

CoR-AT NEXT LEVEL Forum Series 2025-2026

Redefining the Limits to Growth: comprehensive Carbon Management (cCM)

What's NEXT?
Dare to be Different!

No Limits to Learning!
No Limits to Hope!

Against all Odds:
Transformative Change!

CoR-AT NEXT LEVEL Forum 1:

Transformative Innovation in der österreichischen INDUSTRIE



“EDUCATION is the most powerful tool
to change the world.”

Nelson Mandela



“HOFFNUNG ist nicht die Überzeugung,
dass etwas gut ausgeht, sondern die Gewissheit,
dass etwas SINN hat, egal wie es ausgeht.”

Vàclav Havel

“OPTIMISMUS ist eine Haltung,
HOFFNUNG ist eine Tugend [und Verpflichtung].”

Papst Franziskus

What's **NEXT**?
Dare to be Different!

Redefining the Limits to Growth:
comprehensive Carbon Management (cCM)
WAS | WARUM | WIE ? [4 Thesen | 3 Takeaways]

Reinhold W. Lang
Club of Rome – Austrian Chapter | Präsident

No Limits to
CARBON Regeneration!

Against all Odds:
Transformative Change!

Zu Beginn: eine persönliche Würdigung & Widmung als Rahmen

Stefan Schleicher



Gastkommentar **Die Presse** | 15. Dez. 2023

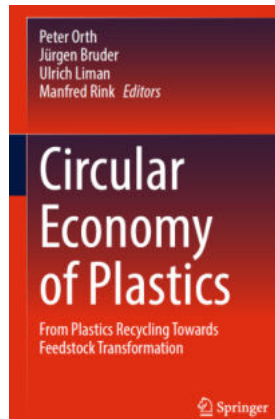


Unsere **Kurzdiagnose** zur **COP 28** (Dubai 2023)

Format dieser Konferenzen hat sich erschöpft:

- Geschäftsordnung (**Einstimmigkeit**)
- Geopolitische Verwerfungen (**nationale Interessen vs. multilaterale Kooperationen**)
- **“Von weglosen Zielen zu zielorientierten Wegen!”**

**Against all Odds:
Transformative Change!**



Chapter 15
Carbon Dioxide (CO₂)—The Ultimate Feedstock for an All-Circular and Climate-Neutral Carbon and Plastics Economy

Titel des Schlusskapitels

- **‘Making a Way out of No Way’**

Alfred Stern



Dr. Stern`s Dissertation Party (MU Leoben, 1996)

Beruflicher Werdegang

- **DuPont & Borealis**
- **CEO der OMV AG** (seit Sept. 2021)

OMV Strategie 2030 (03/2022)

- **strong focus on circular economy**
- **‘net-zero by 2050 or sooner’**



These 1: Zur Bedeutung eines **umfassenden** (industriellen) **Kohlenstoffmanagements für Europa**

What's NEXT?
Dare to be Different!

Wir in **Europa** (und Österreich) müssen an **Energietransformation** und an **Kreislaufwirtschaft** festhalten, weil es die **einzigste Zukunftsoption** für die **europäische INDUSTRIE** und für **globale PROSPERITÄT** ist, und ...

... weil es die **einzigste Option** ist, uns in Europa vor **nicht bewältigbaren, künftigen Migrationsströmen** (insbesondere aus Afrika und dem Nahen Osten) wirksam und humanitär vertretbar **zu schützen!**

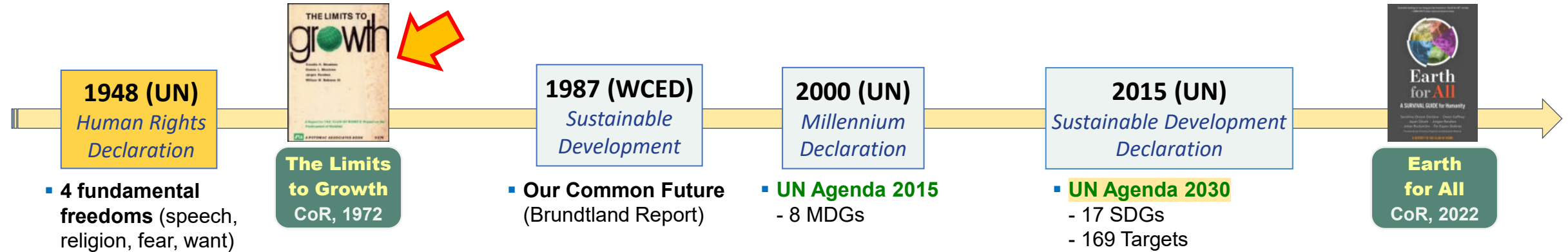
Against all Odds:
Transformative Change!



