

The next 10 years: what to expect, and how to prepare

FUTURE



futuristgerd.com



gerdtube.com



lookupnow.tv

Gerd Leonhard, Public Thinker & Futurist

REPIC

WEEE | BATTERIES | PACKAGING

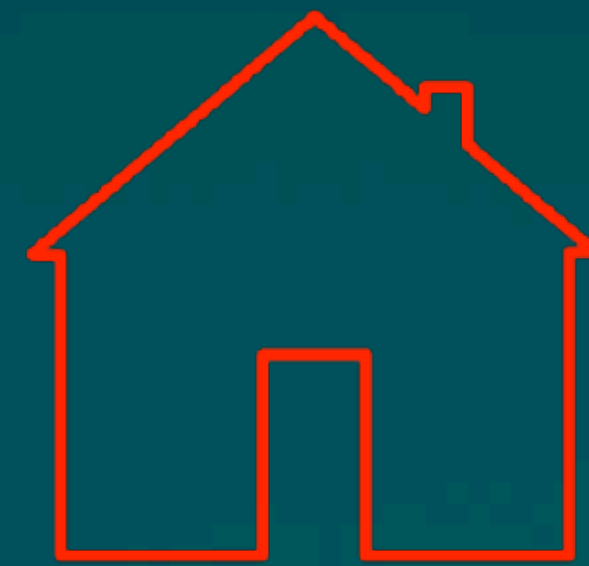
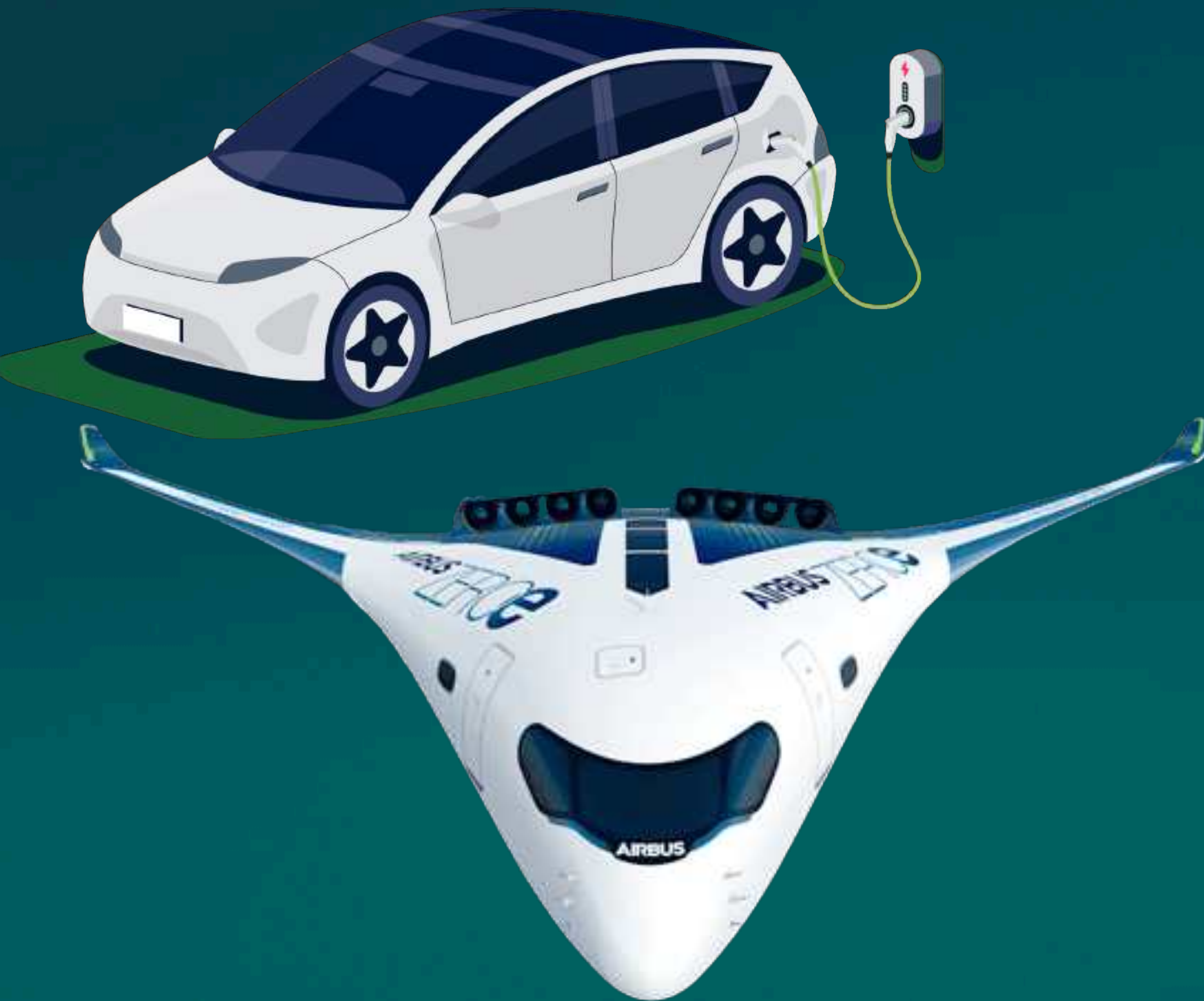
Gerd

An illustration featuring two large, white, stylized hands reaching from the top left and top right to hold a green globe. The background is a dark teal color with several small white dots scattered across it. The globe is positioned in the center, with the text 'ARTIFICIAL INTELLIGENCE' on the left and 'CLIMATE CHANGE' on the right.

**ARTIFICIAL
INTELLIGENCE**

**CLIMATE
CHANGE**

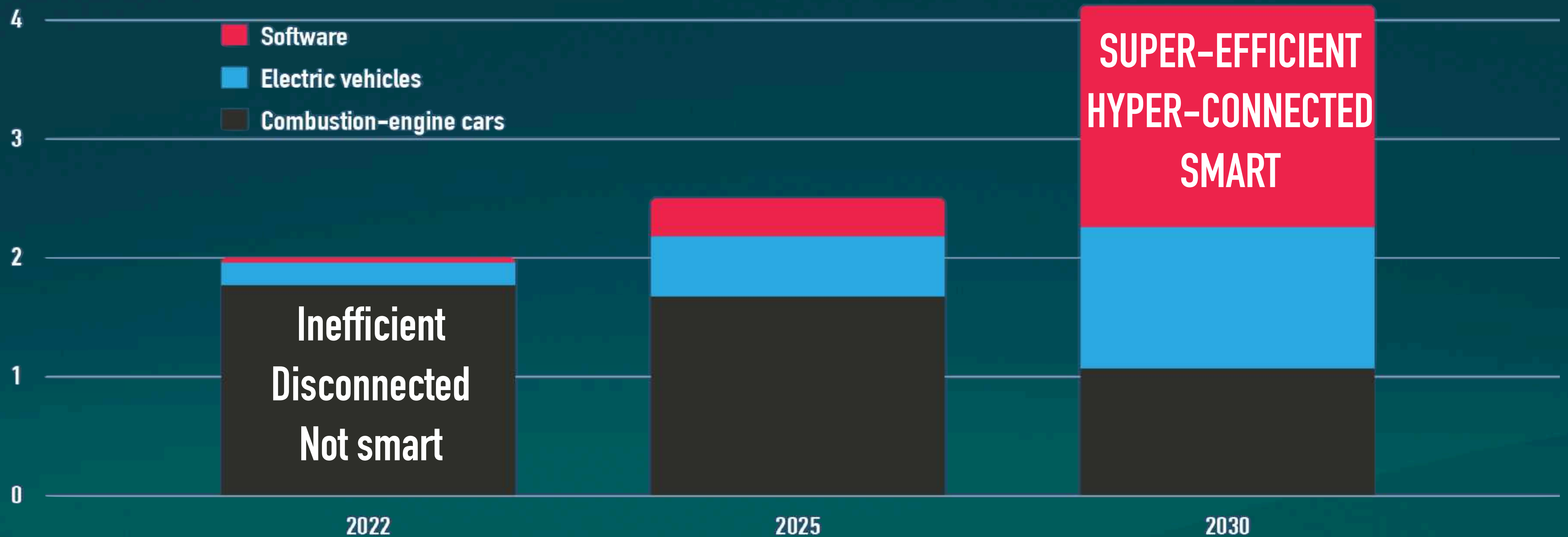
The purpose of looking at the future is not prediction – it is to be better prepared!



“One’s destination is never a place, but a **new way of seeing things**”

(Henry Miller)

GLOBAL CAR INDUSTRY, REVENUE BY SECTOR, \$TRN FORECAST



“We should be optimistic not because our problems are smaller than we thought, but because
OUR CAPACITY TO SOLVE THEM IS LARGER THAN WE THOUGHT”

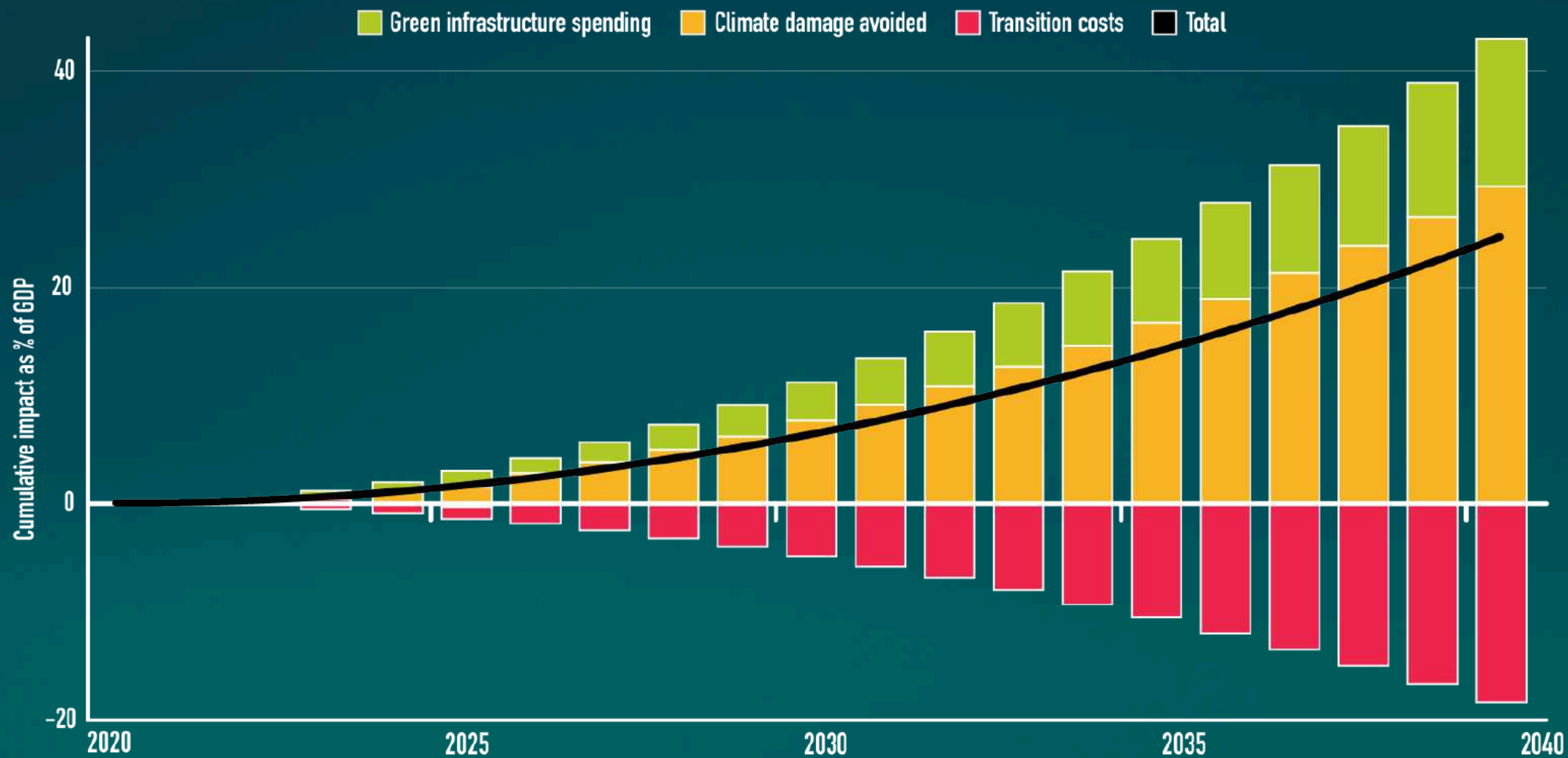
(Kevin Kelly)

| SCIENCE |
| FICTION |

| SCIENCE |
| FACT |

OUR TECH/SCIENCE CAPACITY TO SOLVE OUR PROBLEMS IS INCREASING EXPONENTIALLY...*

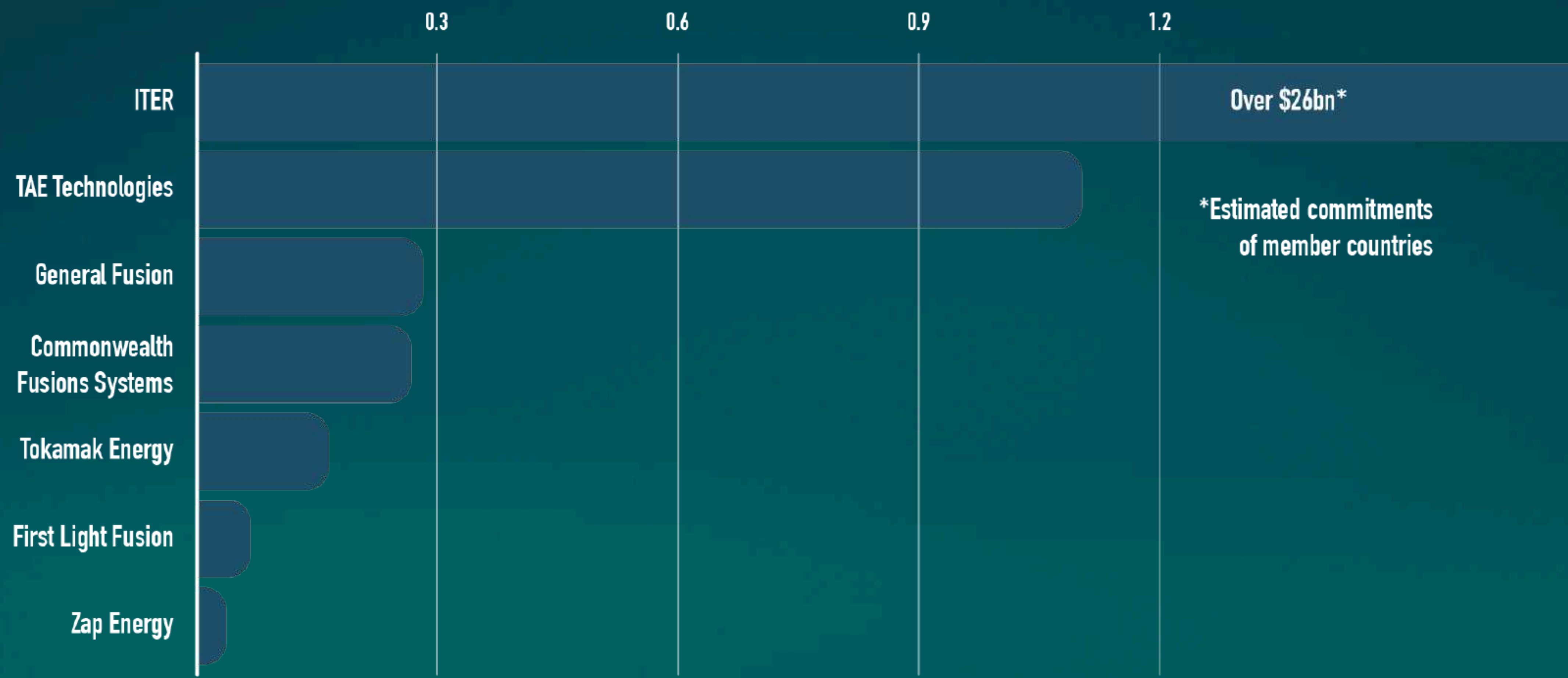
TRANSITION RESULTS IN NET ECONOMIC GAIN ESTIMATED CUMULATIVE GDP IMPACT OF TRANSITION, 2020-2040



OUR TECH/SCIENCE CAPACITY TO SOLVE OUR PROBLEMS IS INCREASING EXPONENTIALLY...*

THE RACE TO BUILD A COMMERCIAL FUSION REACTOR HOTS UP

Fusion-energy companies, investment, \$bn (2021 or latest available)



