IB Circular Economy

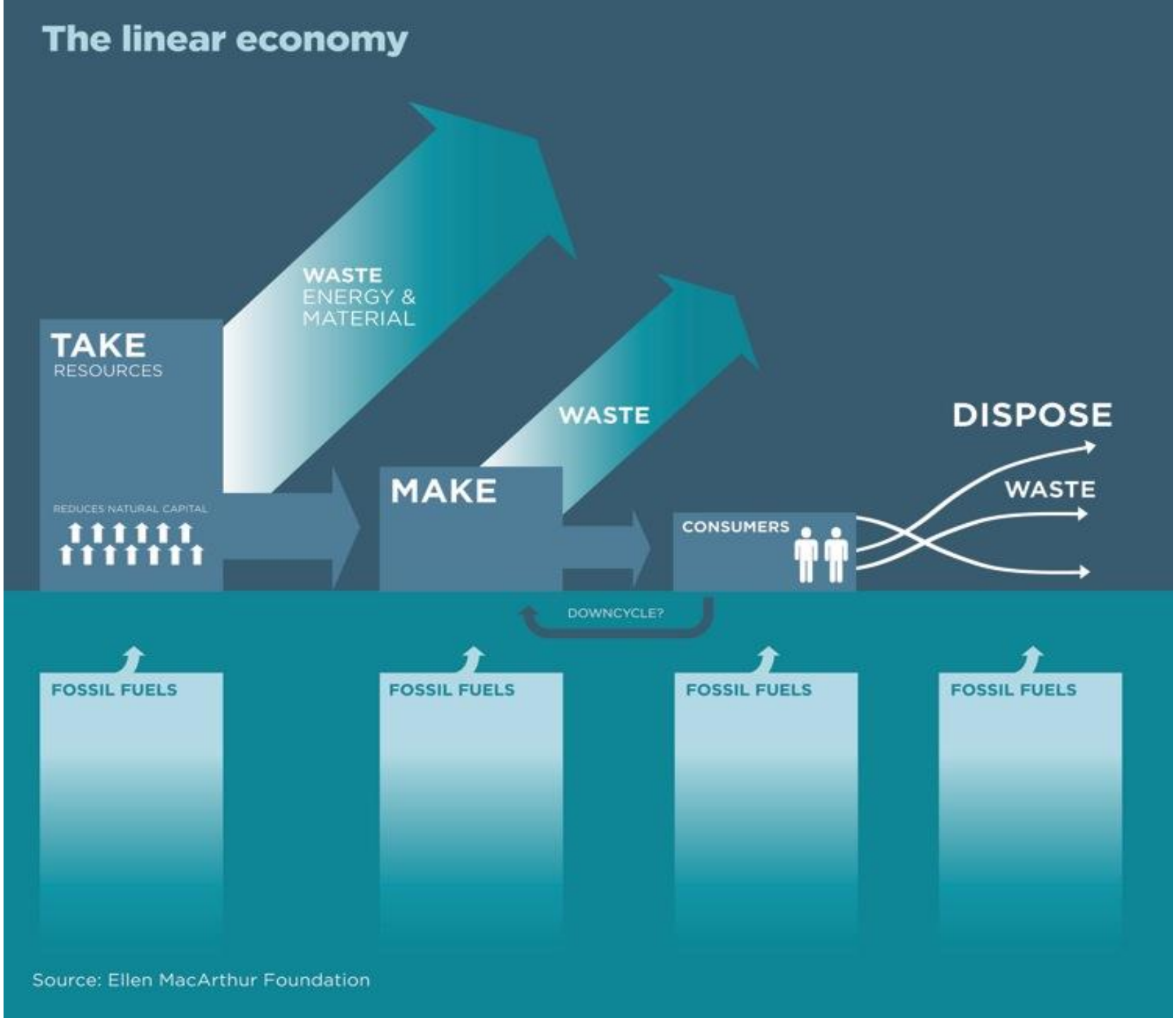
Ken Webster and Sara Heinrich

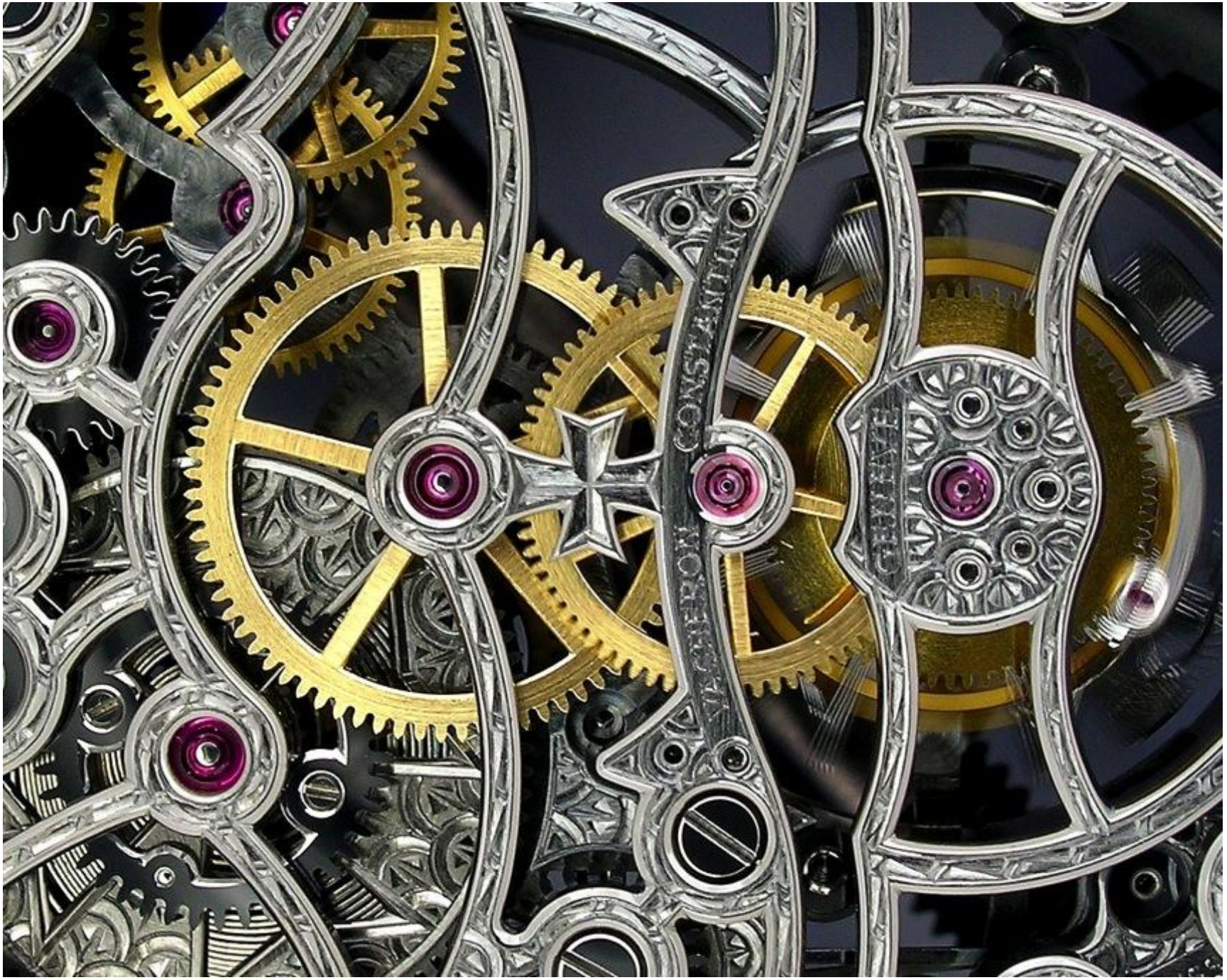
October 2015

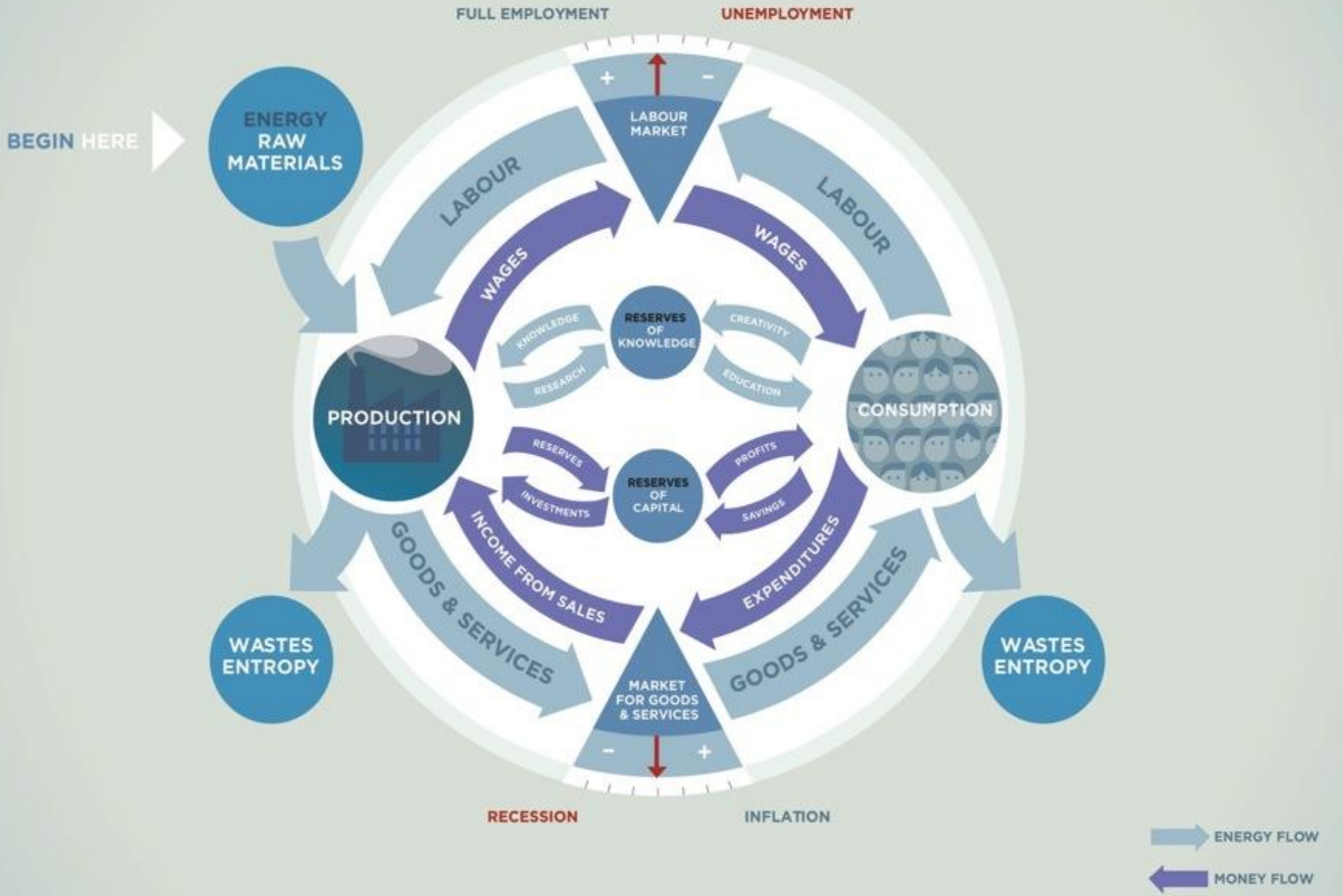
"The mind is inherently embodied.
Thought is mostly unconscious.
Abstract concepts are largely
metaphorical."

George Lakoff “Philosophy in the Flesh”


To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science.
Albert Einstein
THE INFINITELY GREAT
TELESCOPE
THE INFINITELY SMALL
MICROSCOPE
THE INFINITELY COMPLEX
NATURE
SOCIETY
MACROSCOPE
Adapted from: Joel de Rosnay, 1979: The Macroscope


The linear economy
WASTE
ENERGY &
MATERIAL
TAKE
RESOURCES
WASTE
DISPOSE
WASTE
REDUCES NATURAL CAPITAL
MAKE
CONSUMERS
DOWNCYCLE?
FOSSIL FUELS
FOSSIL FUELS
FOSSIL FUELS
FOSSIL FUELS
Source: Ellen MacArthur Foundation


CONSTANTIN
GHIHAI



Adapted from: Joel de Rosnay, 1979. The Macroscope

“The problems standing in the way of prosperity are an unsound… money system and a lack of understanding of the physical reality underlying economics.