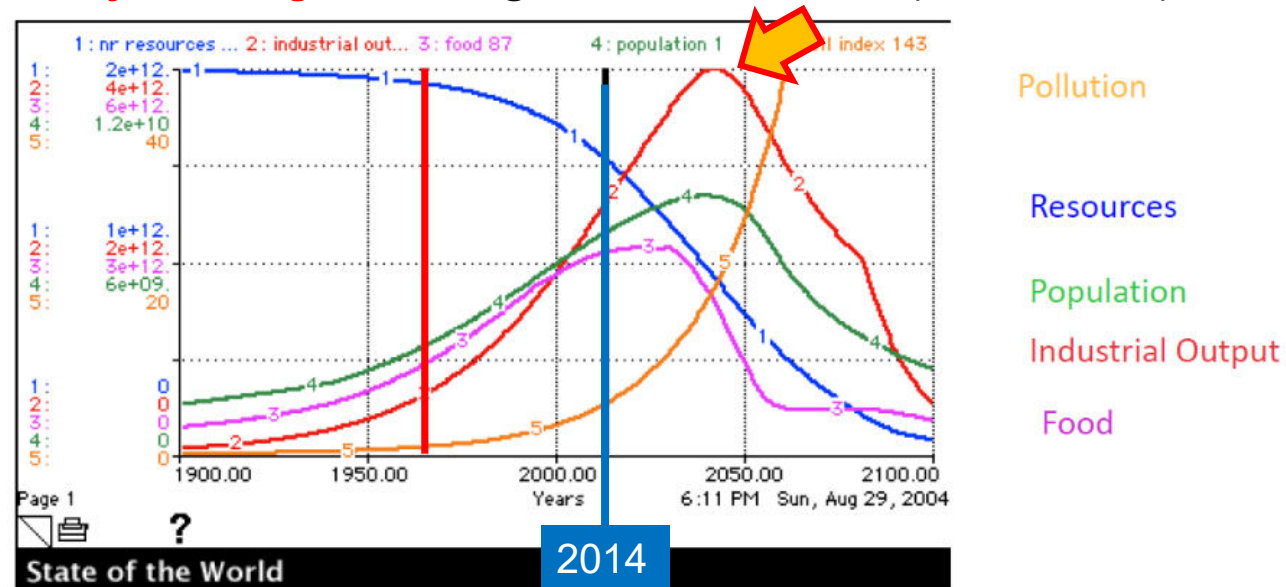
Austrian
Chapter

The Human Enterprise: **Redefining** the Limits to Growth?! (1/2)

Pillars of human civilization on JUSTICE, EQUITY, INCLUSION & PROSPERITY for all:



Early Warnings: The original 1972 scenario (*standard run*)

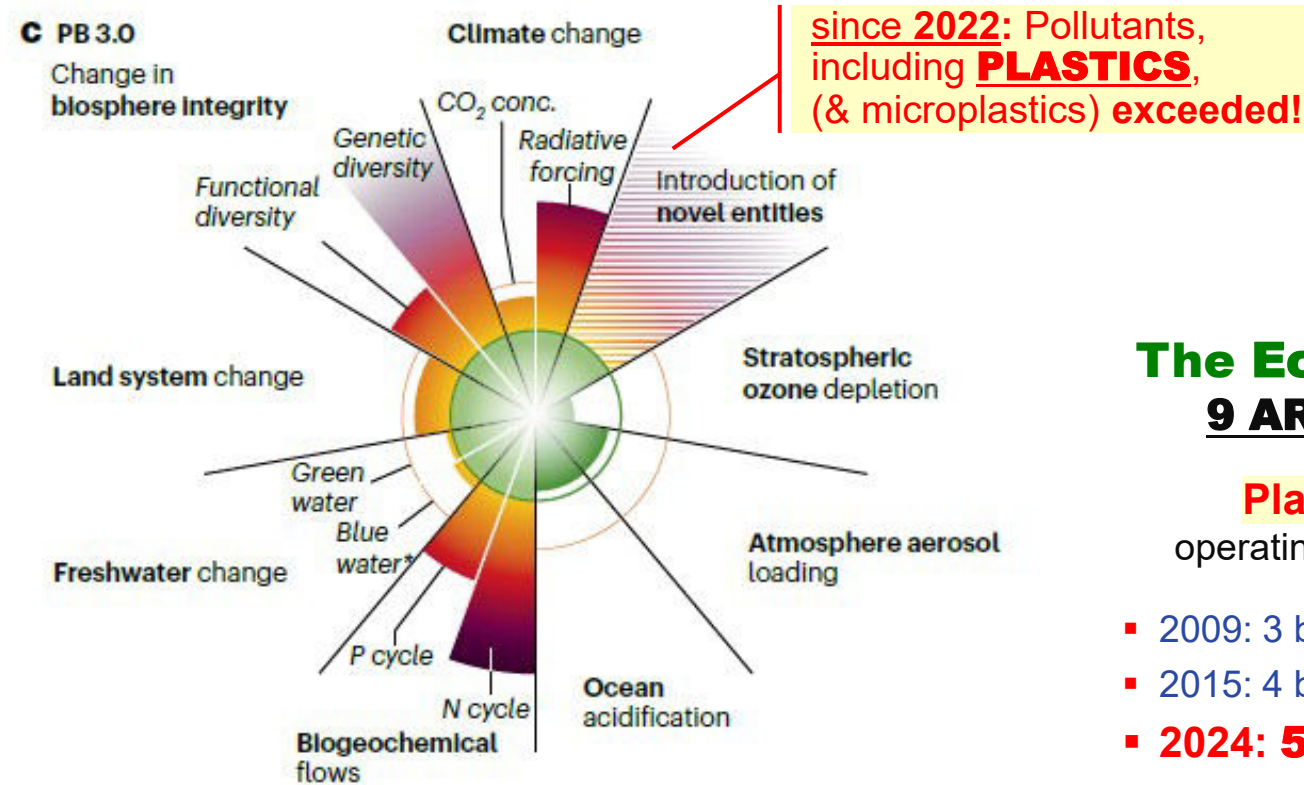
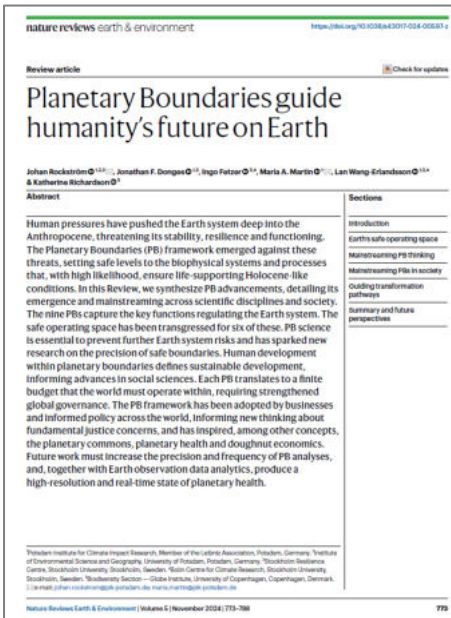