*Estimated commitments of member countries

Source: ITER; PitchBook; The Economist

OUR TECH/SCIENCE CAPACITY TO SOLVE OUR PROBLEMS IS INCREASING EXPONENTIALLY...*

SOLAR AND BATTERIES ARE LEADING THE WAY TO NET ZERO

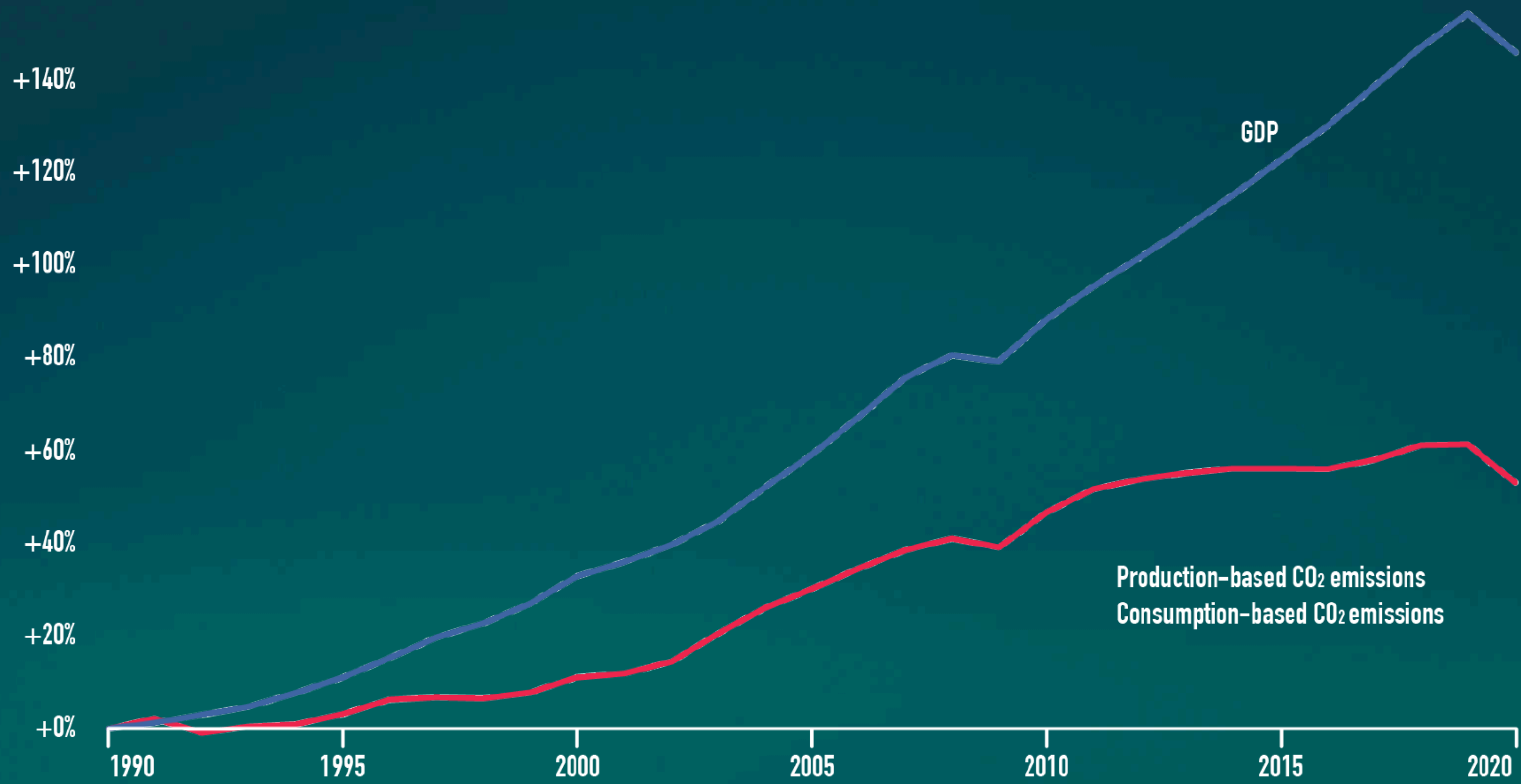
INSTALLED AND ANNOUNCED MANUFACTURING CAPACITY, RELATIVE TO 2030 LEVELS NEEDED IN IEA NET ZERO SCENARIO