What normally passes for economics is really the study of chrematistics. Chrematistics is the study of commerce, of wants and demands and of how they exchange for one another. Or simply put the study of buying and selling.”

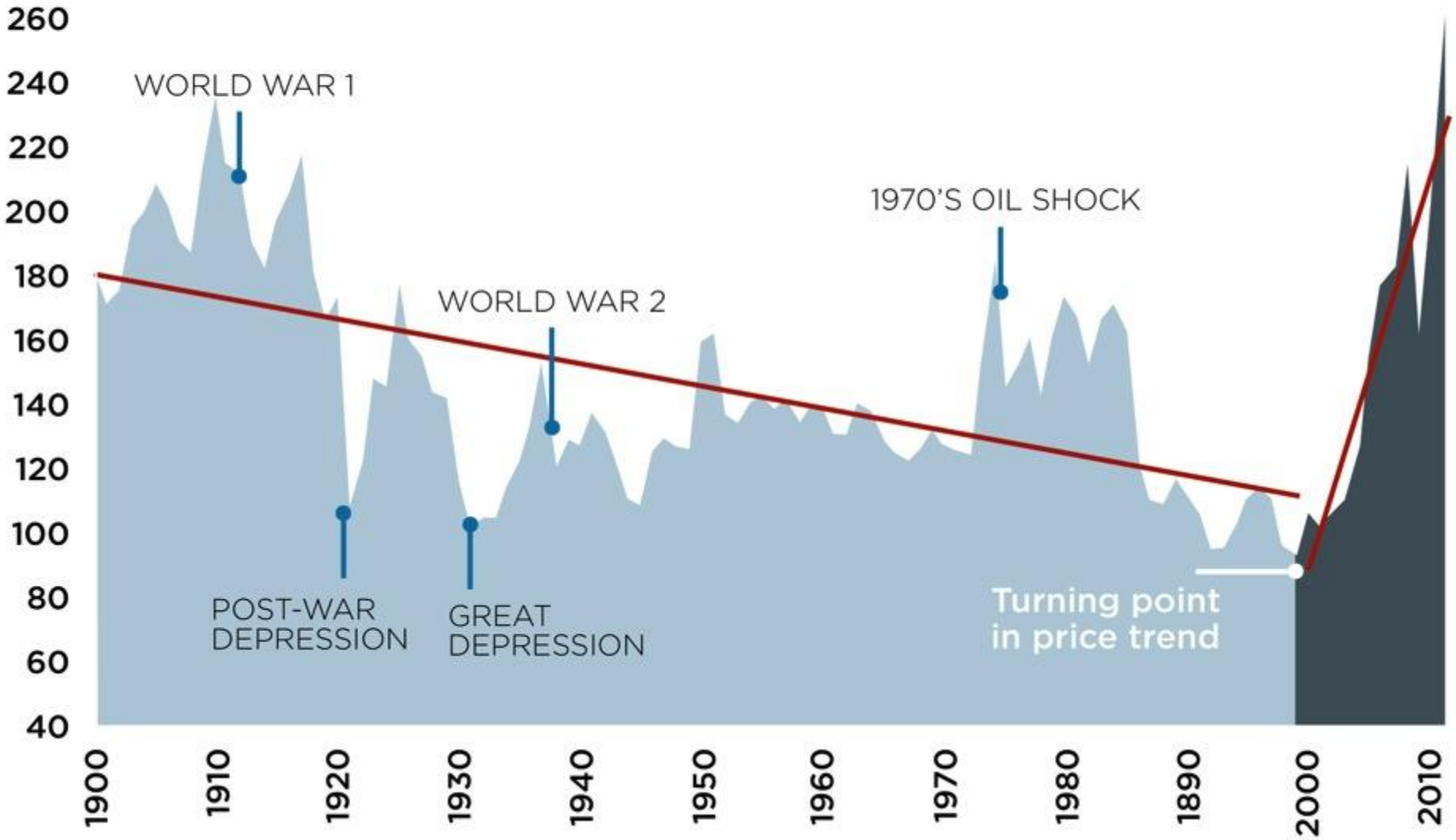
Frederick Soddy Wealth, Virtual Wealth, and Debt: The Solution of the Economic Paradox (1926)

GDP GROWTH RATE FOR 13 OECD COUNTRIES (AVERAGE)

Source: Bonaiuti from OECD data

SHARP PRICE INCREASES IN COMMODITIES SINCE 2000 HAVE ERASED ALL THE REAL PRICE DECLINES OF THE 20TH CENTURY

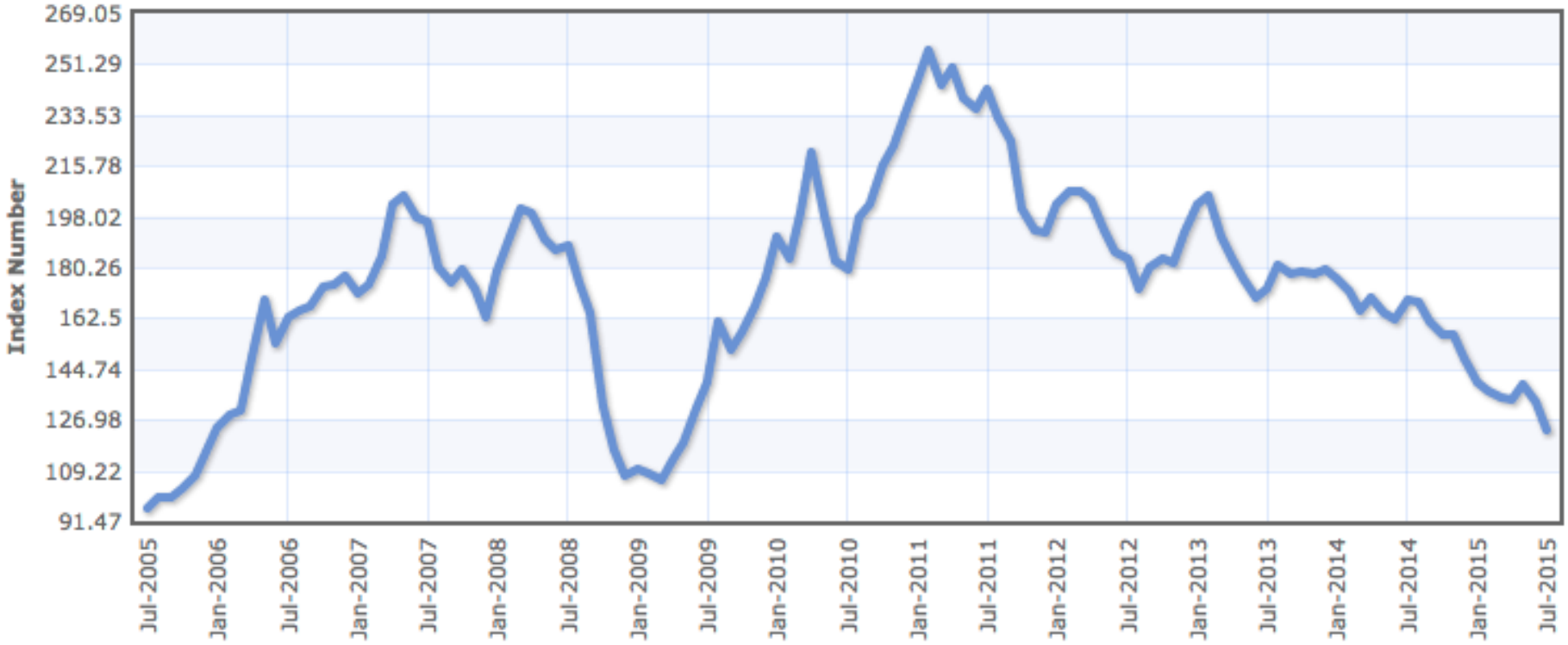
MCKINSEY COMMODITY PRICE INDEX (YEARS 1999-2001=100)



Commodity Metals Price Index Monthly Price - Index Number

Range 6m 1y 5y 10y 15y 20y 25y 30y

Jul 2005 - Jul 2015: 26.710 (27.74 %)

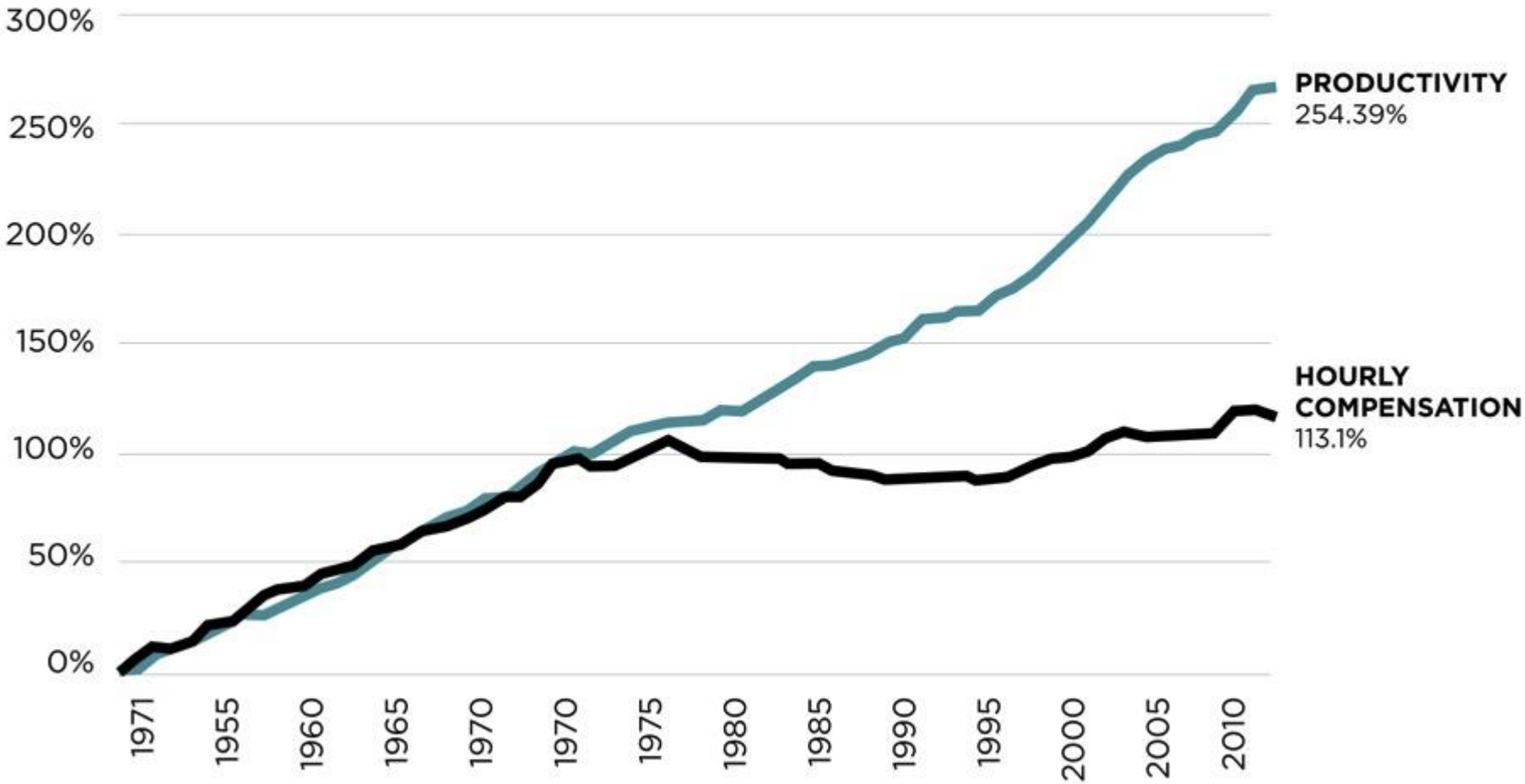


Description: Commodity Metals Price Index, 2005 = 100, includes Copper, Aluminum, Iron Ore, Tin, Nickel, Zinc, Lead, and Uranium Price Indices

