"Chemistry Under The Fourth Industrial Revolution – 4IR"

A Huge Growth Opportunity

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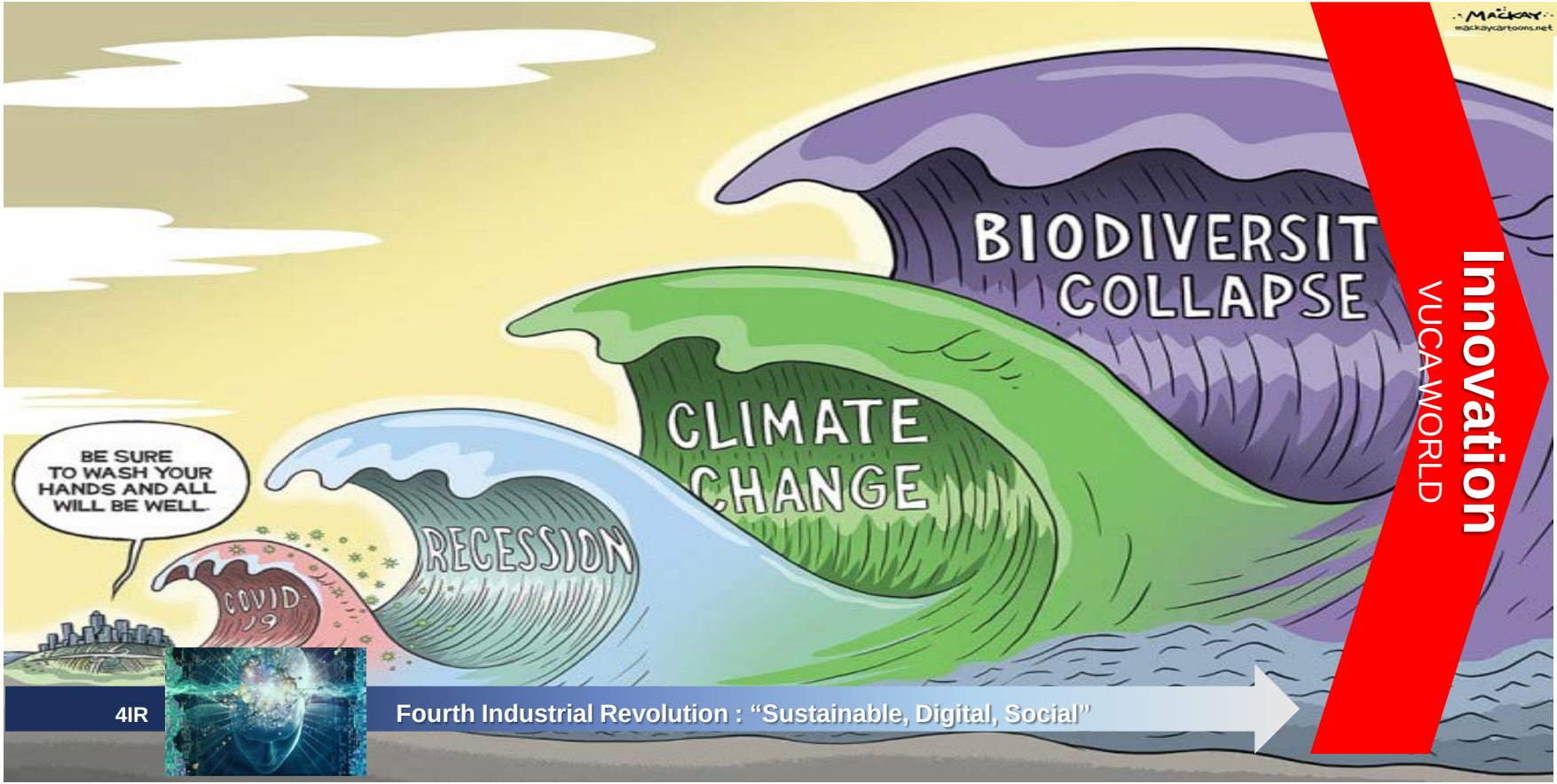
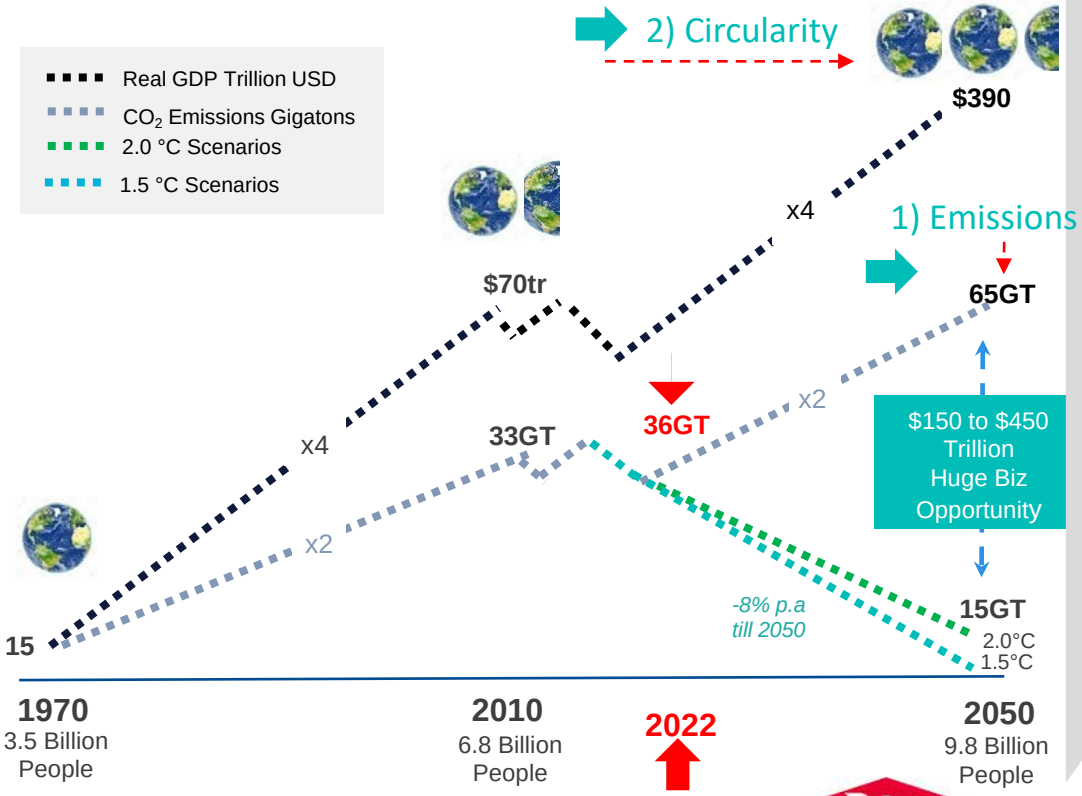
INtersections

