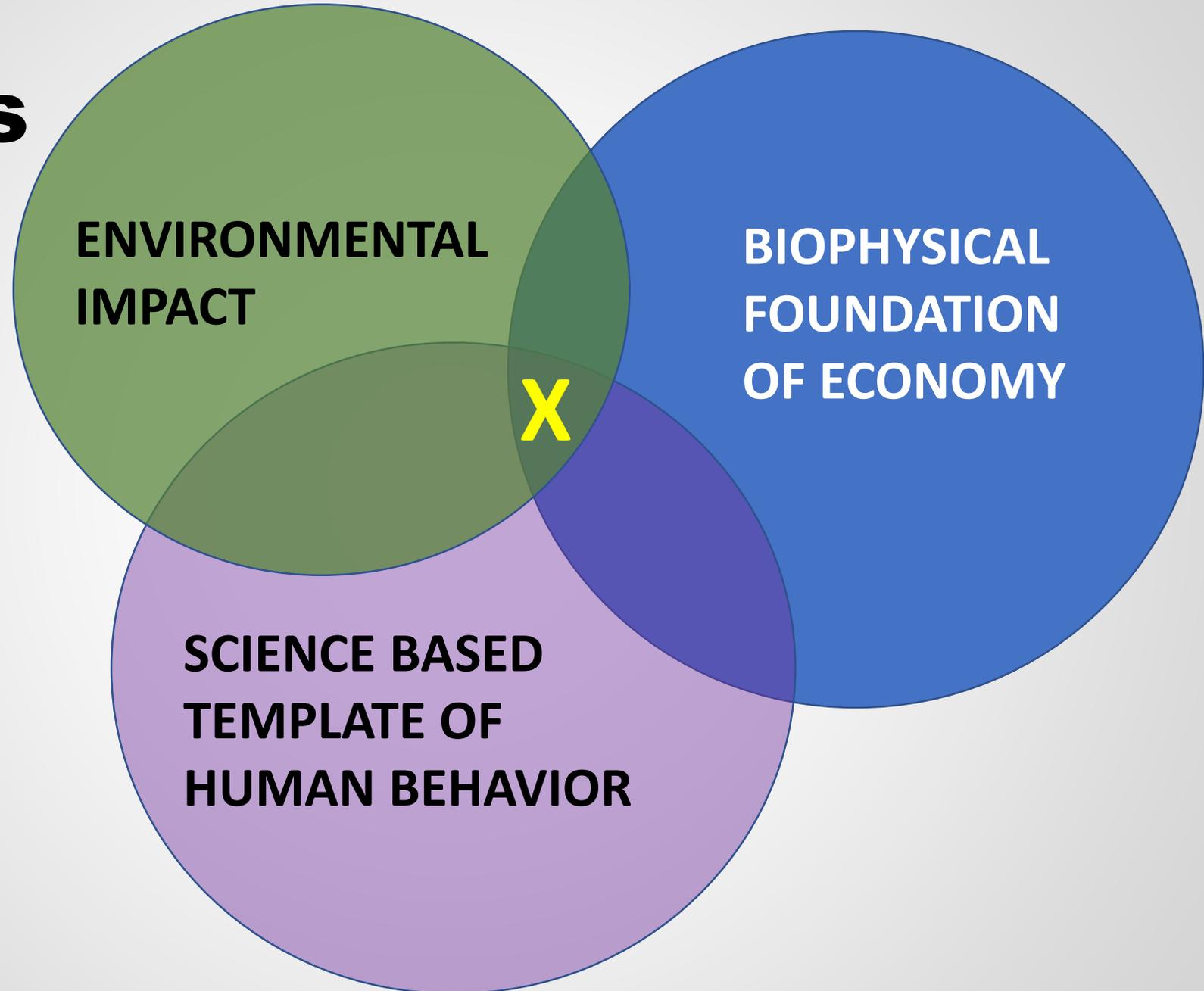


# SUPERORGANOMICS



Nate Hagens  
(Charlies Biophysical conference) [njhagens@umn.edu](mailto:njhagens@umn.edu)

# “Reality” Economics



# Modern Human Culture Functions as a Superorganism

## 1. Energy and Maximum Power Principle

2. Human Behavior

3. GDP and access to power

4. Conclusions/implications



# Energy seeking in nature



Organisms and ecosystems in nature self-organize so as to better access an energy gradient (e.g. branches and leaves to maximize surface area exposed to sun)

# Maximum Entropy Production Principle



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**Humans are part of nature too - Our great grancestors are still with us**

**Our minds can look forward but our feelings come from what worked in the past**

## ***Agenda of the Gene Preference Checklist***

Temperature: 10 F \_\_\_ 65 F  110 F \_\_\_

Wealth: prefer to be poor \_\_\_ prefer to be rich

# of children wanted: zero \_\_\_ greater than zero

Prefer: newspaper \_\_\_ dial up \_\_\_ dsl \_\_\_ broadband

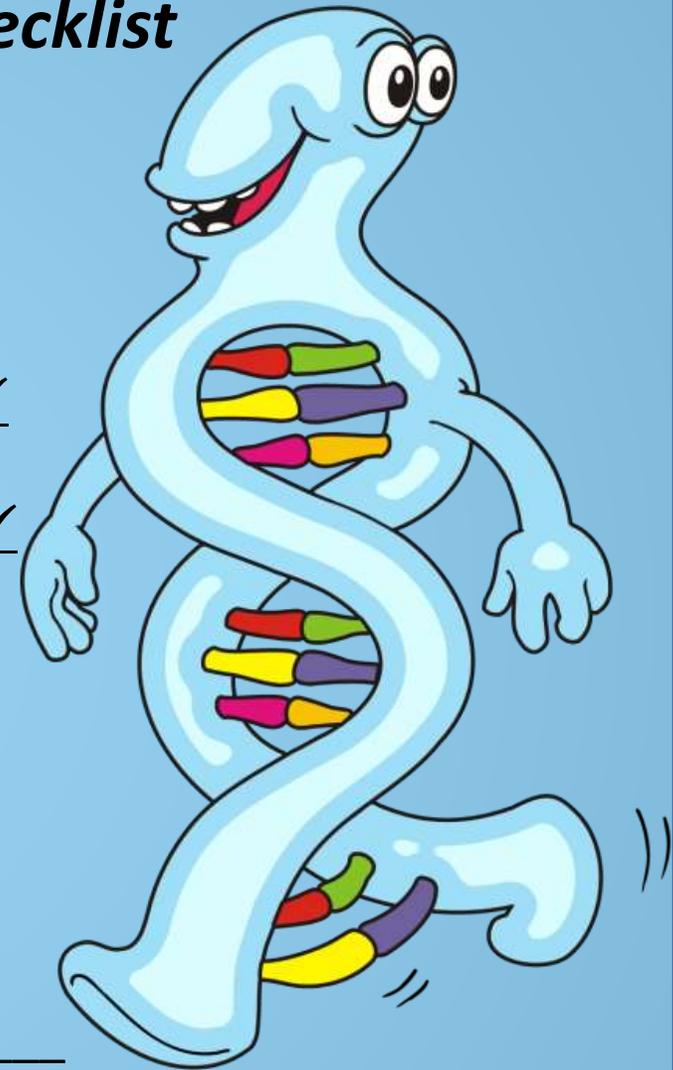
Prefer to be: miserable \_\_\_ comfortable

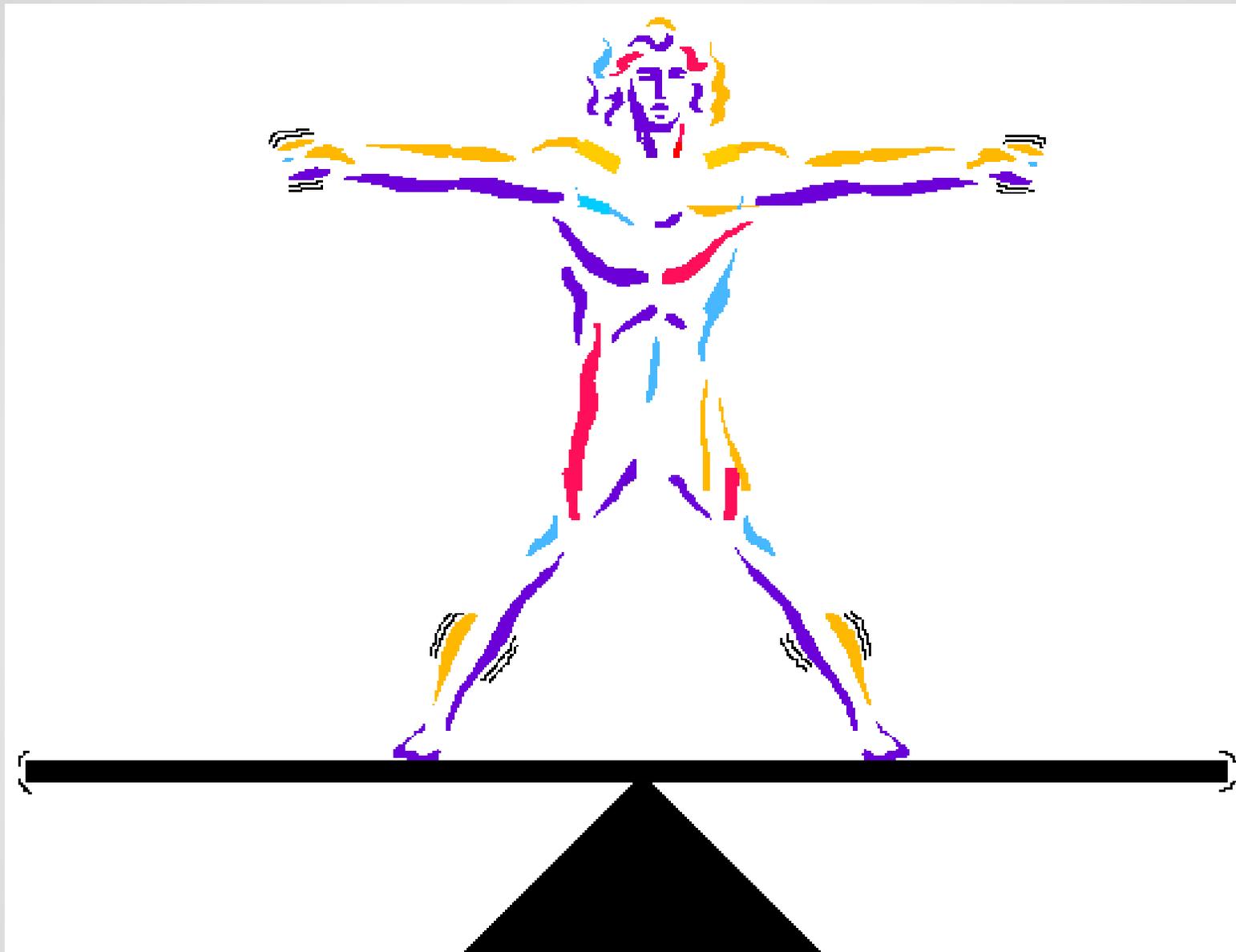
Need to be in town in 2 hours: drive car  walk \_\_\_

Prefer to: win wars  lose wars \_\_\_

Care more about how your life is in: 2017  or 2027 \_\_\_

Prefer to be viewed as: more  or less \_\_\_ successful than ones neighbor





**Human animals seek physical and psychological homeostasis . Most physical needs require energy. (Most psychological needs do not but in our culture still do)**

# “Ultrasociality”



Humans – like ants bees and termites are an extremely social species

# The Origins of Surplus







How many man-days of work can you get on the average global daily wage of \$57?