Source: Dennis Meadows; Lecture at Austrian Institute of Economic Research (WIFO), Vienna/Austria (Sept. 9, 2014); Providing Social Welfare in an Era Without Growth

The Human Enterprise: Global Challenges & the **Anthropocene**

The Planetary Boundaries – PB 3.0 (Nov. 2024)

Nature Reviews Earth & Environment
Volume 5 | Nov. 2024
Johan Rockström et al.

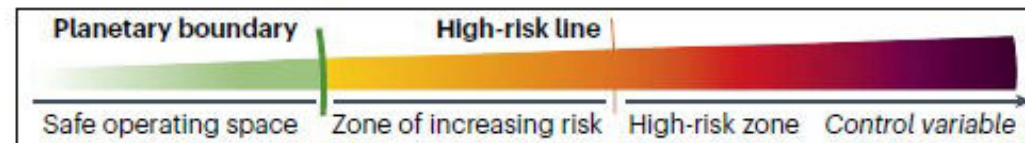


The Ecological Compass **9 AREAS** [now sub-divided]

Planetary boundaries

operating ranges of human activity

- 2009: 3 boundaries crossed
- 2015: 4 boundaries crossed
- 2024: 5-6 boundaries crossed**



Die ‘Grenzen des Wachstums’ überwinden – Wie?

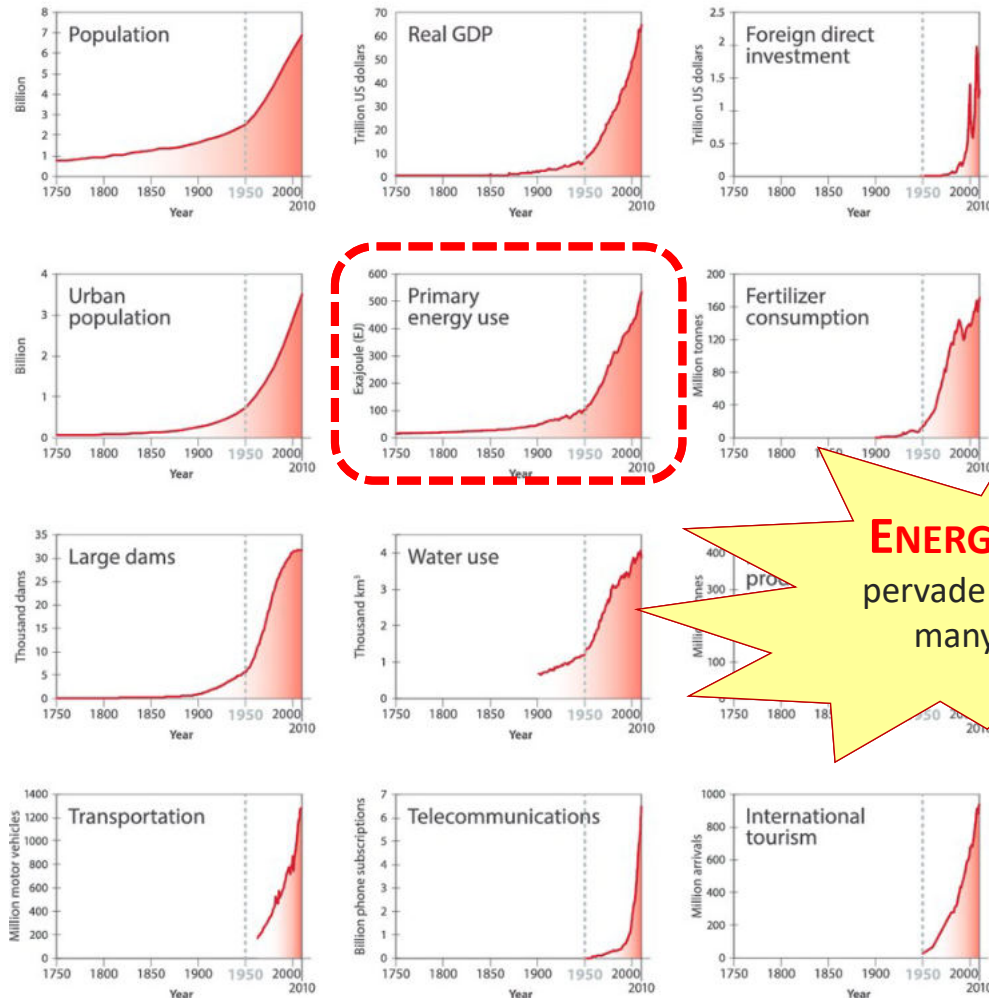
- Von einem linearen Wirtschaftsmodell zu einem resilienten, umfassend zirkulärem Wirtschaftsmodell (“Circular Economy”)
- ... mit “comprehensive Carbon Management (cCM)” als wesentlichen Eckpfeiler und “sensitive intervention point”!