GROWTH OF REAL HOURLY COMPENSATION

PRODUCTION/NONSUPERVISORY WORKERS
AND PRODUCTIVITY 1948-2011

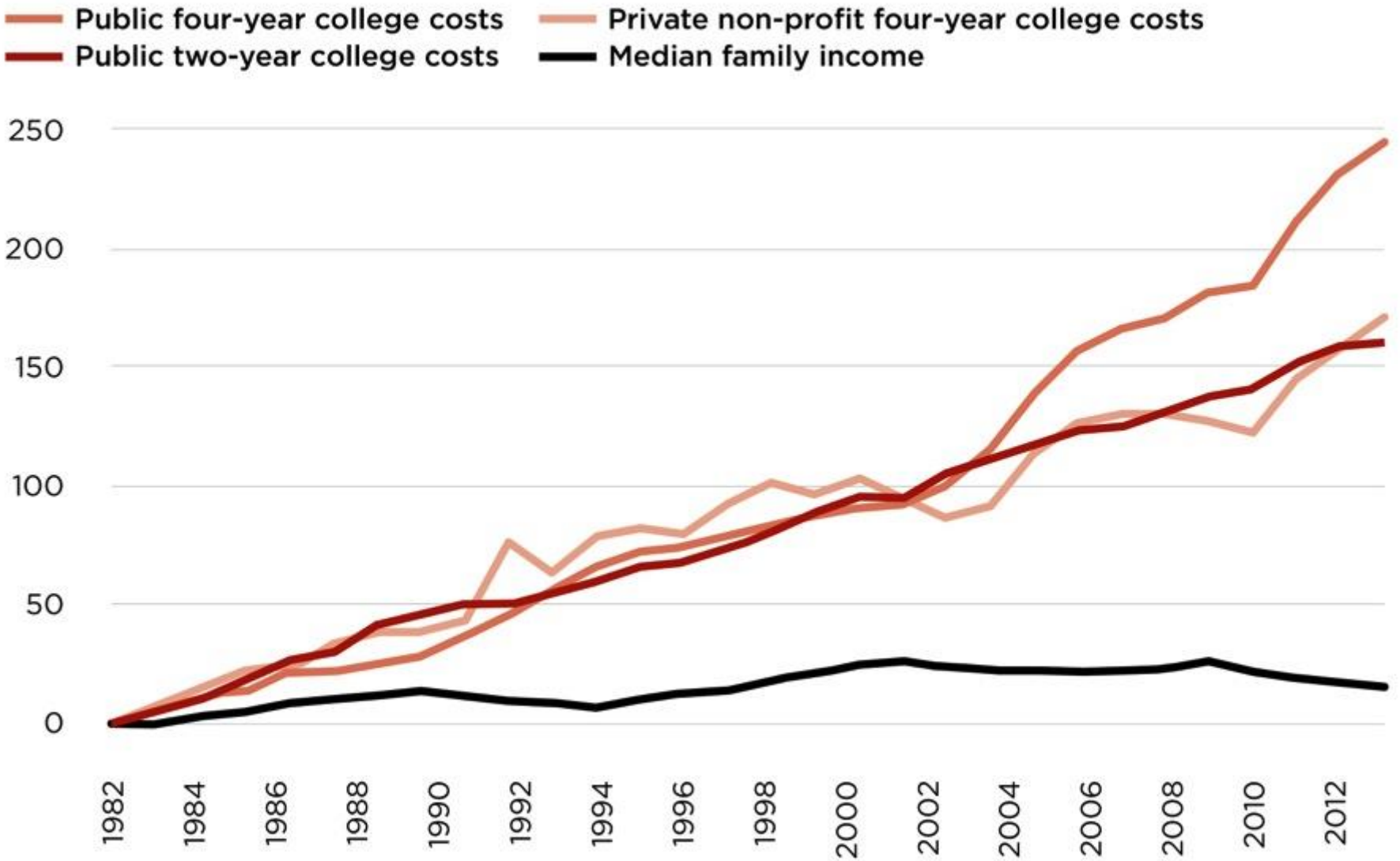
CUMULATIVE PERCENT CHANGE SINCE 1948



Source: Paul Krugman

COLLEGE COSTS AND MEDIAN FAMILY INCOME, 1982–2012

Inflation-adjusted increases

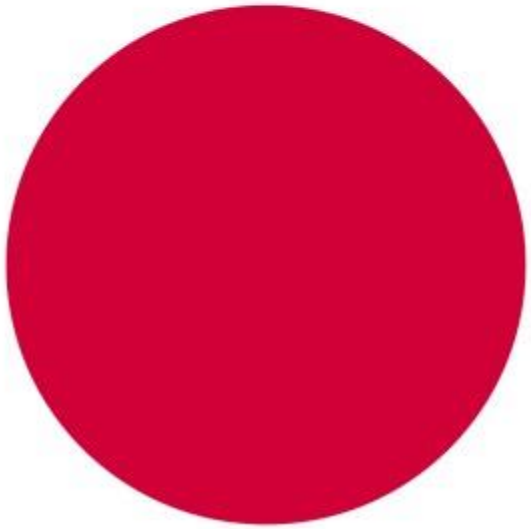


Sources: The College Board, Annual Survey of Colleges; National Centre for Educational Statistics, Integrated Post-secondary Education and Data System. Center for American Progress.


we've decided we'd like you to work from home, preferably for someone else
MODERN TOSS

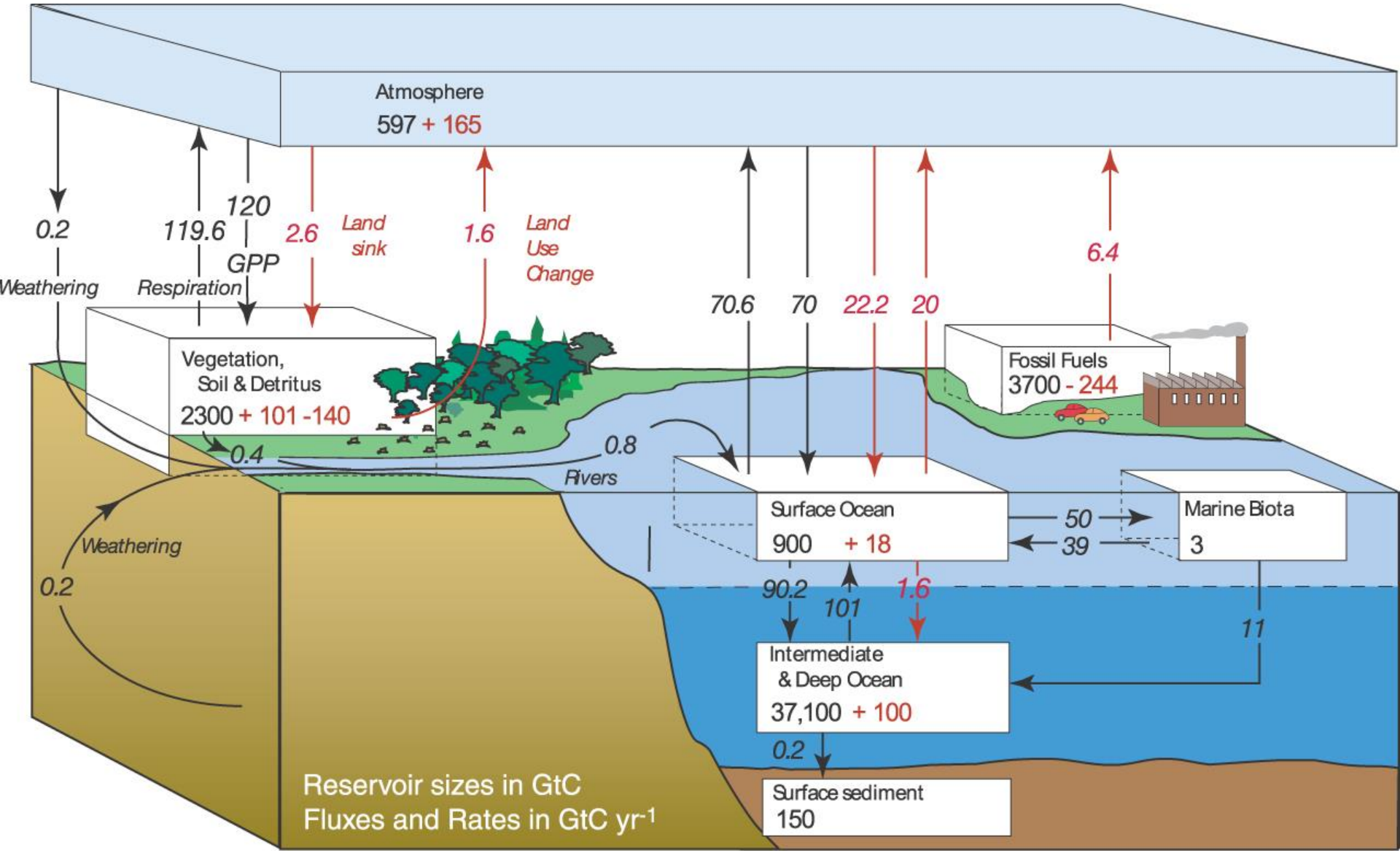
THE 2008 BAILOUT VERSUS OTHER LARGE US GOVERNMENT PROJECTS

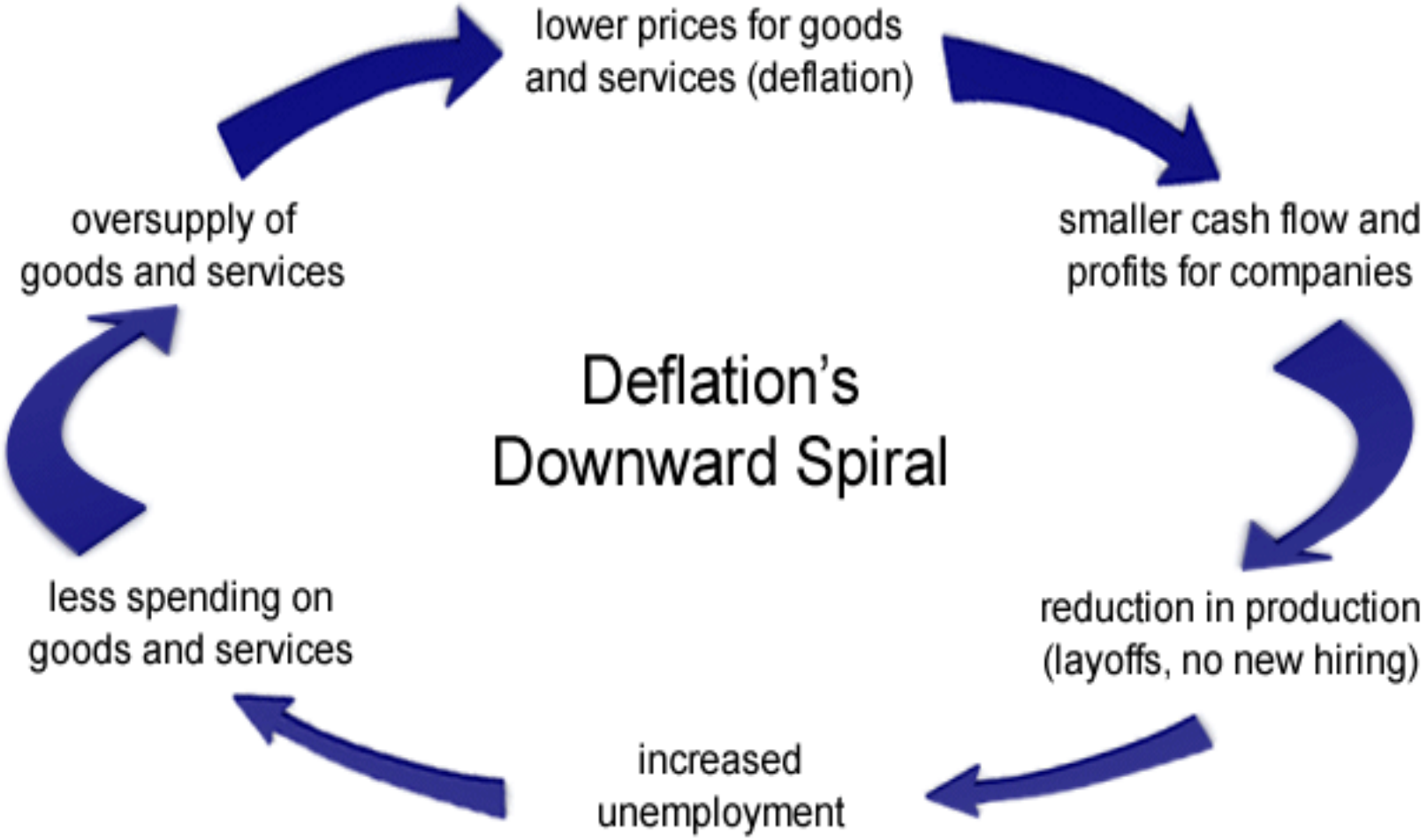
MARSHALL PLAN	USD 115,000,000,000
LOUISANA PURCHASE	USD 217,000,000,000
MOONSHOT	USD 237,000,000,000
S&L CRISIS	USD 256,000,000,000
KOREAN WAR	USD 454,000,000,000
THE NEW DEAL	USD 500,000,000,000
IRAQ WAR	USD 597,000,000,000
VIETNAM	USD 698,000,000,000
NASA (all time budget)	USD 851,000,000,000
TOTAL	**USD 3,925,000,000,000**