Oil at \$20 per barrel

21,679



Oil at \$80 per barrel

5,912



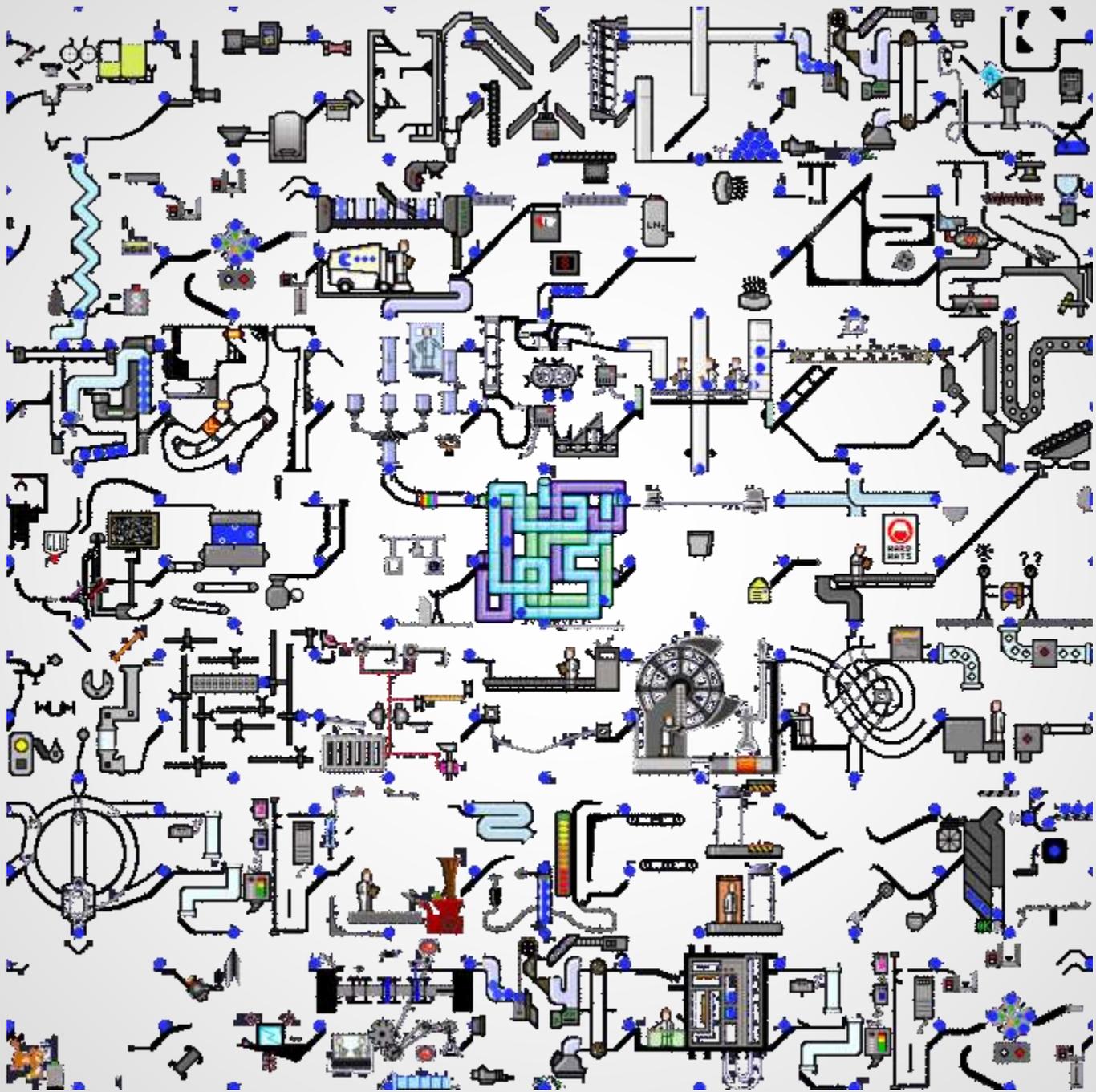
Average human

1



Average American

0.2



# Modern Human Culture Functions as a Superorganism

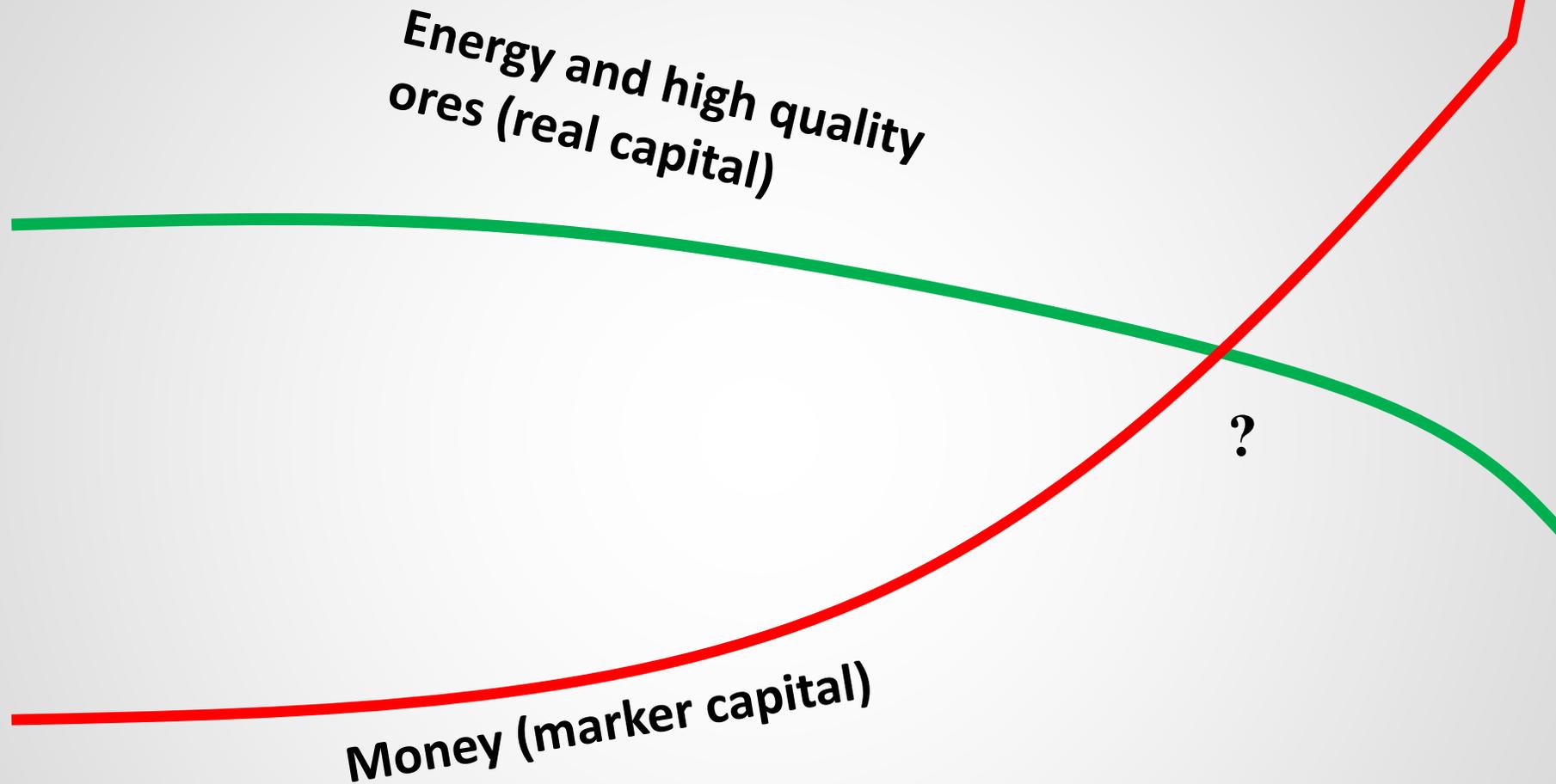
1. Energy and Maximum Power Principle
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# Banks do not loan money, they create it



Since 1971 there has not been a single currency in the world with a link to physical resources

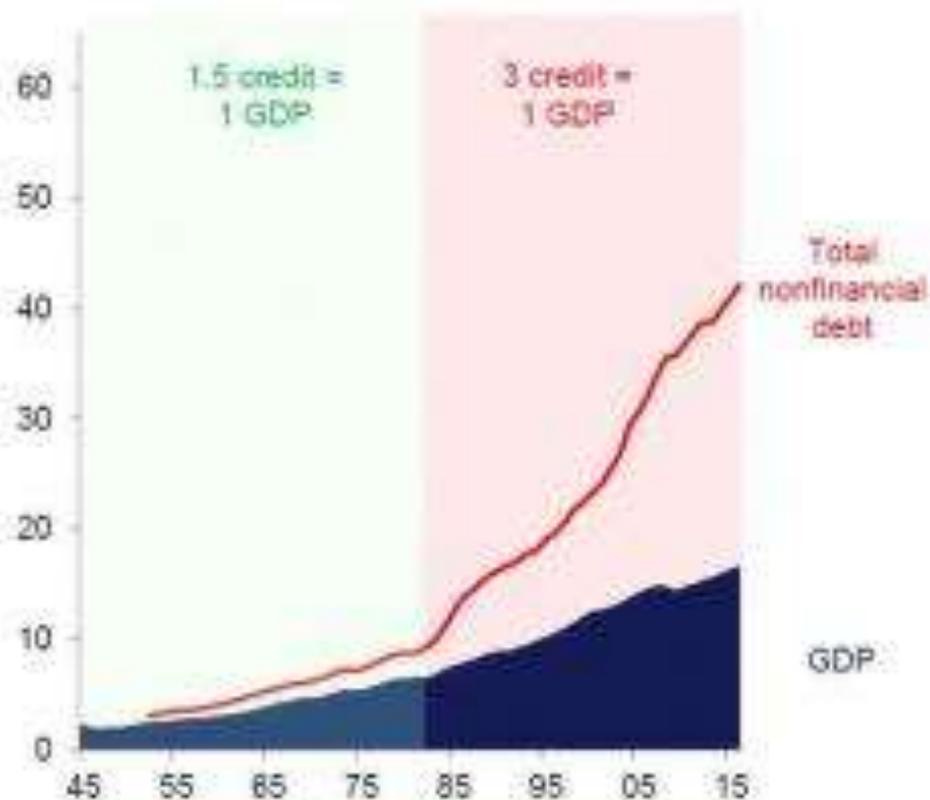


We don't think of it this way – but when we take on debt – as a nation, as a company or as an individual, *the debt someday has to be paid back with energy.*

# Central banks' response to the lack of inflation?

The US' credit addiction began in 1982

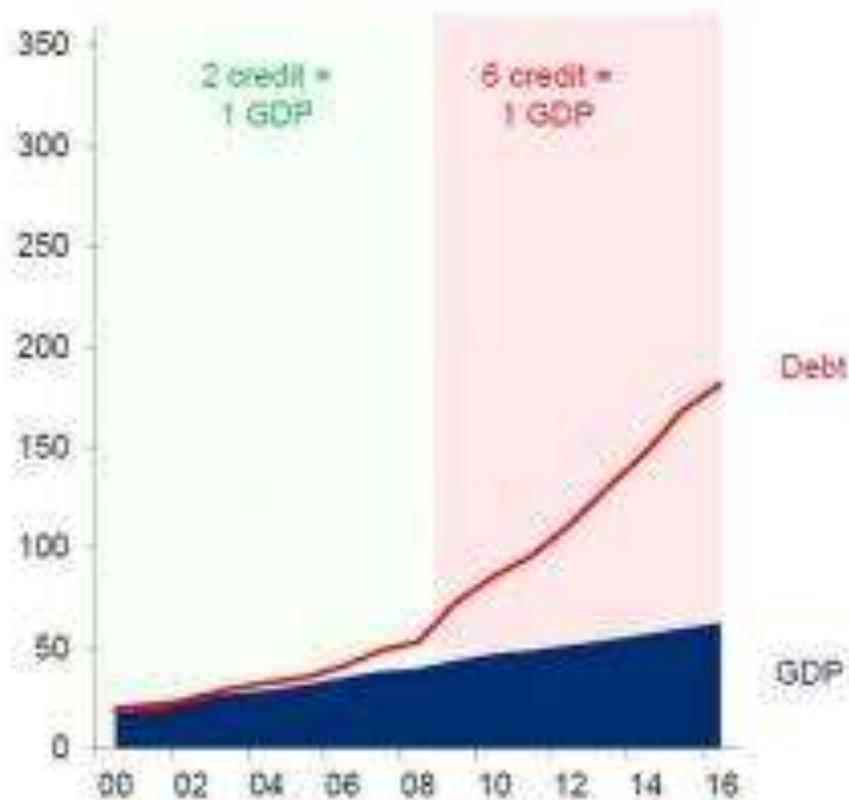
Real value of US GDP vs debt, in 2009 \$



Source: Federal Reserve, BEA, CE Research

In China it was 2009

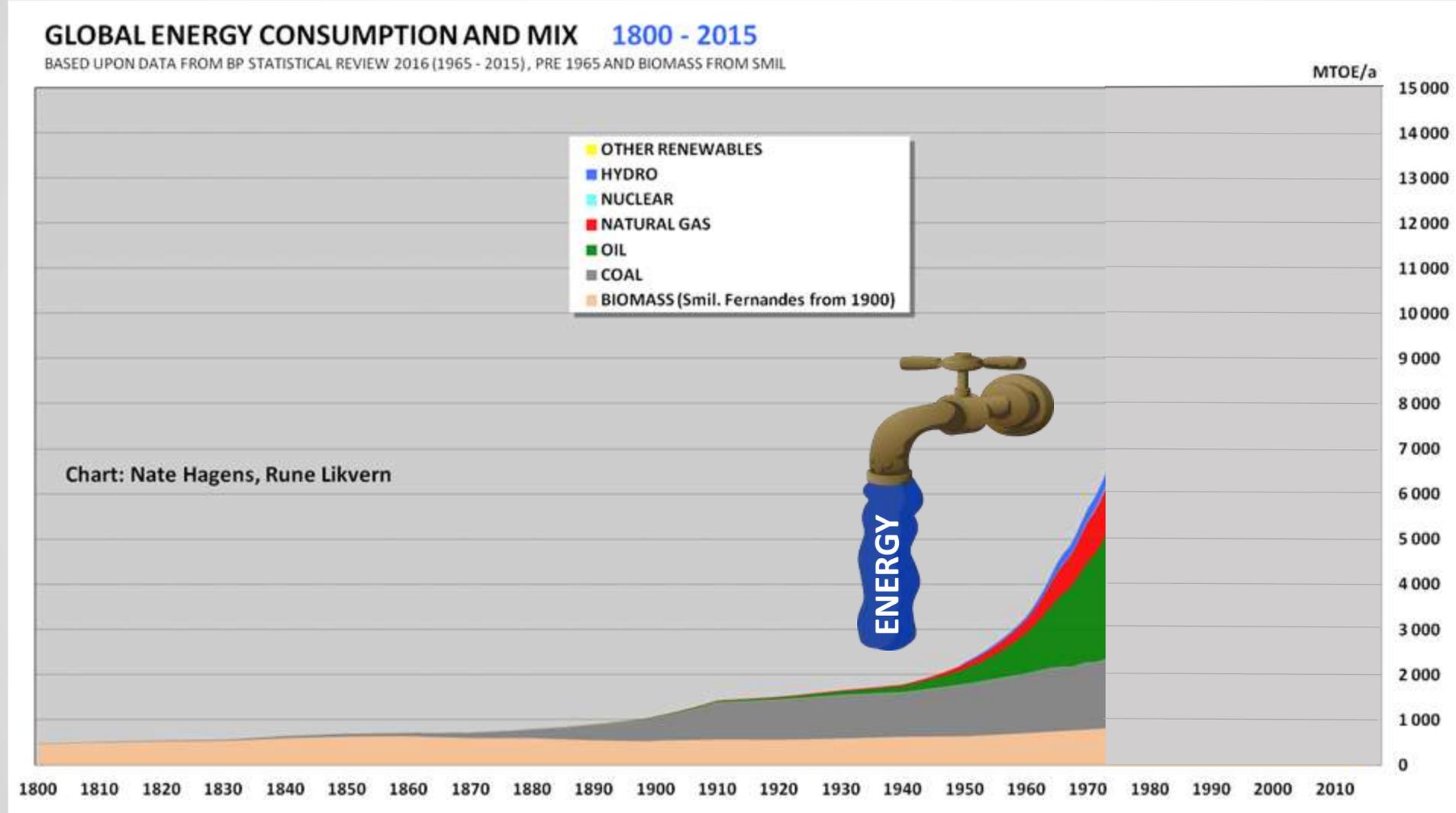
Real estimated value of Chinese GDP vs debt, in 2015 yuan



Source: PBOC, BEA, CE Research. For more colour, see e.g. [Can China Really Deal Itself? M. Potts, JPH17](#)

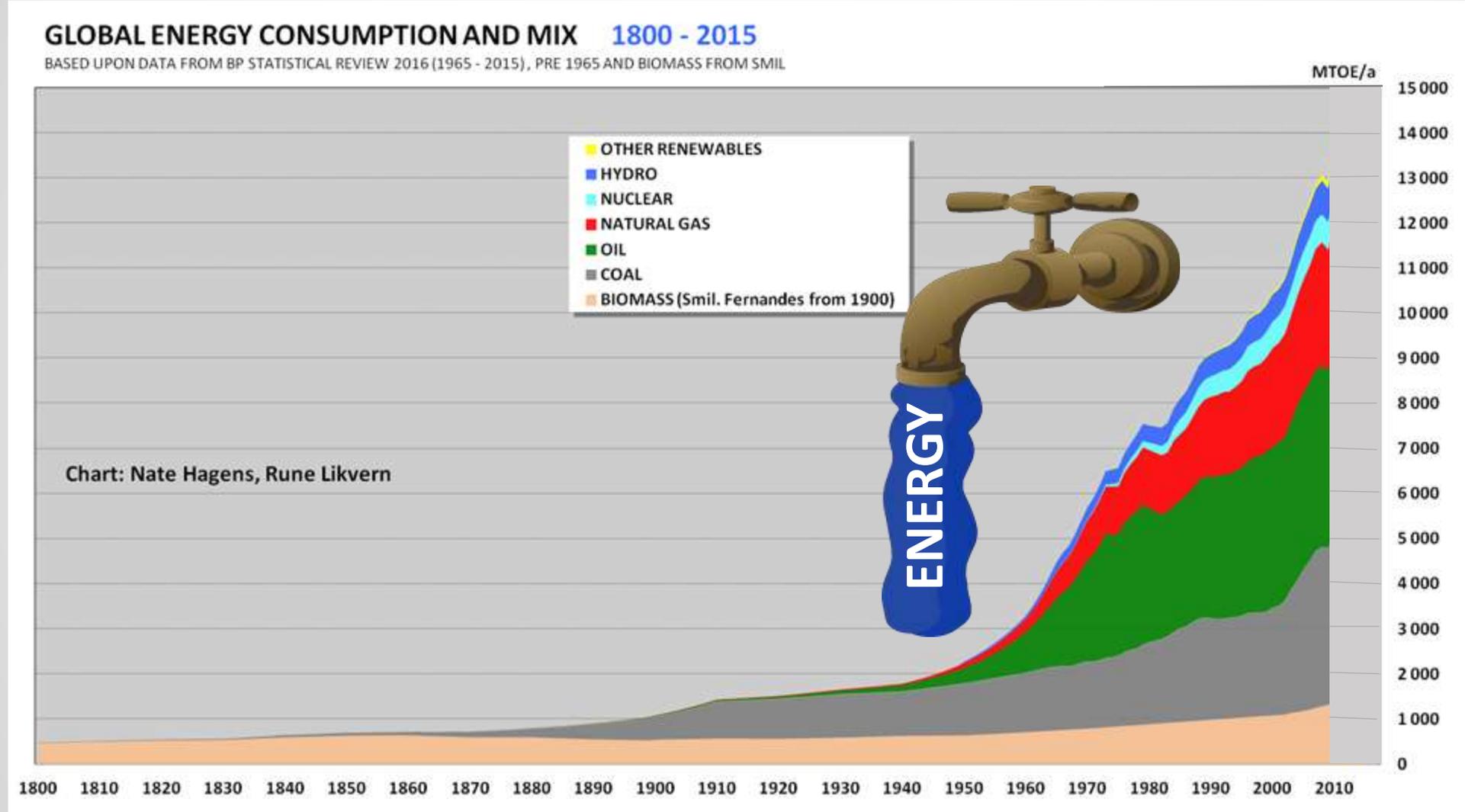
They simply stopped worrying about credit