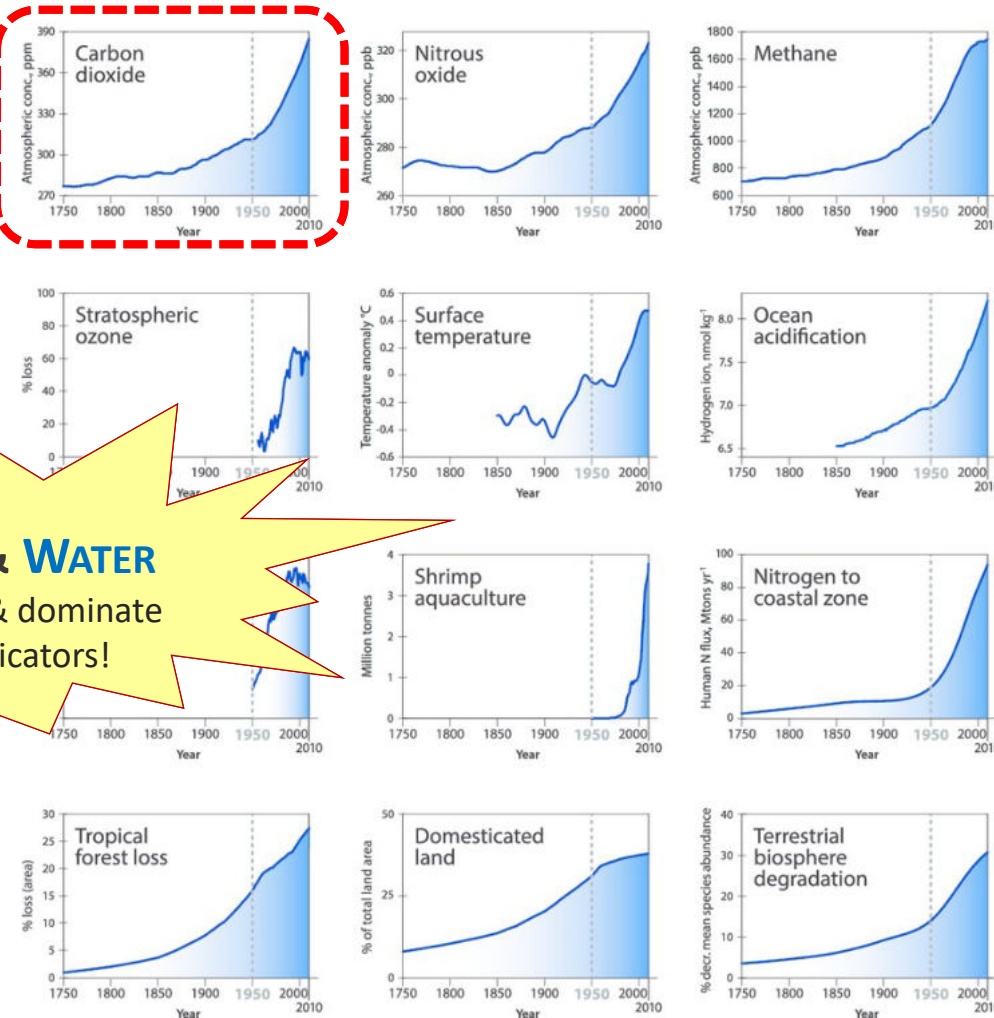
The Human Enterprise: The GREAT ACCELERATION (as of 1750)

The Trajectory of the Anthropocene (W. Steffen et al., 03/2015)

Socio-economic trends



Earth system trends



ENERGY & WATER
pervade all & dominate
many indicators!

GREAT ACCELERATION charts:

- 12 socio-economic indicators
- 12 earth system indicators

The International Geosphere-Biosphere Programme (IGBP)
hosted by the Royal Swedish Academy of Sciences