Truly Historical Times



SUSTAINABLE REVOLUTION: DISRUPTIVE LARGE VALUE GROWTH OPPORTUNITY

World CO_2 Emissions vs. GDP & Climate Change Scenarios



Large Disruptive Opportunity

$150 to $450 Trillion by 2050

Over the past five years (2014–2019)

Renewables Energy	Protein Substitution	Electrical Vehicles Transportation	Sustainable Finance
Global renewable capacity has grown by:	UK sales of meat substitutes have grown by:	Global electric car stock has grown by:	Global sustainable debt issuance has grown by:
50%	More than 85%	More than 900%	More than 1,000%

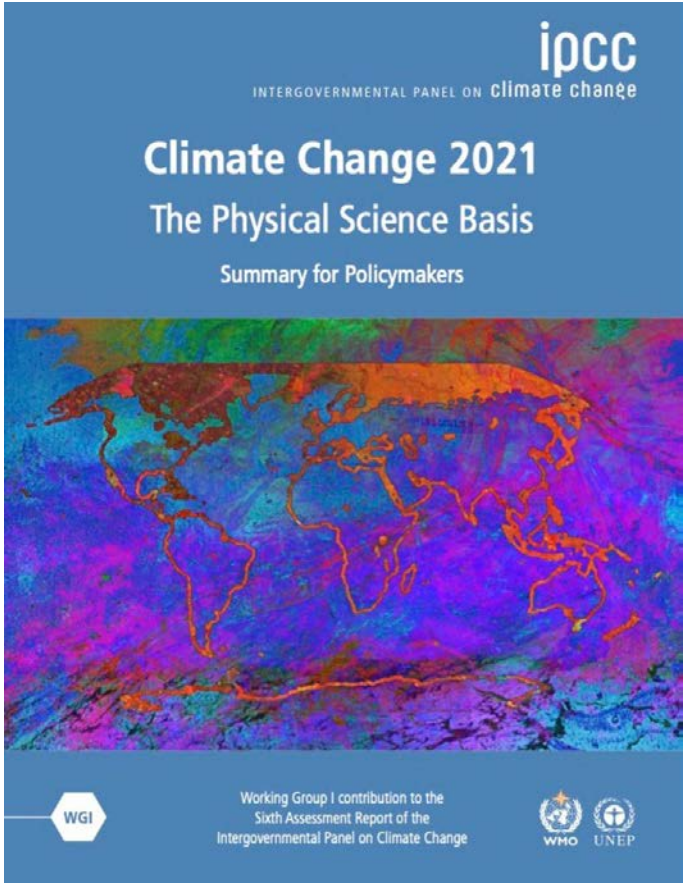
Sources: Bain analysis; IRENA (energy); Euromonitor (protein); IEA (transportation); BloombergNEF, Bloomberg Finance LP (investing)