# Energy and resource led productivity



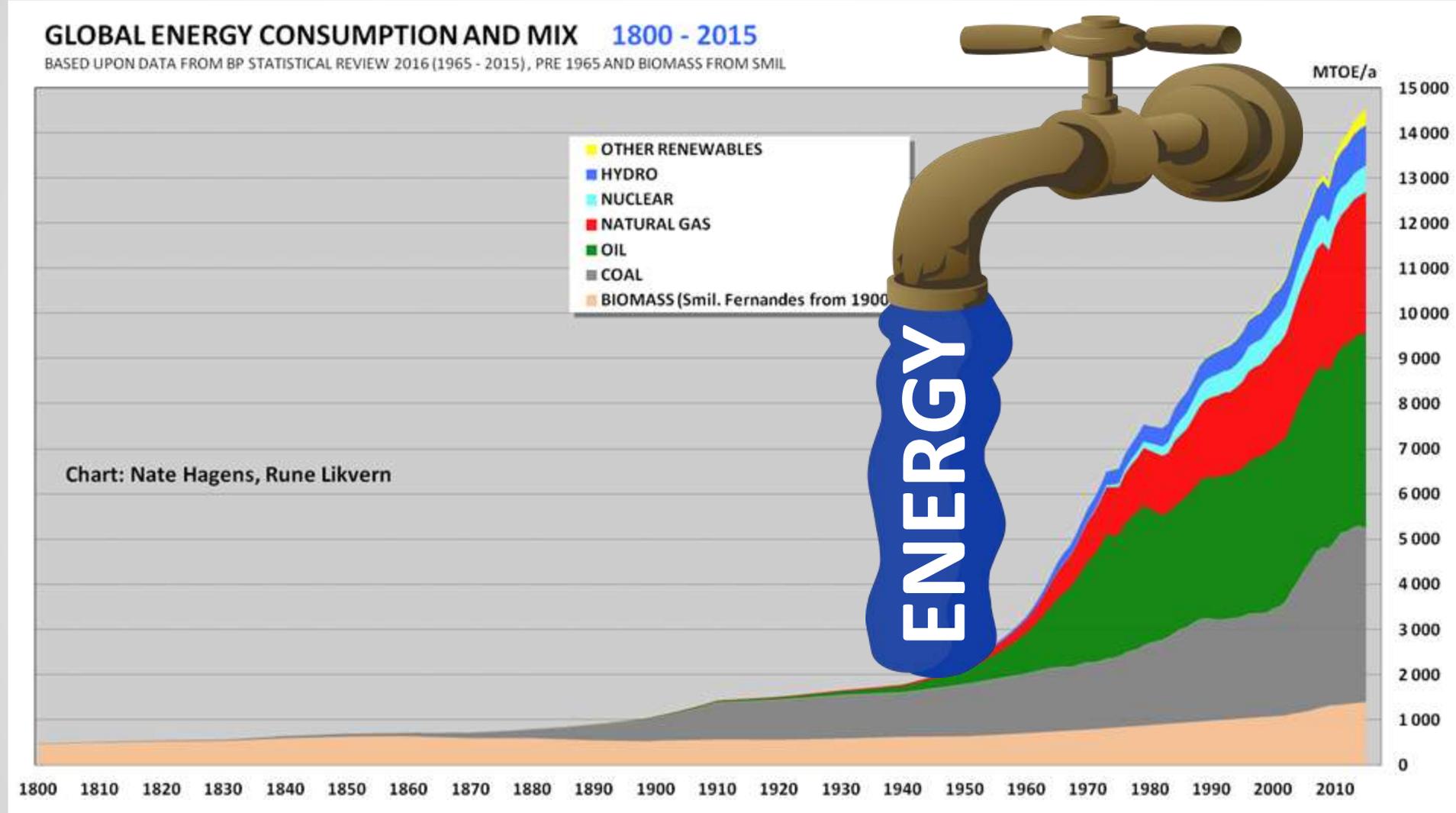
Up until the 1970s we continued our physical world expansion, adding vertical land productivity (fossil carbon) to previous horizontal productivity (farming). We ran into 2 energy crises in 1970s.

# Debt and trade productivity



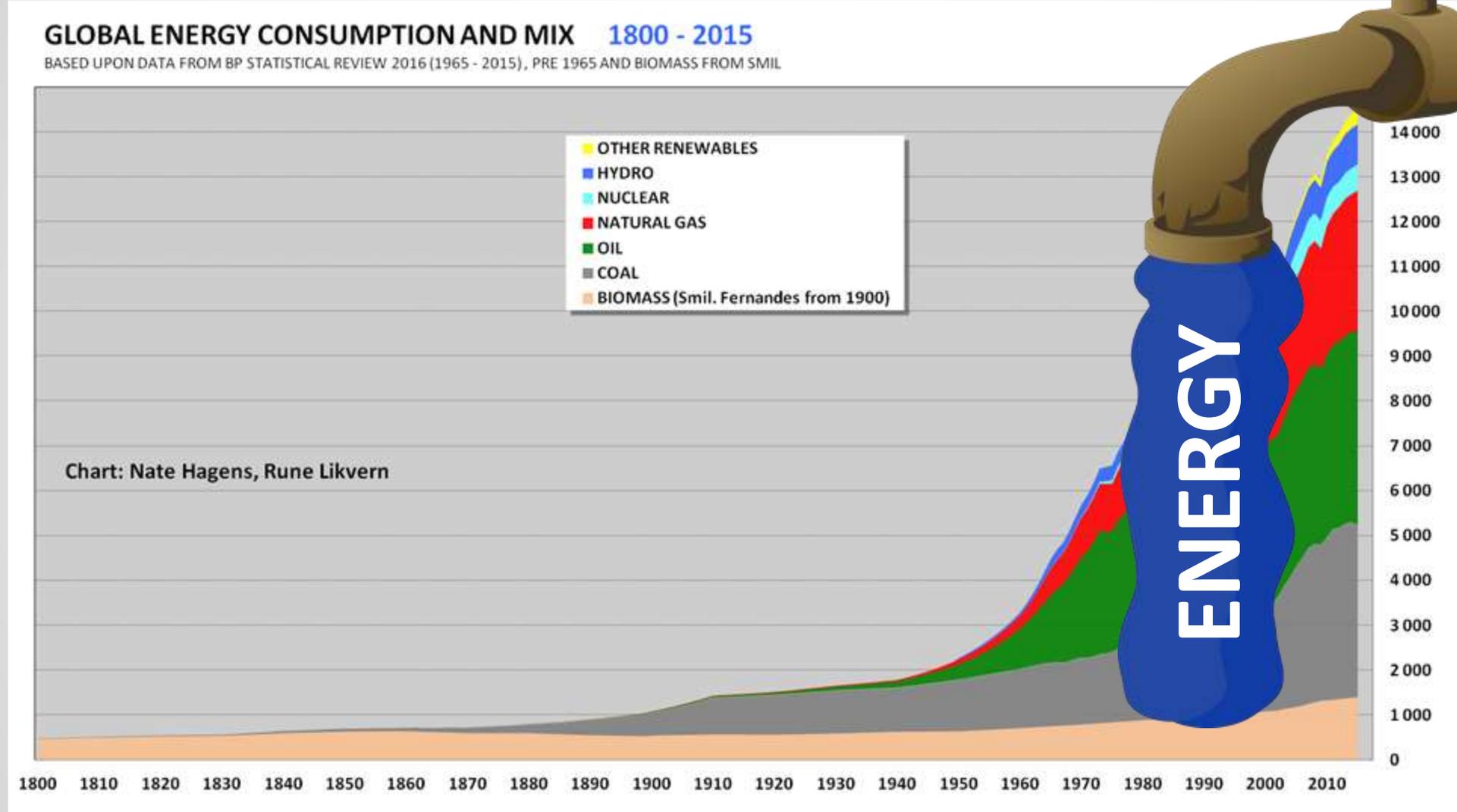
To keep access to energy growing, we went to 1) debt as a way of pulling resources forward in time and 2) globalization as a way of accessing cheaper areas of production and more cooperation. Hit a wall in 2008

# Central bank and government guarantee era



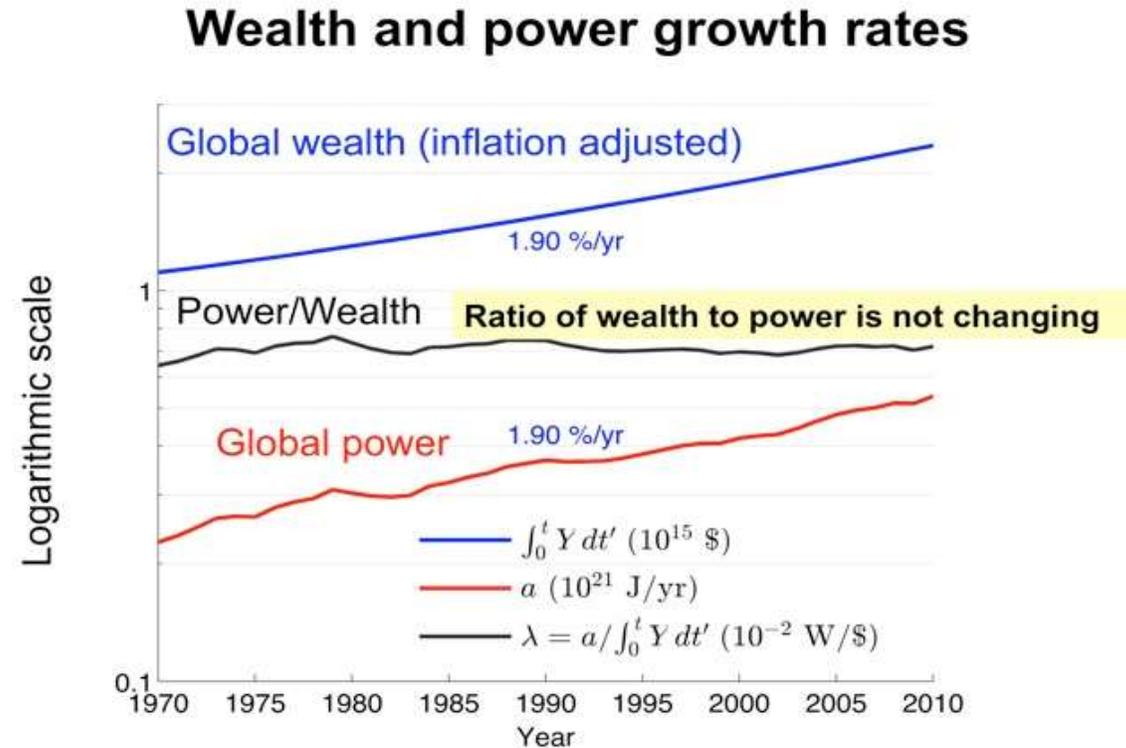
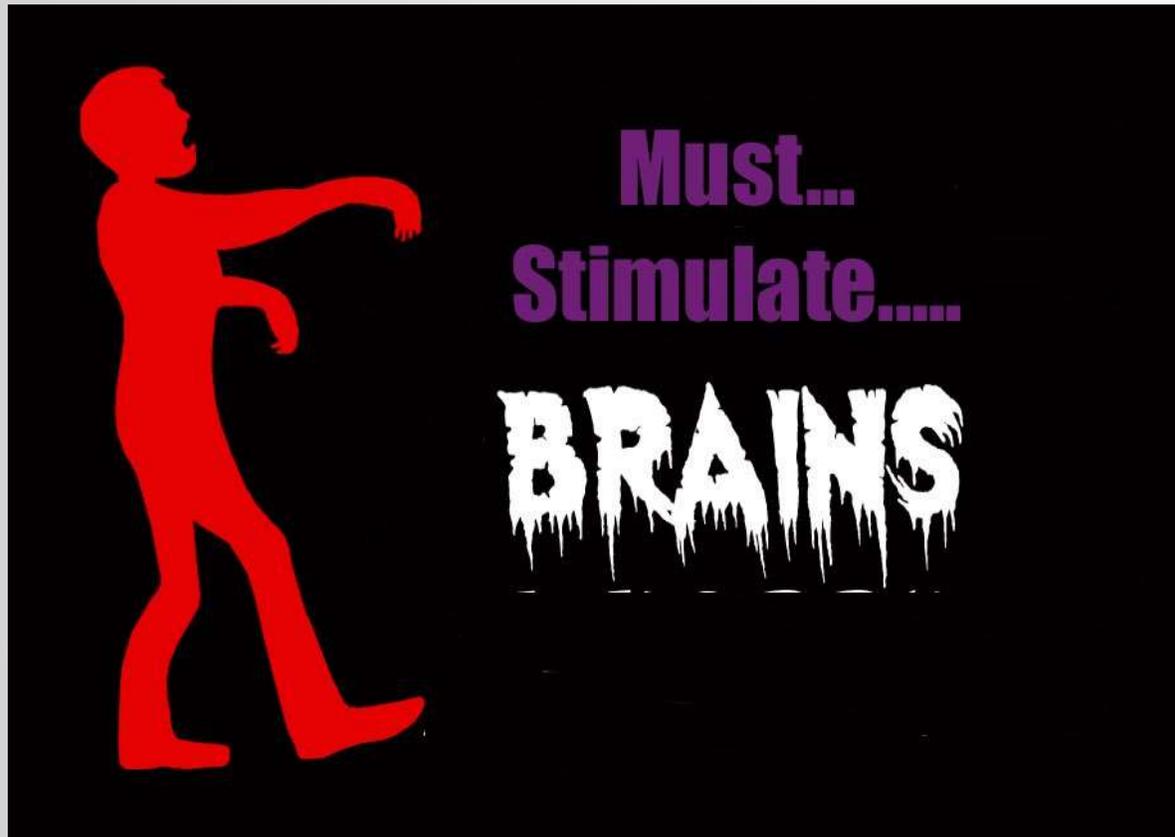
Since 2008, central banks and governments responded with “temporary” too big to fail guarantees, QE, artificially low interest rates, balance sheet expansion, to maintain populations access to energy/services

# Orwellian productivity?



Rule changes (e.g. Italy making prostitution and cocaine sales part of GDP), new tax and benefit schemes, and numerous other 'abstractions' allow us to continue growing the energy spigot. But for how long?