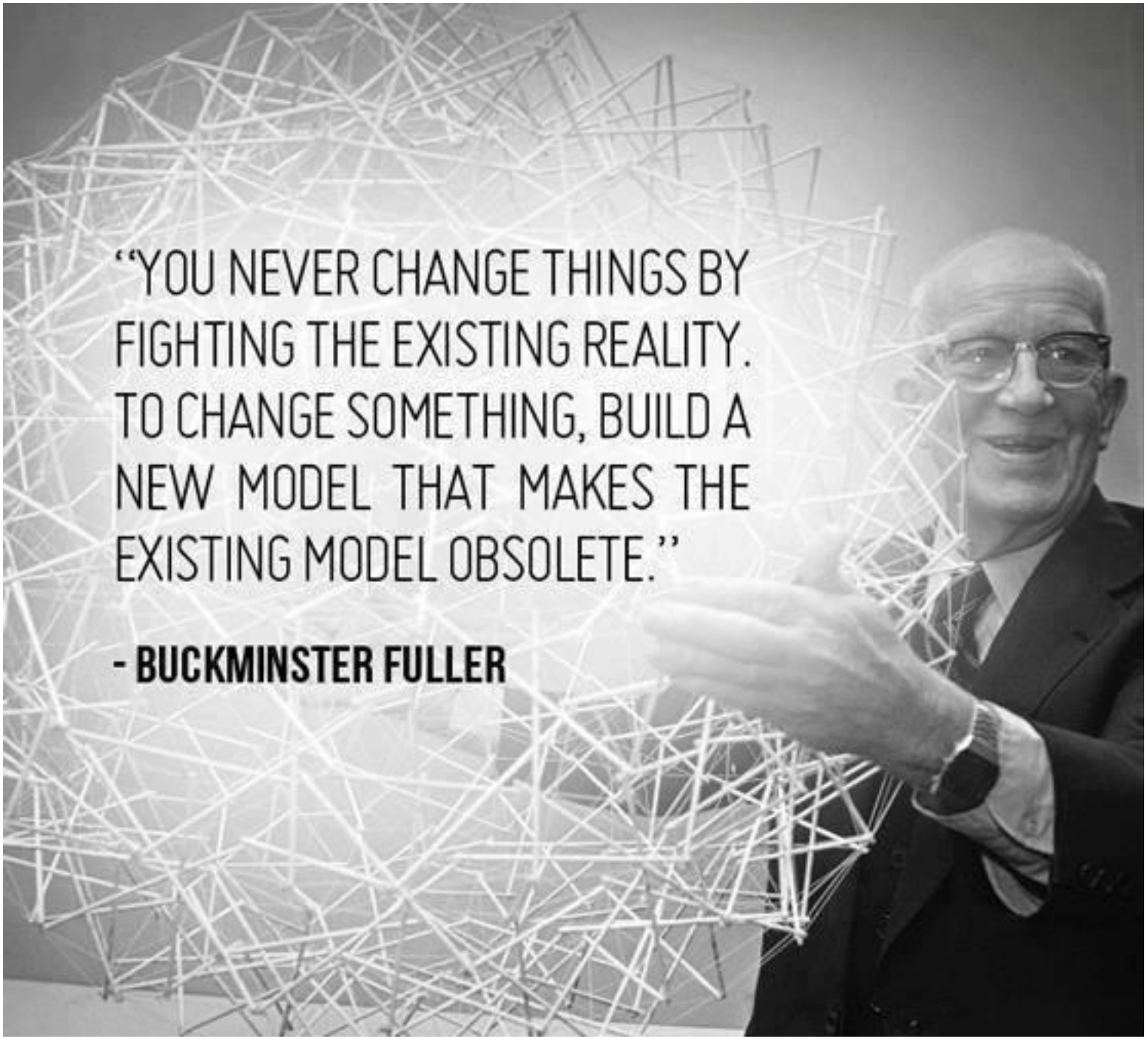
NOV 2008 BAILOUT	**USD 4,616,000,000,000**

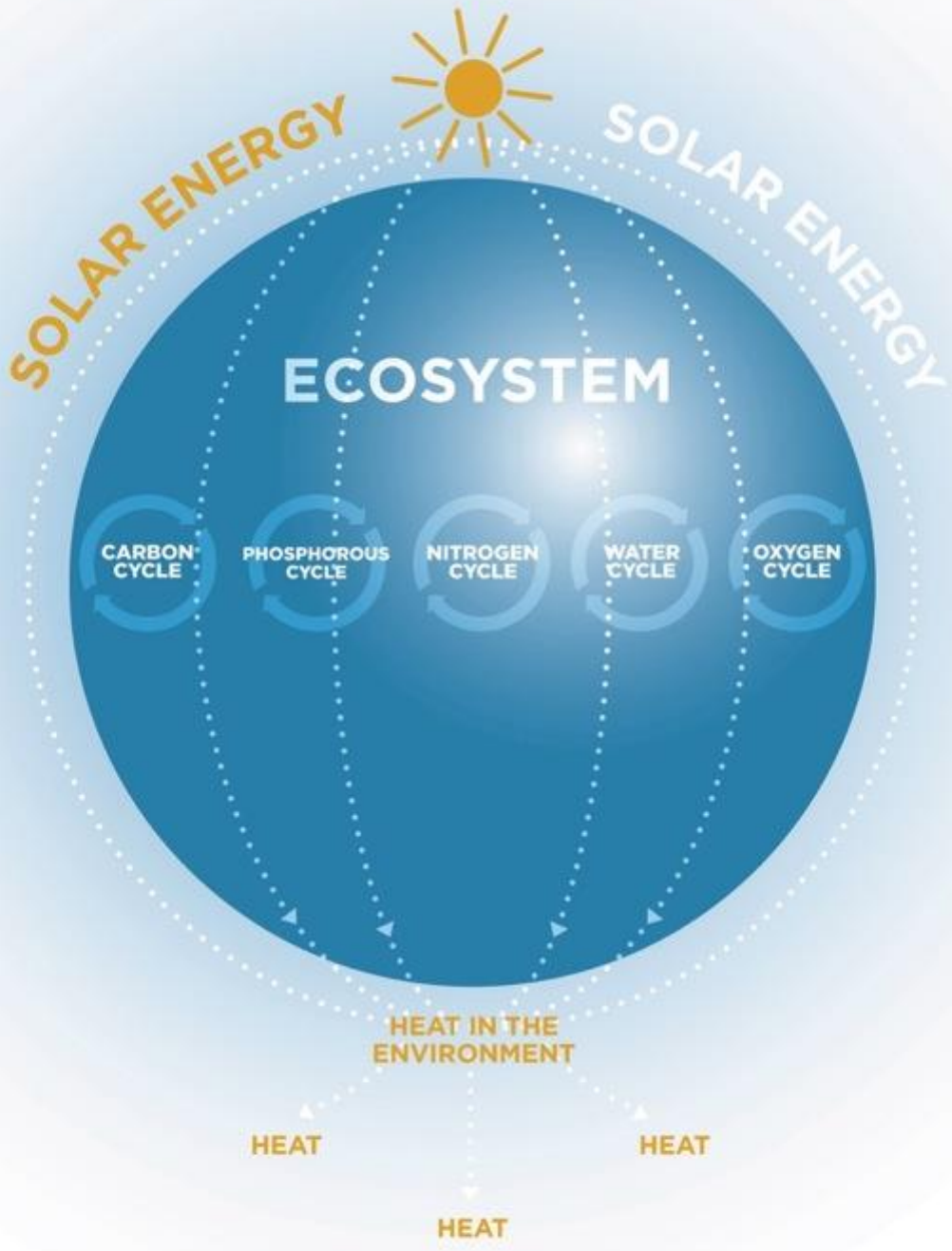
Source: www.voltagecreative.com/blog


Atmosphere
597 + 165
0.2
Weathering
119.6
Respiration
120
GPP
2.6
Land sink
1.6
Land Use Change
70.6
70
22.2
20
6.4
Vegetation, Soil & Detritus
2300 + 101 -140
0.4
0.8
Rivers
Fossil Fuels
3700 - 244
Surface Ocean
900 + 18
50
39
Marine Biota
3
Weathering
0.2
90.2
101
1.6
11
Intermediate & Deep Ocean
37,100 + 100
0.2
Surface sediment
150
Reservoir sizes in GtC
Fluxes and Rates in GtC yr-1


lower prices for goods and services (deflation)
smaller cash flow and profits for companies
reduction in production (layoffs, no new hiring)
increased unemployment
less spending on goods and services
oversupply of goods and services
Deflation's Downward Spiral


Human adaptability and resilience in full flow.
2
4
V-Power
FuelSave
After the financial crash... an improvised wedding venue in Greece.


"YOU NEVER CHANGE THINGS BY FIGHTING THE EXISTING REALITY. TO CHANGE SOMETHING, BUILD A NEW MODEL THAT MAKES THE EXISTING MODEL OBSOLETE."
- BUCKMINSTER FULLER


SOLAR ENERGY
SOLAR ENERGY
ECOSYSTEM
CARBON CYCLE
PHOSPHOROUS CYCLE
NITROGEN CYCLE
WATER CYCLE
OXYGEN CYCLE
HEAT IN THE ENVIRONMENT
HEAT
HEAT
HEAT

SIMPLE, LINEAR CAUSALITY

ONE MAJOR CAUSE

LACK OF CAUSALITY DISORDERED COMPLEXITY

WEAKLY COUPLED BODIES

REALM OF COMPLEXITY
INTRICATE DYNAMIC PATTERNS

ORDERED COMPLEXITY

INTERTWINED CAUSALITY

MUTUAL CAUSALITY

MECHANICS

STATISTICS

Adapted from: Sally Goerner, 1999. After the Clockwork Universe

Performance Economy – Walter Stahel

Cradle to Cradle – McDonough and Braungart

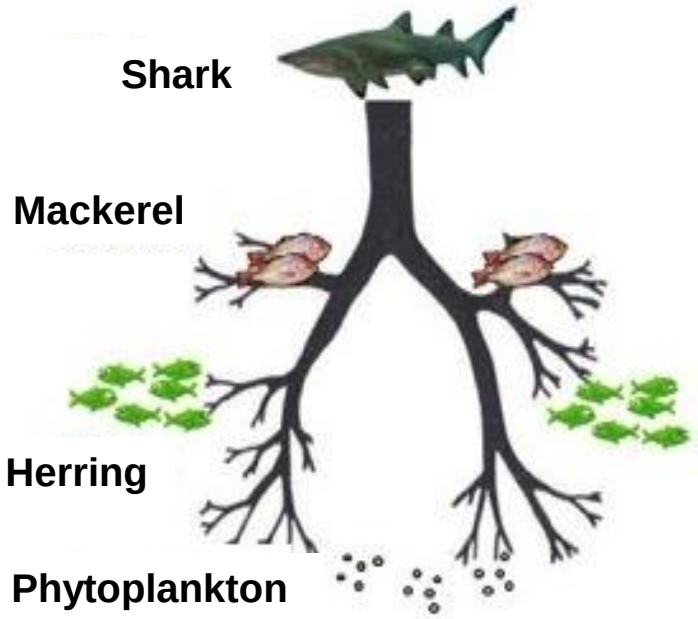
Natural Capitalism – Amory and Hunter Lovins