Sustainability
As a Source of Growth & Innovation

Source : UNEP & McKinsey

Source: The Chemical Industry by 2050 by Rafael Cayuela Wiley-VCH Verlag GmbH, 2013 ISBN 3527344012, 9783527344017

UN WARNING : CODE RED FOR HUMANITY



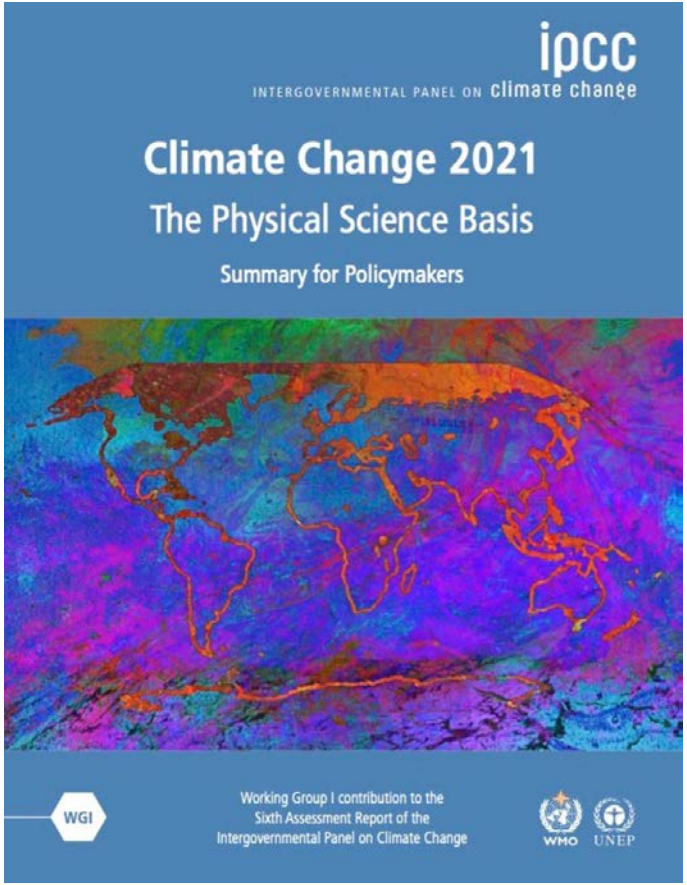
9th August, 2021

UN WARNING

«CODE RED FOR HUMANITY»