Renewable energy or no, the Amoeba is always hungry



Tim Garrett – University of Utah

The ratio of power to wealth has not changed in 50 years globally



~1970s

~2017

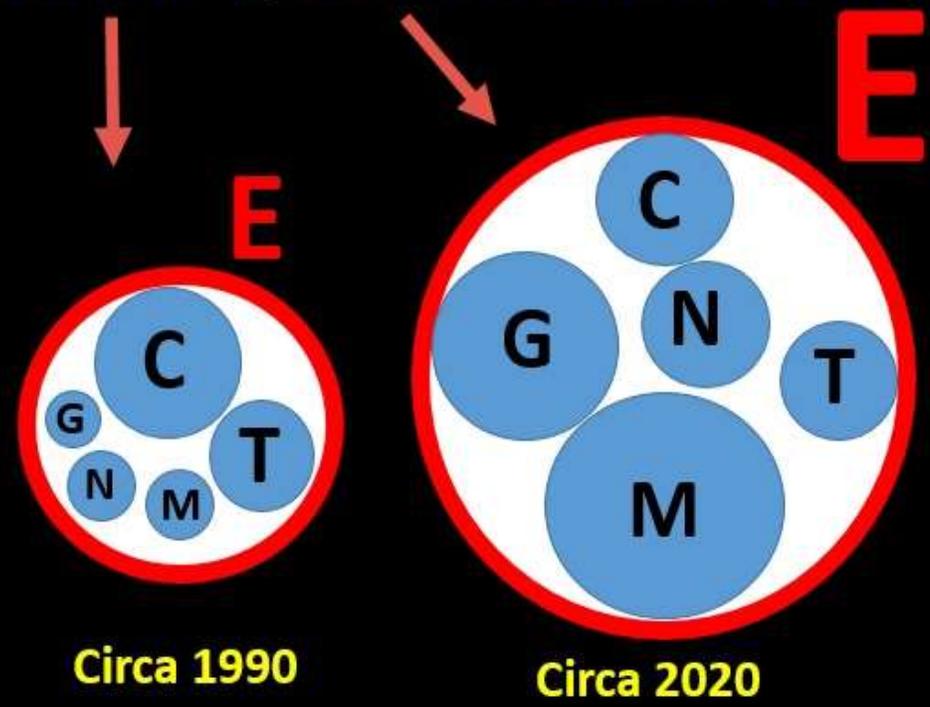


**STRAW = ENERGY AND  
NATURAL RESOURCES SIZE**

**STRAW-(CROSS SECTION VIEW)**

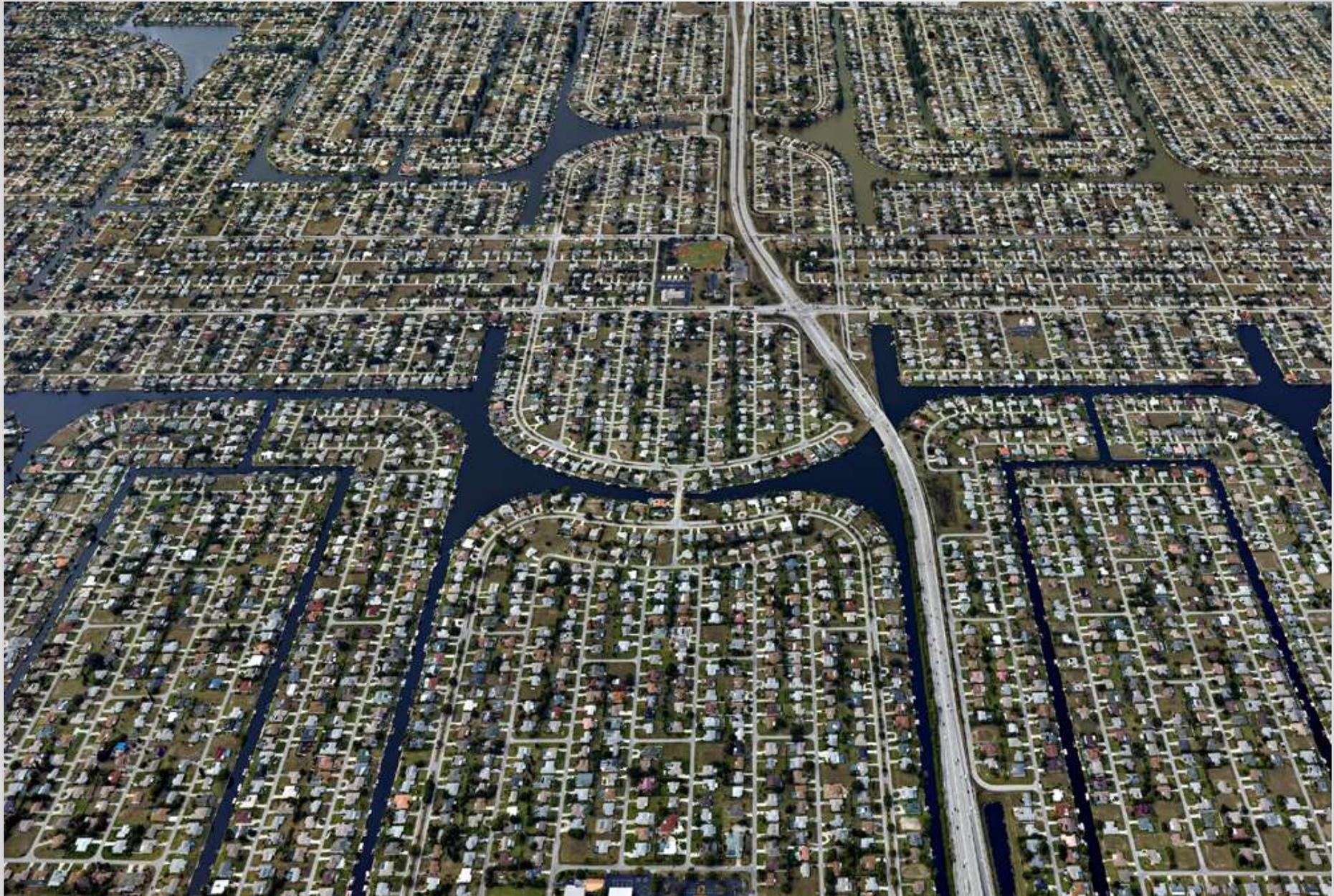
Five things influence the size of the straw (**E**):

- 1) Low cost of energy **C**
- 2) Better technology **T**
- 3) Complexity (Nodes) **N**
- 4) Cheap/free credit **M**
- 5) Government rules **G**

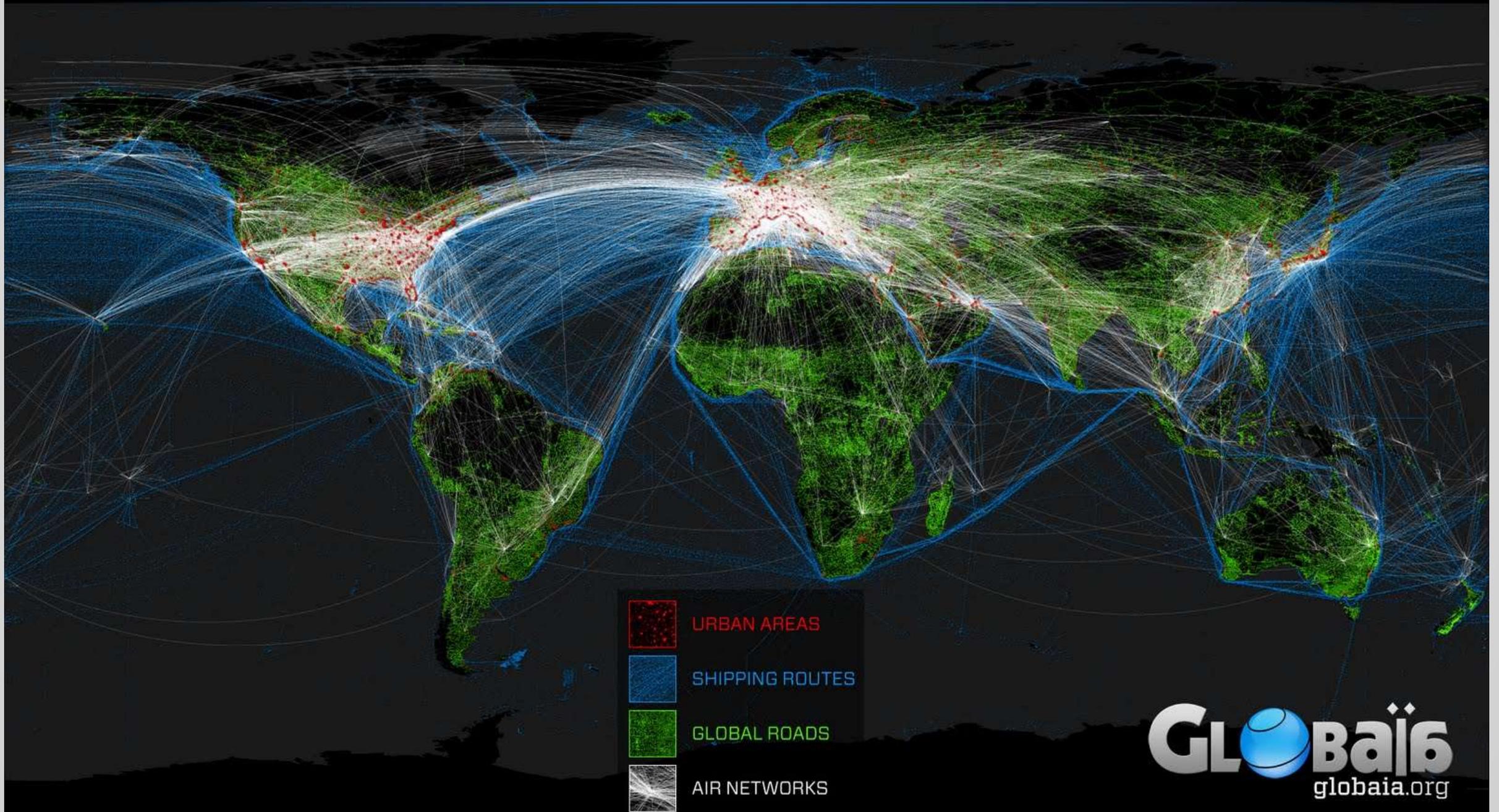


# Collaboration will always access more energy than competition





# THE ANTHROPOGENIC PLANET

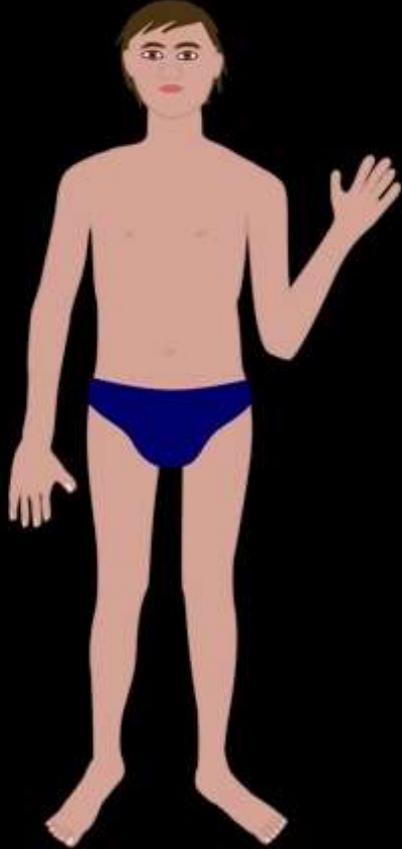


# Downstream of the Superorganism

**Geologic History –Most mass extinctions linked to CO2 change**



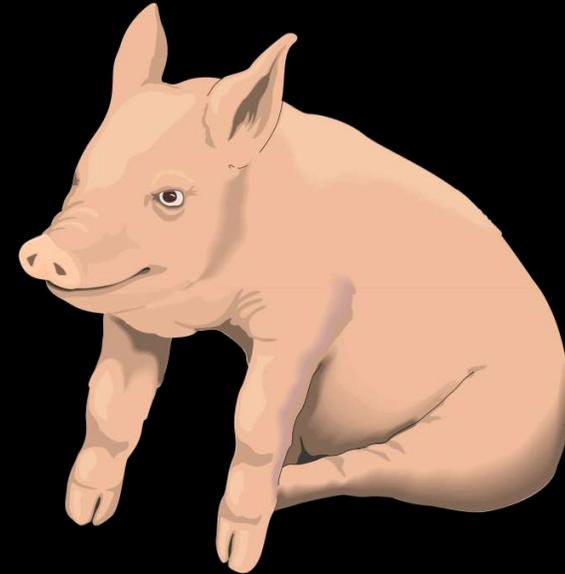
# TERRESTRIAL VERTEBRATES



Humans



Wild land  
animals

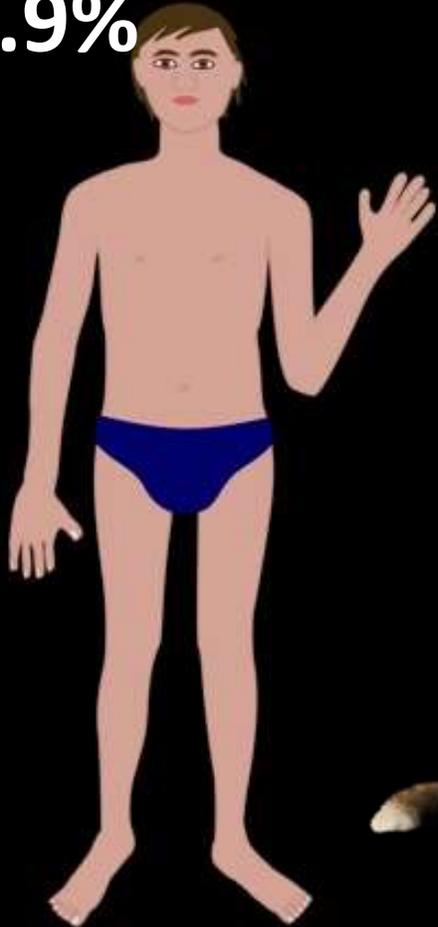


Livestock

# MORE THAN OUR SHARE

(of NPP, biosphere, etc.)