Source: Bloomberg, IEA

OUR TECH/SCIENCE CAPACITY TO SOLVE OUR PROBLEMS IS INCREASING EXPONENTIALLY...*

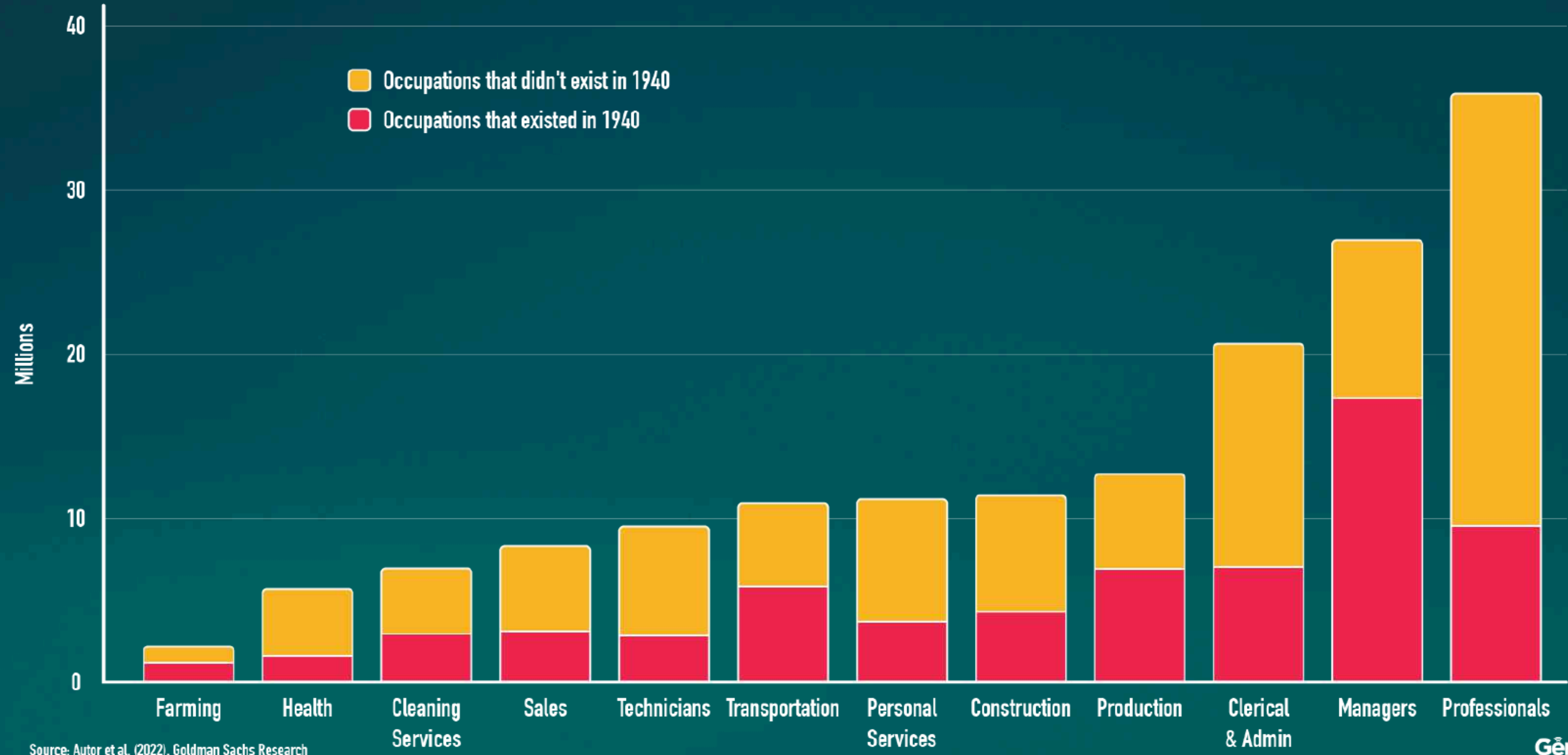
DECOUPLING GDP FROM CARBON



Source: Our World in Data

OUR TECH/SCIENCE CAPACITY TO SOLVE OUR PROBLEMS IS INCREASING EXPONENTIALLY...*

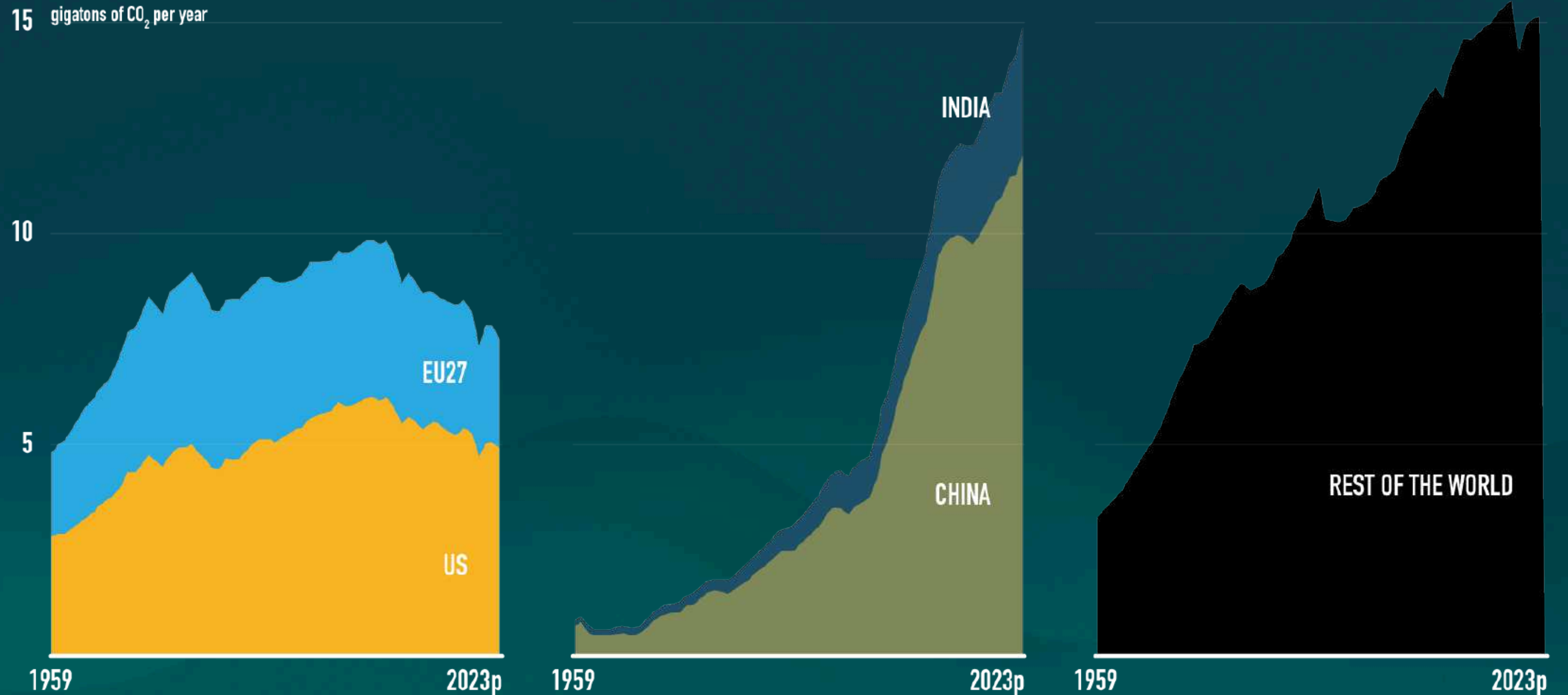
INNOVATION LEADS TO NEW OCCUPATIONS THAT ACCOUNT FOR MOST EMPLOYMENT GROWTH



Source: Autor et al. (2022), Goldman Sachs Research

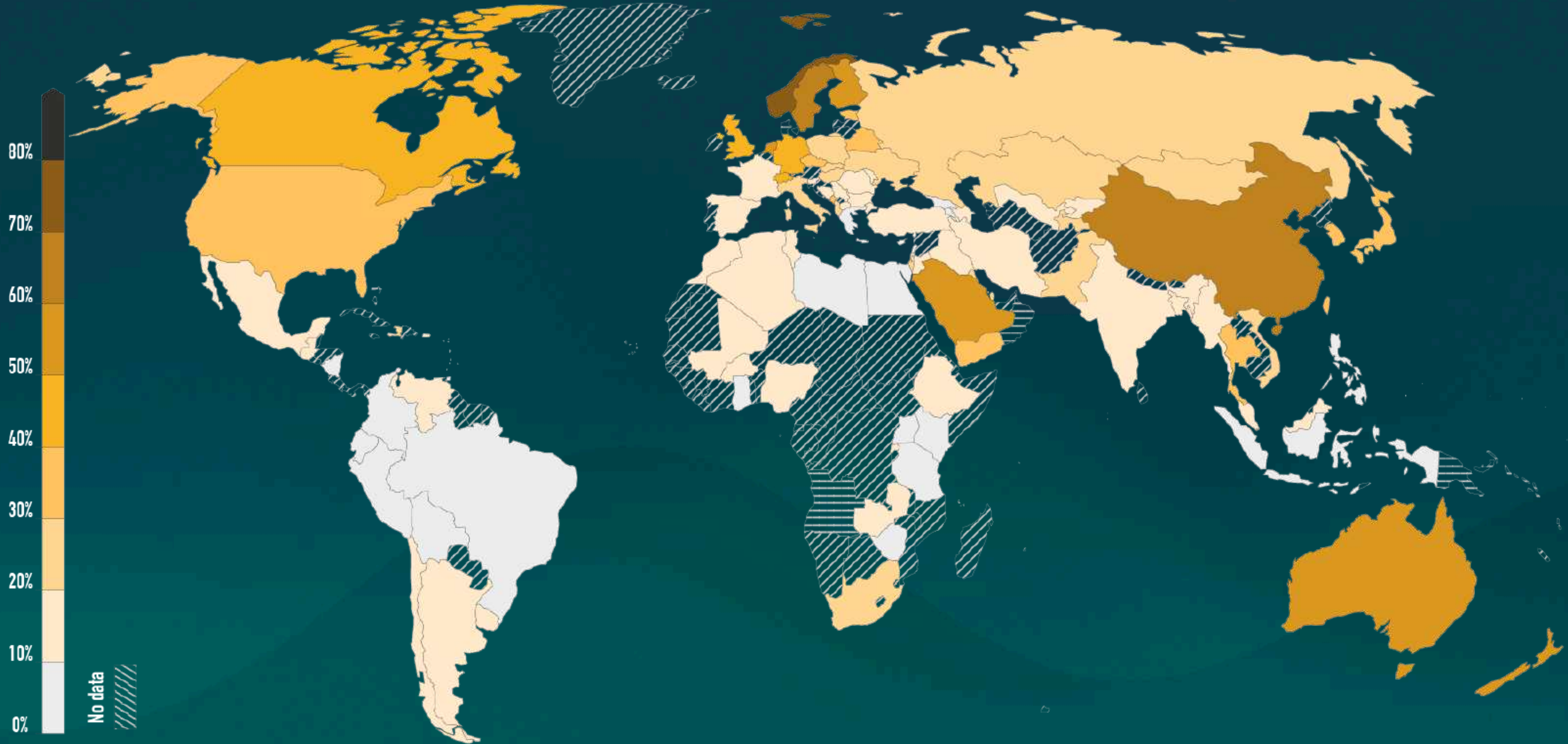
...BUT OUR ABILITY TO COLLABORATE ON GLOBAL CHALLENGES HAS **NOT** IMPROVED

US AND EU EMISSIONS HAVE DECLINED THIS CENTURY;
EMISSIONS ELSEWHERE HAVE NOT



...BUT OUR ABILITY TO COLLABORATE ON GLOBAL CHALLENGES HAS NOT IMPROVED

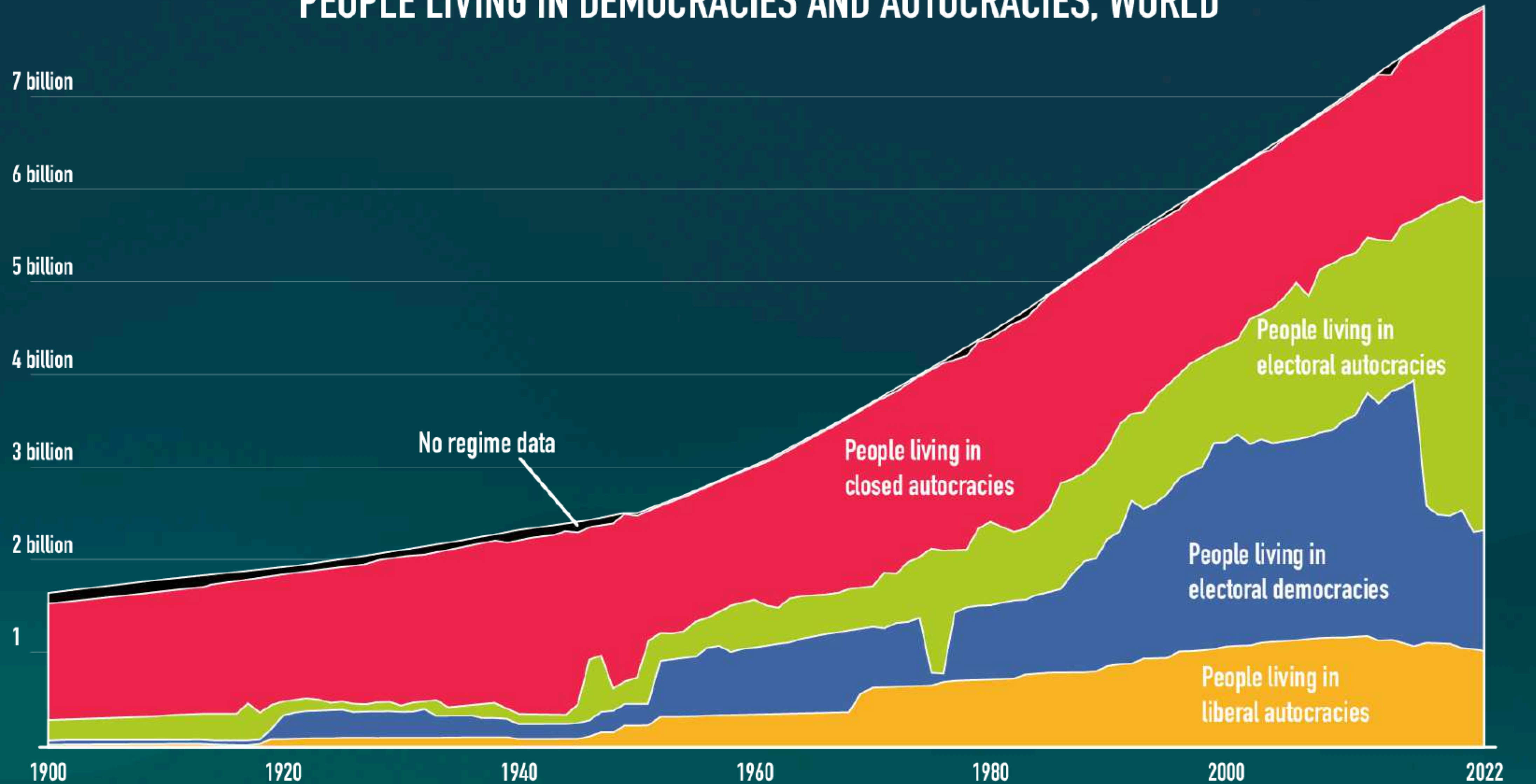
SHARE OF PEOPLE AGREEING WITH THE STATEMENT
"MOST PEOPLE CAN BE TRUSTED", 2022



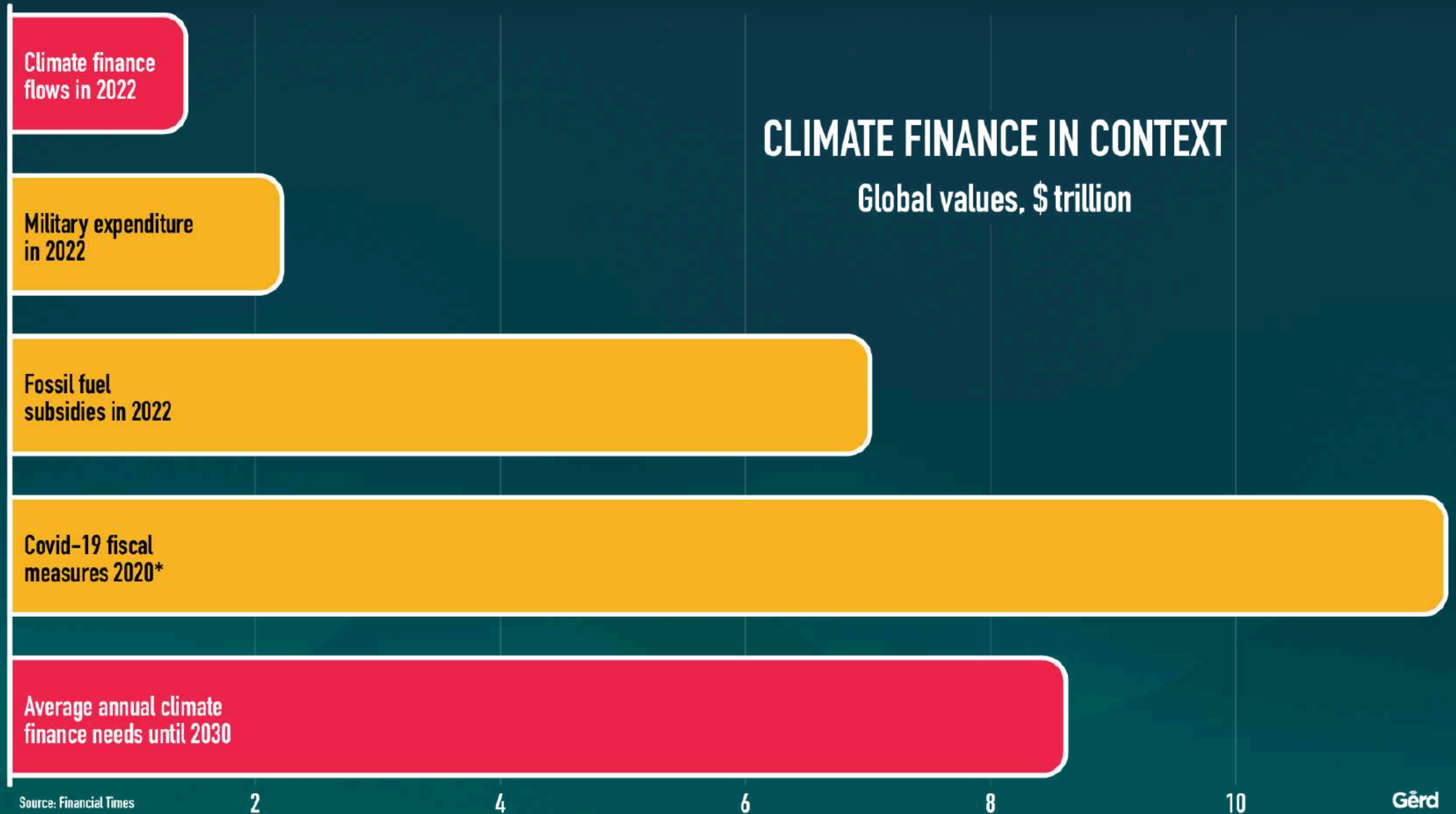
Source: World Values Survey

...BUT OUR ABILITY TO COLLABORATE ON GLOBAL CHALLENGES HAS **NOT** IMPROVED

PEOPLE LIVING IN DEMOCRACIES AND AUTOCRACIES, WORLD

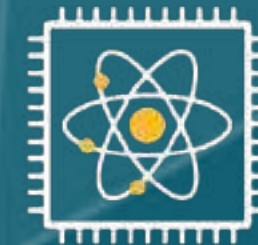


...BUT OUR ABILITY TO COLLABORATE ON GLOBAL CHALLENGES HAS **NOT** IMPROVED



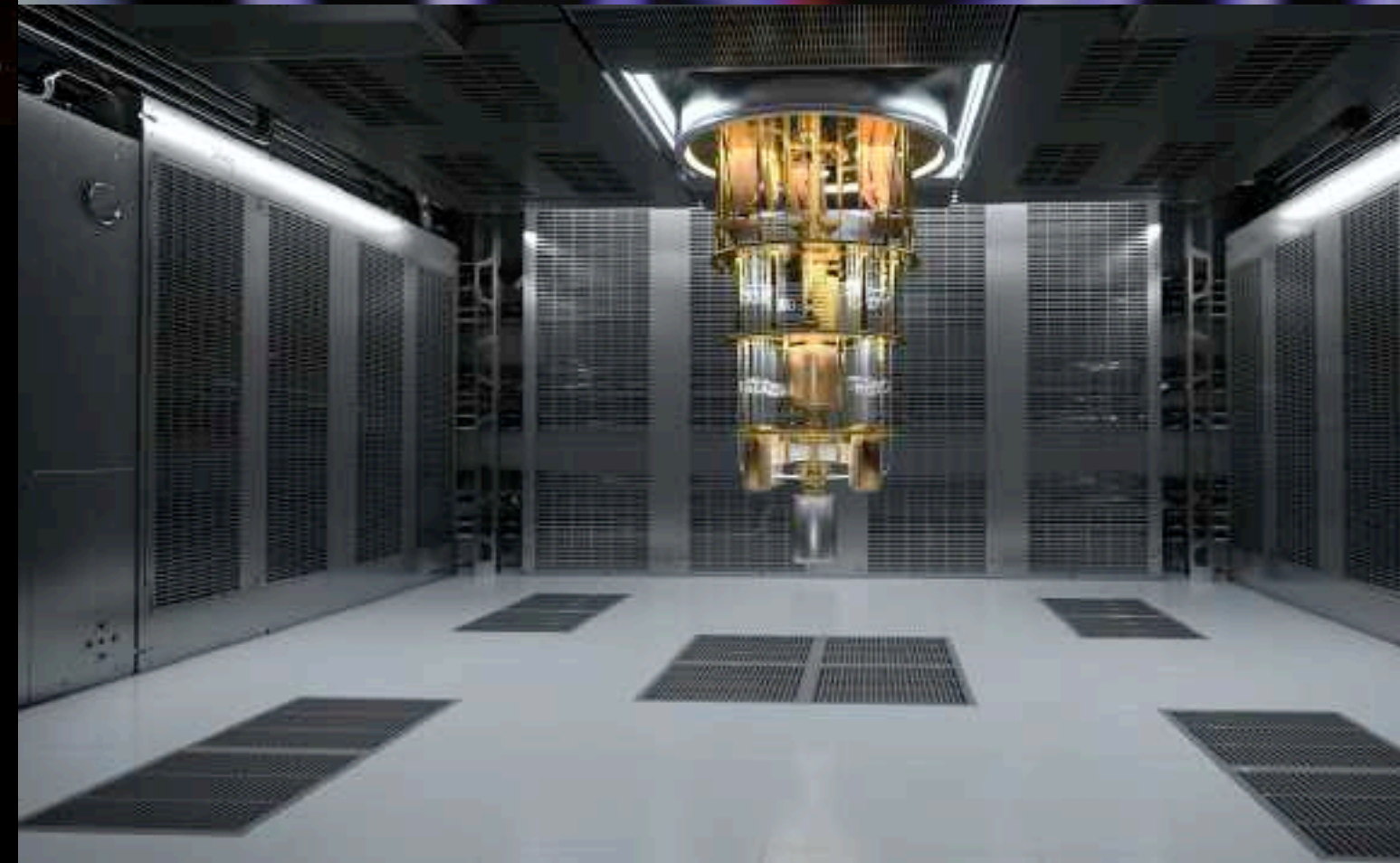
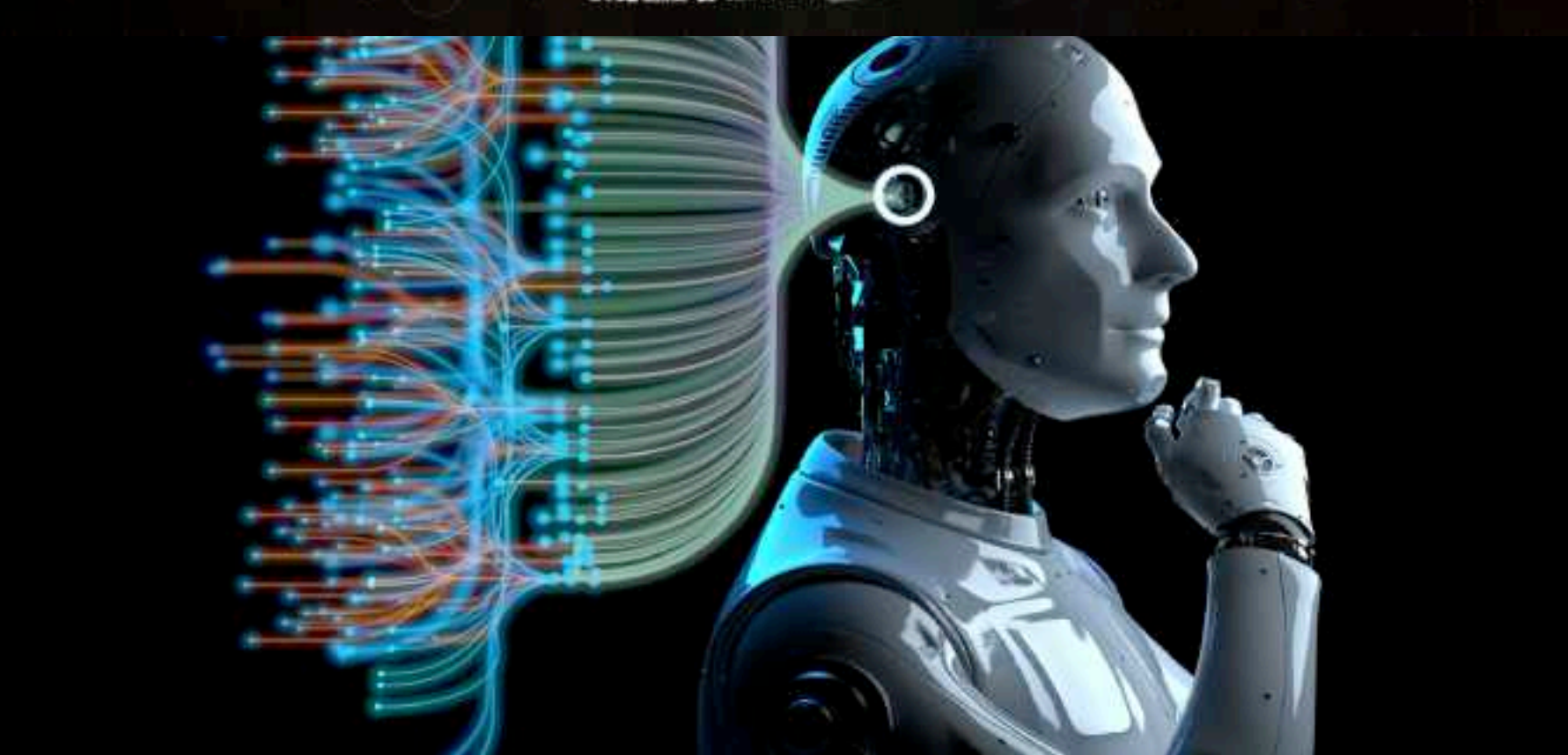
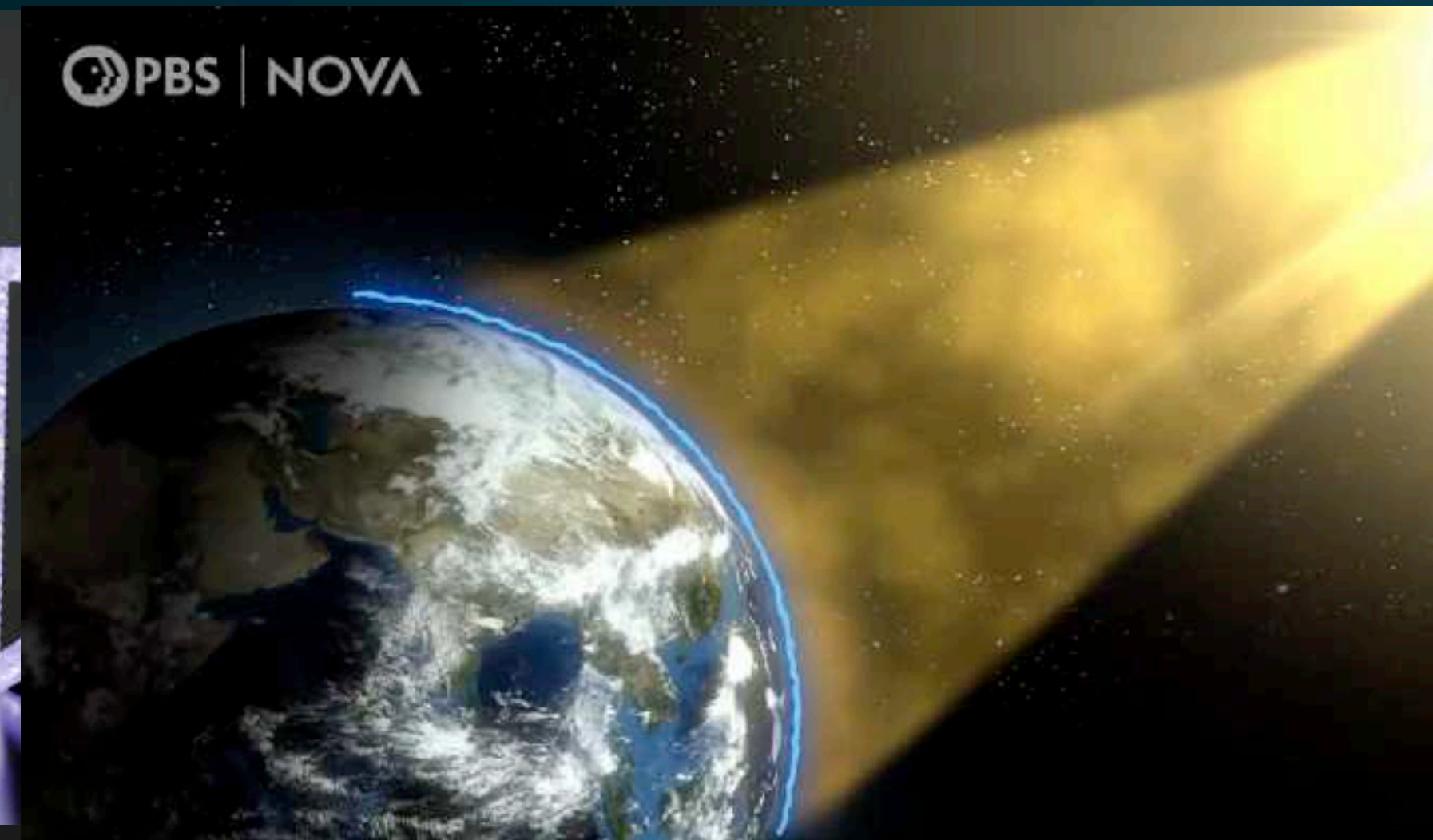
Tools **AND** Telos