Climate Efforts Poised to Accelerate Even Further

UN WARNING : CODE RED FOR HUMANITY



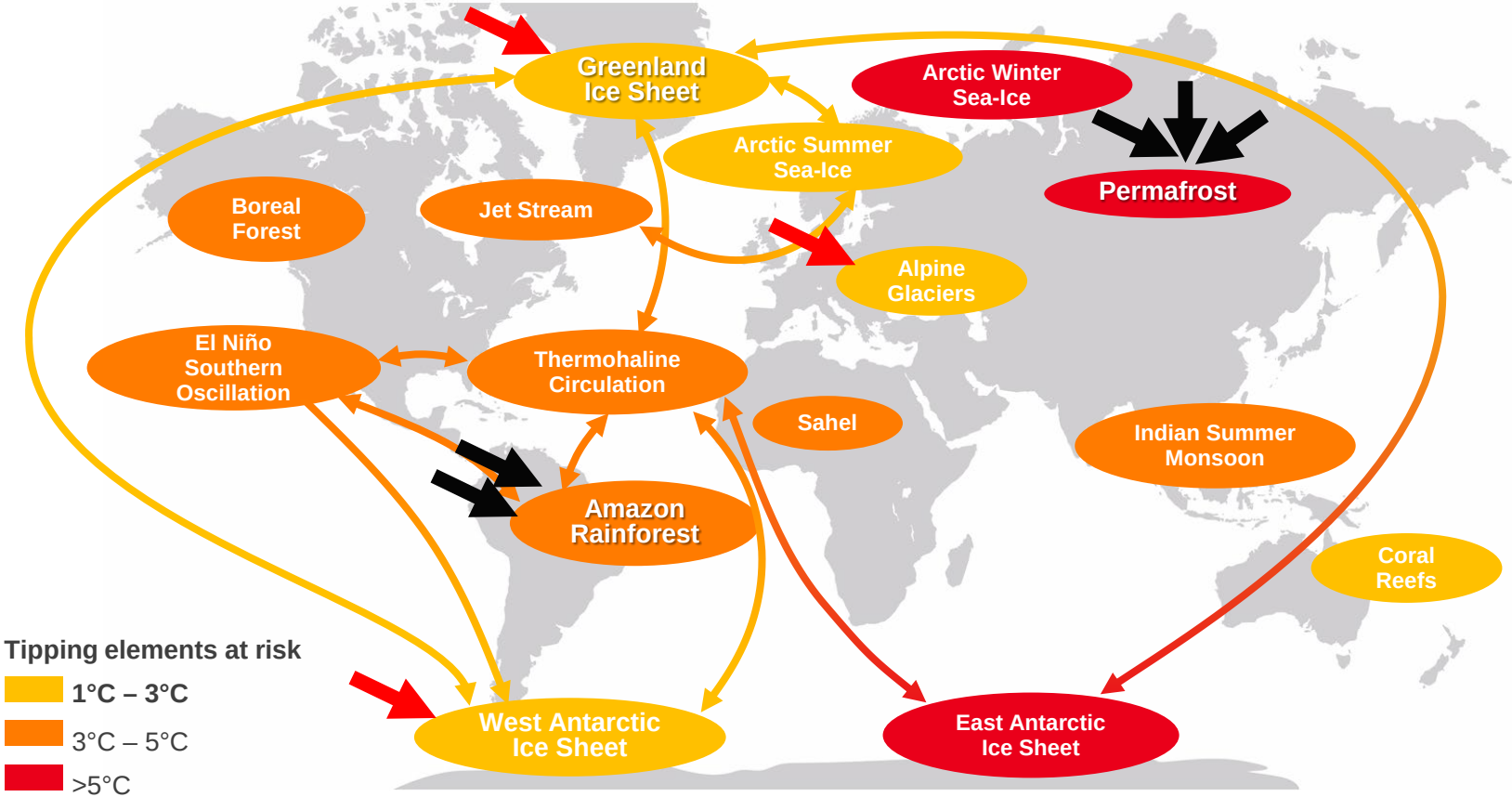
Global Warming Between 1850–1900 and 2010–2019 (°C)		Historical Cumulative CO_2 Emissions from 1850 to 2019 ($GtCO_2$)					
1.07 (0.8–1.3; likely range)		2390 (± 240; likely range)					
Approximate global warming relative to 1850–1900 until temperature limit (°C)[a]	Additional global warming relative to 2010–2019 until temperature limit (°C)	Estimated remaining carbon budgets from the beginning of 2020 ($GtCO_2$) *Likelihood of limiting global warming to temperature limit*[b]					Variations in reductions in non-CO_2 emissions[c]
		17%	*33%*	*50%*	*67%*	*83%*	
1.5	0.43	900	650	500	400	300	Higher or lower reductions in accompanying non-CO_2 emissions can increase or decrease the values on the left by 220 $GtCO_2$ or more
1.7	0.63	1450	1050	850	700	550	
2.0	0.93	2300	1700	1350	1150	900	

[a] Values at each 0.1°C increment of warming are available in Tables TS.3 and 5.8.