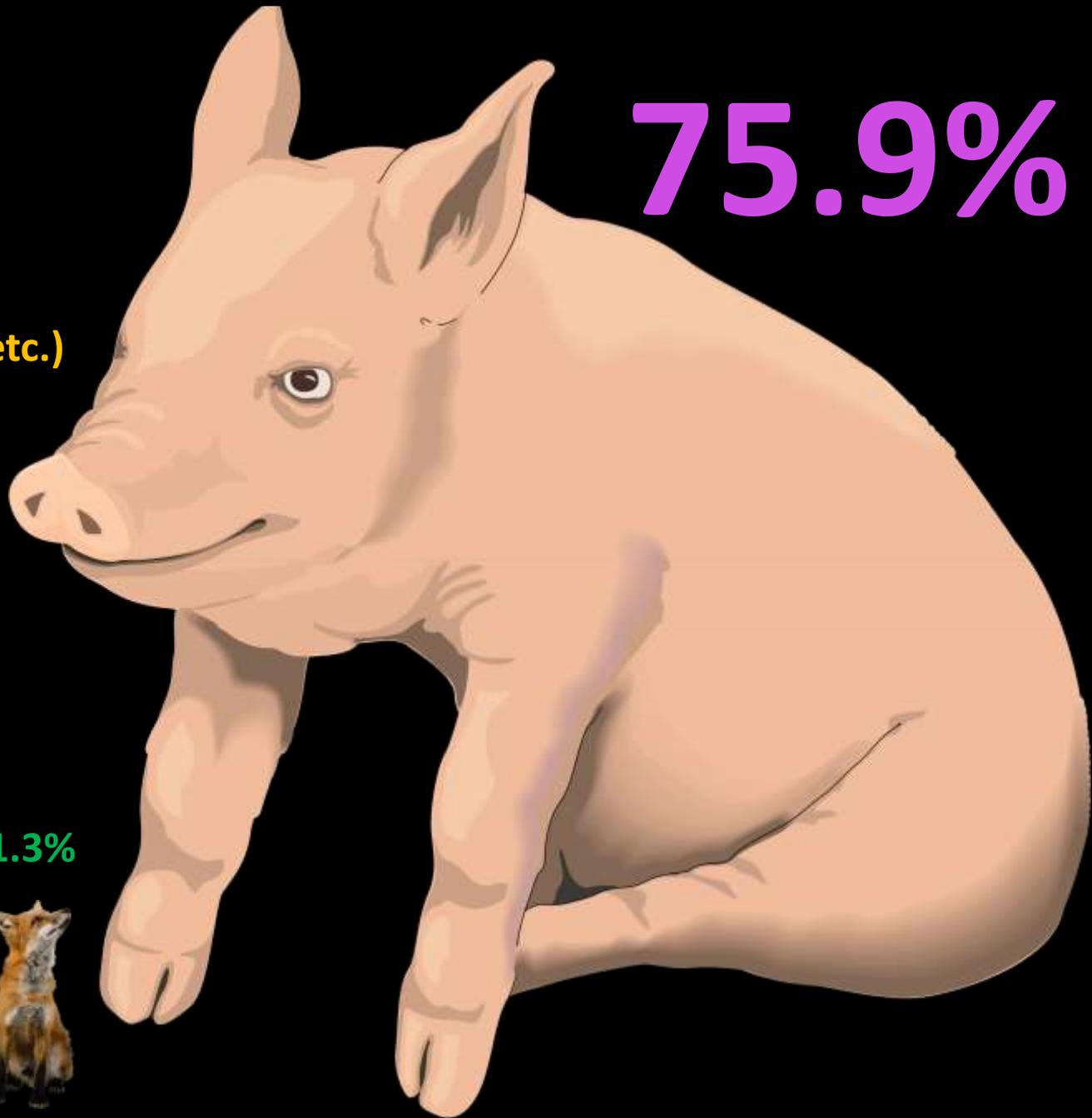
22.9%



1.3%

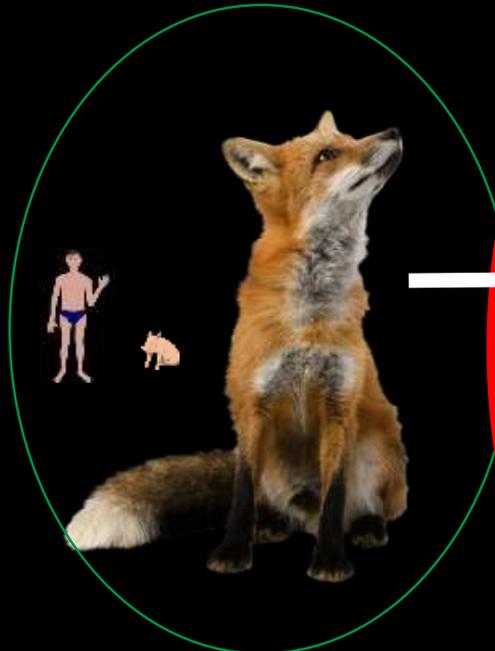


75.9%



# THE BIOMASS BUBBLE

10,000 B.C.E.



~300 million tons

2015 C.E.



~1,850 million tons

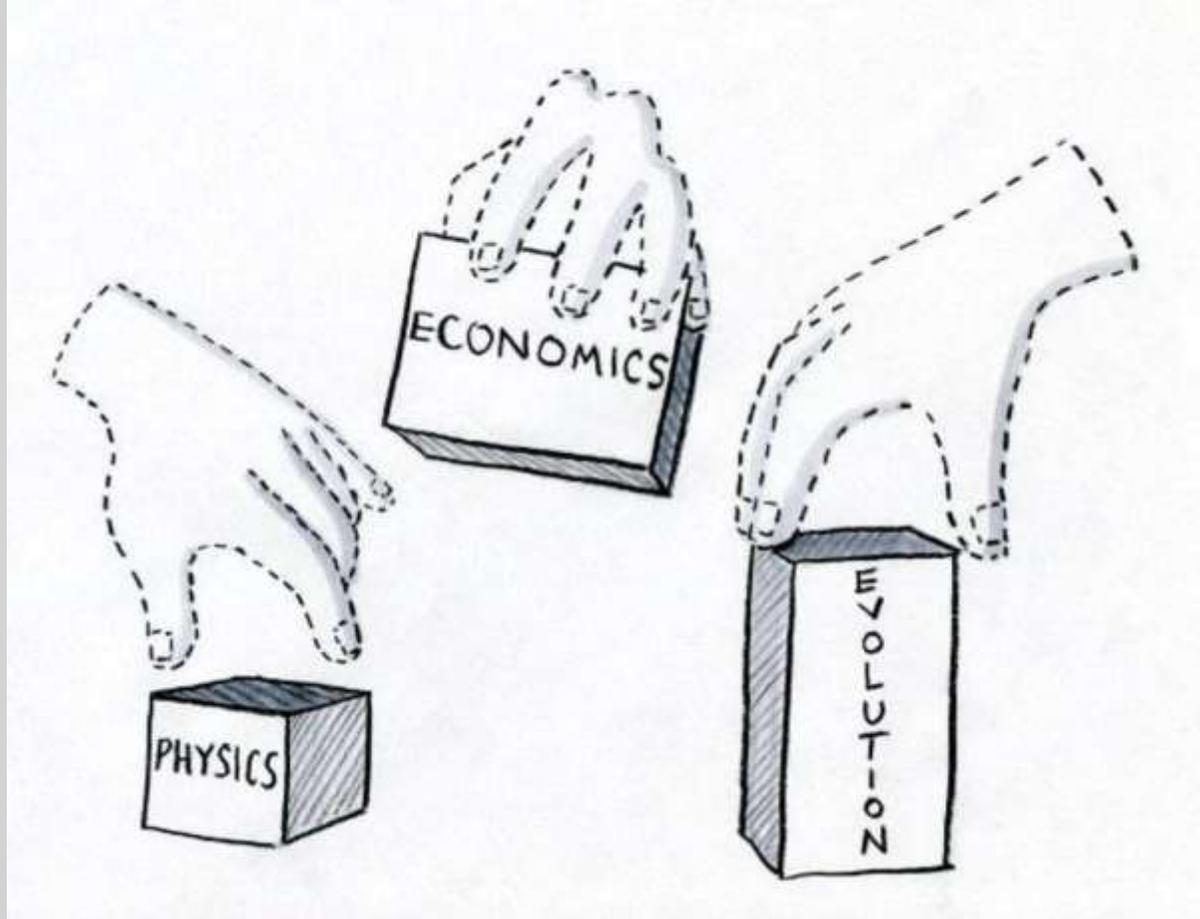
Hardly anyone acknowledges this most basic facet of our current reality

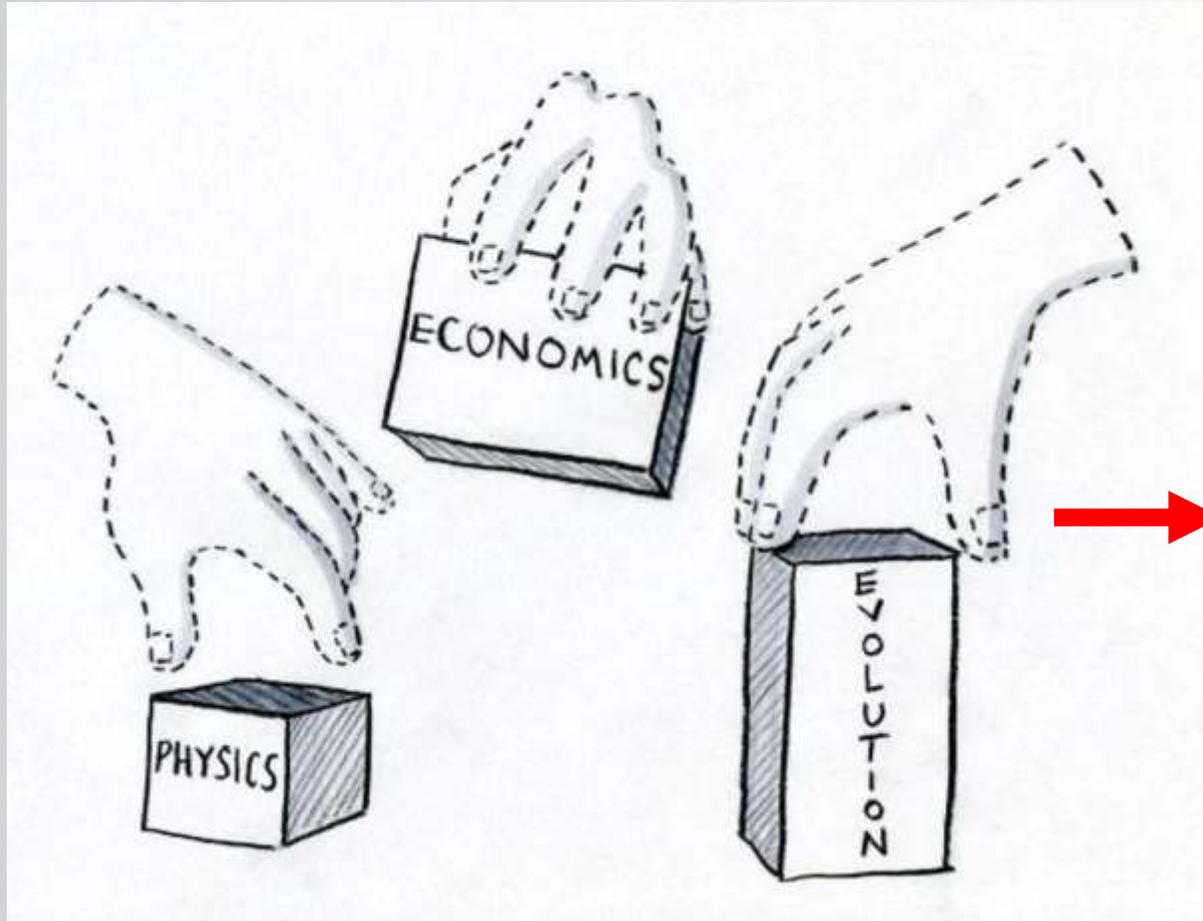
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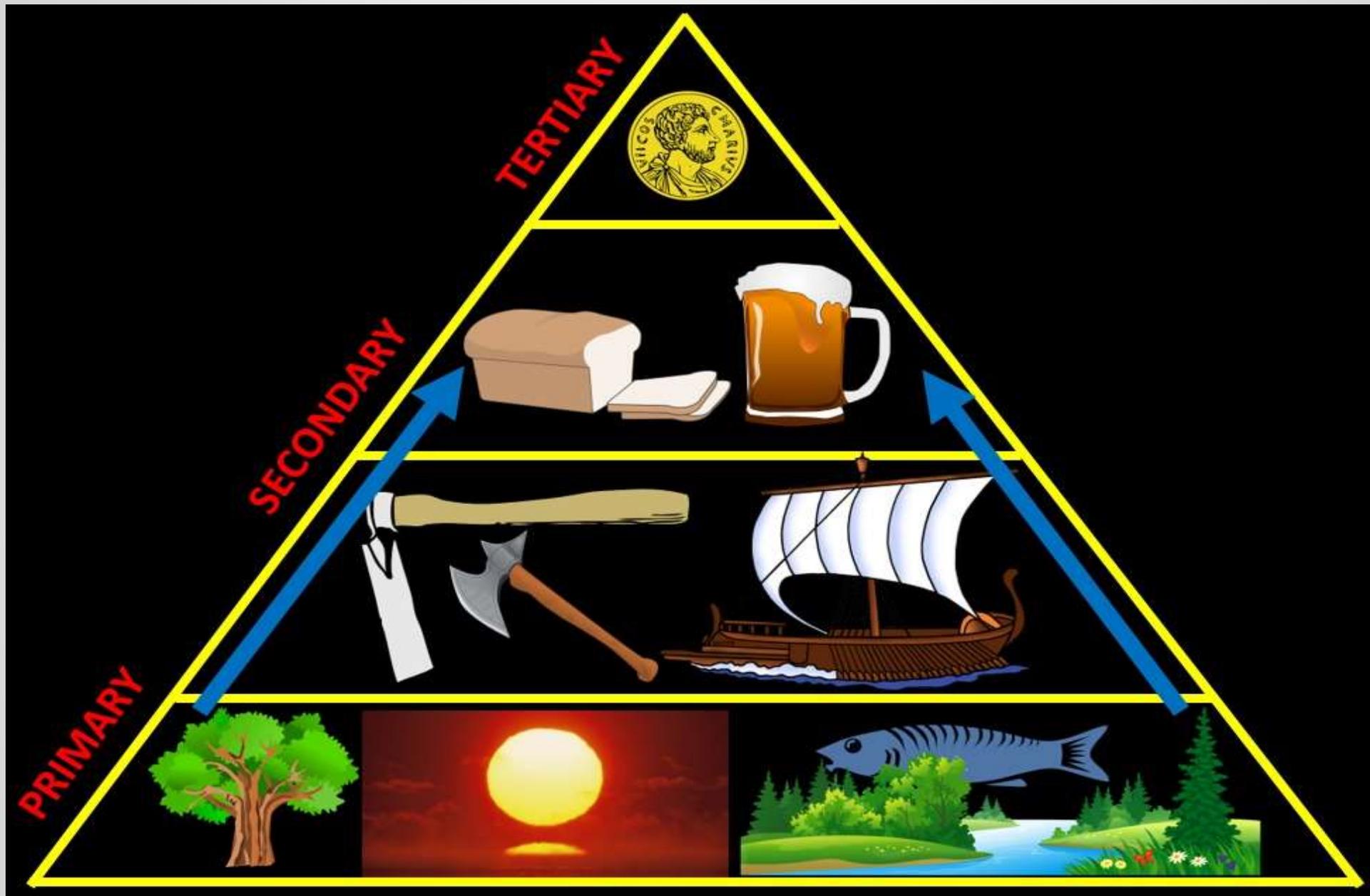