FUTURE



The next 10 years will bring more change than the previous 100 years

AI is just the first of **SIX** King/Queen-Making Technologies. Next is Quantum Computing, Fusion Energy, Nano-Tech & Synthetic Biology, Genome Editing and Geo-Engineering



THE FUTURE OF ELECTRONICS MANUFACTURING: TRANSFORMATION^X

1. ****Industry 4.0 and Smart Manufacturing****: The integration of advanced technologies such as artificial intelligence (AI), machine learning, and the Internet of Things (IoT) is revolutionizing the manufacturing process.
2. ****Sustainability and Green Manufacturing****: A rapidly growing focus on sustainable practices in electronics manufacturing. This includes the use of renewable energy, reduction of waste, and the development of eco-friendly materials.
3. ****Supply Chain Resilience****: New technologies that enable real-time visibility and predictive analytics
4. ****Advanced Materials and Miniaturization****: The demand for smaller, more powerful devices is driving the development of advanced materials and miniaturization technologies. This includes the use of organic electronics and 3D printing.
5. ****Electronics in Green Technologies****: Electronics are playing an increasingly important role in green technologies such as electric vehicles and renewable energy systems. This is expected to drive significant growth in the industry.
6. ****Advanced Packaging and Printing Technologies****: The use of advanced materials and the adoption of advanced packaging and printing technologies for fabrication are helping to achieve goals such as miniaturization, durability, and sustainability.

DIGITAL REVOLUTION



SUSTAINABILITY REVOLUTION



PURPOSE REVOLUTION



MEGA-CHALLENGE

Economy



Planet

WORK

Humans
Doing Routines



Machines
Doing Routines

DIGITAL
REVOLUTION

INFO TECH



BIO TECH



ENERGY & CLIMATE TECH



AI TECH



THE DISRUPTIVE IMPACT OF SYNTHETIC BIOLOGY

WHEN, AND HOW, THE TECHNOLOGY WILL AFFECT YOUR INDUSTRY



Likely Outcomes

0-5 Years

5-10 Years

10+ Years

(Mainly)
Product Substitution

Meat and
aquaculture

Bio-based
pharma

Beauty

Chemicals

Fuel

(Mainly)
Process Improvement

OTC
medicines

Medical
devices

Textiles

Food
(excluding
meats)

Agriculture

Mining

(Mainly)
Raw Material Changes

Electronics

Fashion

Electricity

Water

Automobiles

Construction

Machinery

SYNTHETIC BIOLOGY (SynBio) applies engineering principles to develop new biological parts, devices, and systems or to redesign existing systems found in nature.



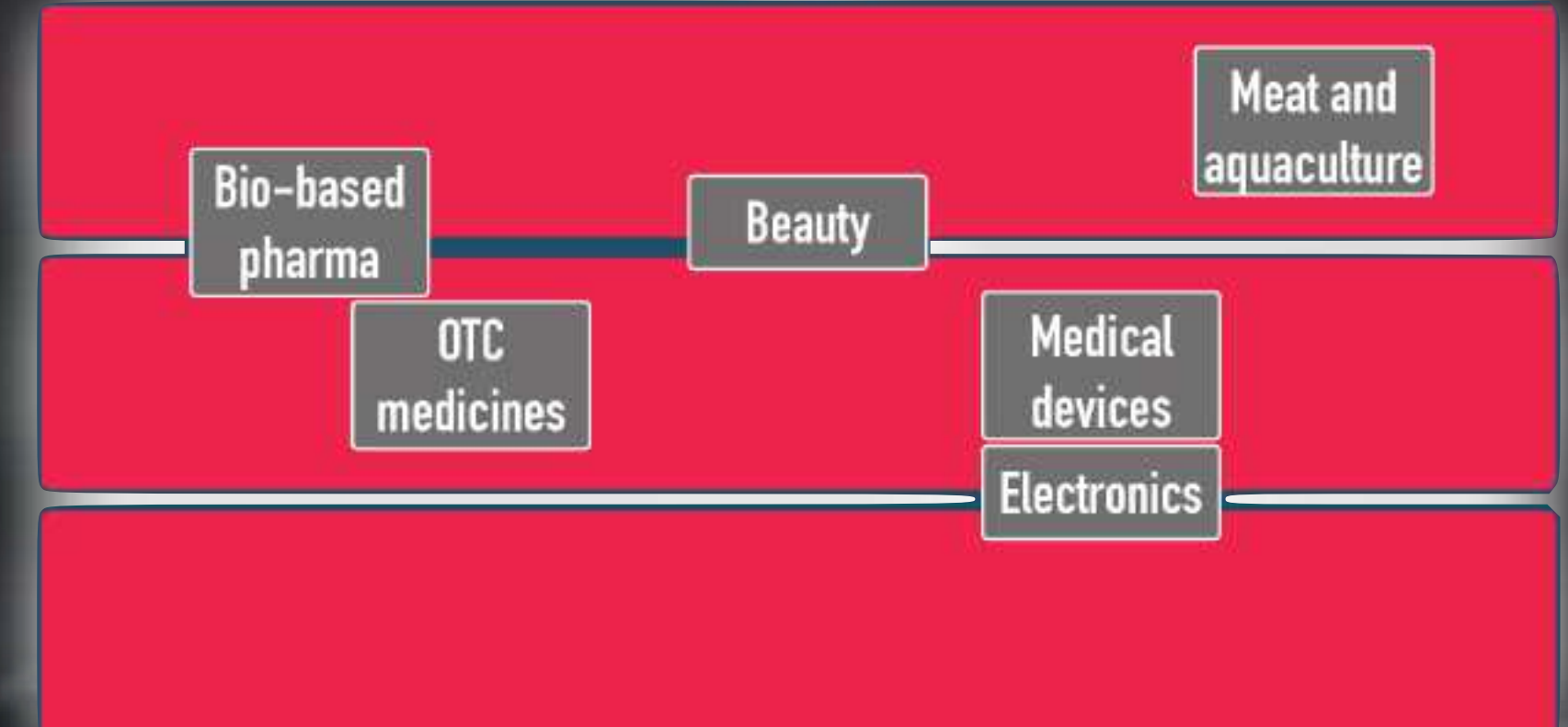
Likely Outcomes

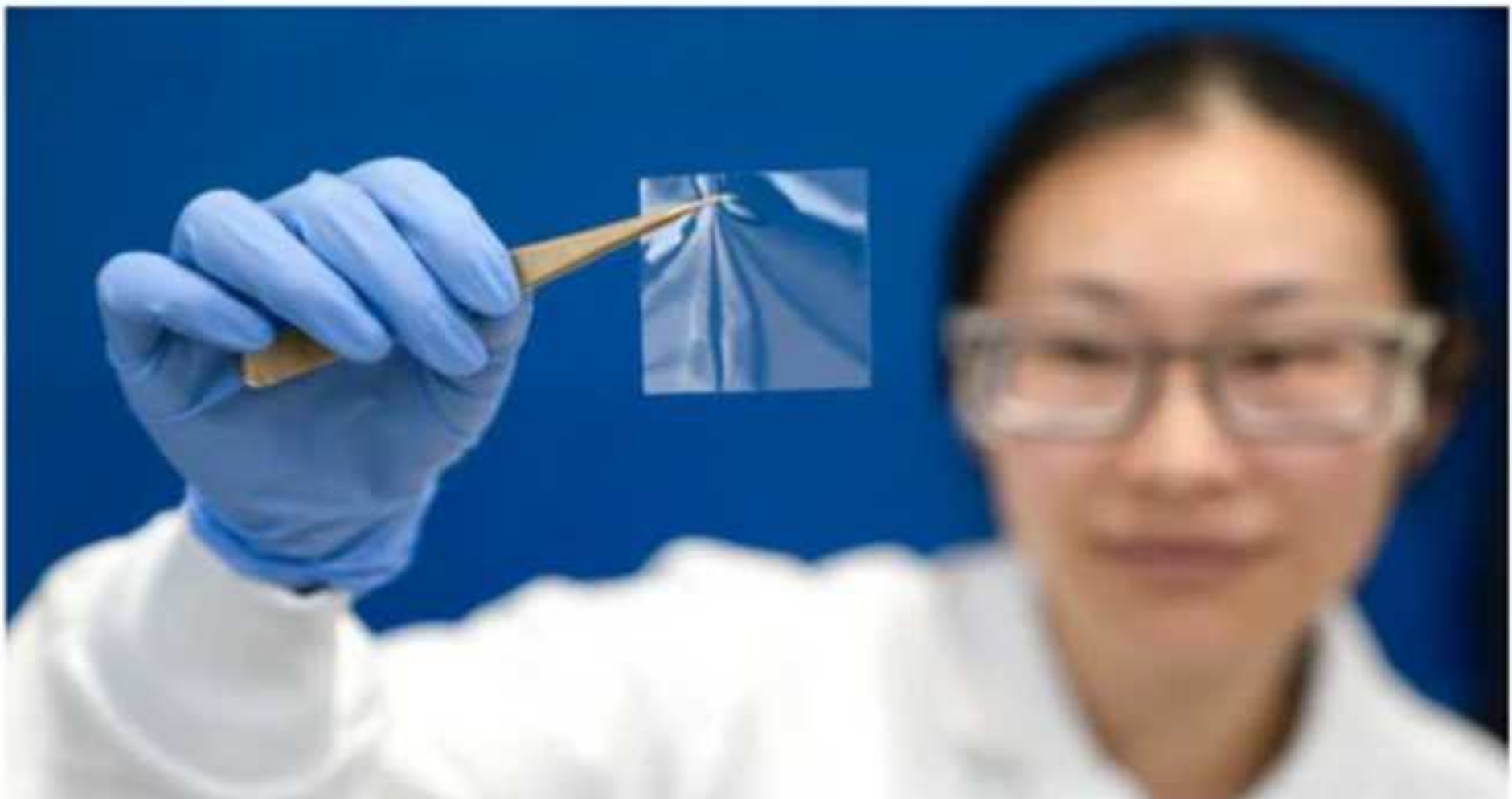
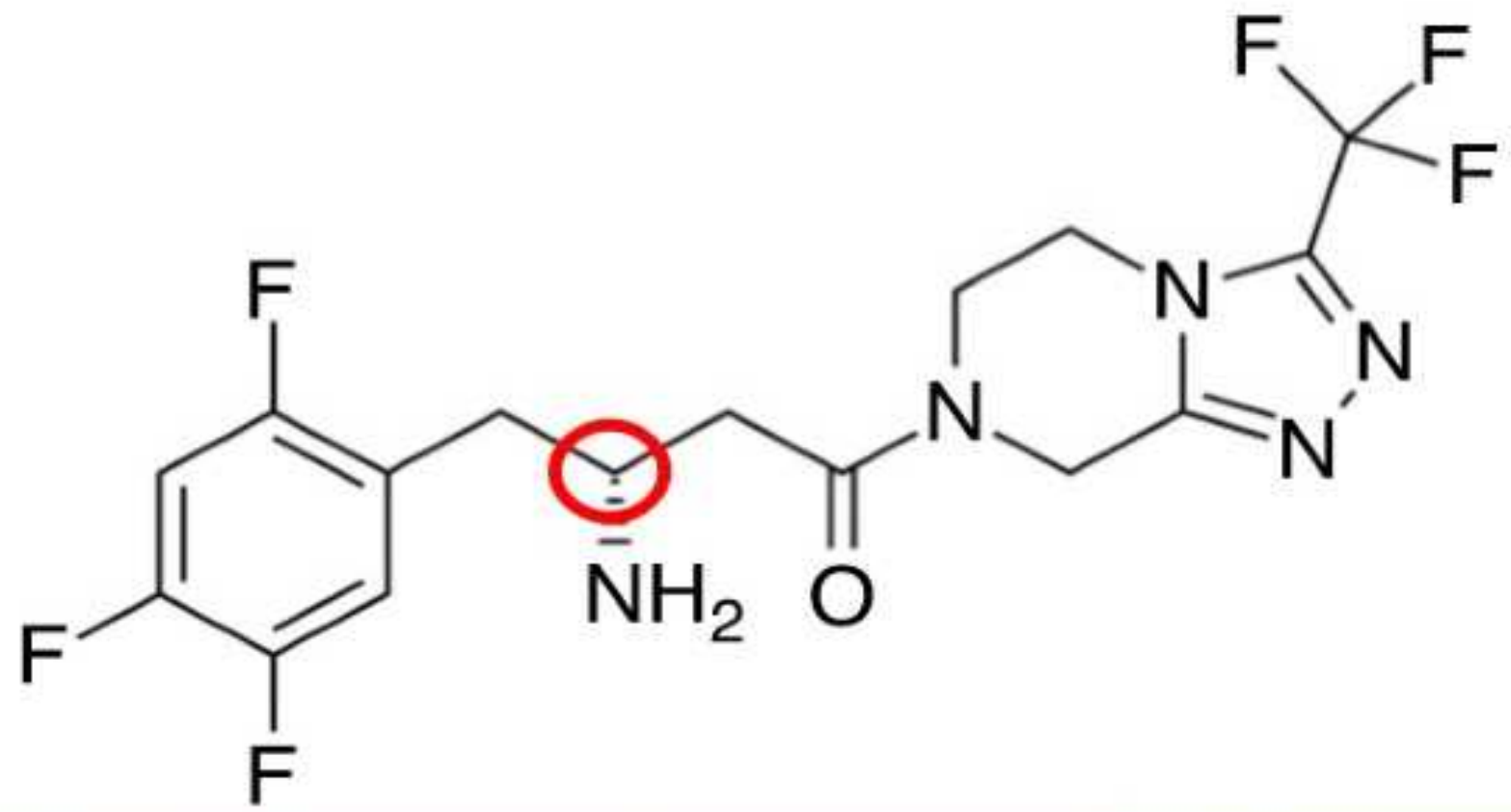
(Mainly)
Product Substitution

(Mainly)
Process Improvement

(Mainly)
Raw Material Changes

0-5 Years





SYNTHETIC BIOLOGY AND THE FUTURE OF ELECTRONICS: INNOVATIONS IN MATERIALS SCIENCE AND SUSTAINABLE MANUFACTURING PROCESSES

1. Biodegradable Electronics

****Eco-friendly Materials:** Development of biodegradable electronic components, such as circuits, batteries, and displays, made from organic or microbial sources.

****BIODEGRADABLE POLYMERS:** ENGINEERING BACTERIA OR YEAST TO PRODUCE BIODEGRADABLE POLYMERS THAT CAN REPLACE TRADITIONAL PLASTICS IN ELECTRONIC DEVICES,

2. Sustainable Manufacturing:

****Bio-based Materials:** Utilising bioengineered materials, such as bio-based semiconductors, insulators, and conductors, to create more sustainable and eco-friendly electrical appliances. ****Energy-efficient Production:** Using synthetic biology to optimize microorganisms for the production of key electronic components

3. Enhanced Battery Technology:

****BIO-BATTERIES:** DEVELOPMENT OF BATTERIES USING BIOLOGICAL COMPONENTS, SUCH AS PROTEINS OR ENZYMES, THAT CAN GENERATE ELECTRICITY THROUGH BIOCHEMICAL REACTIONS. THESE BIO-BATTERIES CAN BE MORE SUSTAINABLE AND HAVE LESS ENVIRONMENTAL IMPACT COMPARED TO TRADITIONAL BATTERIES.

