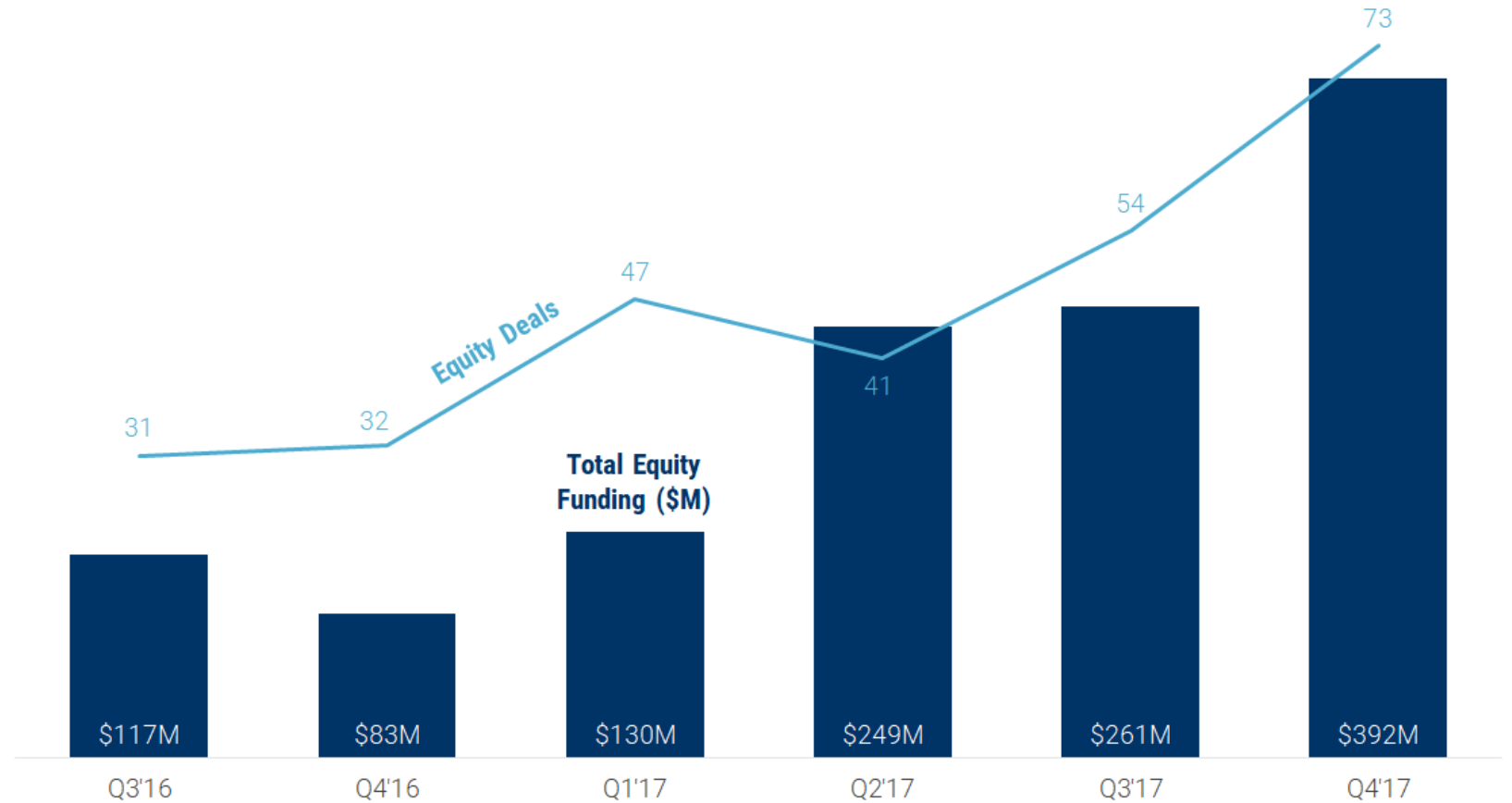
Blockchain

Investors
are
Flocking to
the Space



Q4'17 caps biggest year for blockchain equity rounds

Quarterly blockchain equity financing (excluding ICOs). Q3'16 - Q4'17



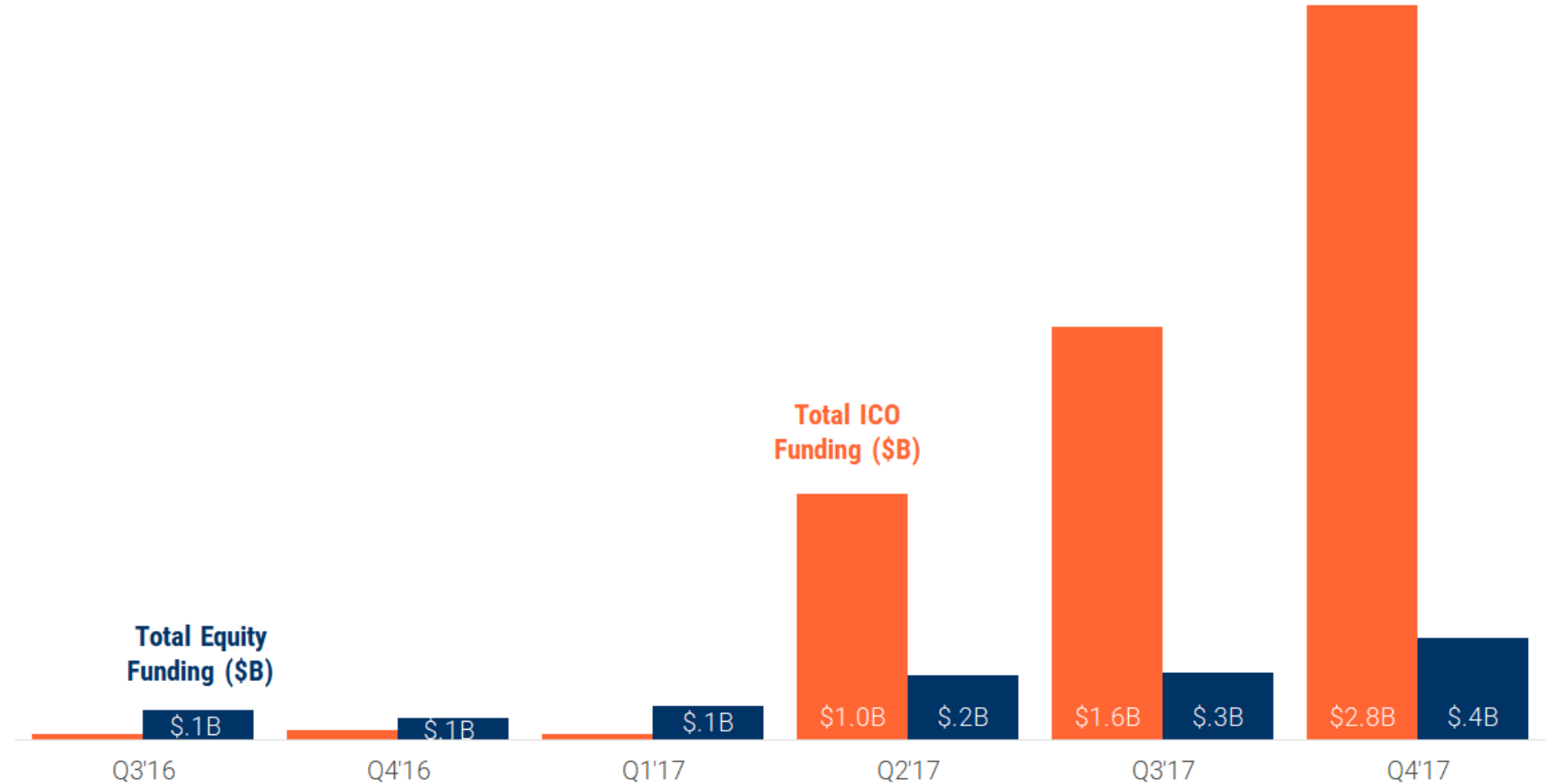
Blockchain



Blockchain equity funding pales in comparison to ICOs

Quarterly blockchain equity and ICO financing. Q3'16 - Q4'17

As are
buyers of
tokens and
coins



Source: CB Insights, TokenData



What's Holding You Back?