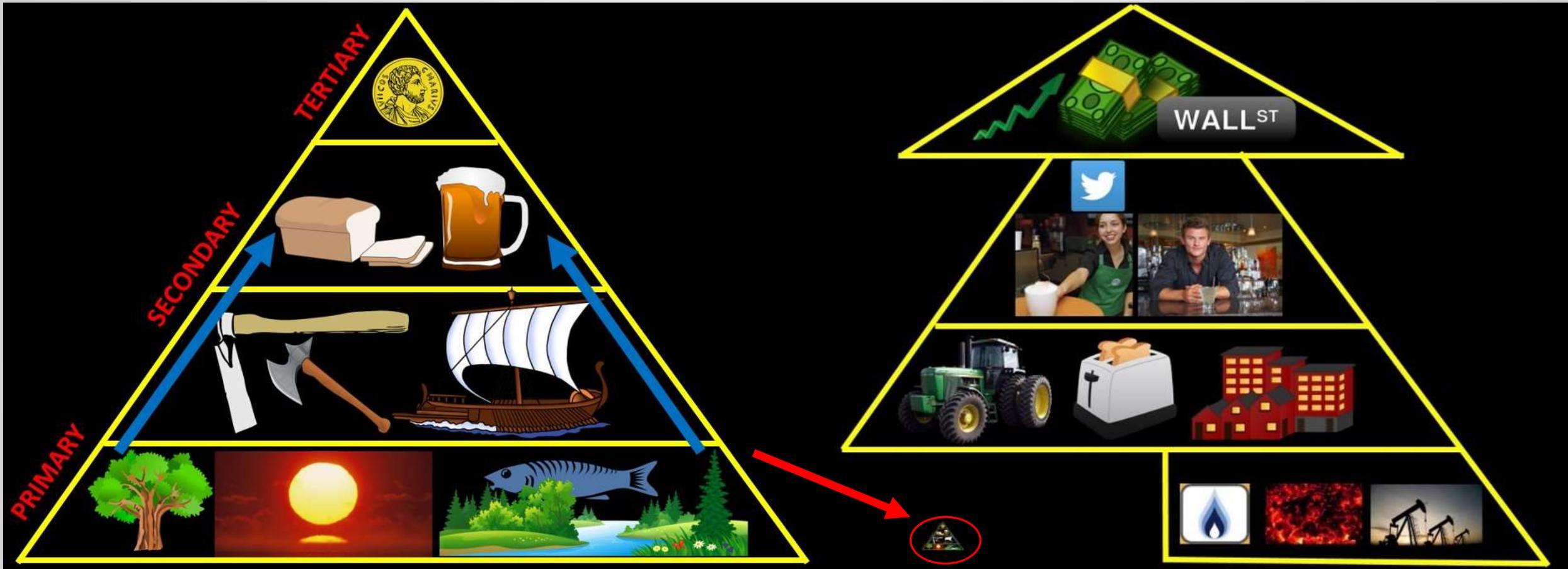
# The main implications of “Superorganomics”





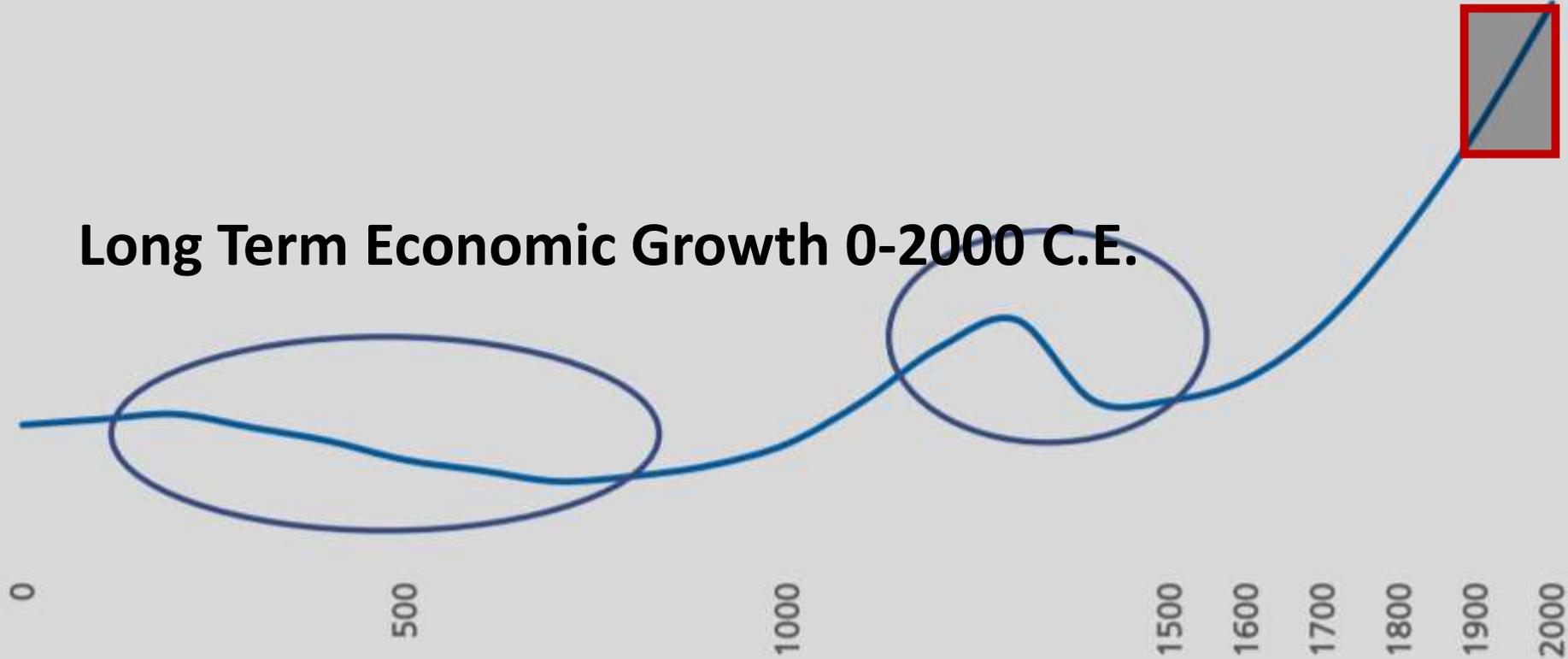
1. The human Amoeba (superorganism) IS the invisible hand





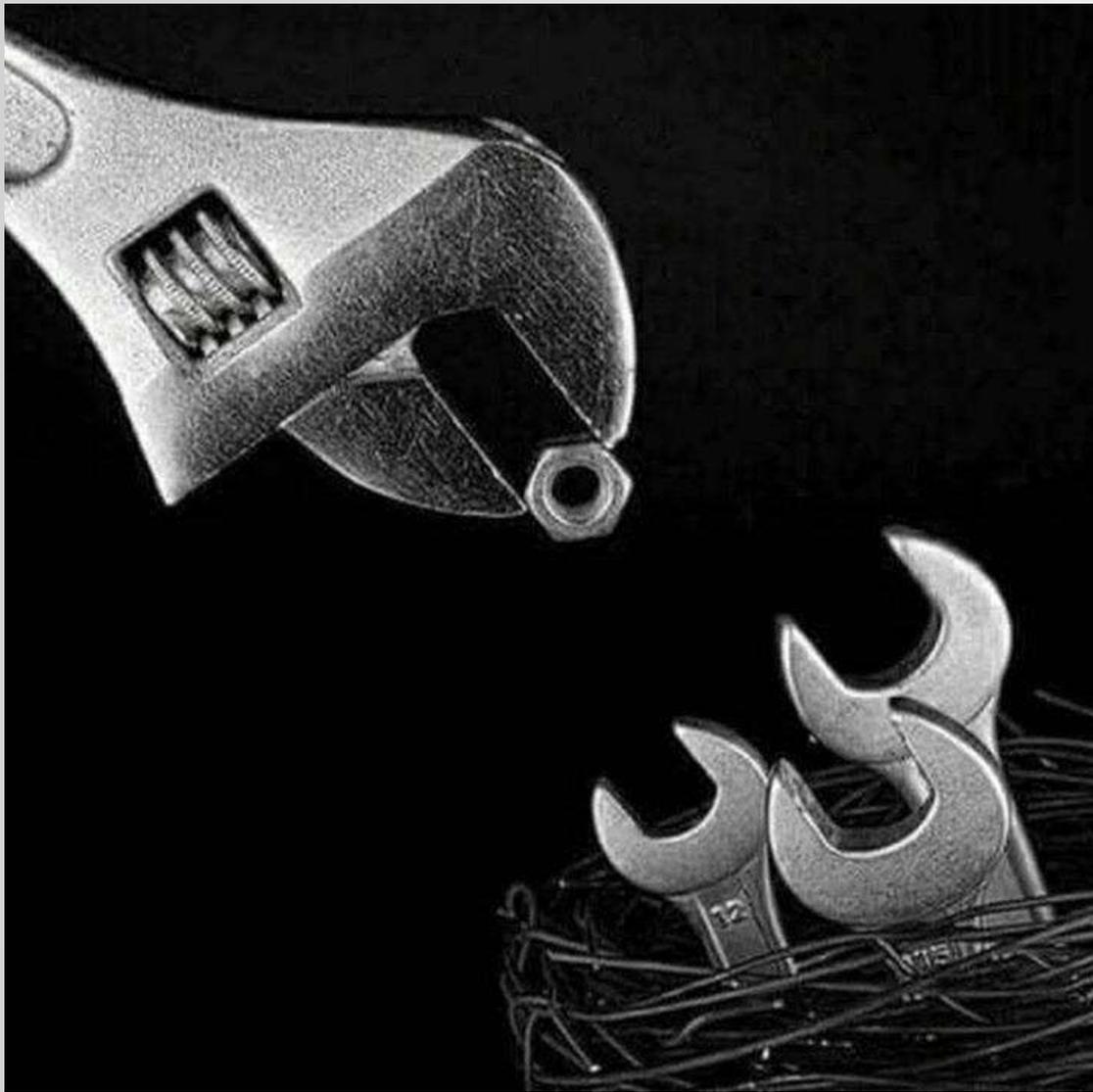
2. As a global culture, humans are now maximizing not surplus, but surplus 'value'

# Long Term – Growth wasn't the norm



Global GDP from 0 A.D. Source Angus Maddison, IIER calculations

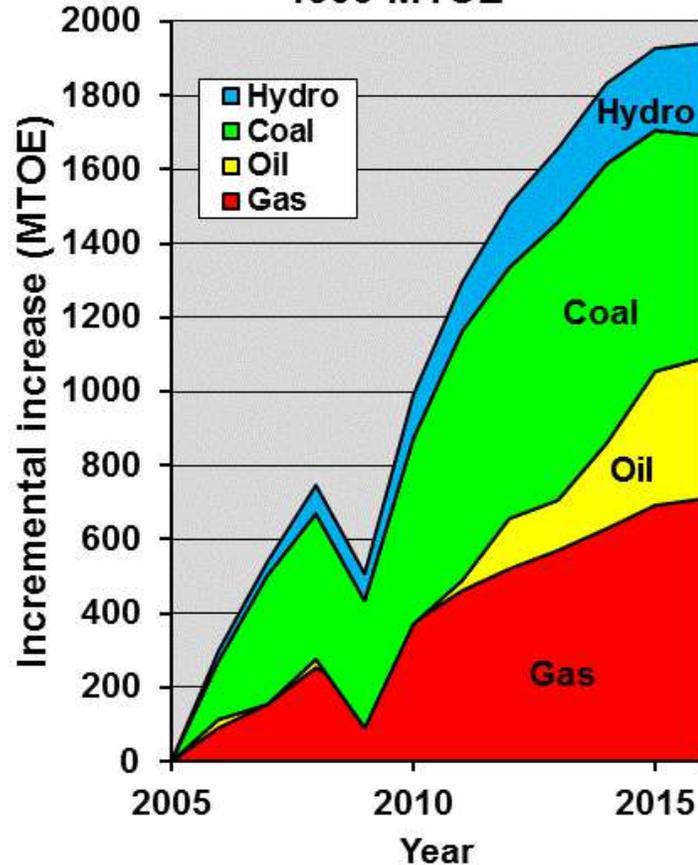
**3. Economic theory wasn't chosen because it was true and valid – it was chosen/used in the service of the superorganism/heat engine**



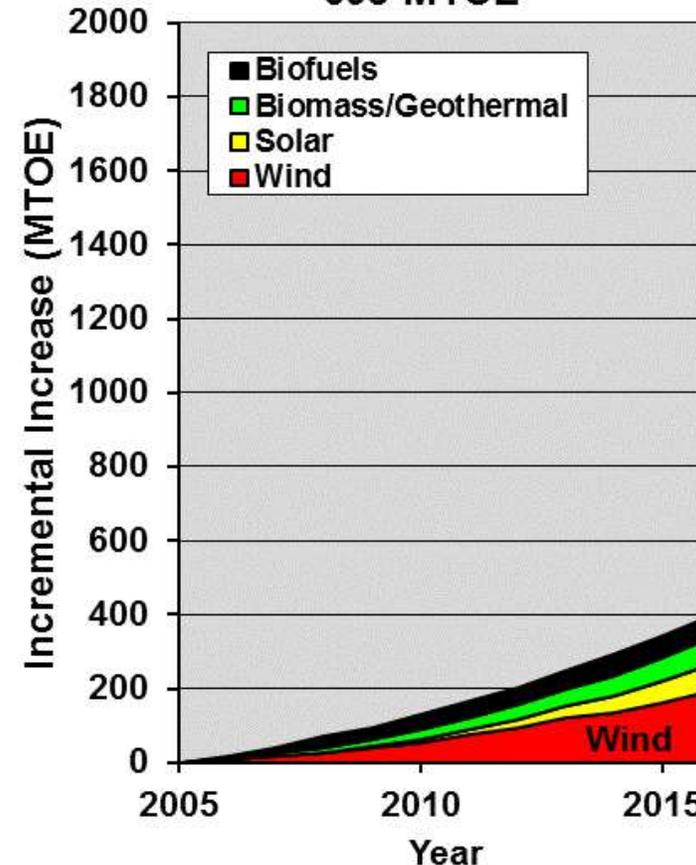
4a. As long as human cultures maximize GDP, efficiency and better technology will build a larger global heat engine.

# Increase in Global Energy Consumption 2005-2016 Non-Hydro Renewables compared to Other Sources

Non-Renewable including Large Hydro  
1906 MTOE



Non-Hydro Renewables  
398 MTOE



© Hughes GSR Inc, 2017

(data from BP Statistical Review of World Energy, 2017)

**4b. Growing renewables will likely just build a bigger heat engine in aggregate**

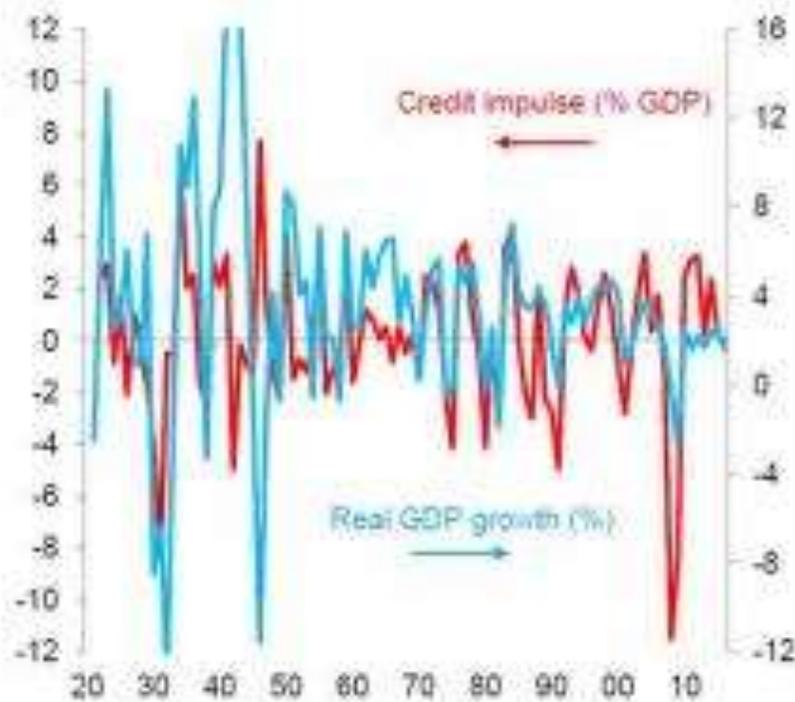


5. The mass extinction and metabolic impacts on biogeochemistry are downstream effects, not easily 'willed' away or solved by changing prices

# 6. The main way we are accessing energy today is via the credit impulse.

To track short-term effects, use the credit 'impulse'

Credit both drives growth and is driven by it  
US private credit impulse vs GDP growth



Source: Federal Reserve, FOMC, G1 Research. See also [Quarterly Report on Credit, M. Topp, OMB, 2010](#).