4. Smart and Adaptive Materials

****Self-healing Materials:** Creating materials that can repair themselves when damaged, increasing the longevity and reliability of electrical appliances. These materials can be engineered using proteins or other biological molecules that can self-assemble or heal under specific conditions. ****Responsive Materials:** Developing materials that can respond to environmental stimuli (e.g., temperature, light, or pH) to enhance the functionality and efficiency of electrical appliances.

5. Biofabrication of Components: 3D Bioprinting: Using bio-inks made from engineered cells to 3D print complex electronic components or entire devices.

6. Circular Economy Solutions: RECYCLING TECHNOLOGIES: ENGINEERING MICROORGANISMS TO BREAK DOWN AND RECYCLE ELECTRONIC WASTE, RECOVERING VALUABLE METALS AND MATERIALS FOR REUSE IN NEW APPLIANCES.

Sustainability Revolution: Climate Emergency: Paradigm Resets

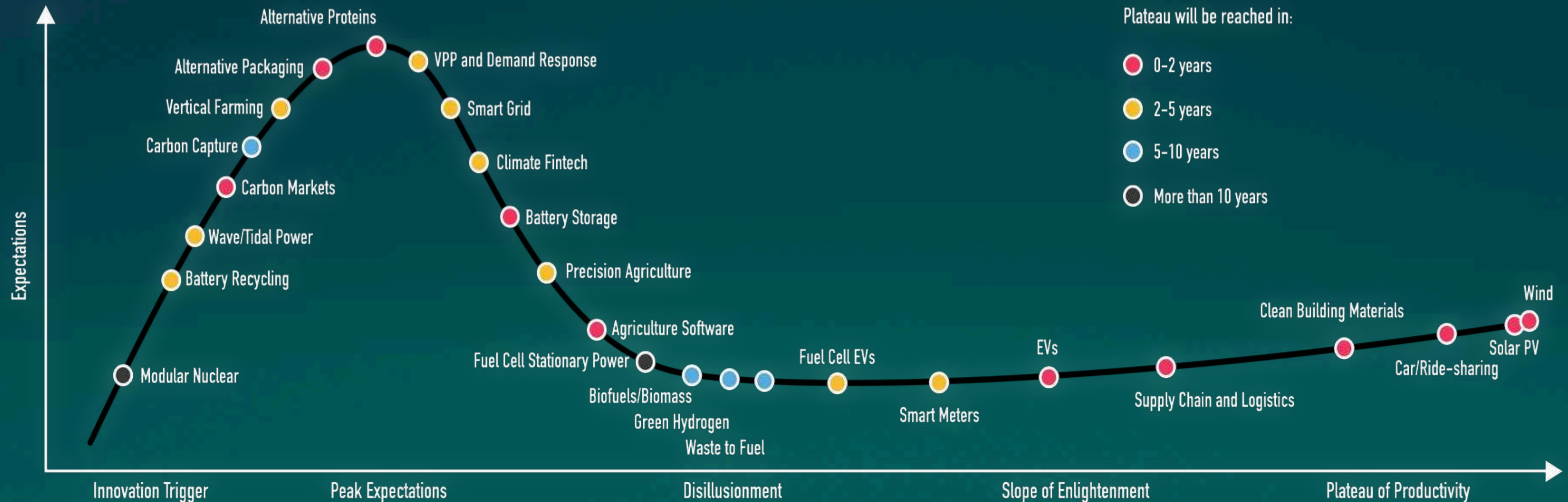
MEGA-CHALLENGE

Economy



Climate

SELECT CLIMATE TECH INNOVATION HYPE CURVE



Climate Emergency Default by 2025: You ain't seen nothing yet!

Lufthansa to charge up to €72 per ticket to cover climate costs

The surcharge goes into effect for tickets booked from June 26 and departing from European countries.

SHARE



'Personal carbon allowances' could restrict how often you travel, according to a new report

A report by a travel company says the climate crisis is no longer a distant threat, and we need to stop treating it like one

Liv Kelly • Friday 6 October 2023

Editor's note: Denmark to tax livestock emissions

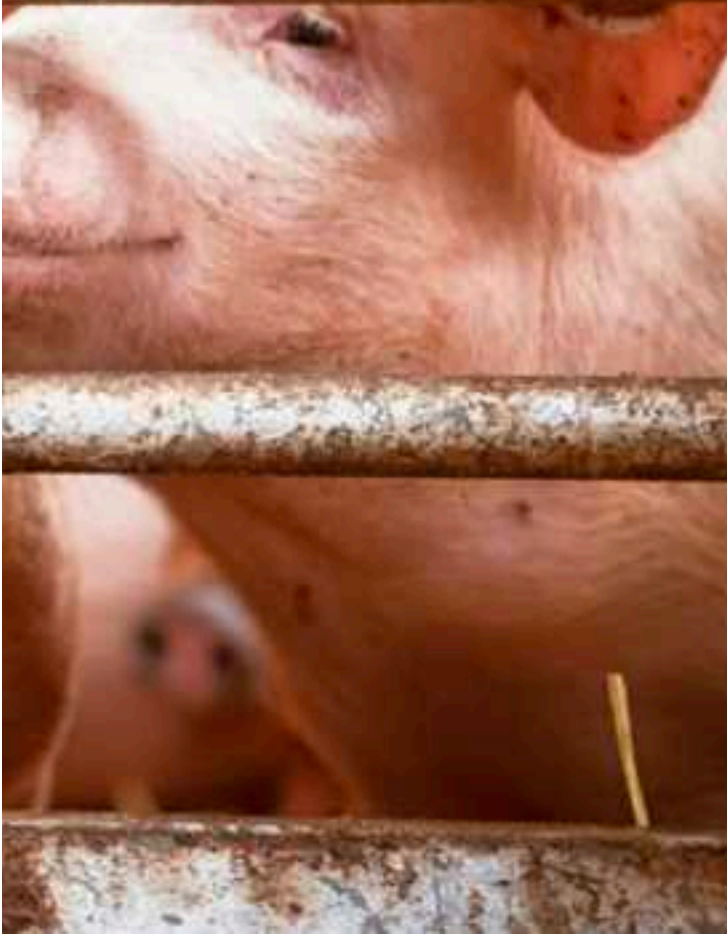
Philippa Nuttall



Are We Ready for a Global Carbon Tax?



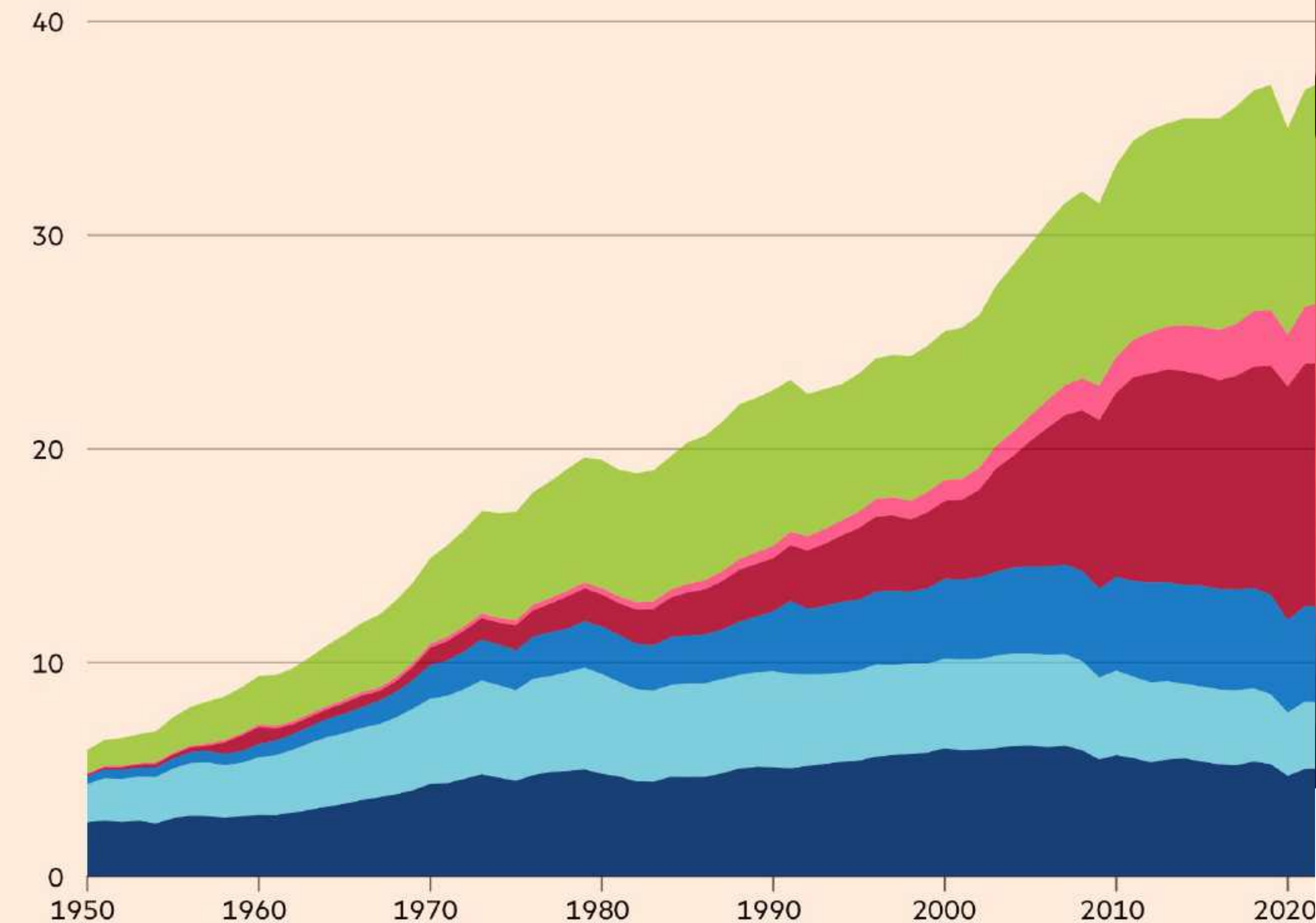
To address existing inequities in greenhouse gas emissions and combat climate change, leaders at the [African Climate Summit](#) in September called for a global carbon tax regime and vowed to use it as the basis of their negotiating position at



Emerging economies are generating all the rise in global emissions

Global CO₂ emissions (bn tonnes), by region

US EU & UK Other high-income China India Rest of the world



Market forces are not enough to halt climate change

Investor returns imply that the welfare of future human beings is close to irrelevant



© James Ferguson

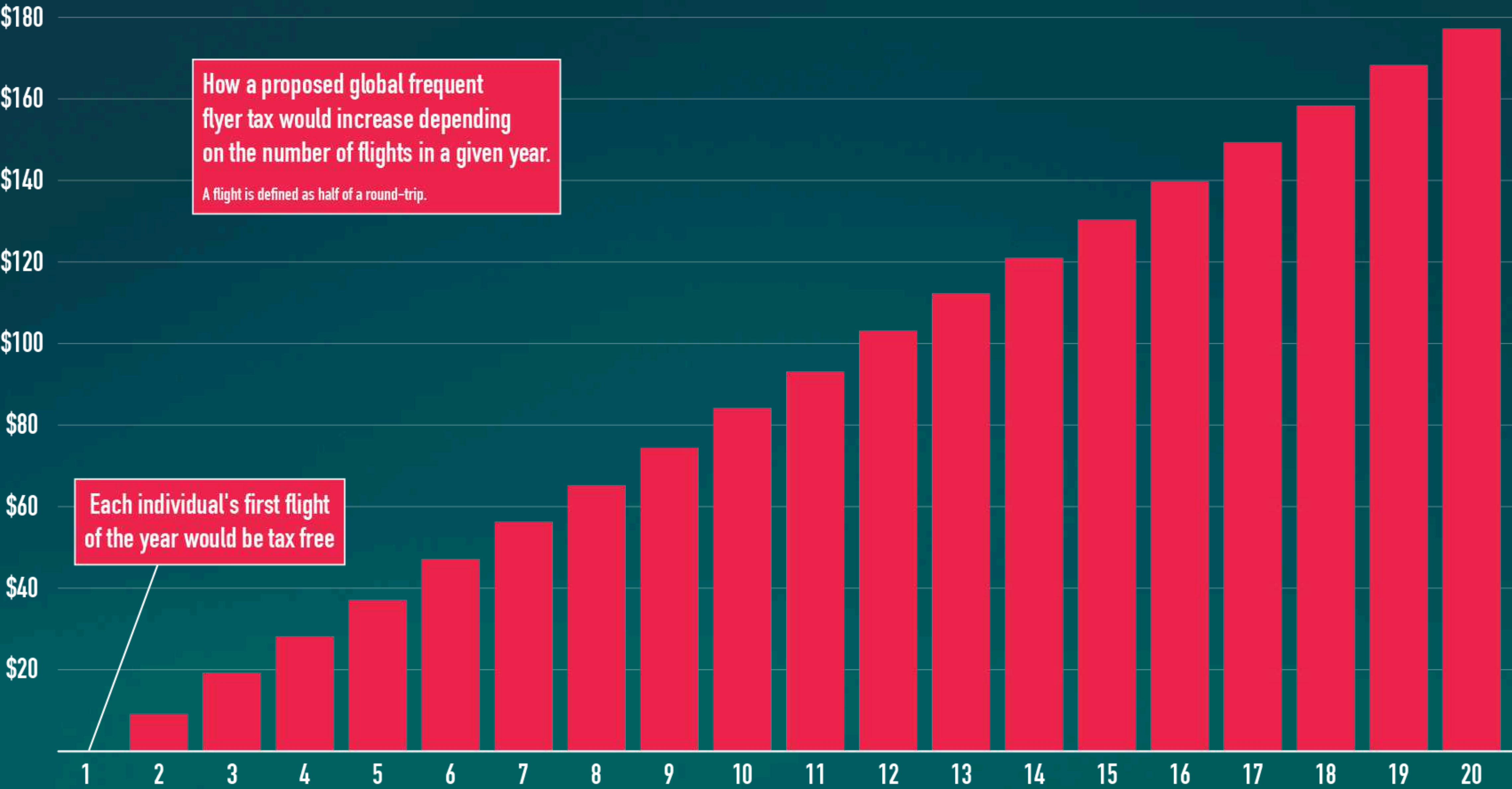
At the heart of attempts to halt damaging climate change is a pair of ideas: decarbonise electricity and electrify the economy. So, how is it going? Badly, is the answer.

GLOBAL INCOME DECILES AND ASSOCIATED LIFESTYLE CONSUMPTION EMISSIONS

PERCENTAGE OF CO2 EMISSIONS BY WORLD POPULATION



PROGRESSIVE FREQUENT FLYER TAX



Source: International Council on Clean Transportation



CREATION



EXTRACTION



De-Growth or Re-Growth?