CLIMATE PHYSICAL RISKS / TIPPING POINT : ALSO ACCELERATING

CLIMATE PHYSICAL RISKS / TIPPING POINT : ALSO ACCELERATING

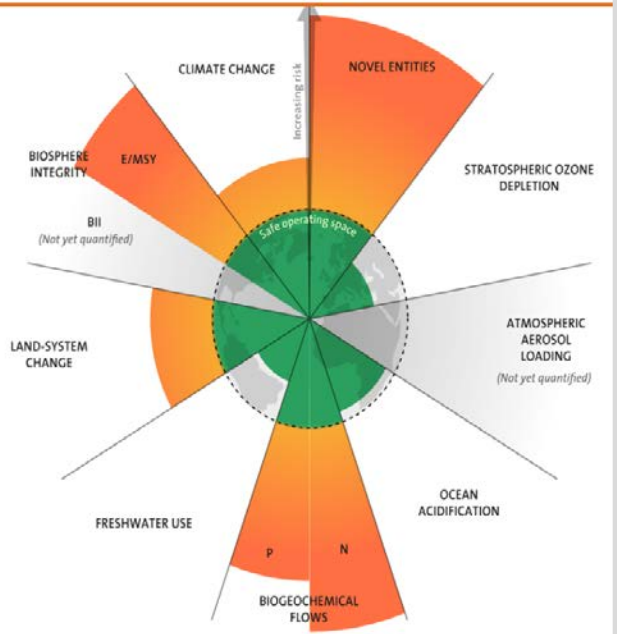
PHYSICAL RISKS & TIPPING POINT ACCELERATING : MITIGATION



PLASTICS PLANETARY BOUNDARY EXCEEDED = BANS & CIRCULARITY

Stockholm Resilience Centre | Stockholm University

January 2022



Credit: Designed by Azote for Stockholm Resilience Centre, based on analysis in Persson et al 2022 and Steffen et al 2015. Click to download.

Shifting to circular economy

The researchers conclude that current increasing trends of chemical production and release put the health of the Earth system at risk. The authors call for actions to reduce the production and release of pollutants.

"We need to be working towards implementing a fixed cap on chemical production and release," says Carney Almroth.

"And shifting to a circular economy is really important. That means changing materials and products so they can be reused not wasted, designing chemicals and products for recycling, and much better screening of chemicals for their safety and sustainability along their whole impact pathway in the Earth system", adds Sarah Cornell from the Stockholm Resilience Centre.

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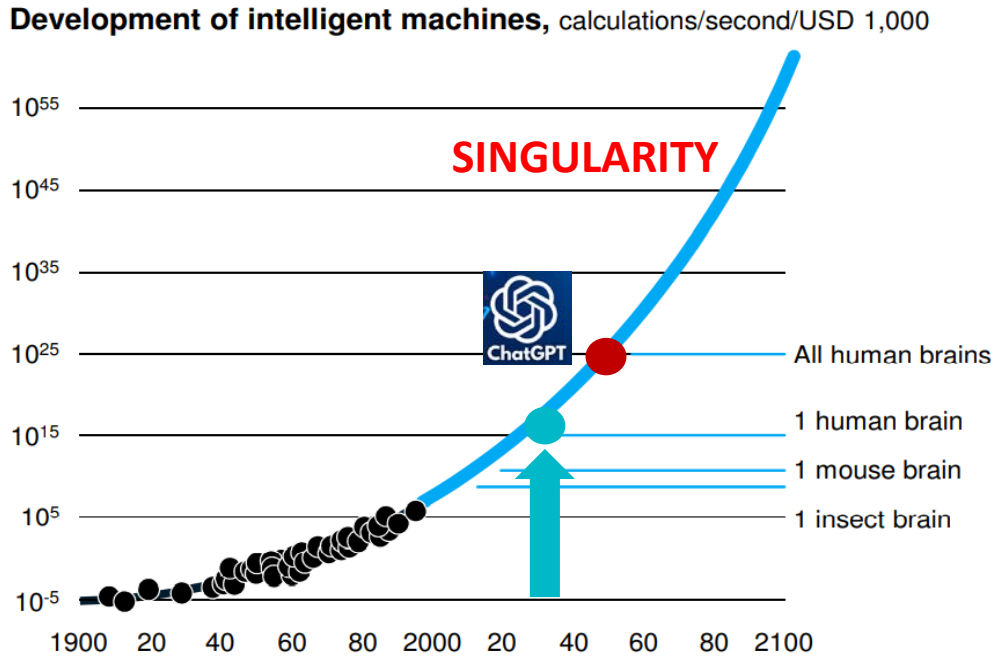
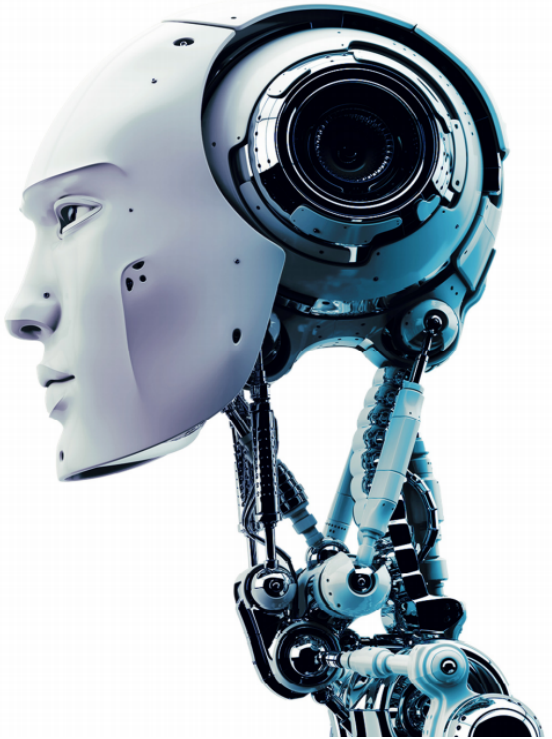
DIGITAL REVOLUTION : EXPONENTIAL COMPUTATIONAL CAPACITY