Euro area strength not so mysterious  
Euro area private credit impulse (% GDP) vs GDP growth indicator



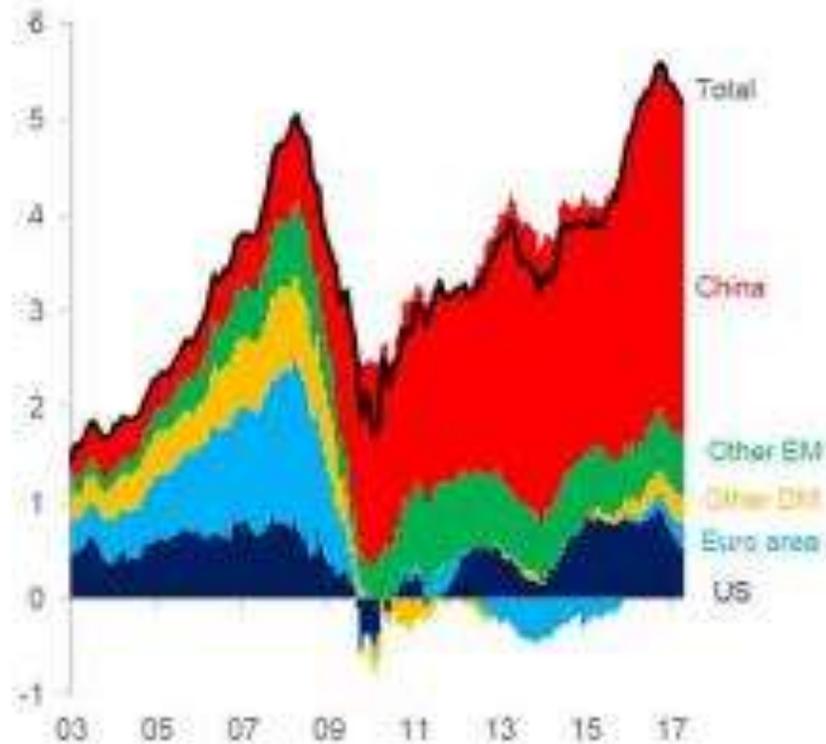
Source: Deutsche, FOMC, G1 Research. See also [Quarterly Report on Credit, M. Topp, OMB, 2010](#).

The change in the flow of credit drives GDP growth

# Global credit dynamics are therefore important

## A surge in global credit, driven by China

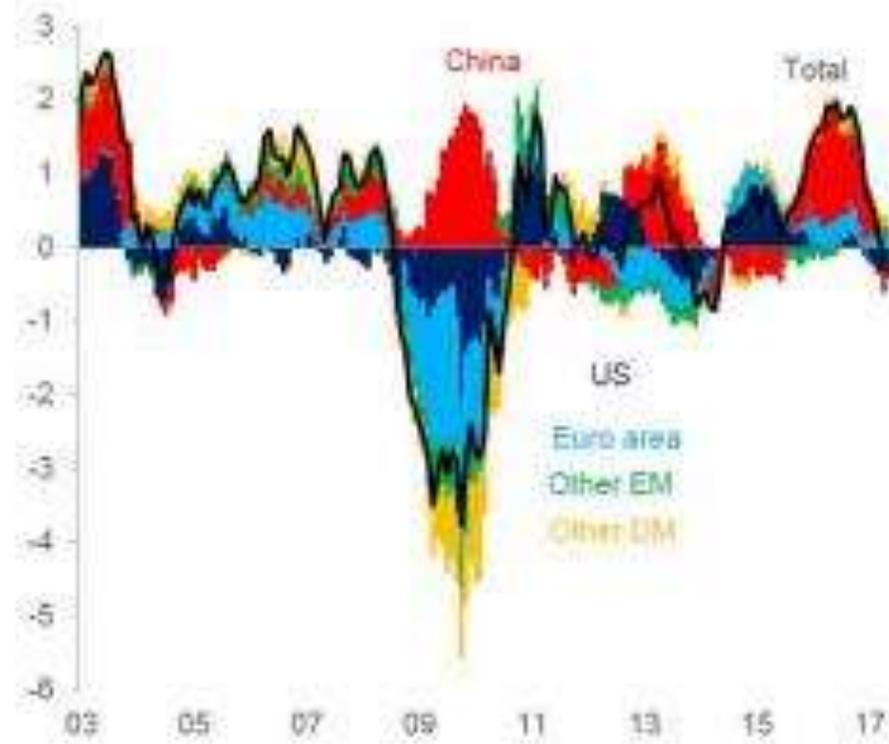
Private sector credit creation\*, rolling 12m, \$tn



Source: National central banks, CEI Research. \*US series contains bank credit only. See 'Global credit creation: a combined financial statement' and M. King, 2017.

## But the impulse is now fading

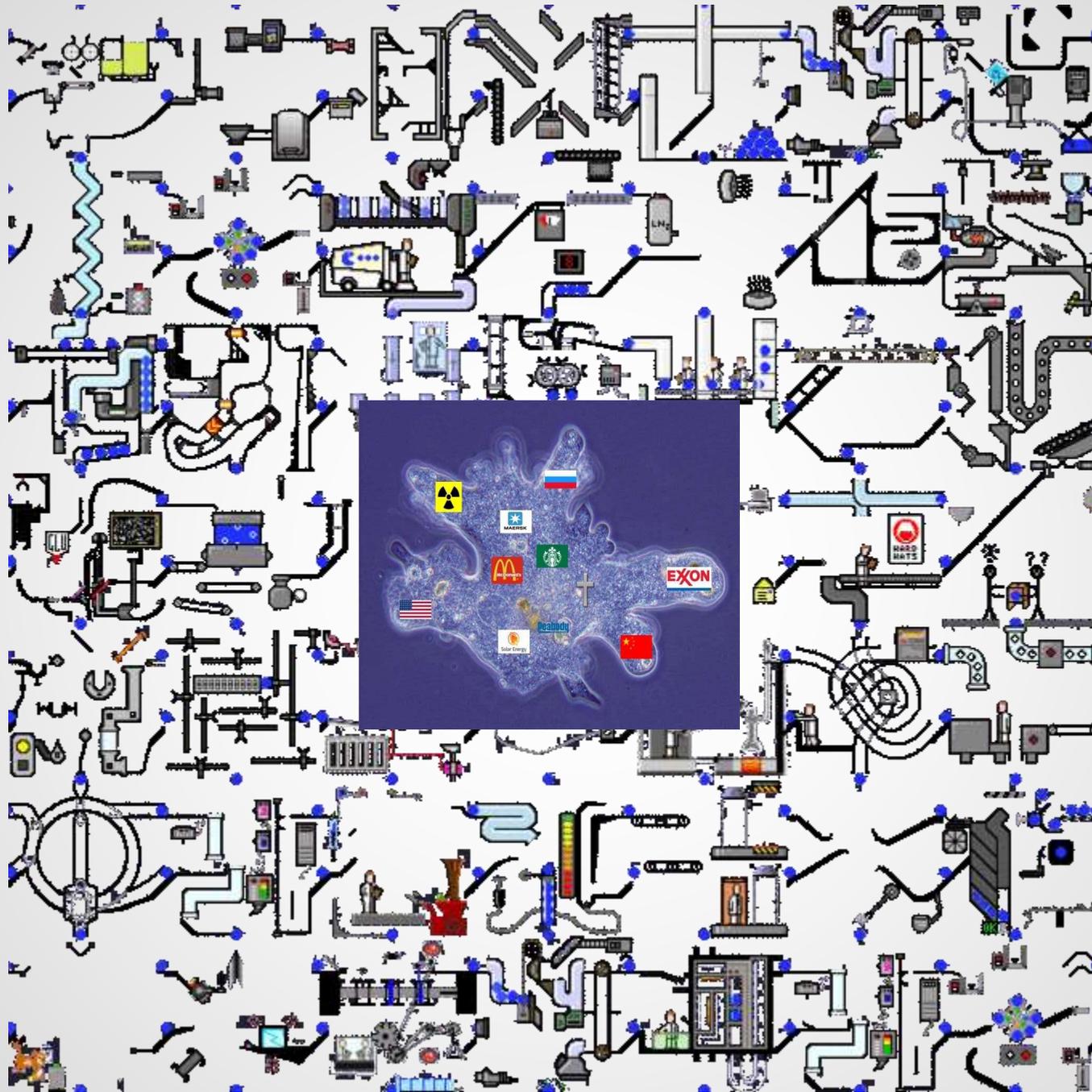
12m chg in private non-financial credit growth rate, % global GDP



Source: BIS, ABS. Uses slightly different credit series from that in previous pages.

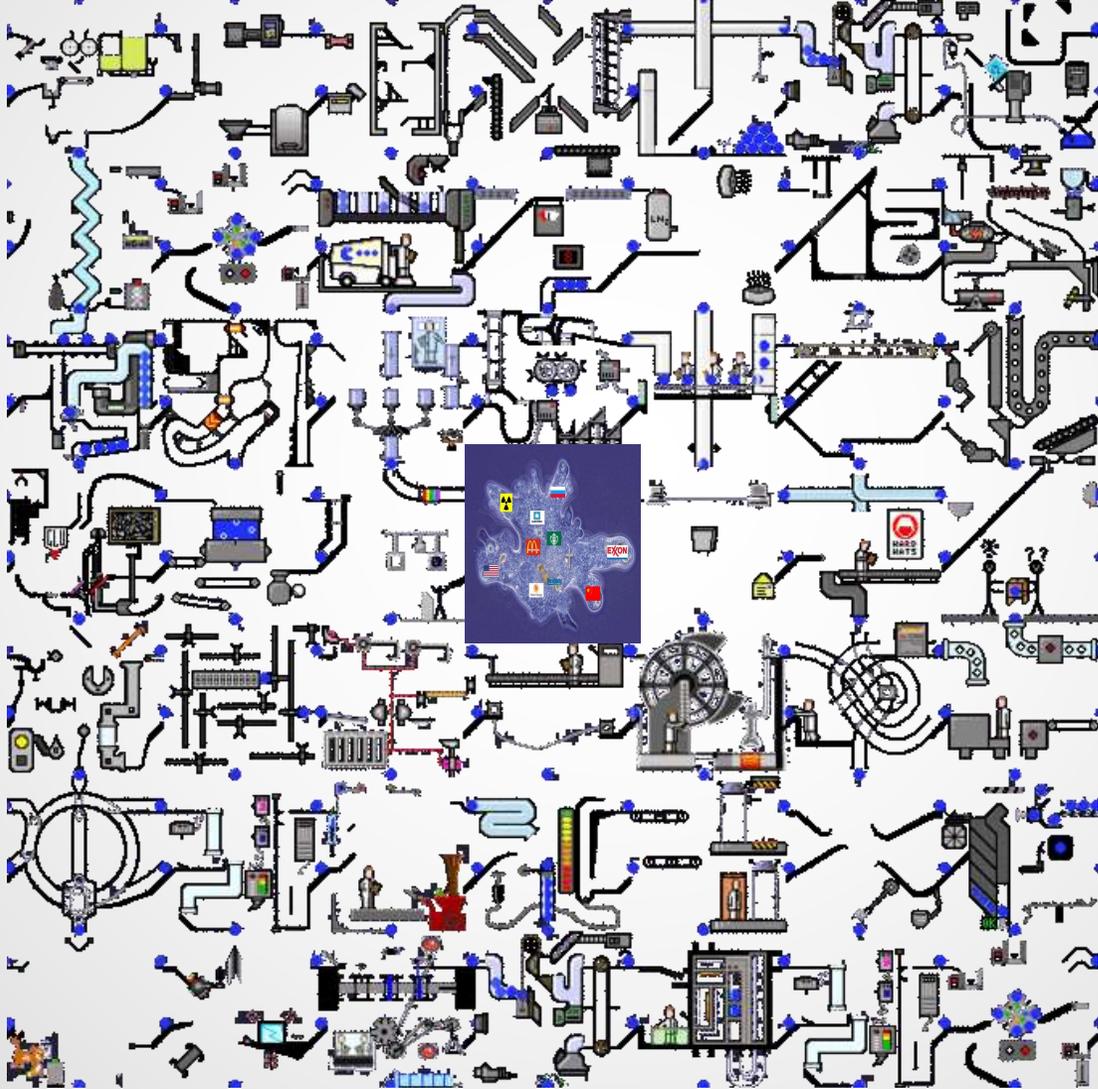
We've just had the biggest surge in the post-crisis era

**6b. As long as we can increase credit, we'll continue to grow. When we can't we won't.**

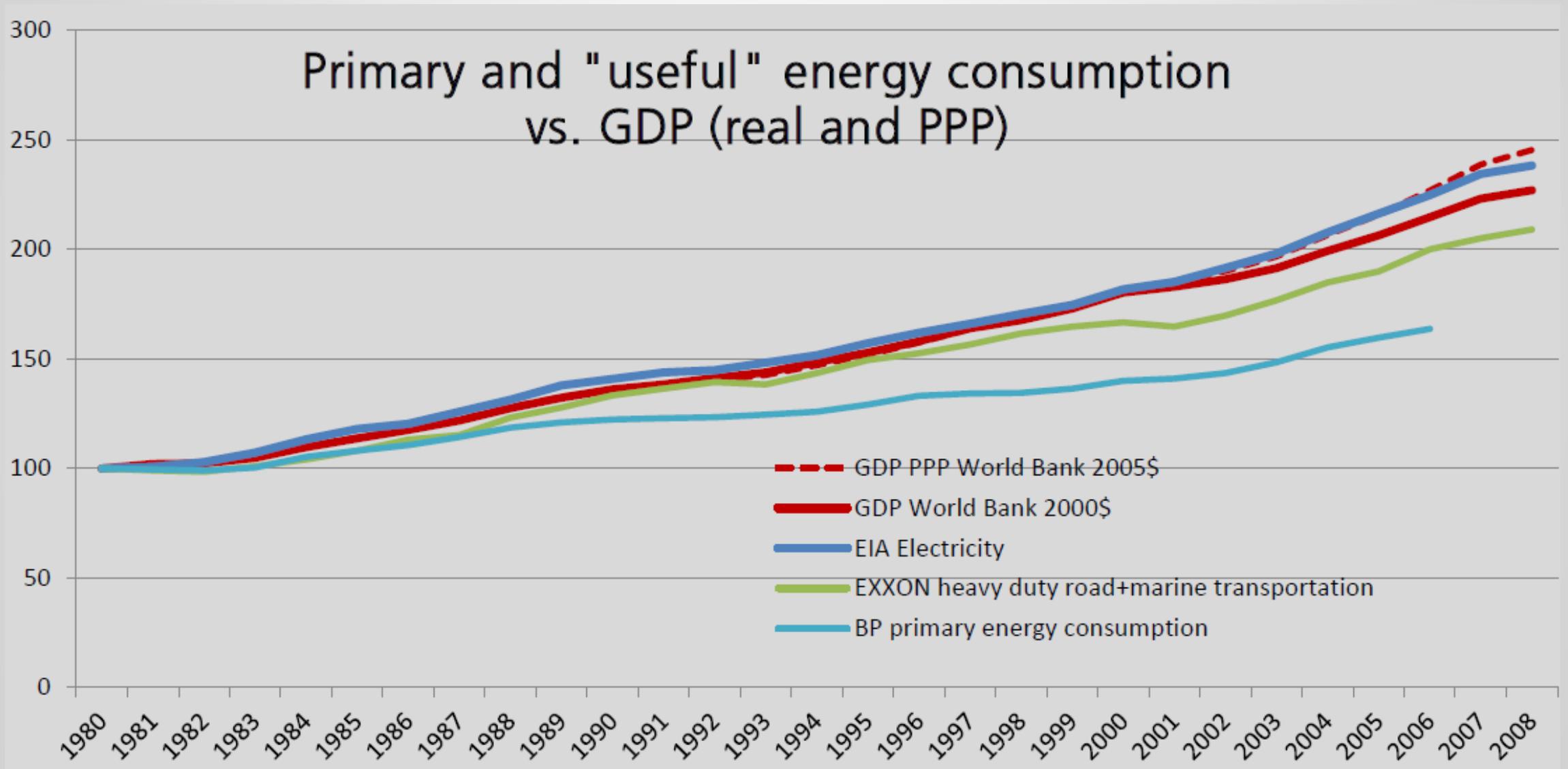


**7. We will keep growing until we run out of 'food'**

# 7b. Then we'll respond to the Great Simplification...



# WORLD GDP



8. Macroeconomics =

G D



## 8b. Microeconomics =



In a world of 100x exosomatic fossil surplus, utility basically means **‘whatever’**.