PRINCIPLES OF DEGROWTH



Sustainability

Never deteriorate supporting ecosystems



Useful Production

What is not needed should not be made



Circularity

Waste not, want not



Sharing

Sufficiency for all, excess for none



Cooperation

People and planet, not profit



Local Production

Produce local, consume local



Work-Life Balance

Work less, play more

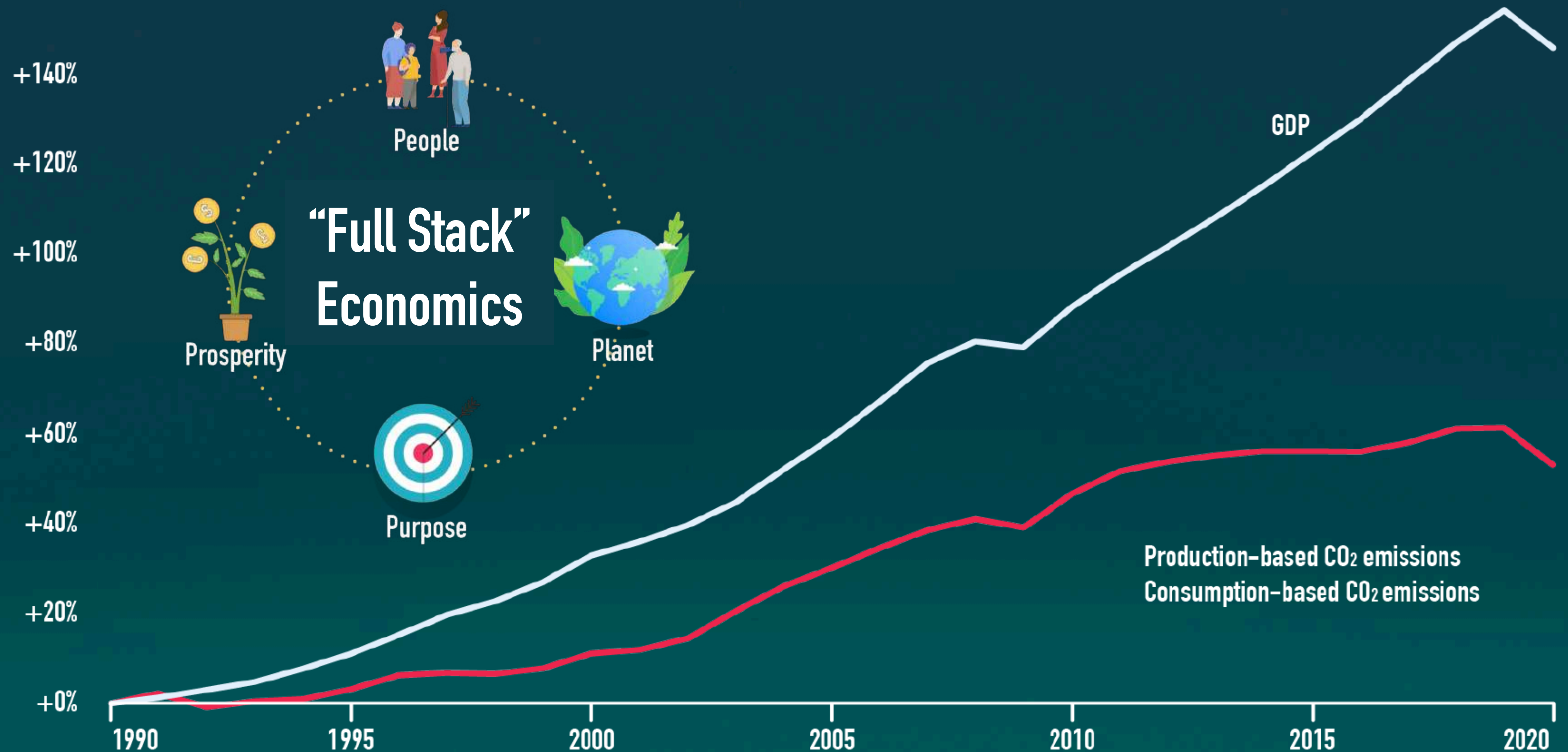


Relational Goods

Less stuff, more relationships

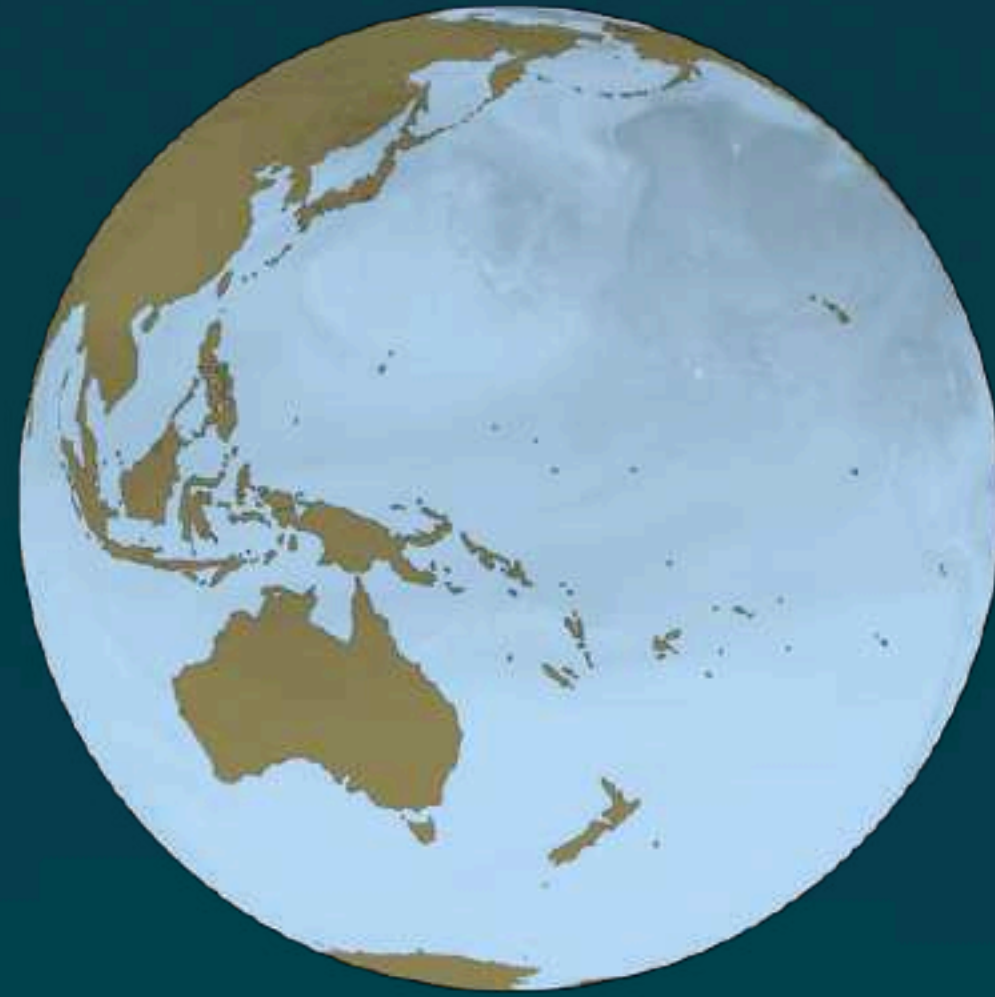
BUSINESS AS USUAL
**IS DEAD
OR DYING**

YES WE CAN: Decouple Growth from Emissions!



THE HARDEST THING TO CHANGE IS THE UNDERLYING ECONOMIC PARADIGM

PROFIT
GROWTH



PEOPLE
PLANET
PURPOSE
PROSPERITY



CAPITALISM

Profitable



Sustainable

PEOPLE
PLANET
PURPOSE
PROSPERITY



From EGOSystems to ECOSystems

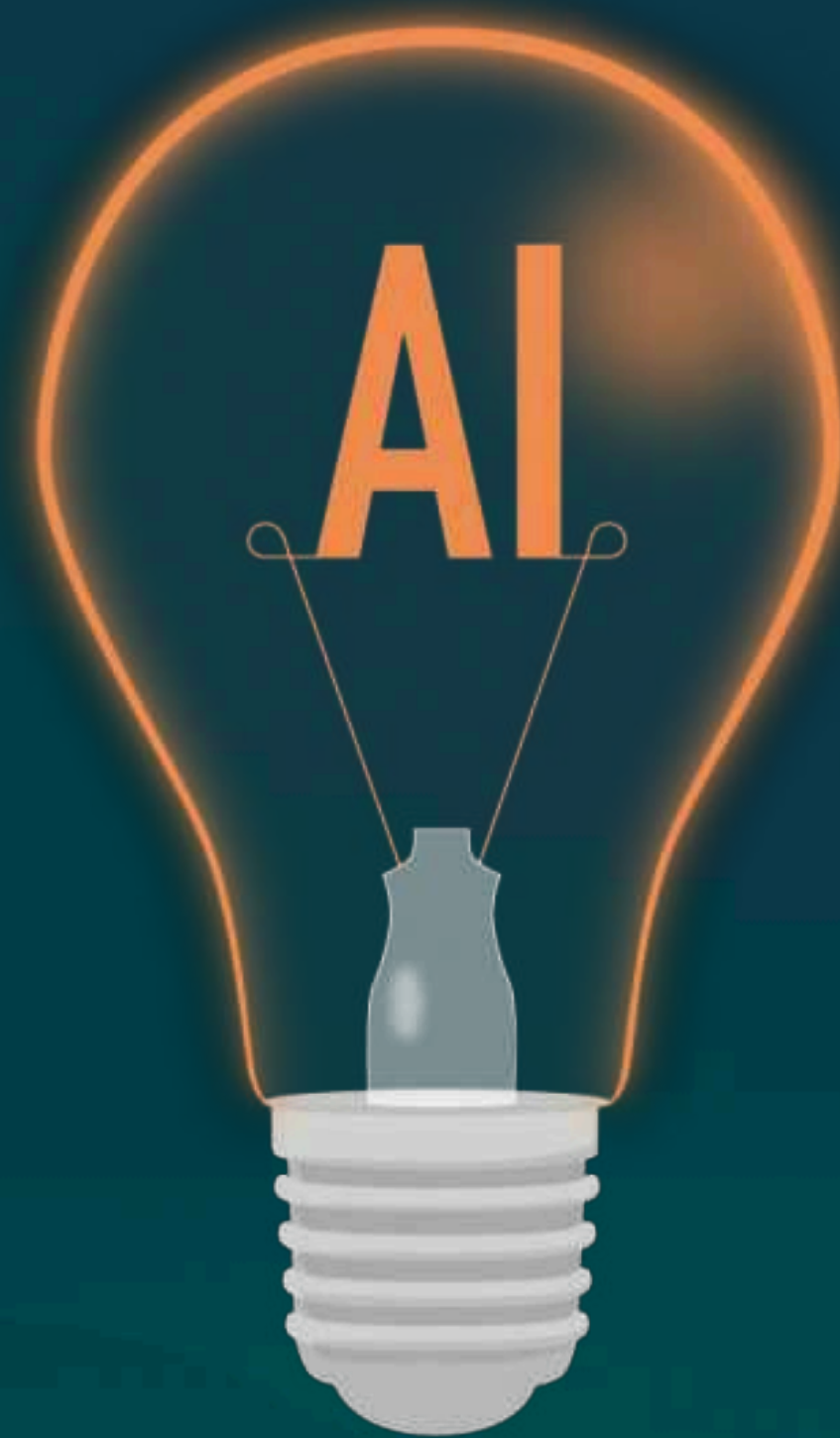
EGO

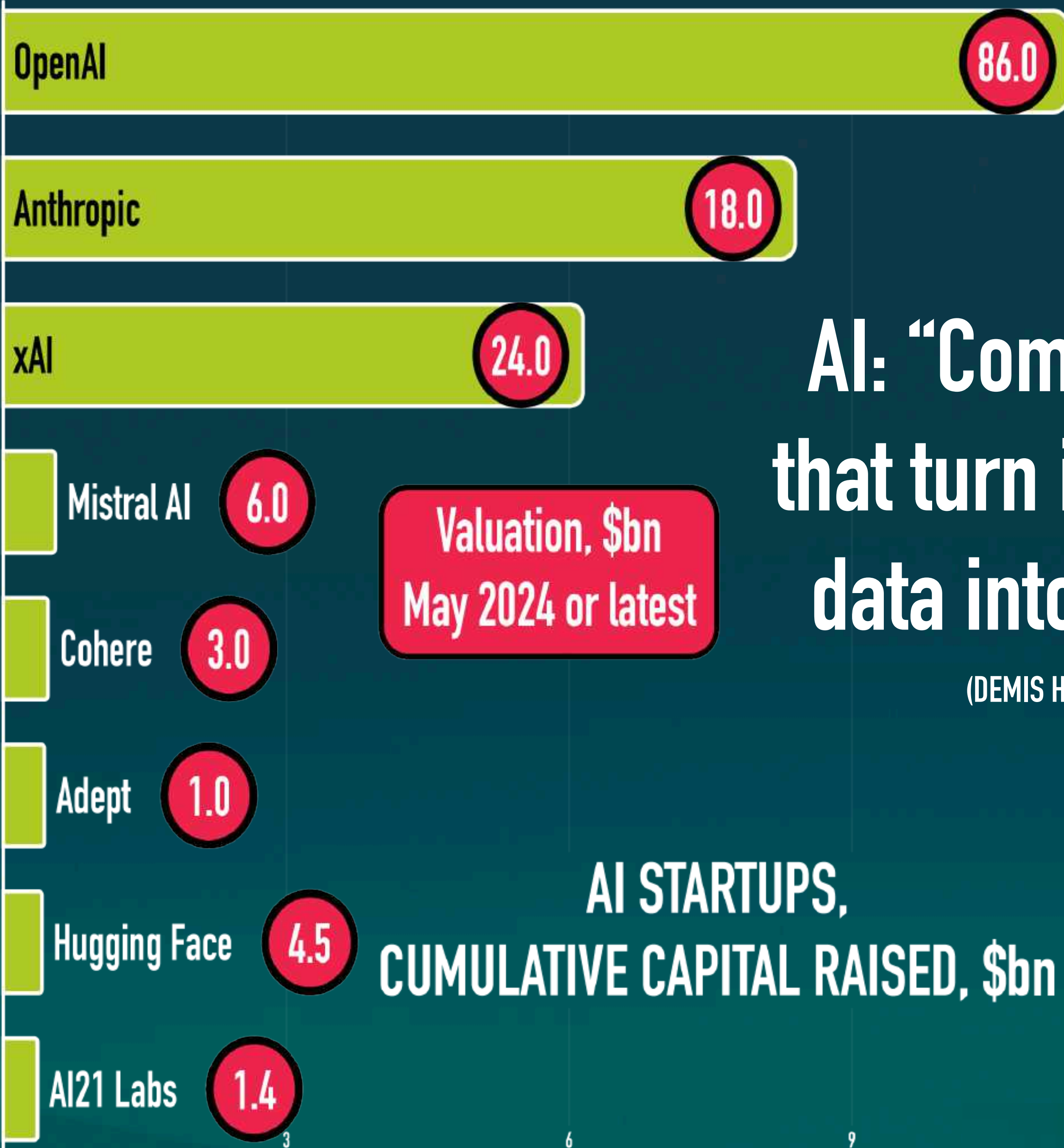


ECO



Innovative | Disruptive vs Existential





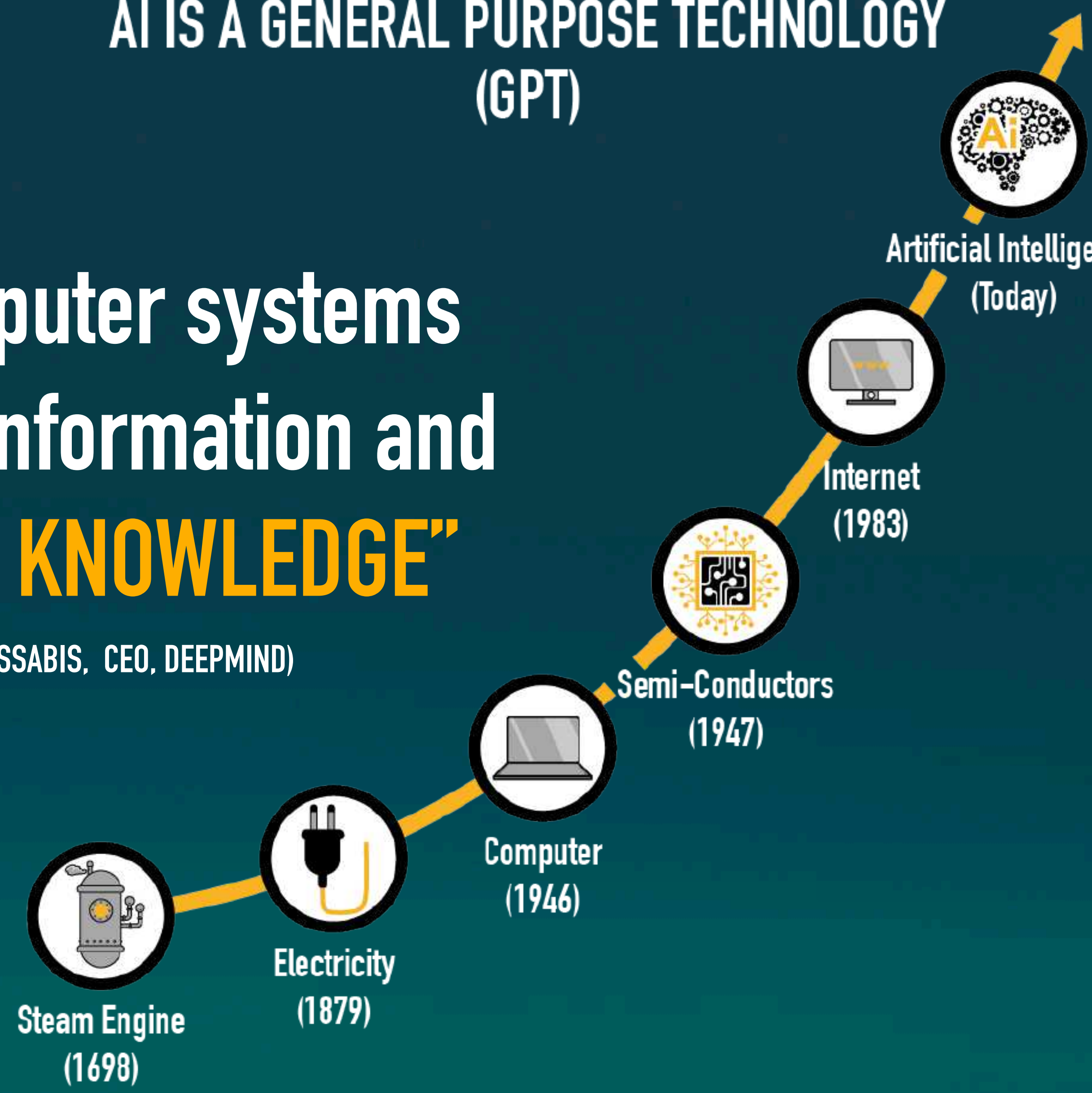
Valuation, \$bn
May 2024 or latest

AI: “Computer systems
that turn information and
data into **KNOWLEDGE**”