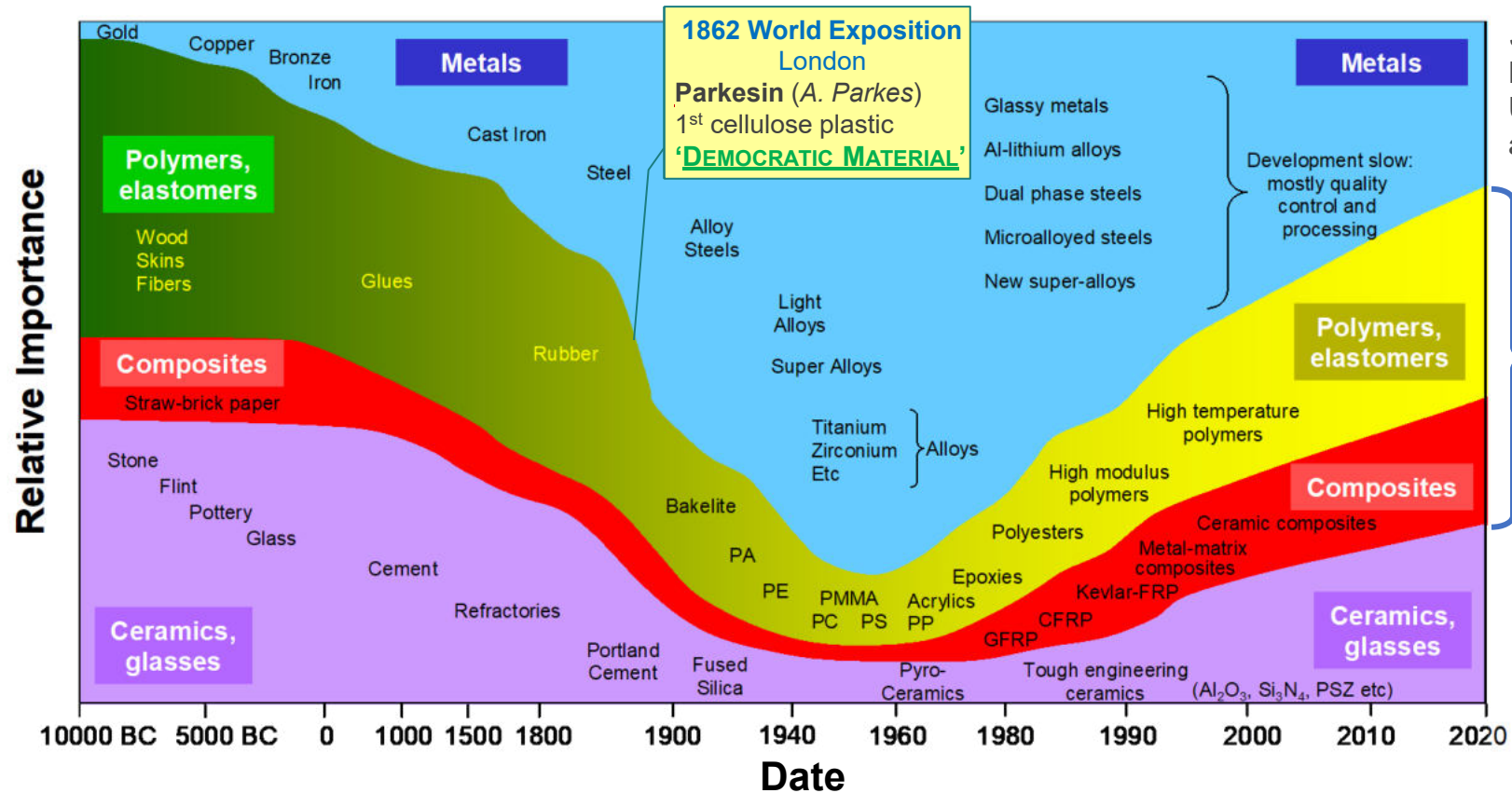
inspired in 2000
by **Paul Crutzen**
(Vice Chair of IGBP)



The Human Enterprise: The essential role of MATERIALS (as of 10,000 BC)

From STONE Age via BRONZE & IRON Age to PLASTICS Age?

Importance of 'GRAND' MATERIAL CLASSES in the history of human civilization



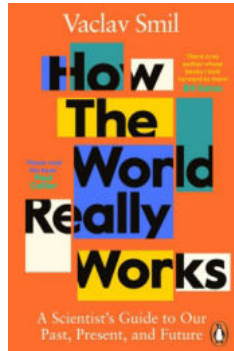
Source:
Prof. M. Ashby (1999)
Univ. of Cambridge (UK);
adapted by R. W. Lang

THE **PLASTICS AGE** (?): "Plastics – Materials of the 21. Century"



The Human Enterprise: The Hard-to-abate (HTA) sectors (worldwide)

The **SCIENCE** behind how we got here and where we're going ... ["Numbers don't lie!"]



How the World
Really Works
Vaclav Smil
May 2022

Chapter 3: The 4 material/matter pillars of modern civilization

- **Cement:** *a world created by concrete*
- **Steel:** *ubiquitous and recyclable*
- **Plastics:** *diverse, useful, troublesome*
- **Ammonia:** *the gas that feeds the world*

"essential" materials:

- **~15 %** energy
- **~23 % CO₂**

HTA-Total*: ~35% !!!

*includes HTA industries and HTA transport

CO₂ emissions of Transport Sector
p.a. worldwide (2018, IEA)

Mobility & Transport*	2018 share
Road (passenger)	45 %
Road (freight)	30 %
Aviation	12 %
Shipping	11 %
Pipelines oil, gas, water, steam etc.	2 %

**HTA transport
> 50 %**

Present and Future Production Volumes p.a. worldwide

Essential Materials [rough estimate]	2019 in Mt	2050 x-fold growth in Low-Income Countries*
Cement	4500	x10+
Steel	1800	x15
Plastics	370	x30+
Ammonia	150	x2+

UN SDGs:
"A world we want for all!"