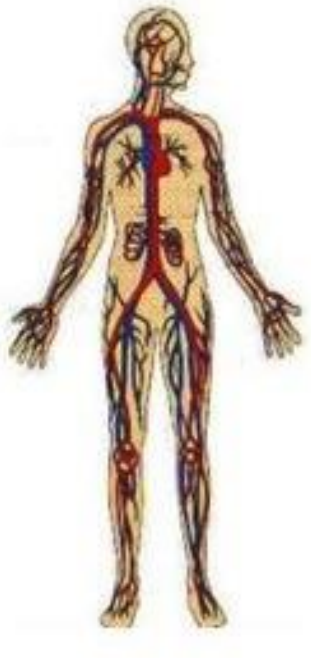
Industrial Ecology – Thomas Graedel

Biomimicry– Janine Benyus

Different scales

Fewer, Bigger, More efficient

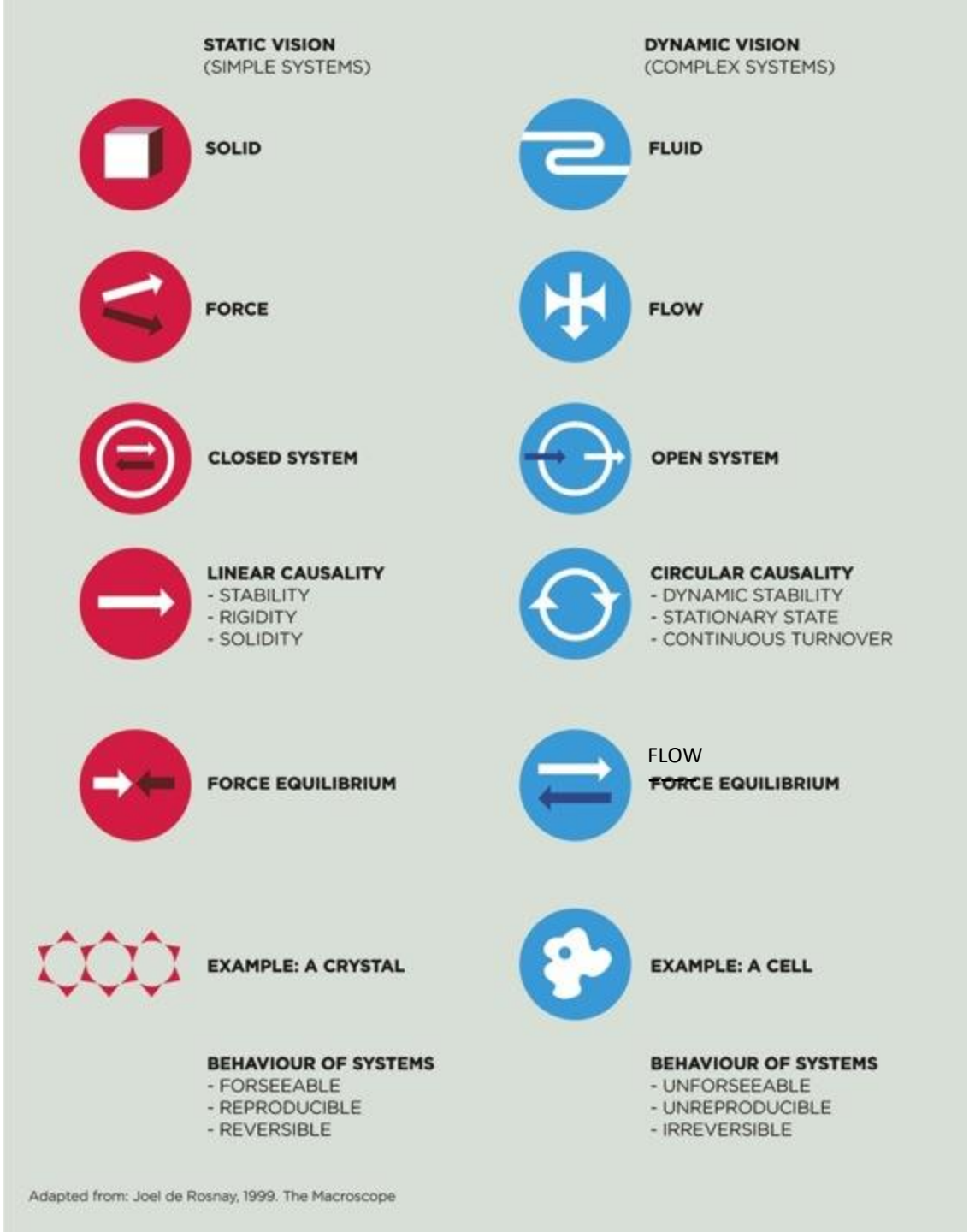


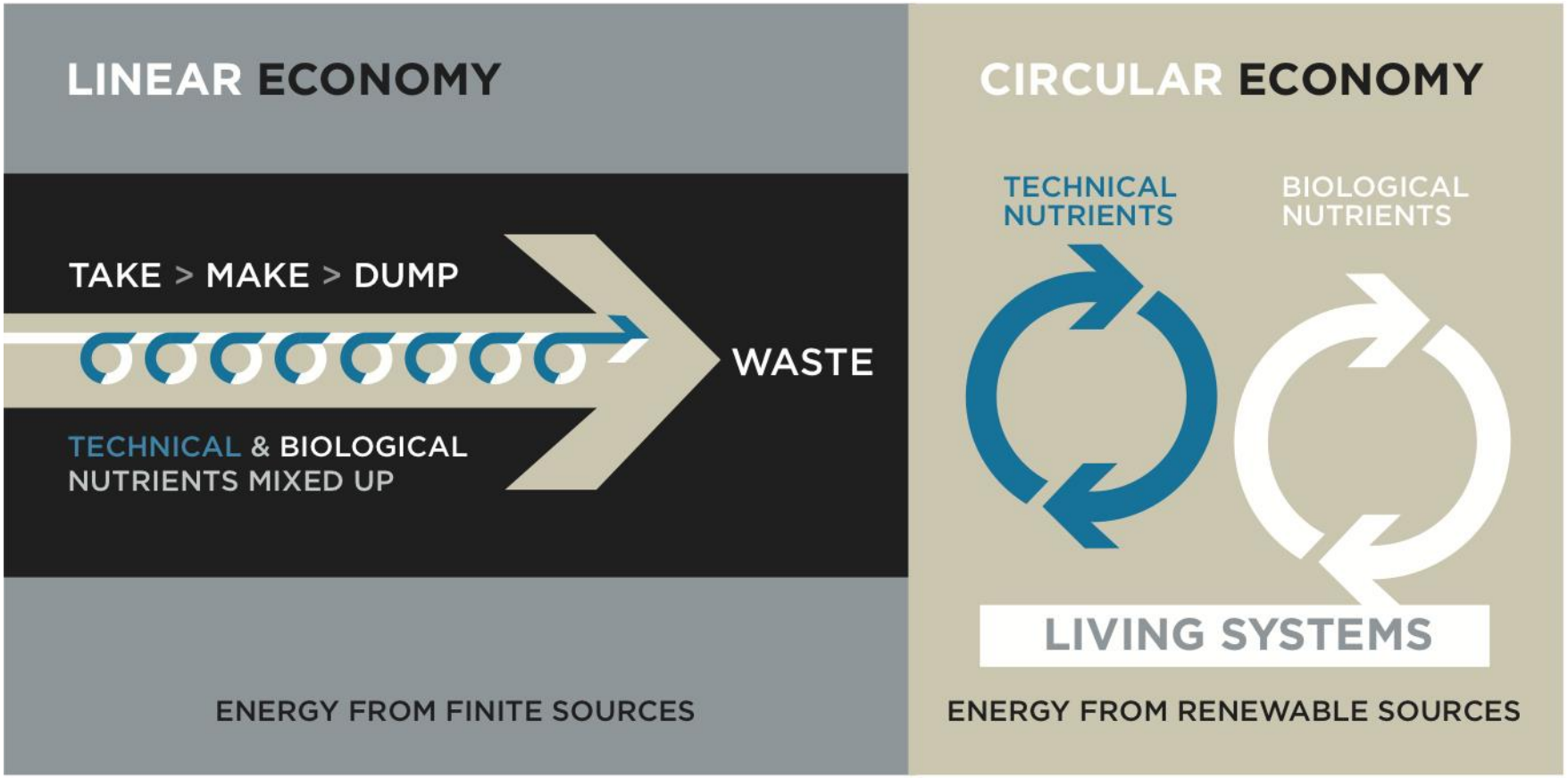


Many, Smaller, More Diverse, More Resilient

limited case

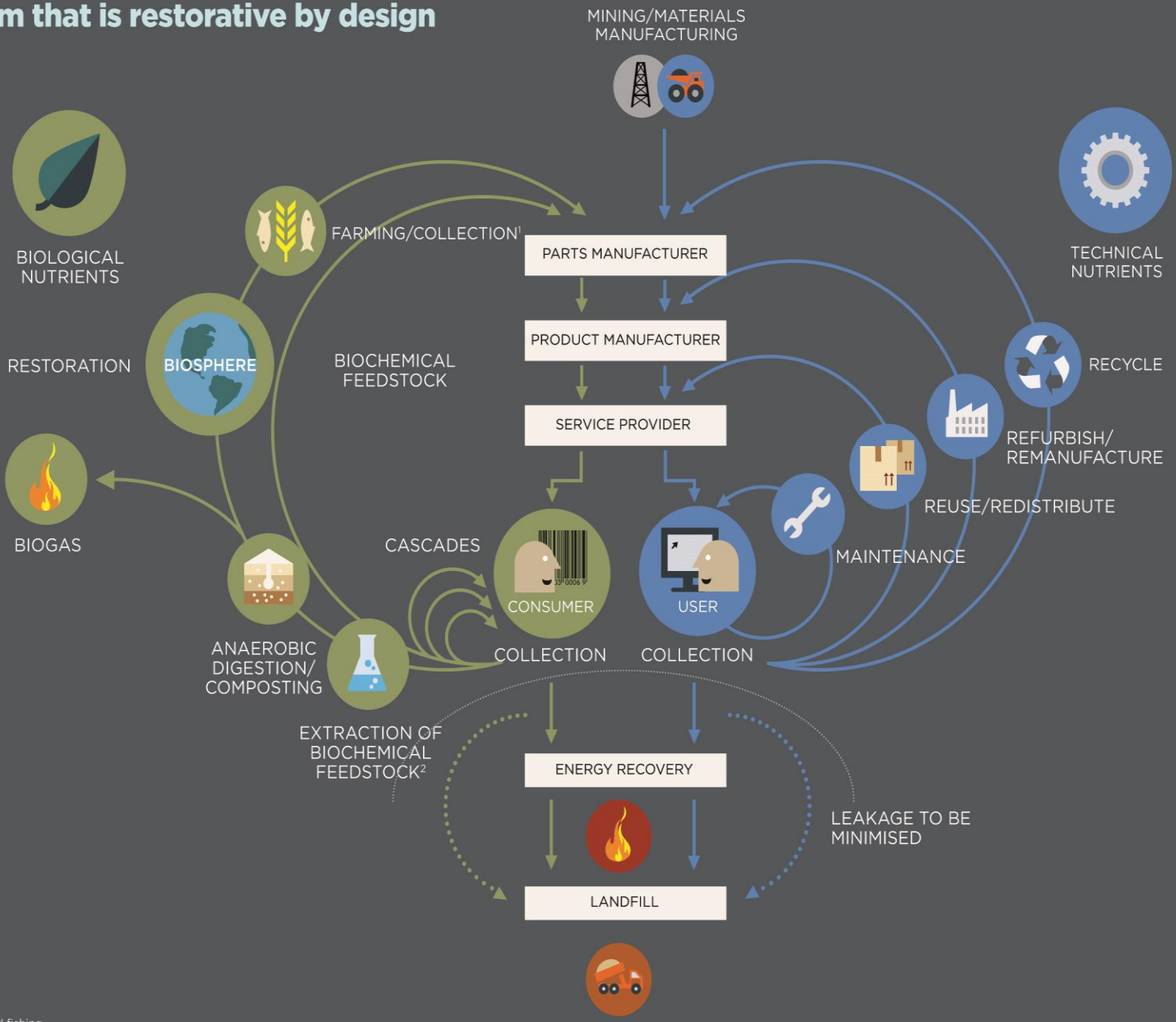
general case





AFTER W McDONOUGH AND M BRAUNGART

The circular economy - an industrial system that is restorative by design



1 Hunting and fishing
2 Can take both post-harvest and post-consumer waste as an input
SOURCE: Ellen MacArthur Foundation - Adapted from the Cradle to Cradle Design Protocol by Braungart & McDonough

INSIGHT & ANALYSIS : *Providing robust evidence about the benefits of the CE*

Jointly with McKinsey & Company, and most recently with the Word Economic Forum we have undertaken research to address a number of key questions:

1. Can the circular economy decouple economic growth from resource constraints?
2. Is this approach commercially interesting to individual businesses?
3. Is this approach beneficial to the economy at large?
4. What are the levers for scaling up this approach across the global economy?