Computational Capacity vs. Cost Doubling Every Two Years

Technolgy Tend To Be Overestimated In The Short Term and Overestimated In The Short Term (Eric Schmidt)





Source: Based on Kurzweil's "The Law of Accelerating Returns" (2001);

DIGITAL REVOLUTION : NEXT DECADE TRANSFORMATION

Source : Singularity University

Living Technologies Poised To Accelerate
Disrupting All Aspects Of Life

- **Computational Capacity** To Surpass Human Brain by 2028 & Mankind by 2045
- **Quantum Chemistry** Processes & Molecules getting real (1,000 to 10,000 qubits) by 2025-30
- **Artificial Intelligence (AI)** could Double Global the World GDP by 2035 (McKinsey)
- **Life Expectancy** Extended By 5 to 10 years every single decade
- **Enhancing Humans**, thanks to Brain Computer Interfances (BCI), AI As Service, etc.
- **Multiple Industries in disruption** from automotive, to energy, insurance, chemicals?

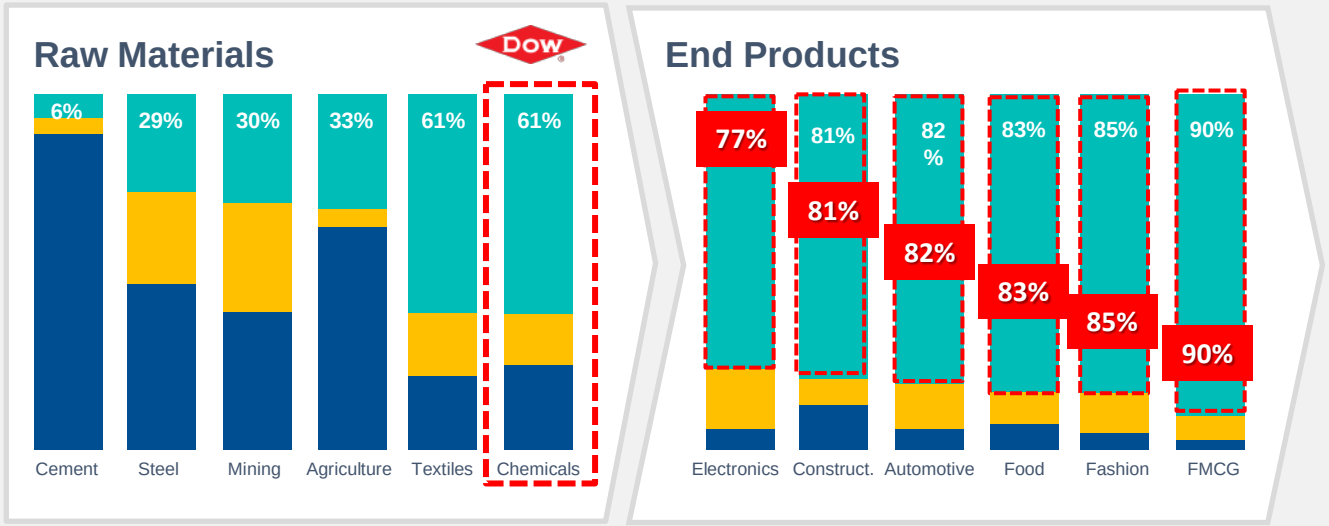
A New Wave Of Innovation & Exponential Growth Coming....