Equity

*World Bank definition (LICs): GNI per capita of \$1,135 or less in 2024

*Global transport emissions – total (2018):
~8 Gt CO₂ (24 %)

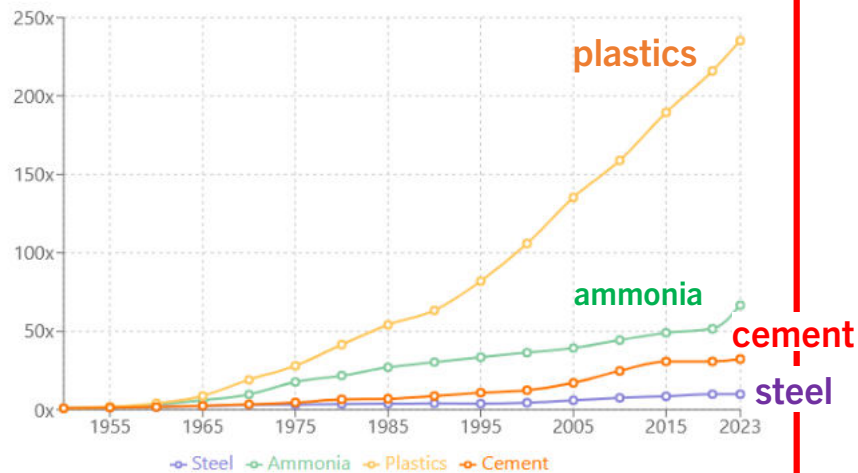
<https://ourworldindata.org/co2-emissions-from-transport>



The GROWTH dynamics in the ANTHROPOCENE (1950 – 2023)

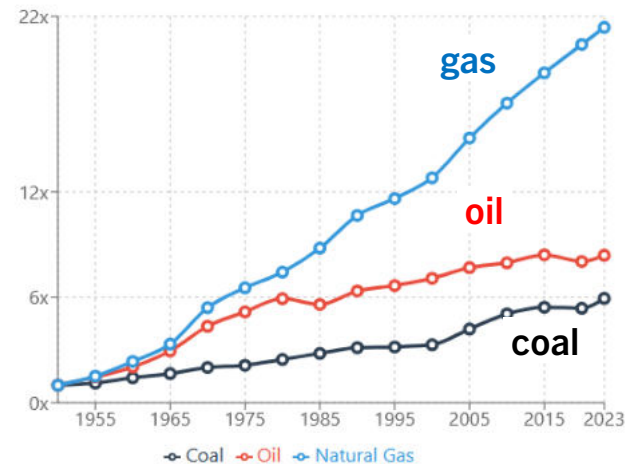
The 4 “essential” materials:
cement | steel | plastics | ammonia

Industrial Materials Production - Linear Scale (Normalized to 1950 = 1.0)

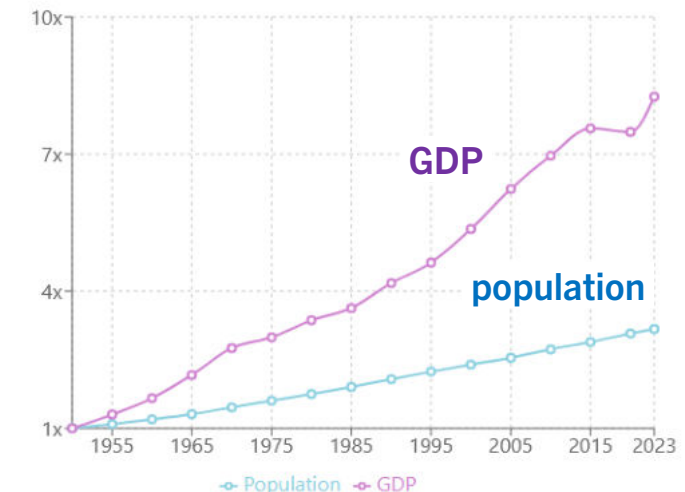


Historical Energy Production (1950-2023)

All Energy Sources - Normalized to 1950 = 1.0



Global Population and GDP (Normalized to 1950 = 1.0)



**Double/triple digit
GROWTH factors:**

- **Plastics (235x)**
- **Ammonia (67x)**
- **Cement (32x)**
- **Steel (10x)**
- **Natural gas (21x)**

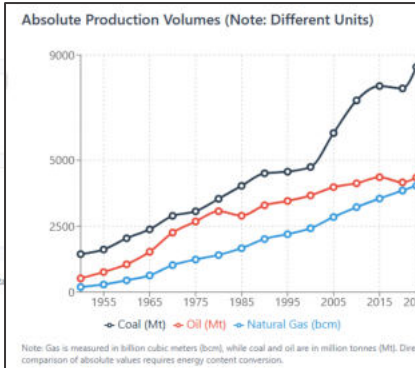
Key Growth Factors (1950-2023)

Steel 10.0x 189 → 1,888 Mt	Ammonia 66.7x 3.6 → 240 Mt
Plastics 235.3x 1.7 → 400 Mt	Cement 32.3x 133 → 4,300 Mt

Energy Production Growth Summary (1950-2023)

Coal 5.9x Steady growth, peaked ~2013	Oil 8.4x Rapid growth 1950-1980	Natural Gas 21.4x Highest growth, accelerating
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Data sources: BP Statistical Review of World Energy, IEA Energy Statistics, Mt = Million tonnes, bcm = Billion cubic meters.



Note: Gas is measured in billion cubic meters (bcm), while coal and oil are in million tonnes (Mt). Direct comparison of absolute values requires energy content conversion.

Key Growth Factors (1950-2023)

Population 3.2x 2.5 → 8.0 billion	GDP 8.3x 11.4 → 94.1 trillion USD
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Data sources: USGS, World Bank, UN Population Division, IEA, World Steel Association, various industry reports. GDP in constant 2015 USD. Mt = Million tonnes.