We identified four key principles of value creation

Power of the inner circle

Power of circling longer

Power of cascaded use

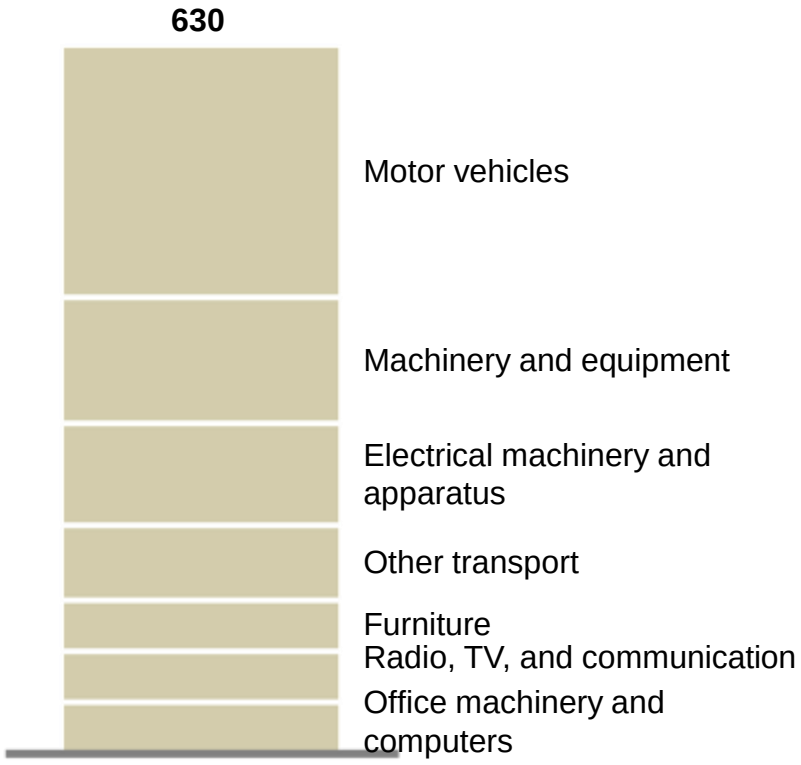
Power of pure, non-toxic or easier-to-separate inputs and designs

The economic case is compelling

ADVANCED SCENARIO | ROUGH ESTIMATE

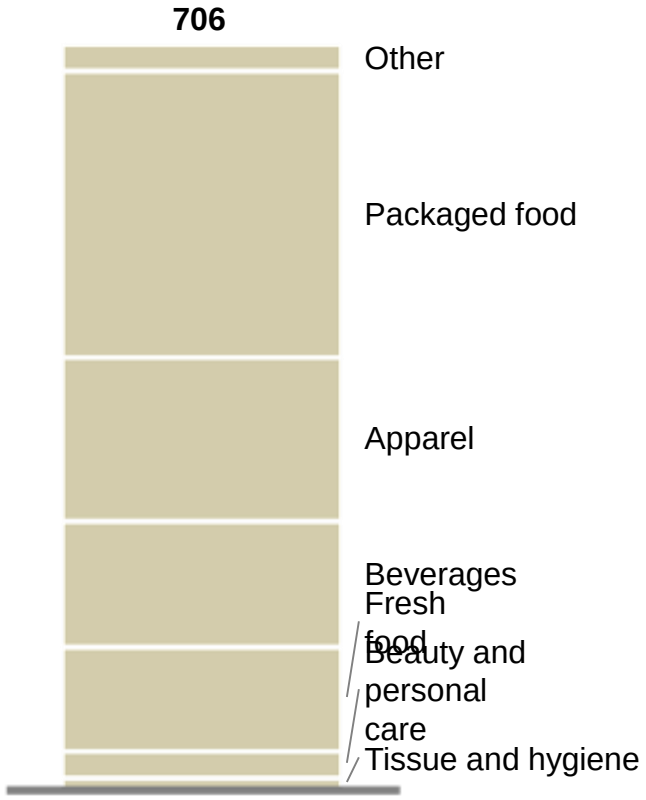
Complex durables with medium lifespans, EU

USD billion per year, net material cost savings based on current total input costs per sector



Consumer industries, global

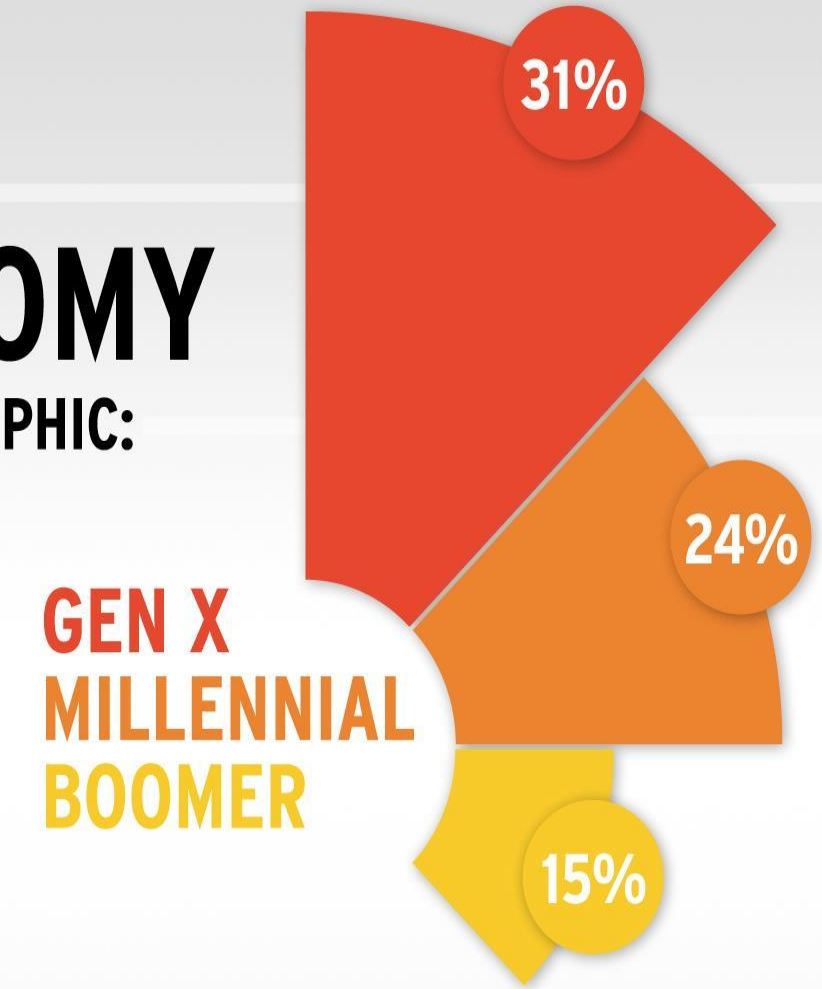
USD billion per year, net material cost savings based on total material savings from consumer categories



APPEAL OF A

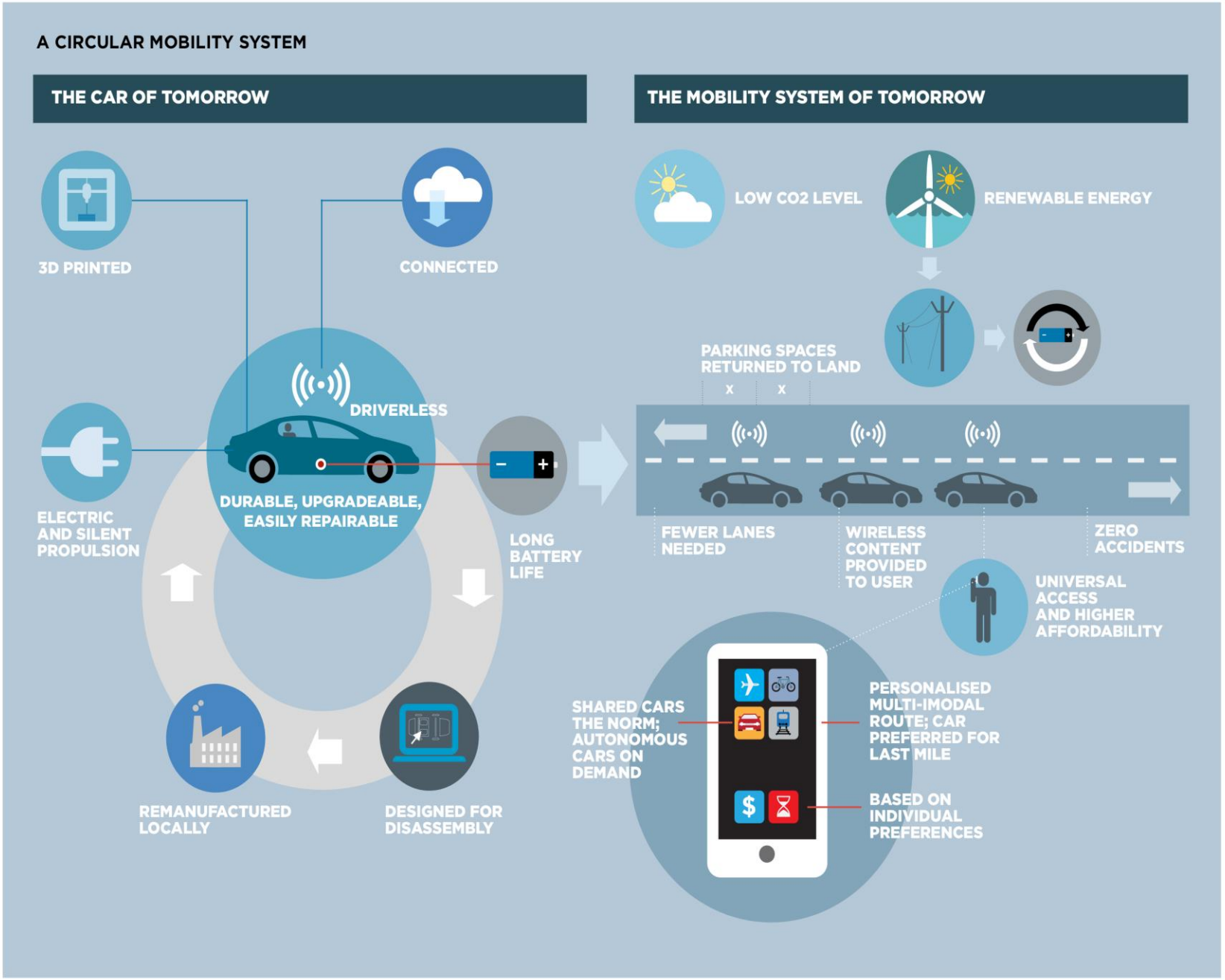
SHARING ECONOMY

BY DEMOGRAPHIC:



SOURCE: CAMPBELLMITHUN, CARVONVIEW; BASE: 383 RESPONDENTS

CampbellMithun


A CIRCULAR MOBILITY SYSTEM
THE CAR OF TOMORROW
THE MOBILITY SYSTEM OF TOMORROW
3D PRINTED
CONNECTED
DRIVERLESS
ELECTRIC AND SILENT PROPULSION
DURABLE, UPGRADEABLE, EASILY REPAIRABLE
LONG BATTERY LIFE
REMANUFACTURED LOCALLY
DESIGNED FOR DISASSEMBLY
LOW CO2 LEVEL
RENEWABLE ENERGY
PARKING SPACES RETURNED TO LAND
FEWER LANES NEEDED
WIRELESS CONTENT PROVIDED TO USER
ZERO ACCIDENTS
UNIVERSAL ACCESS AND HIGHER AFFORDABILITY
SHARED CARS THE NORM; AUTONOMOUS CARS ON DEMAND
PERSONALISED MULTI-IMODAL ROUTE; CAR PREFERRED FOR LAST MILE
BASED ON INDIVIDUAL PREFERENCES