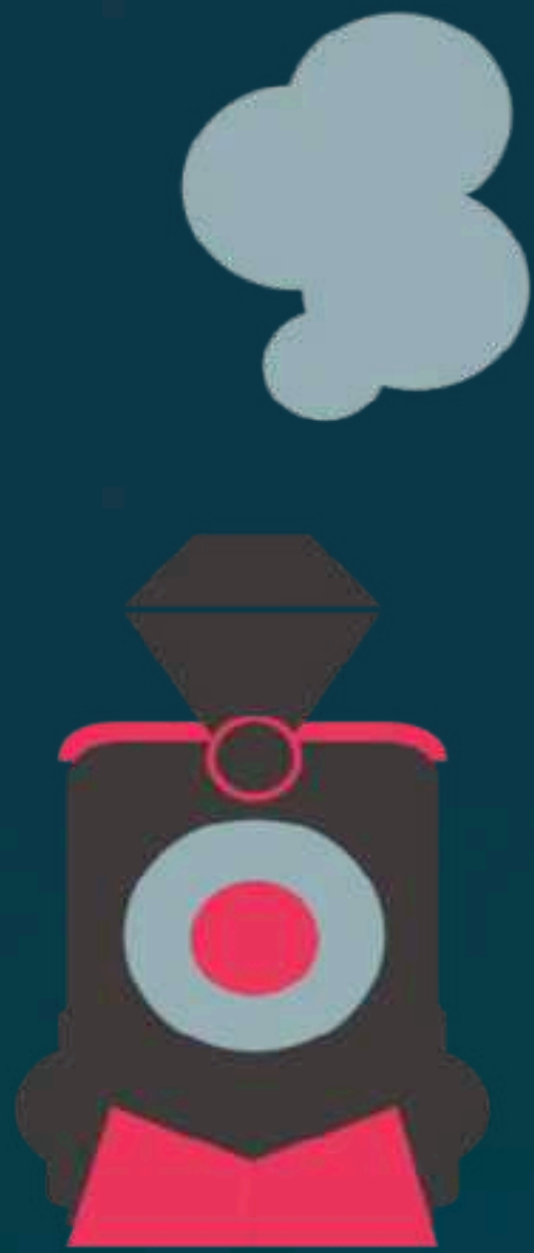
(DEMIS HASSABIS, CEO, DEEPMIND)

AI STARTUPS,
CUMULATIVE CAPITAL RAISED, \$bn

AI IS A GENERAL PURPOSE TECHNOLOGY
(GPT)



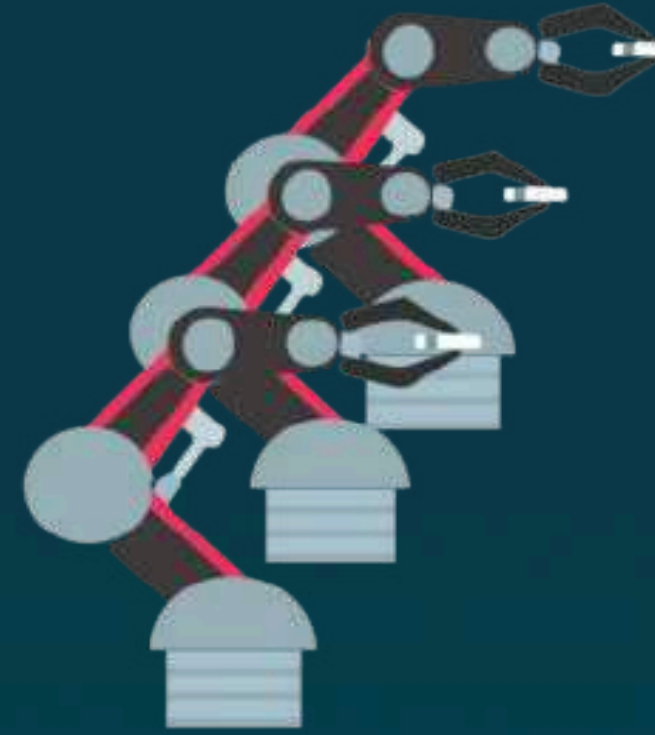
Source: Nasscom Community



Industry 1.0



Industry 2.0



Industry 3.0



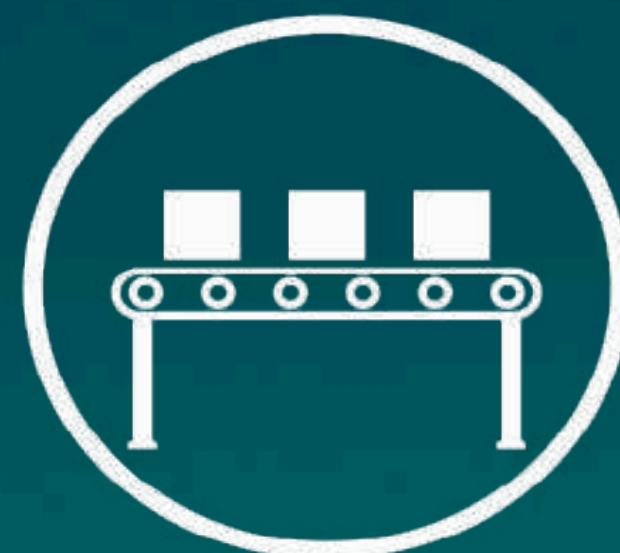
Industry 4.0



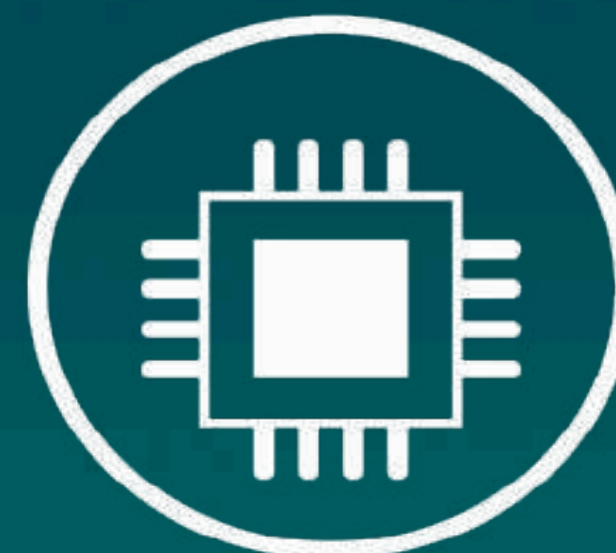
Industry 5.0



1784



1870

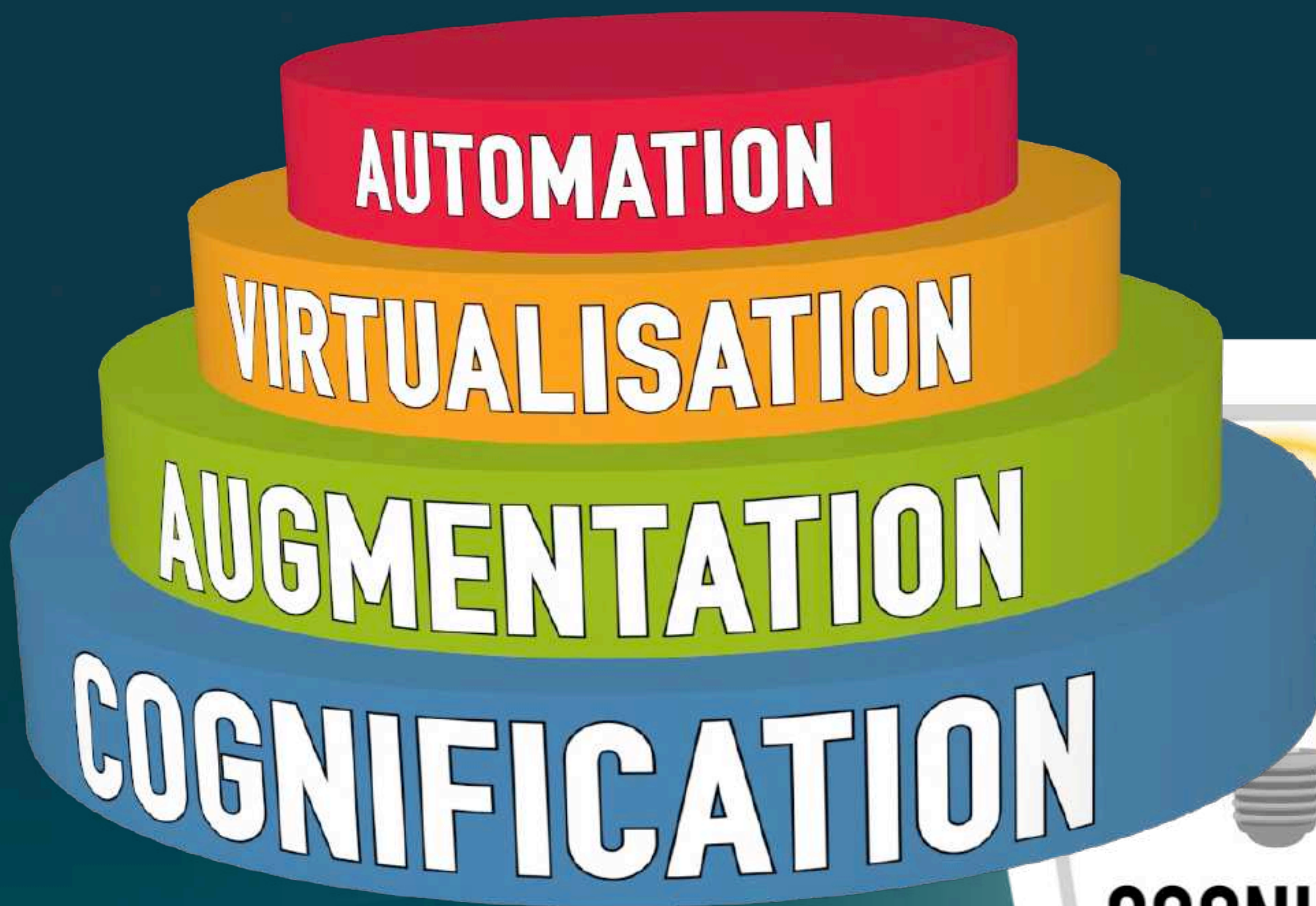


1969



Today





COGNIFIER

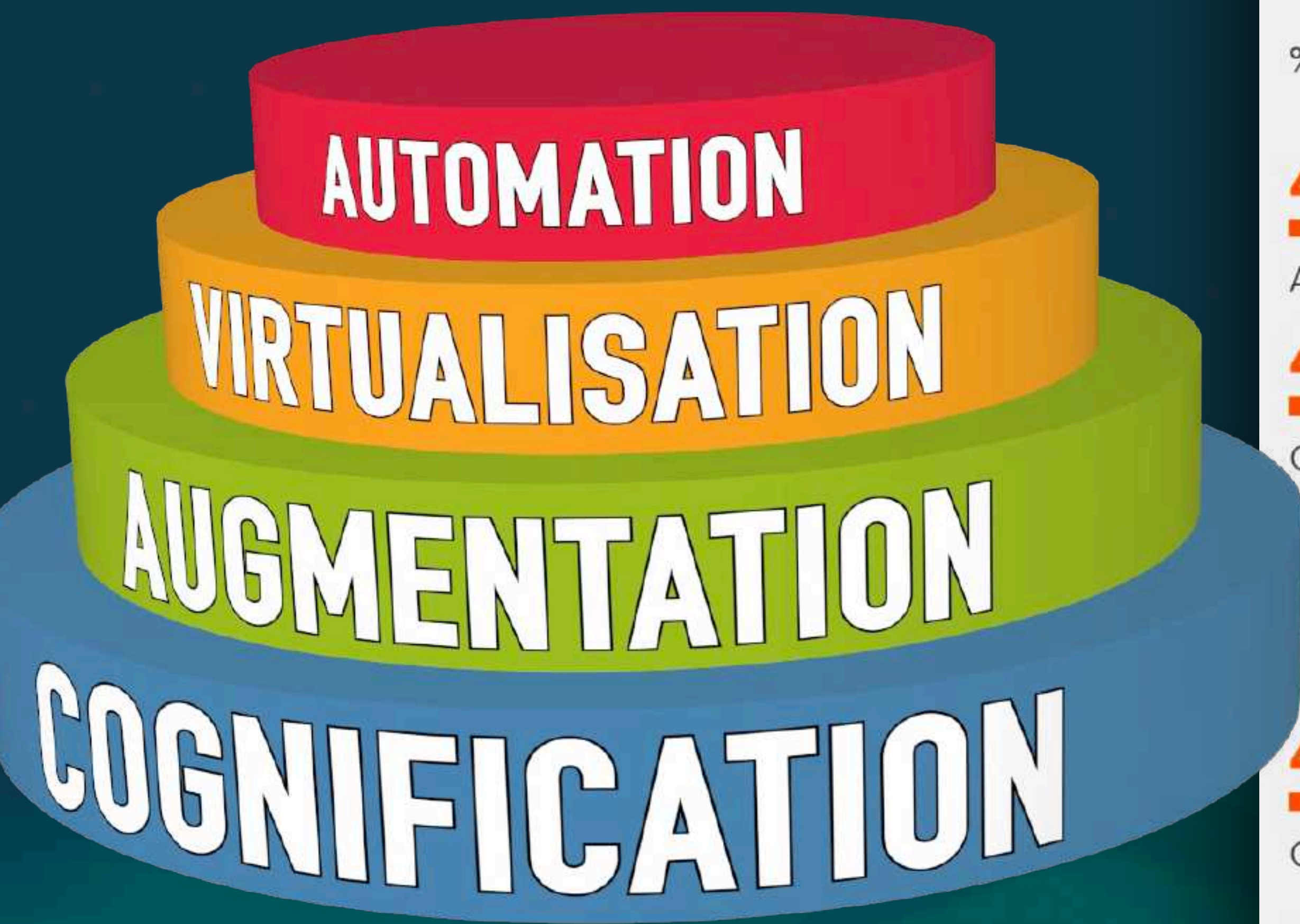
SMART
HEALTH

SMART
RETAIL

SMART
TRANSPORT

AI Components: Cognification | Augmentation | Virtualisation | Automation





How Companies Expect Generative AI to Improve Customer Experiences

% of professionals

49%

Analyse customer data to create more intelligent shopping suggestions

44%

Create more targeted marketing campaigns based on consumer data

44%

Build customer service chatbots that can mimic human interactions

43%

Create, optimise and improve product page images and copy

42%

Integrate into travel planning or shopping

Source: Euromonitor International Voice of the Industry: Digital Survey, fielded August/September 2023 (n= 169)

SUPPLY CHAIN 2030?