Source & acknowledgement:
P. F. Lang and R.W.Lang with support of claude ai (07/2025)

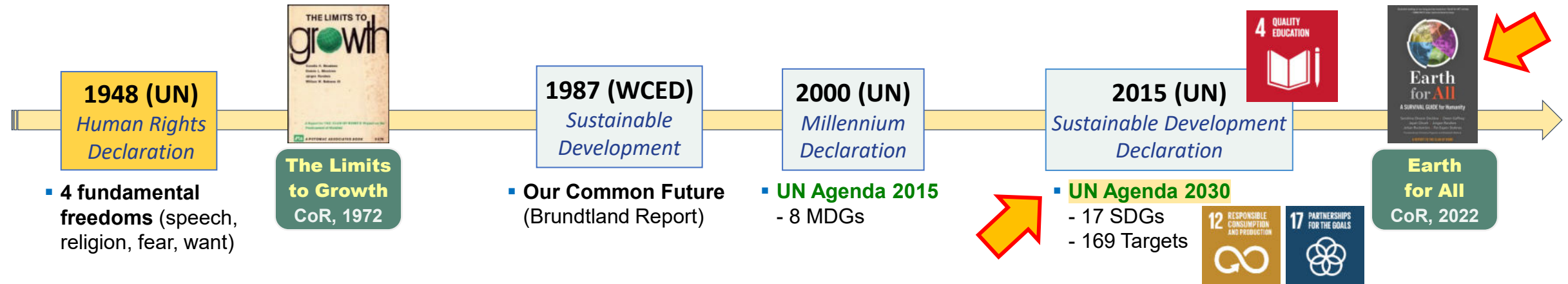
The Human Enterprise: Circular Economy & Climate Crisis in context

CIRCULARITY GAP Reports by Circle Economy



The Human Enterprise: **Redefining** the Limits to Growth?! (2/2)

Pillars of human civilization on JUSTICE, EQUITY, INCLUSION & PROSPERITY for all:



Digital Analysis:

CoR Executive Summary **‘Earth for All – E4A’** (09/2022)

CoR **Deep Dive Papers** [02 – GROWTH (05/2022); 08 – ENERGY (08/2022)]

CoR:at **‘Earth4All Austria’** (07/2024)



Terms: No. of hits (digital search)	Earth for All E.S.* (09/2022)	DDP 02 GROWTH (05/2022)	DDP 08 ENERGY (08/2022)	Earth4All Austria (07/2024)
Circular Economy	1	0	2	18
circular CARBON	0	0	0	0
regenerative CARBON	0	0	0	0
CARBON circularity	0	0	0	0
CARBON regeneration	0	0	0	0

* However: 10 hits for “regenerative”, 1 hit for “circularity and regeneration”
9 hits for “Carbon/CO₂”

What's NEXT?
Dare to be Different!

CoR-AT
NEXT LEVEL
Forum
Series 2025/26



What's NEXT?
Dare to be Different!

comprehensive Carbon Management | cCM

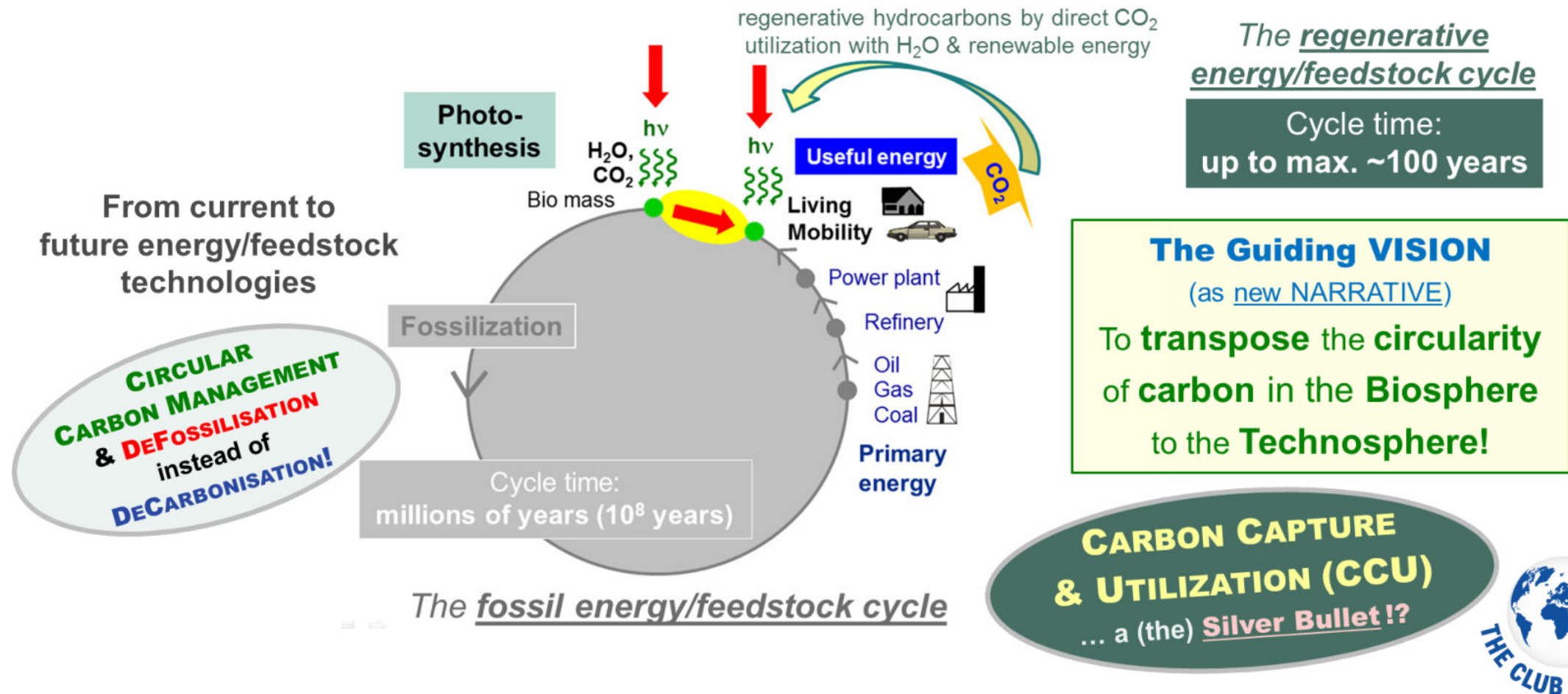
Die Vision: “A NEW BioEconomy” getrieben durch die HTA-Industrien und die Land- & Forstwirtschaft