<https://daodaily.news/9956-2/>

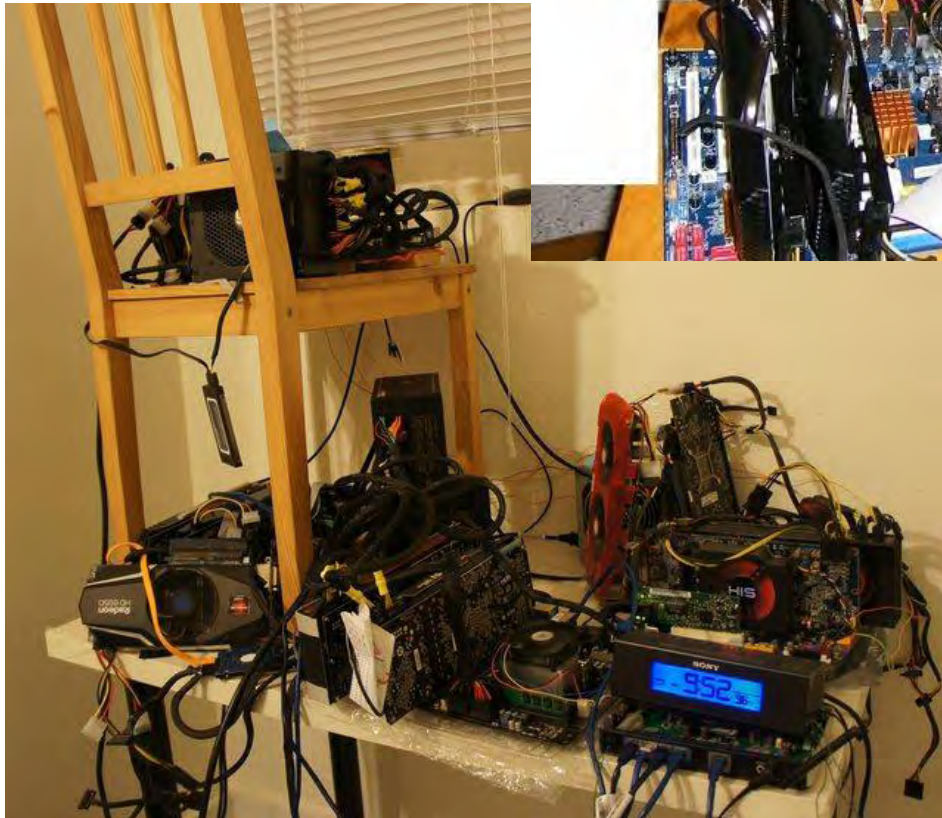


<https://steemit.com/introduceyourself/@anthonyc/hi-i-m-anthony-and-welcome-to-my-messy-miner-man-cave>

DIY Mining



<http://www.buttcoinfoundation.org/>



DIY Mining 2.0

<http://www.newsweek.com/bitcoin-mining-track-consume-worlds-energy-2020-744036>



<https://www.bitcoinisle.com/2017/11/19/a-visit-to-a-bitcoin-mining-farm-in-sichuan-china-reveals-troubles-beyond-regulation/>



DIY Mining 3.0



<https://www.pcworld.com/article/3014471/bitcoin-miner-knc-is-planning-another-four-week-datacenter-build-out.html>

<https://bitnewsbot.com/bitcoin-com-cloud-mining-contracts-record-daily-sellouts/>

What's Holding You Back?

Serious Computing = Serious CapEx Investment

Digiconomist

Newsweek

...greater than the current energy consumption of 159 individual countries, including Ireland, Nigeria and Uruguay. The [Bitcoin Energy Consumption Index](#) by cryptocurrency platform Digiconomist puts the usage on a par with Denmark, consuming 33 terawatts of electricity annually. <http://www.newsweek.com/bitcoin-mining-track-consume-worlds-energy-2020-744036>



A Few Numbers for Perspective

Bitcoin network versus VISA network average consumption



> \$7 Bln

Annualized Global Mining Revenues

4,470,000

Number of US Households that could be powered by Bitcoin

23,699

kilotons of CO₂ emitted per year by Bitcoin activities

How to mitigate High CapEx & Energy Costs?

Newsweek

More than half a billion people may be inadvertently mining cryptocurrencies from their computers, smartphones and other devices, according to research conducted earlier this year by ad blocking firm AdGuard.