Ecovative Design - Replacing technical with biological

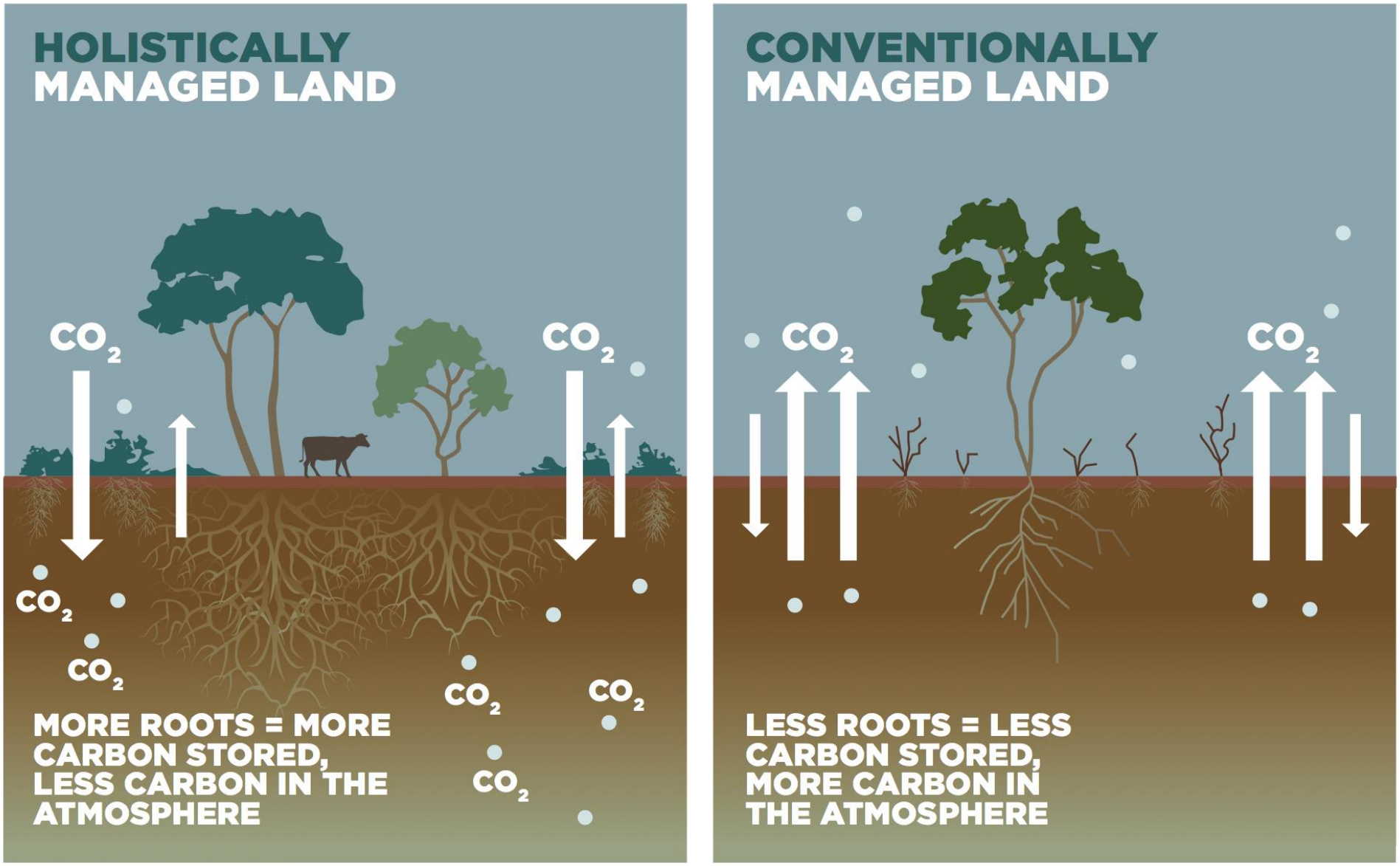
Ecovative design created Mushroom Materials, a compostable, bio-based alternative to petroleum-based expanded plastics.

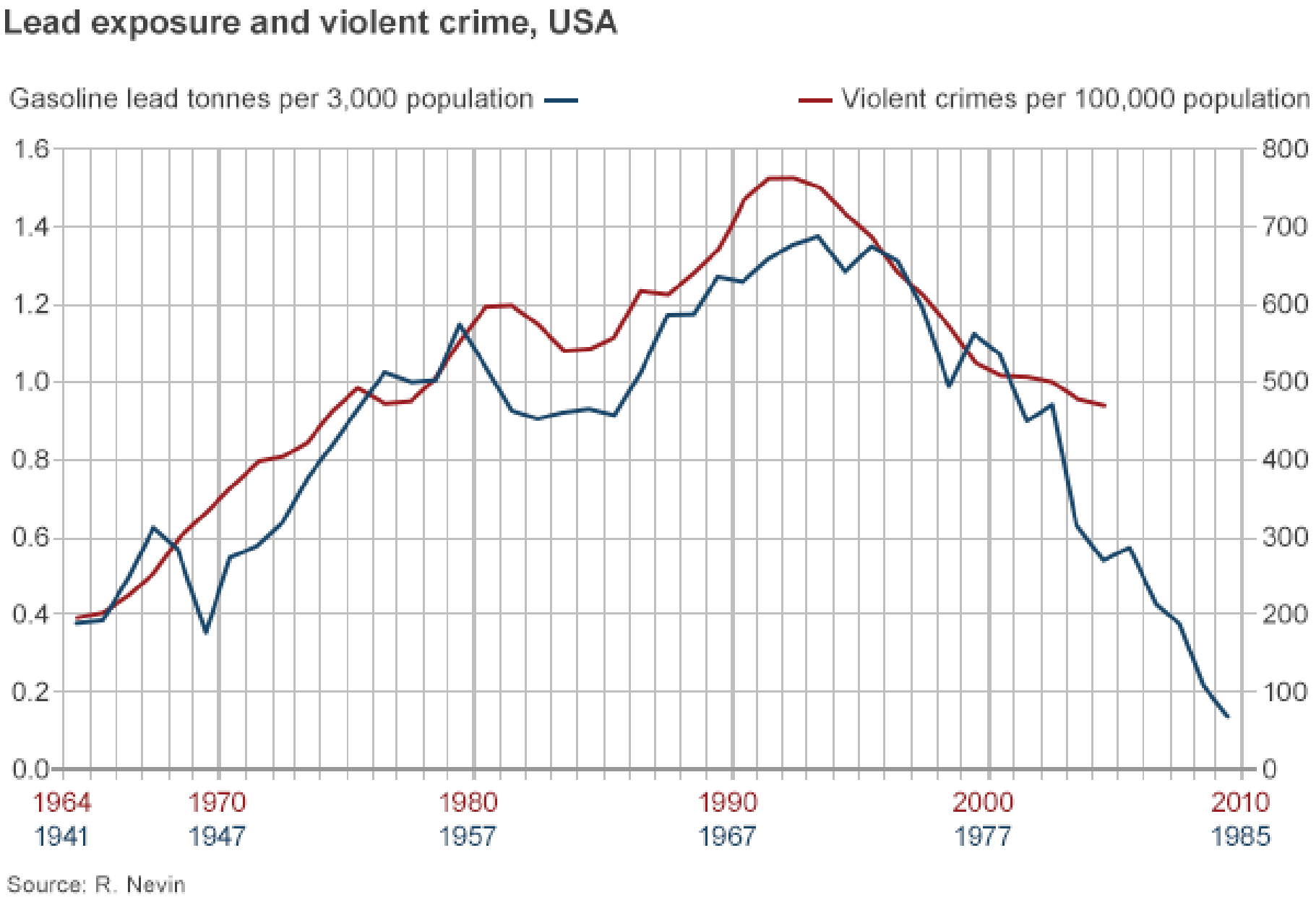
- Agricultural material used as feedstock, bonded together with mycelium, the ‘roots’ of mushrooms.
- Manufacture a number of products including protective packaging, insulation and even surfboards.
- Packaging components are supplied to Dell, Steelcase and a growing number of Fortune 500 companies.
- A second manufacturing plant, in New York, will become operational mid-2015.

Key Figures:

- **Founded in 2007**
- **Raised $14 million funding since launch**
- **65 employees**