PATH TO ZERO JOURNEY: CHEMISTRY IS ESSENTIAL

Dow Carbon Neutral & Circular Materials Have an Impact to Cut Customers CO_2e Emissions (Scope 3)

Emission split in Scopes 1, 2 and 3 upstream for selected industries (CO_2e, 2019)

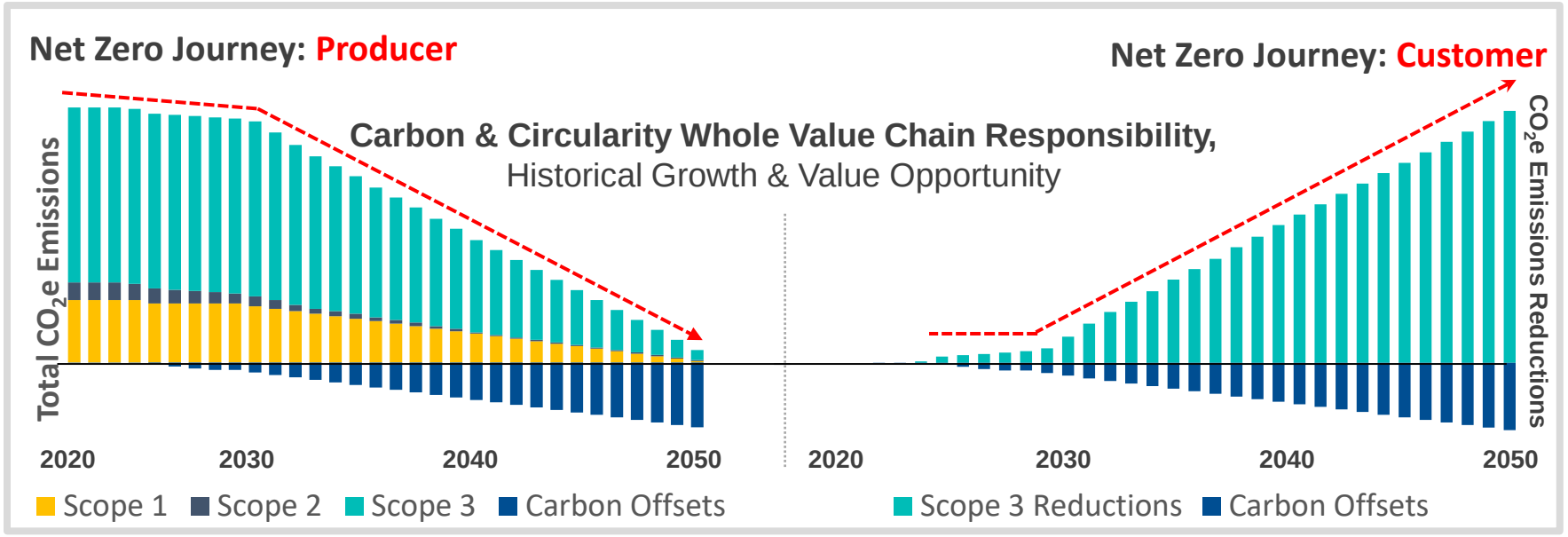
- **Supply chain** (Scope 3 upstream)
- **Purchased power, etc.** (Scope 2)
- **Operations** (Scope 1)



Note: Top companies selected based on number of reported Scope 3 upstream categories and industry fit; FMCG = fast-moving consumer goods
Source: CDP, BCG