Hidden software was found embedded within [220 popular websites](#), which have an aggregated audience of over 500 million people. The mining tool hijacks a computer's central processing unit (CPU) and uses it to run mining software in the background.

Canada to the Rescue



Energy Company Hydro-Quebec Looks to Attract Bitcoin Miners

Jan. 26, 2018 <https://bitcoinmagazine.com/articles/energy-company-hydro-quebec-looks-attract-bitcoin-miners/>



THE COINTELEGRAPH
future of money

Canada's surplus isn't enough

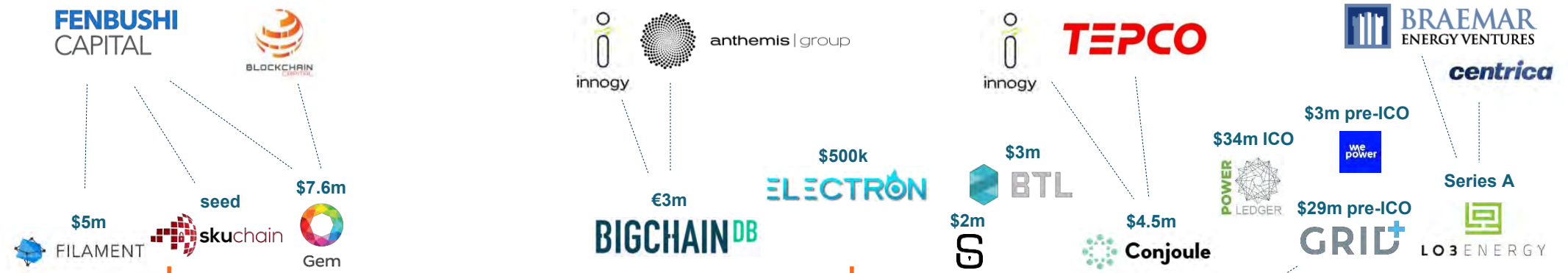
Ironically, Hydro Quebec may have to renege on its commercial power strategy - as forecasts show that they would not be able to meet the booming demand of industries looking to take advantage of the energy surplus in the province. The company is reviewing its plans after 70 cryptocurrency mining operators applied to set up shop in the province in the space of the week. <https://cointelegraph.com/news/even-with-energy-surplus-canada-unable-to-meet-electricity-demands-of-bitcoin-miners>



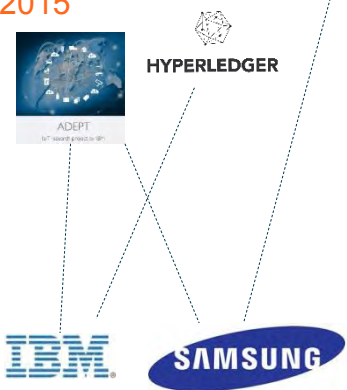


Blockchain in Energy & Industry: A Growing Intersection

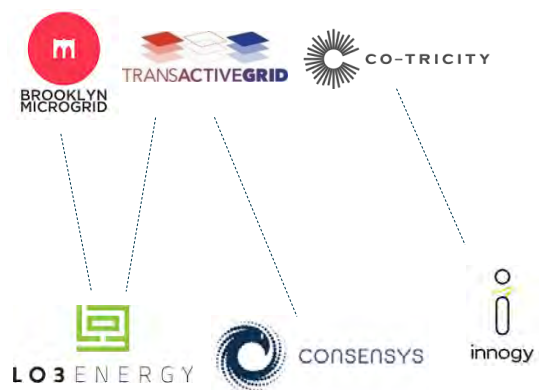
Investments



2015



2016



2017



Partnerships

Business and Technology Evolves

A long term vision for **Ethereum** is to transition away from “proof of work” to a mining model called proof-of-stake (PoS). This way **Ethereum’s energy requirements would collapse by more than 90%**.

Swirls has developed a new consensus algorithm called **Hashgraph** based on a) Gossip about Gossip and b) Virtual Voting.

- Much less computation required
- More Efficient
- MUCH Faster – 1000’s to 100,000’s transactions/sec vs 7/sec for Bitcoin
- More Fair
- More Secure

Finally - Who?

The challenges and opportunities we face
are enormous

Who can we trust to make
the Lemonade?