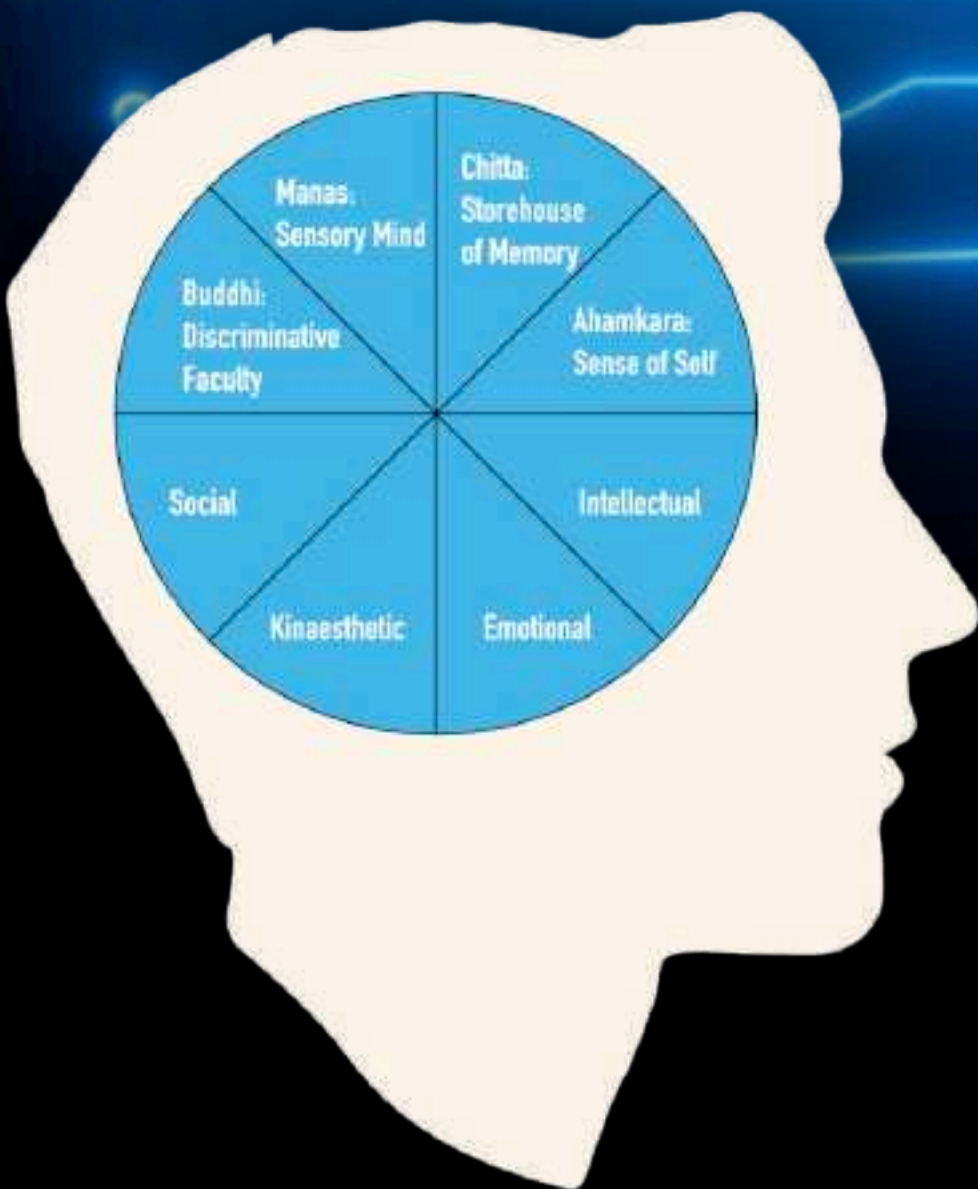


Every professional will
have an **AI ASSISTANT** of
their own, within the
next 3 years

(Thomson Reuters Report 2024)

Machines **DON'T** 'Think' or 'Feel'
Machines **DON'T** have hunches
Machines **DON'T** 'understand'
Machines **DON'T** imagine
Machines **DON'T** care

AI



GENERATIVE AI / GENAI: Software/AI that can turn data, information and binary, explicit knowledge into **CONTENT & MEDIA**



ASSISTED INTELLIGENCE

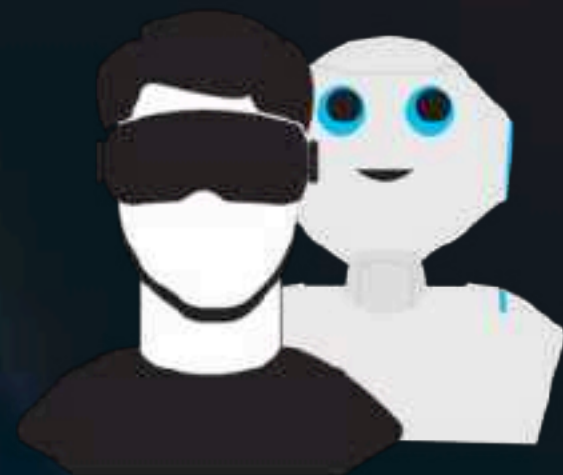


AUTOMATION



Who will be **MISSION CONTROL** for humanity?

AUGMENTED INTELLIGENCE



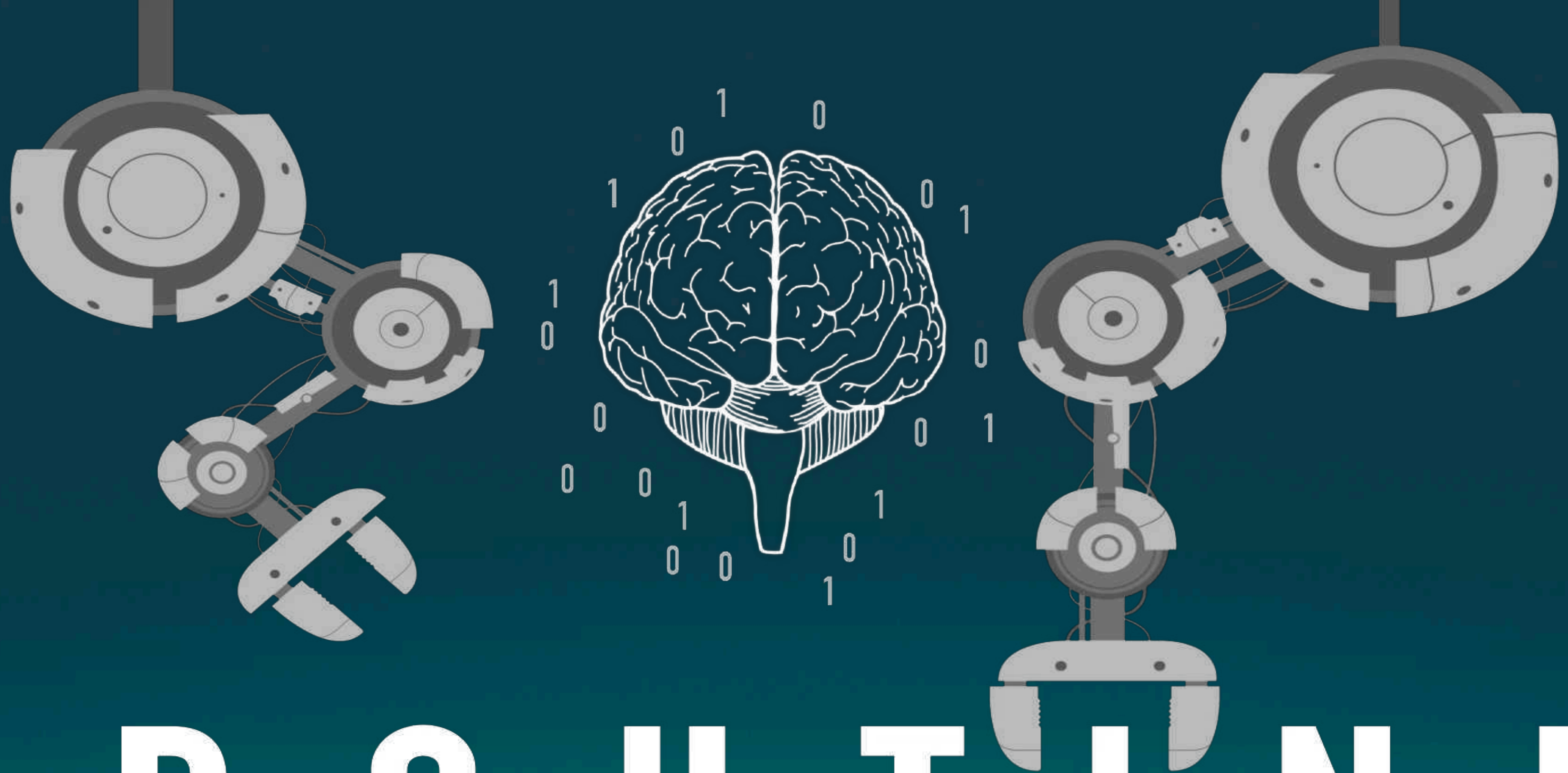
AUTONOMOUS INTELLIGENCE



If? Why?

How?

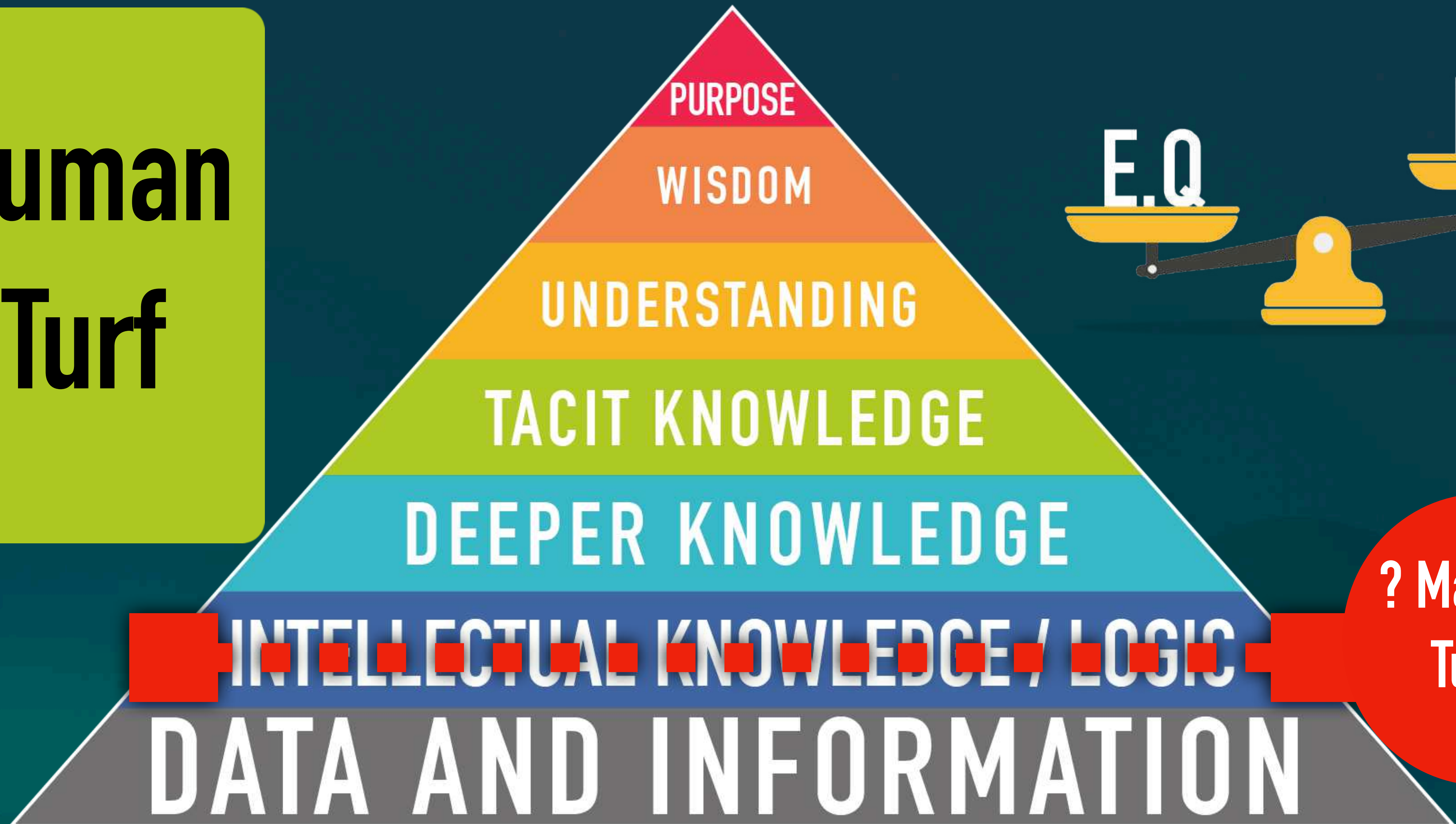
Who



ROUTINE

The Future of Human Work: Beyond Data, Information and *Knowledge

**Human
Turf**





If you work or LEARN like a robot,
the robots **will** take your job!



EXPLICIT KNOWLEDGE

VS.

TACIT KNOWLEDGE



Explicit Knowledge is knowledge that can easily be expressed, codified, and recorded so it can be shared



Objective, logical and technical



Codified



Easily transferable



It can be recorded and stored in physical/electronic form



Tacit Knowledge is knowledge that cannot be expressed easily and is often acquired by personal experience



Subjective, cognitive and experiential



Non-codified



Difficult to transfer - often requires face-to-face interaction and teaching



Can't be recorded or stored

Human-Only Work is our Future

TACIT KNOWLEDGE

Tacit Knowledge is knowledge that cannot be expressed easily and is often acquired by personal experience



Subjective, cognitive and experiential



Non-codified



Difficult to transfer – often requires face-to-face interaction and teaching



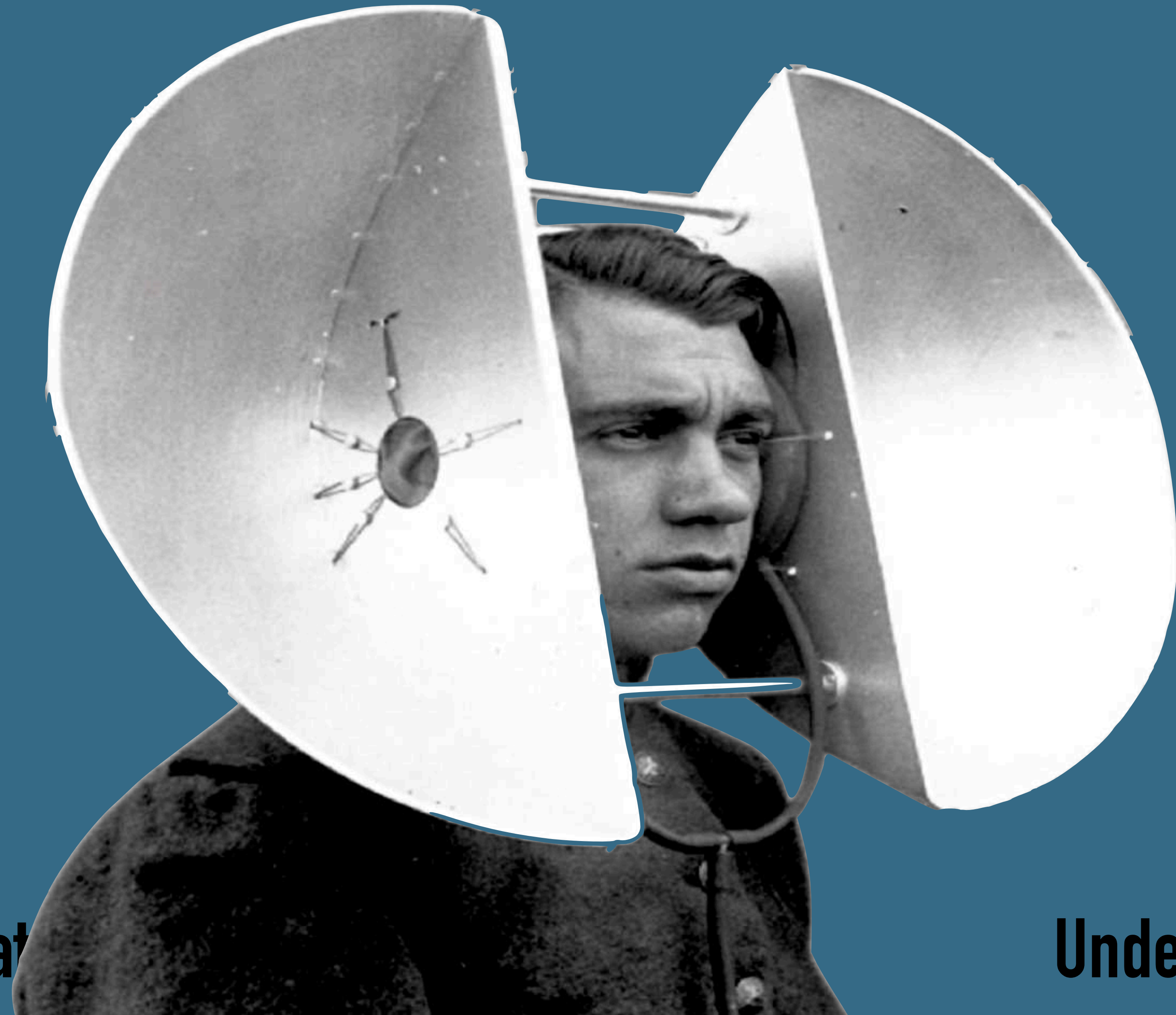
Can't be recorded or stored



Act | Create

The Future Mindset

Observe | Perceive



Imagine | Contemplat

Understand | Feel

Thanks for your time, now let's talk!

FUTURE



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gerdtube.com



lookupnow.tv

Gerd Leonhard, Public Thinker & Futurist

REPIC

WEEE | BATTERIES | PACKAGING