INTEGRATED NET ZERO JOURNEY: HISTORICAL VALUE GROWTH OPPORTUNITY

Total Emissions Reductions VITAL for Customer Emissions Reductions



Chemistry Success = Humanity Success

SUSTAINABLE & DIGITAL TRANSFORMATION: NEW GROWTH & INNOVATION MODEL

New Wave Of Growth, Innovation & Collaboration

Sustainable Transformation
Sustainable Chemistry

New GROWTH Business Model

Key Assumptions

The Value of Today
Is Largely Not the Value of Tomorrow

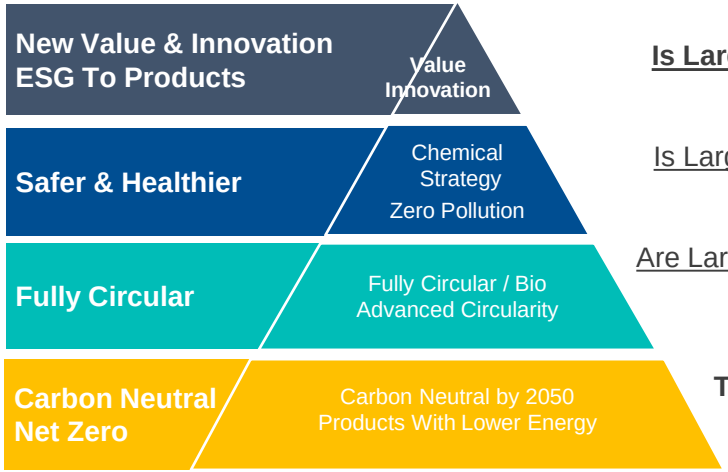
The Industry of Today
Is Largely Not the Industry of Tomorrow

The Crackers of Today
Are Largely Not the Crackers of Tomorrow

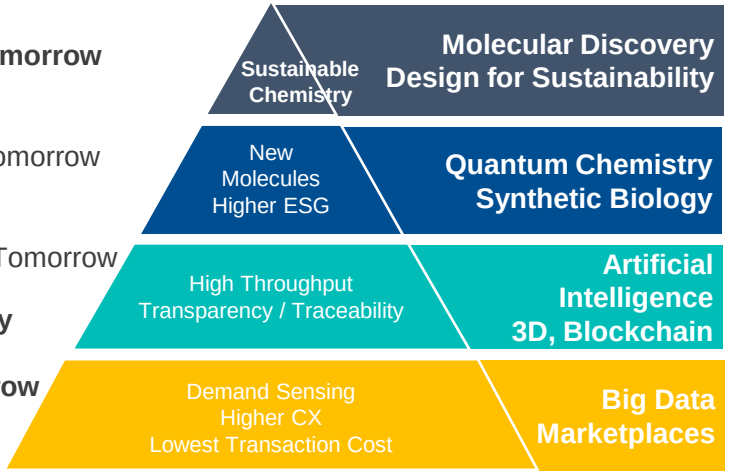
The Molecules of Today
Are Largely Not
The Molecules of Tomorrow

WARNING:
Large & Disruptive
GROWTH Opportunity

Digital Transformation
Chemical Industry



Sustainable Transformation



Digital Transformation

Source : The Chemical Industry under the 4th Industrial Revolution : The Sustainable, Digital & Citizens One by Rafael Cayuela & Andrew Hagan ISBN13 9783527344017

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A global commitment to Circularity

Our Corporate Sustainability Goals

Our targets: accelerating carbon neutrality and plastics circularity

Protect the climate

By 2030, Dow will reduce its net annual carbon emissions by 5 million metric tons. This represents a 15% reduction from Dow's 2020 baseline, and a 30% reduction from the 2005 baseline.
By 2050, Dow intends to be carbon neutral (Scopes 1+2+3 plus product benefits).

Stop the waste

By **2030**, Dow will enable 3 million metric tons of plastic to be collected, reused or recycled through its direct actions and partnerships.

Close the loop

By **2035**, Dow will enable 100% of Dow products sold into packaging applications to be reusable or recyclable.

COVID19 Reminded Us "Nature" Is More Powerful Than "Humans"

And its is Imperative To Restore Balance Between :

1) *Humans & Nature…….*
2) *Humans & Humans*
3) *Humans & Digital Technologies*

Thanks

DOW®

"Under The 4IR We Will Restore the Balance Between "Nature & Humans", Explore The Molecular Universe, Design The Molecules Of The Future & Our Own Sustainable Future"

Exciting Times Ahead…
Best Time Ever To Be in Chemistry….
THE FUTURE IS NOW…..