The Usual Suspects

Government?

Industry, Large Companies?

SMEs (Small to Medium Enterprises)?

Individuals?

Big companies?



CEO Polman: 'Unilever Sustainable Living Plan', a blueprint that will lead to company doubling in size while halving its carbon footprint.



Reduction of CO_{2e}

1,000,000 MT from 2008-2014

167,000 MT per year on average

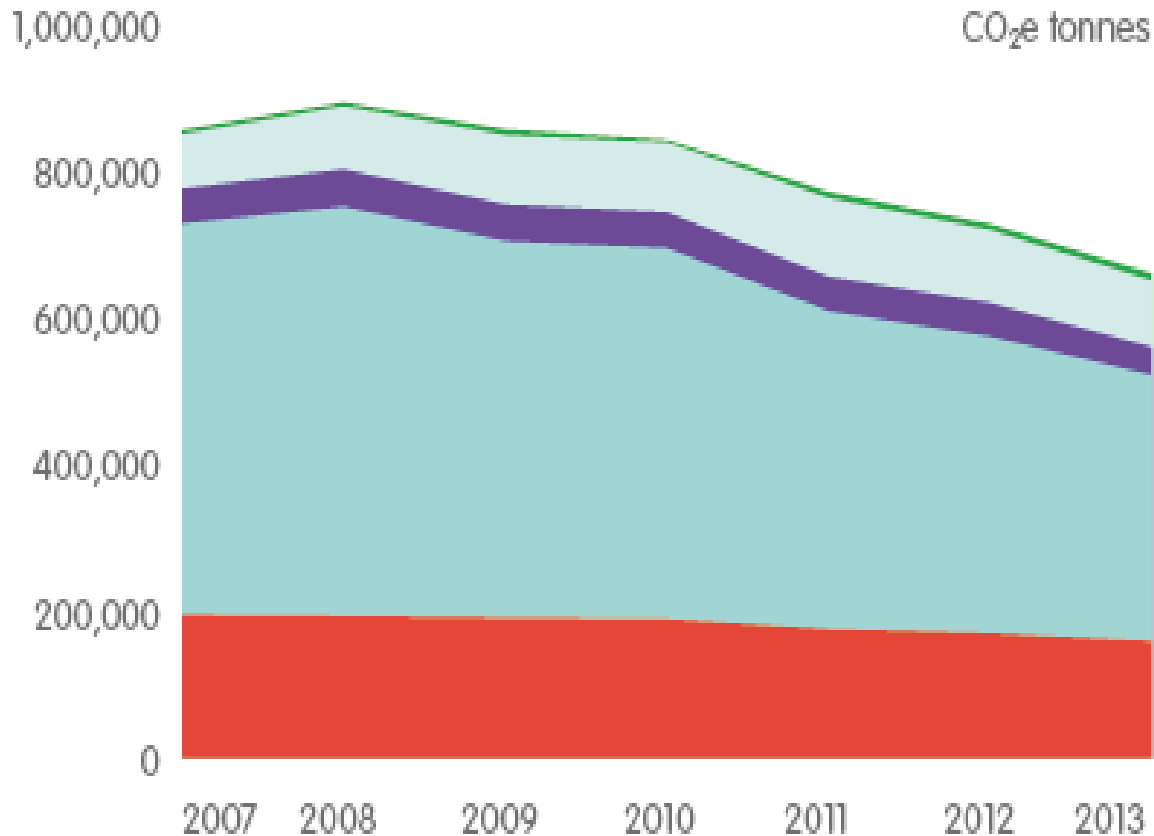
1 MT/yr per Unilever employee



Big companies?



CCE's Business Operations 2007-13



Reduction of CO₂e

182,000 MT from 2007-2013

26,000 MT per year on average

2 MT/yr per CCE employee

- Business travel and other
- Third Party Distribution
- CCE Fleet
- Cold Drinks Equipment
- Operations and Commercial sites

Individuals?

“EVERYONE
THINKS OF
CHANGING
THE WORLD,
BUT NO ONE
THINKS OF
CHANGING
HIMSELF.”