Multiple benefits





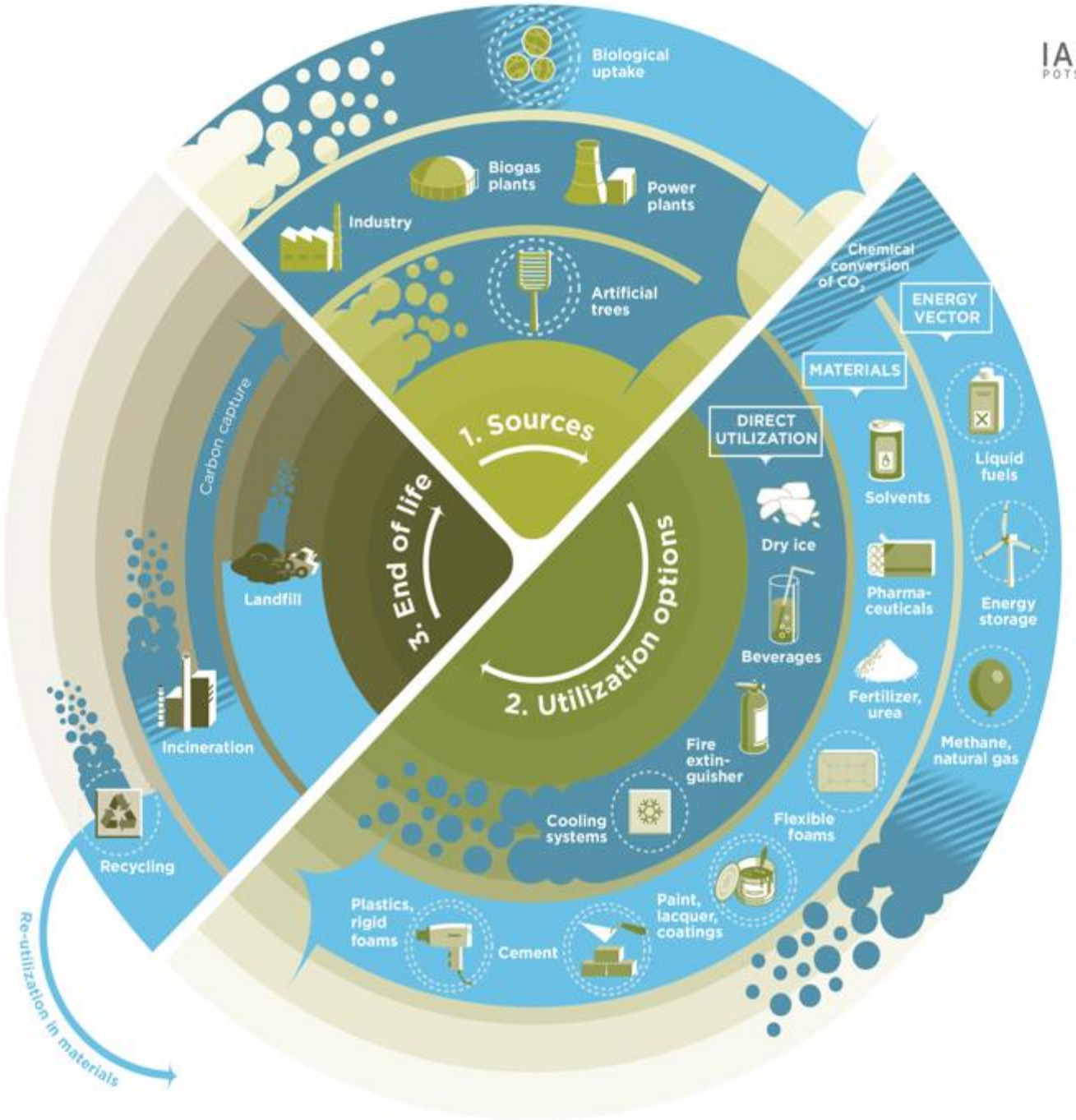
big picture longer term
perspective

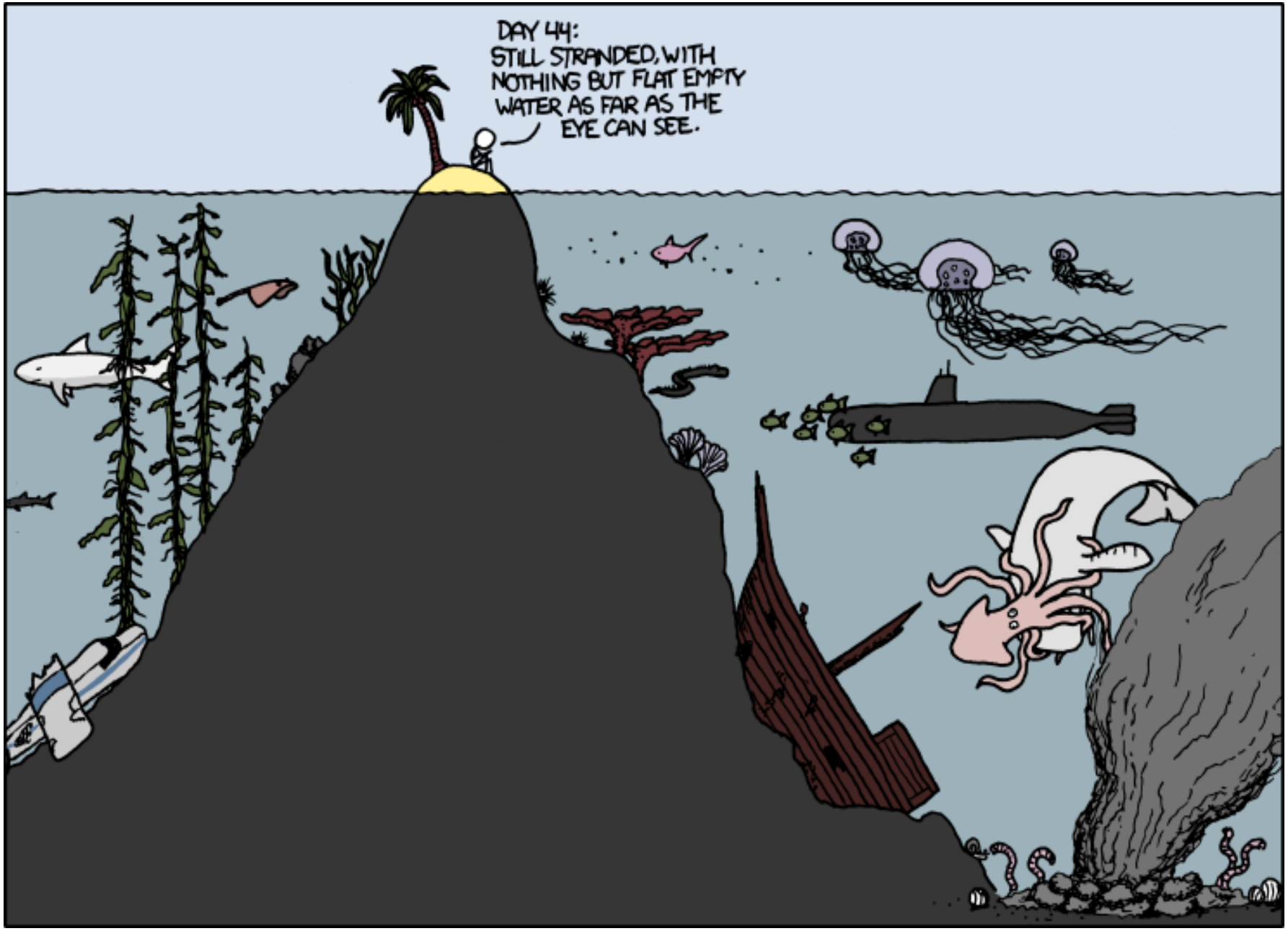
CO_2 AS FEEDSTOCK

Carbon dioxide from flue gas or as byproduct of chemical processes can be used for various purposes, either directly or after chemical conversion in carbon compounds. These purposes can cover various materials or energy vectors. These technologies are summarized by the term Carbon Capture and Utilization (CCU).

Legend:

- Carbon dioxide
- Carbon compound
- Conversion
- Release to the atmosphere
- Near future
- Distant future




DAY 44:
STILL STRANDED, WITH NOTHING BUT FLAT EMPTY WATER AS FAR AS THE EYE CAN SEE.

Circular Economy ‘Sandwich’(business and design in the centre)

Philosophy

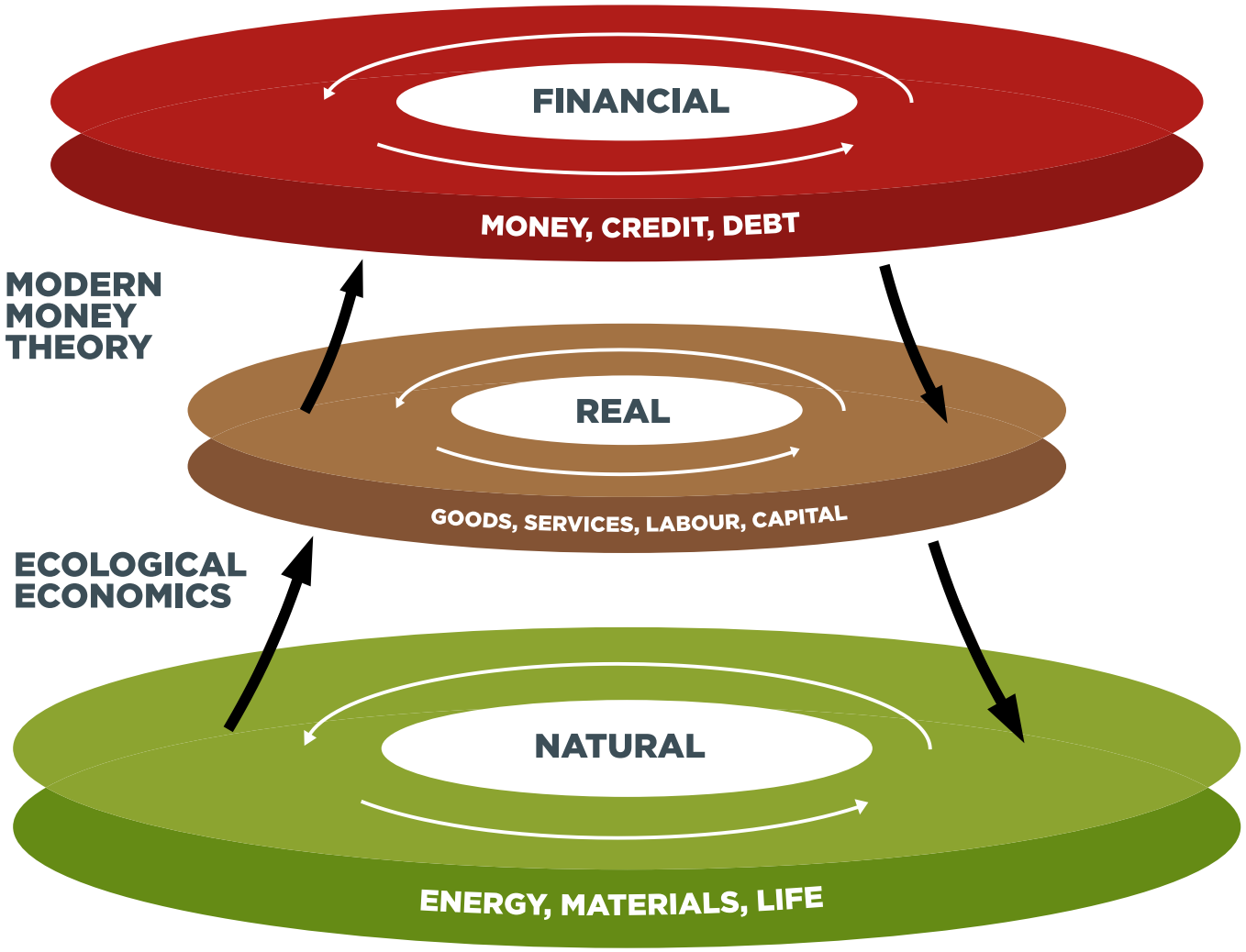
- worldviews matter – how we think and learn
- science sees a world of dynamic non-linear systems
- economics reflects science (?!...)

Action

- everythng is food (two cycles – technical and biological)
- shift to renewables
- shift from selling goods to services/performance
- rebuild/maintain capital to increase useful flows (upcycle)
- celebrate diversity (a source of creativity and resilience)

Enabling

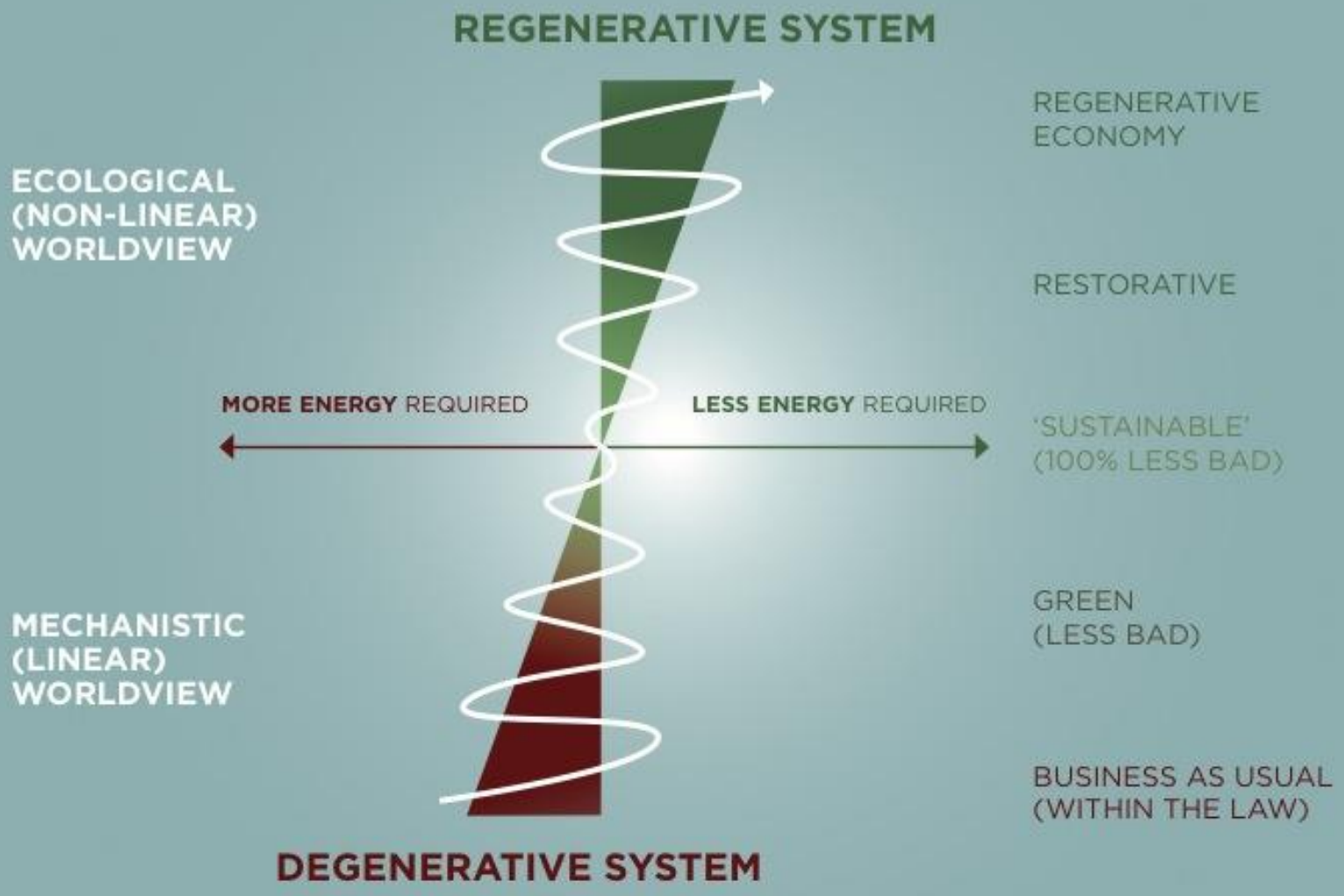
- prices to reflect full costs to assist markets (e.g. tax non-renewables not people)
- money and finance are endogenous variables (money mostly a med. of exchange)



Prof Tim Jackson

WASTE = FOOD
DIVERSITY = STRENGTH
SHIFT > RENEWABLES
PRICES = FULL COSTS
MONEY = GOODS AND SERVICES
(MEDIUM OF EXCHANGE)

REGENERATIVE & DEGENERATIVE SYSTEMS



Source: Adapted from Bill Reed's diagram at Regenesis Group

LAKOFF “Every language in the world has a way in its grammar to express direct causation: a local application of force that has a local effect in place and time. You pick up a glass of water and drink it: direct causation. You bomb a hospital, destroying it and killing those inside: direct causation.

No language in the world has a way in its grammar to express systemic causation. You drill a lot more oil, burn a lot more gas, put a lot more CO2 in the air, the earth’s atmosphere heats up, more moisture evaporates from the oceans yielding bigger storms in certain places and more droughts and fires in other places: systemic causation. The world ecology is a system — like the world economy and the human brain.

From infanthood on we experience simple, direct causation. We see direct causation all around us: if we push a toy, it topples over… And so on. The same is not true of systemic causation. Systemic causation cannot be experienced directly. It has to be learned, its cases studied, and repeated communication is necessary before it can be widely understood.”

Don’t Think of an Elephant, p 36

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2–20 NOVEMBER 2015

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