**(Very brief) Antidotes to the Superorganism**

What's happening seems like somebody's fault...



*Viewed from perspective of superorganism we are all complicit but no one is to blame*



What's happening is largely because fossil slaves are asking for pay raises and thus the Amoeba is eating at a slower pace

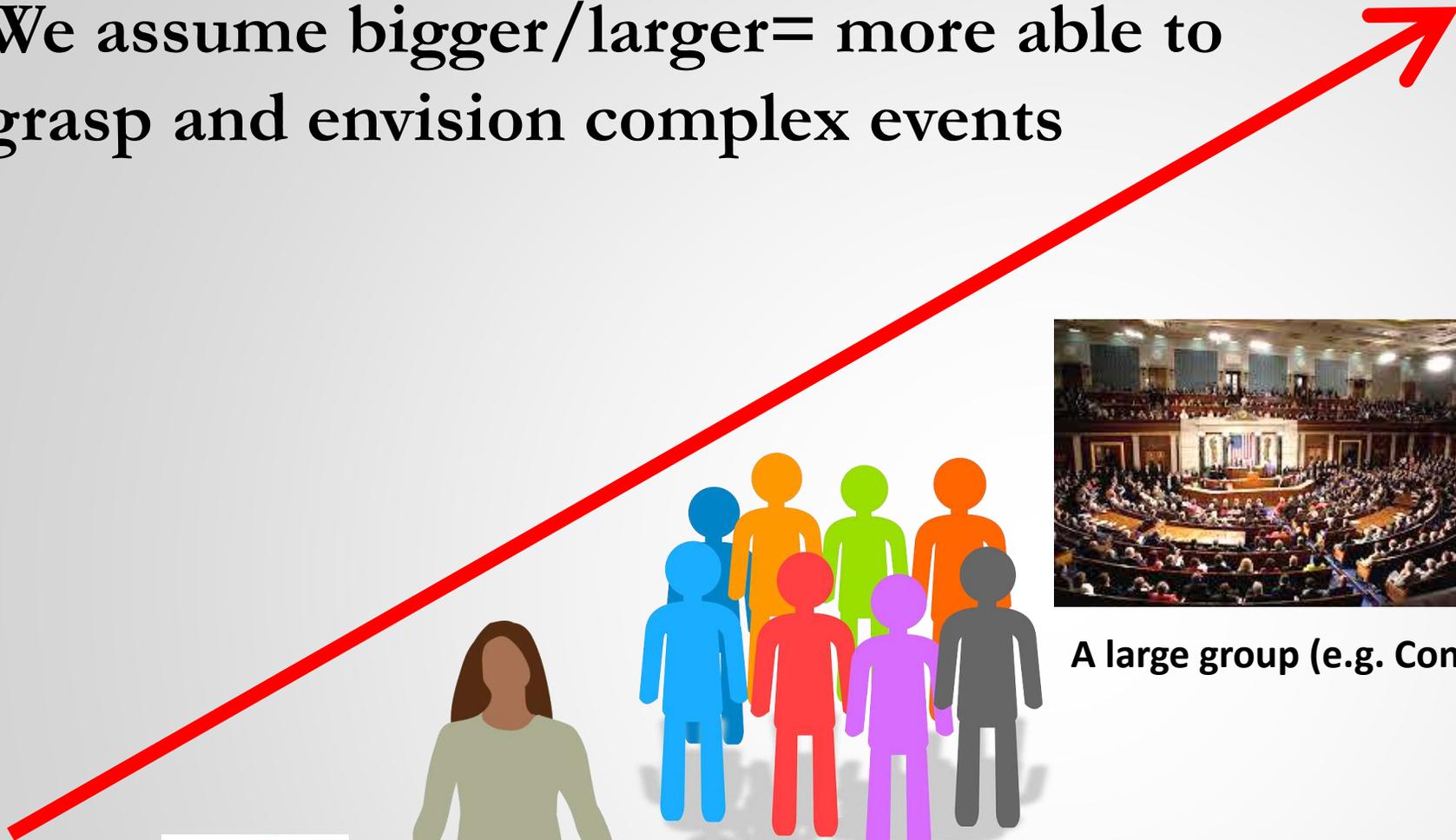


**Agenda  
of  
Gene**

**Sapiencie**

*PINATA*

We assume bigger/larger= more able to grasp and envision complex events



A world of 8 billion



A nation of humans



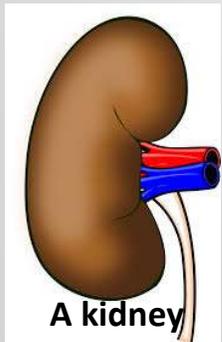
A large group (e.g. Congress)



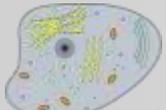
A small group of colleagues



A person



A kidney



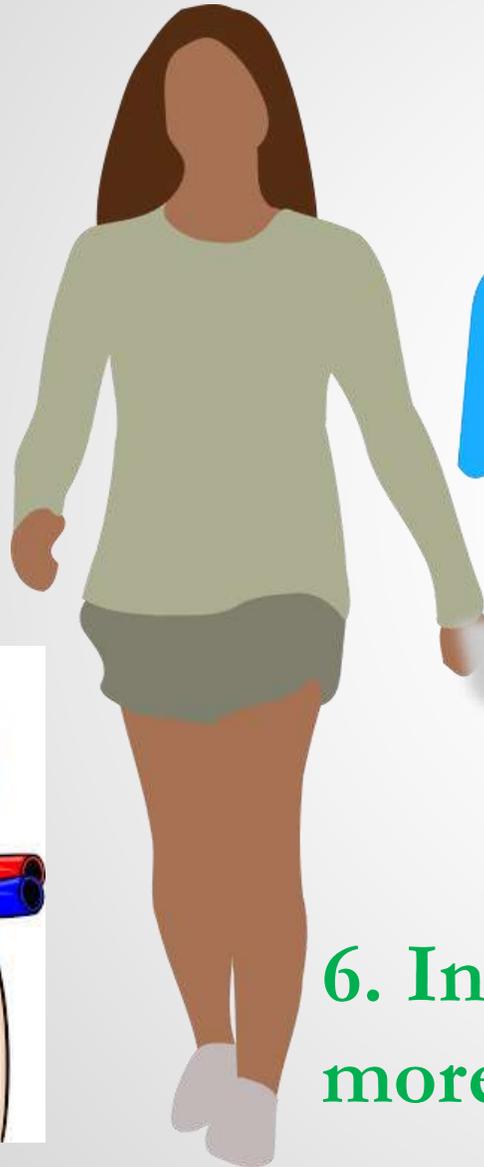
A single human cell

The Larger the group, the Dumber it gets



VERY  
HIGH

HIGH



A person



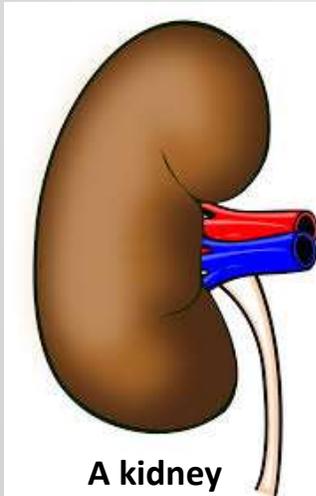
A small group of colleagues

LOW



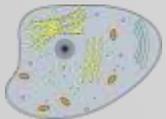
A nation of humans

LOW



A kidney

LOW



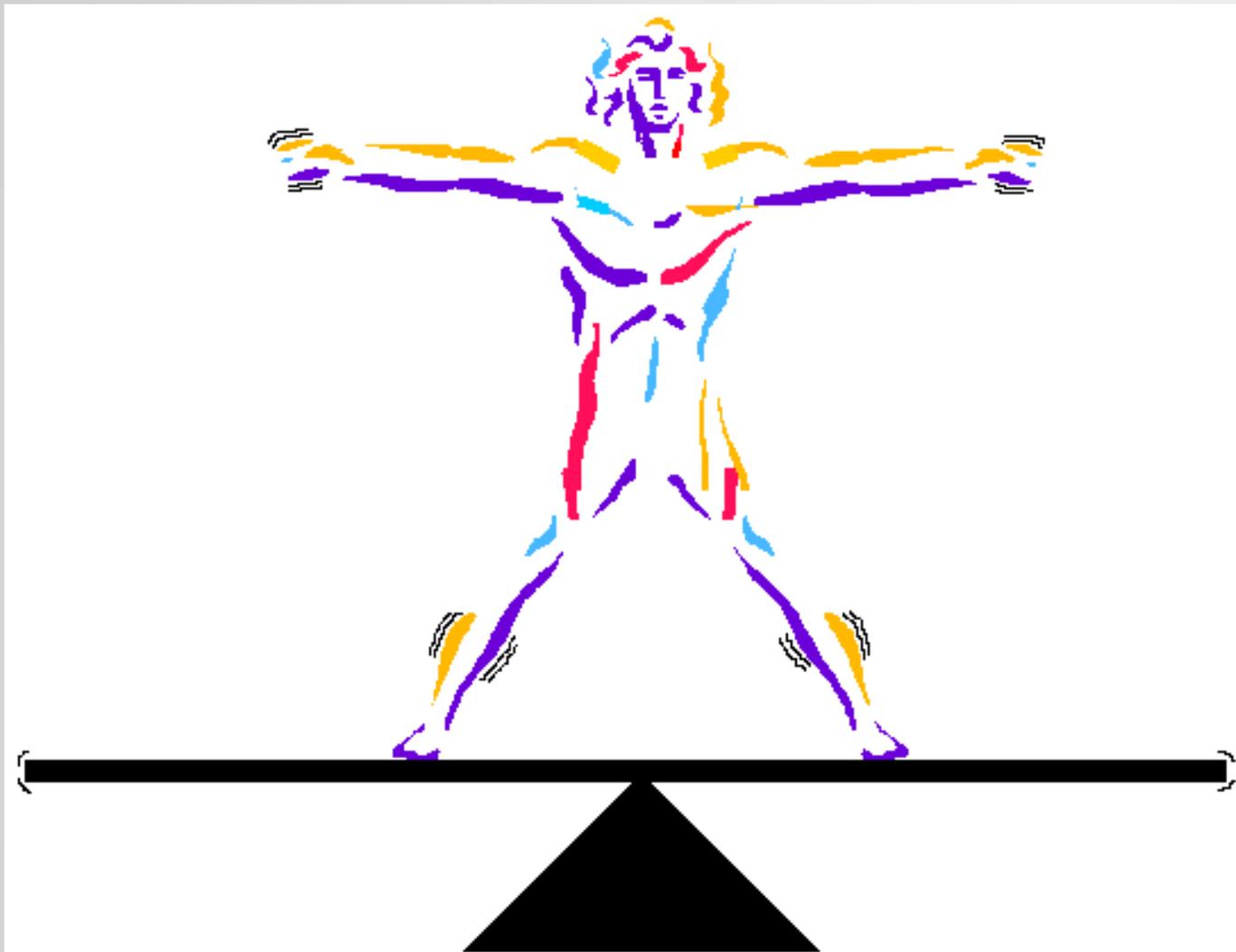
A single human cell

LOW



A world of 8 billion

6. Individuals/small groups have far more power to influence events than is assumed



Good news: our physical needs require energy. Most psychological needs do not. After the superorganism splinters there will be new models of how humans receive 'brain services'. *But we have to understand who we are first.*



The vast majority of pro-future people are working in the pre-speed bump mindset. The post-speed bump – *break up of the superorganism*- requires different strategies.

## SUCH AS:

- ~ Social media projects educating people about resource constraints affecting growth and “living with less”, creating a positive spin on limits
- ~ Low tech inventions that give us similar ‘brain services’ but use lower resource inputs, sourced regionally
- ~ Societal stability projects (UBI type initiatives, support for science and media, etc.)
- ~ Energy and resource based economic planning, including re-regionalizing key supply chains
- ~ A new ‘Reality Party’ political campaign
- ~ New systems thinking activist superheroes

The irony of above list is the Superorganisms existence precludes the natural responses to it...*but not necessarily.*

# The Probability Distribution of the Future

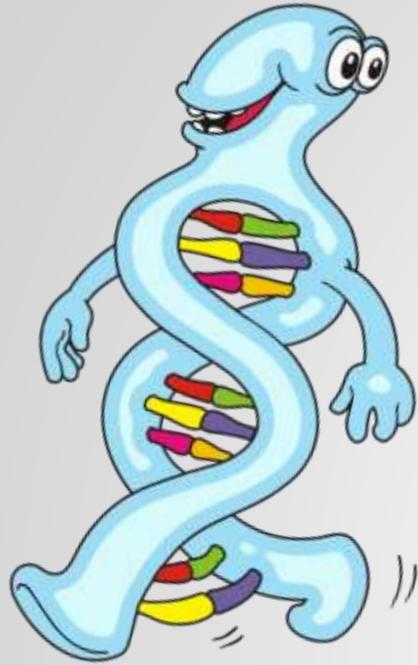


# The “Reality Barbell”



“Owning” who we are  
towards a new culture  
amidst and beyond the  
bottlenecks

Protecting and  
preparing for  
response to limits



We do not live in normal times.  
The world is not yet fully broken.  
What is our species capable of?  
Knowing who we are is first step  
Please add to steering for Good.