-Leo Tolstoy



Some Individuals I Know



Only 4 lifestyle changes

~ 10 going solar

~ 4 using bikes & trains
more than cars

~ 3 air-drying clothes

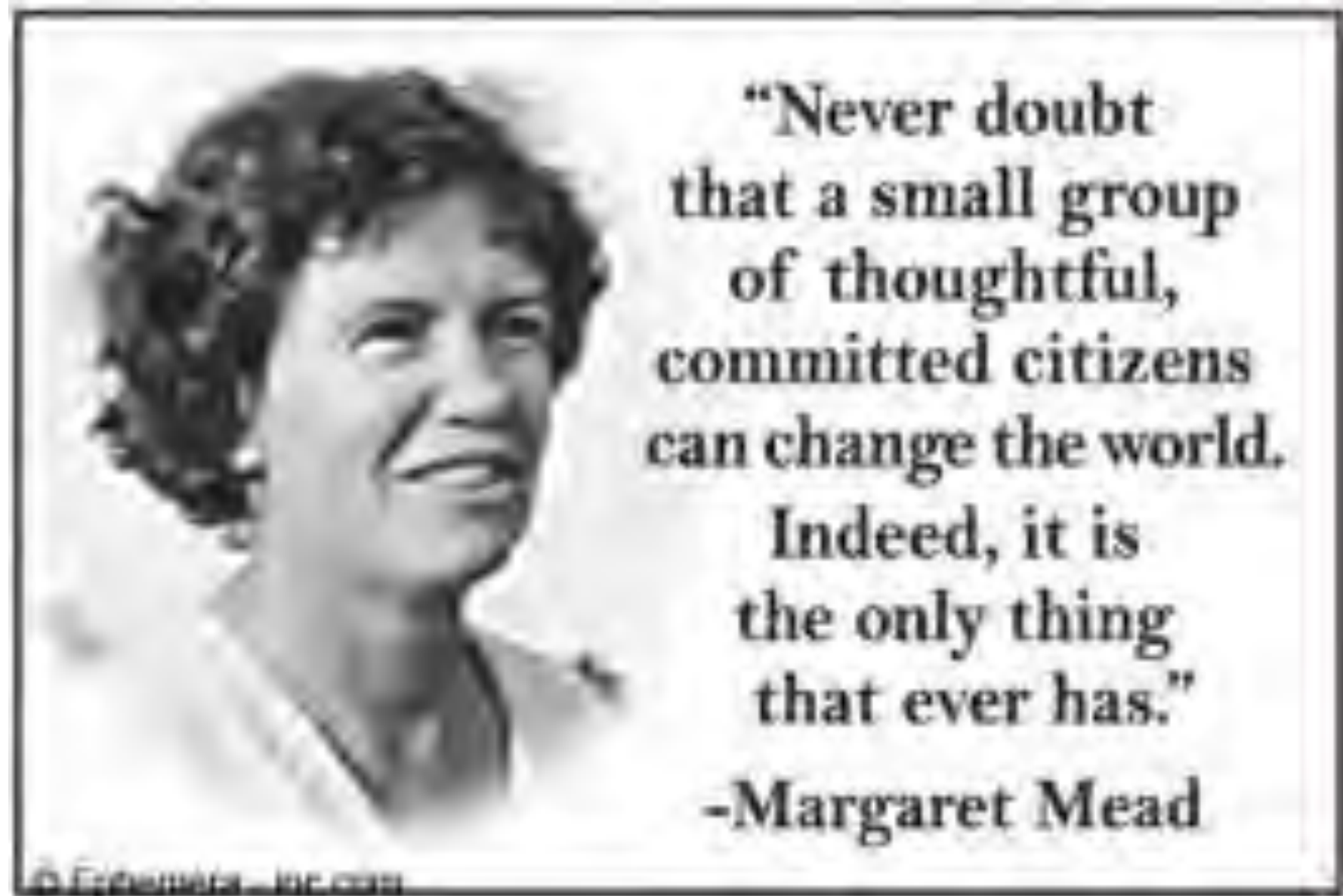
~ 4 going mostly vegan

~21 MT/yr for 1 family

> 5 MT/yr per person

~ (0.4) RT flight SFO - IAH

Entrepreneurs, Start-ups, SMEs



Over 90,000

Approx. 900

Approx. MT/yr CO₂ savings

MT CO₂ savings/employee!



Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

<http://www.sciencedirect.com/science/article/pii/S0048969715301017>

The 2017 Young Global Leaders Award for Circular Economy SME

The Davos Prize

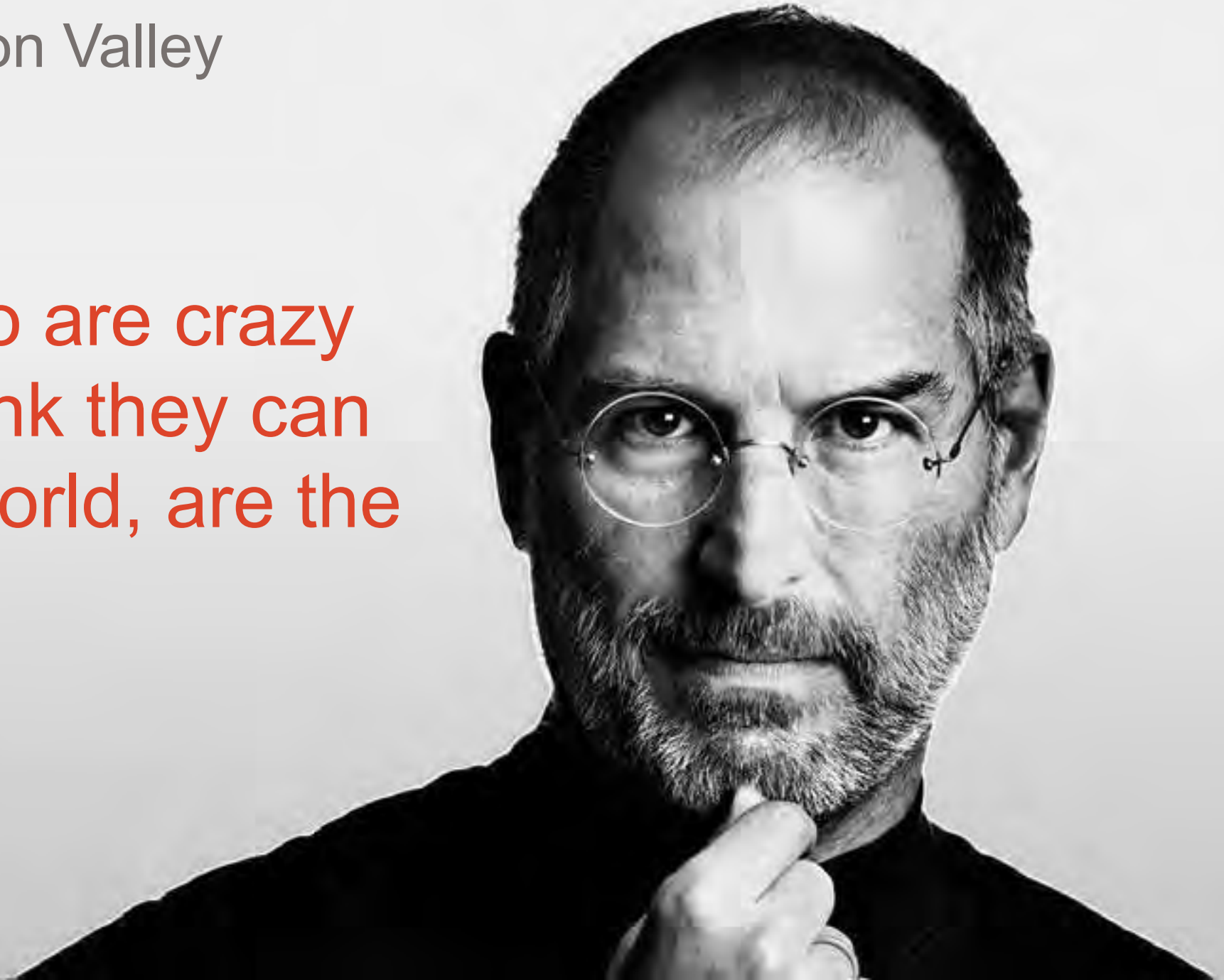
The Audience voted MBA the overall winner from the 7 other category winners including **Patagonia Clothing, Nike** and the **Scottish Government**.



Channeling Silicon Valley

The ones who are crazy enough to think they can change the world, are the ones who do.

Steve Jobs



Thank you!

Q&A