Die Ziele: Eine “cCM-Roadmap” – Von weglosen Zielen zu zielorientierten Wegen!

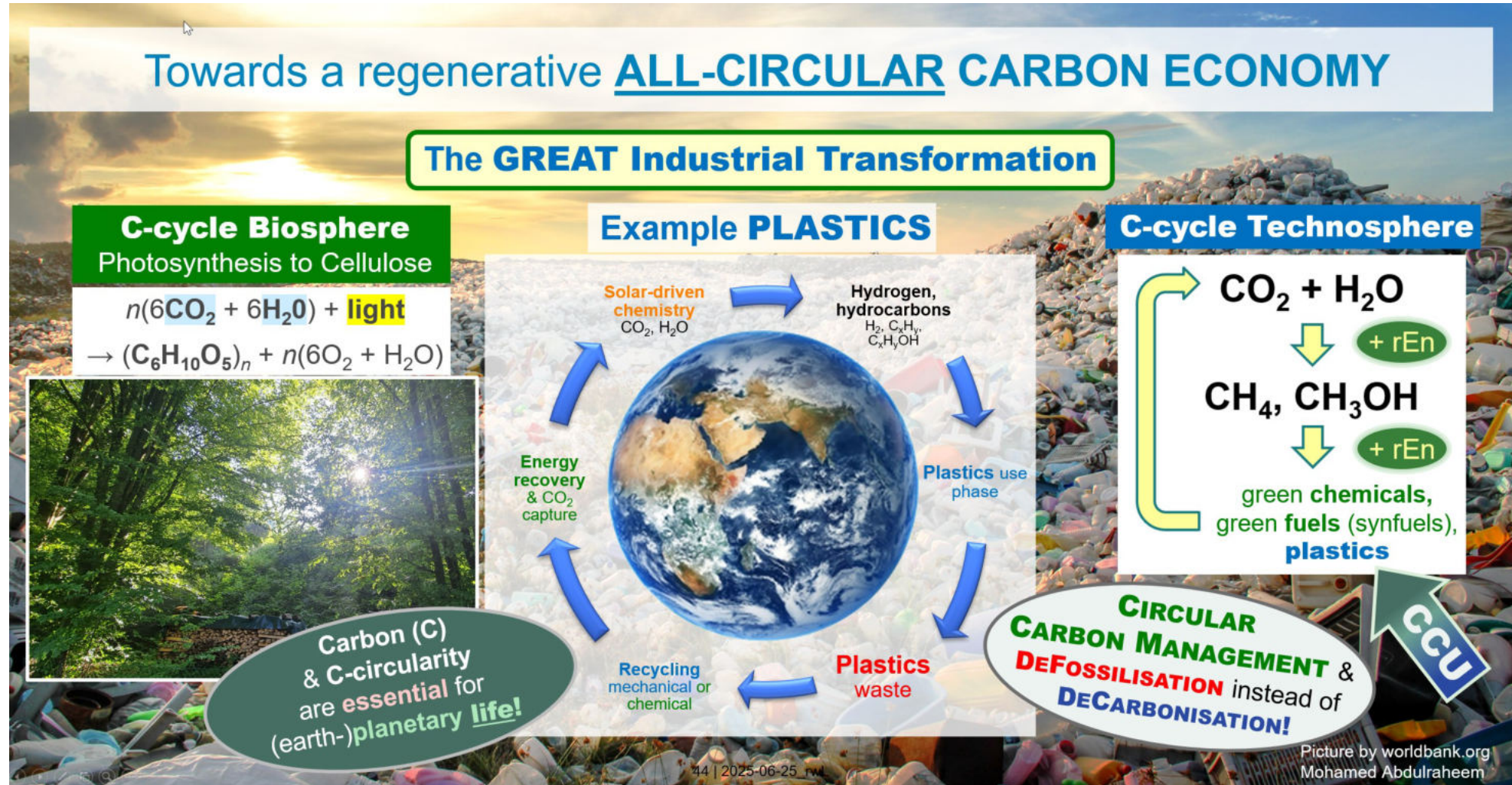
Kohärenz & Alignment von Strategien & Policies zu Klima, Energie, Kreislaufwirtschaft & BioÖkonomie

VISION: A **NEW BioEconomy** based on comprehensive Carbon Management in the HTA sectors – **DEFOSSILIZATION** instead of Decarbonization (1/4)

Towards a regenerative ALL-CIRCULAR CARBON ECONOMY



VISION: A **NEW BioEconomy** based on comprehensive Carbon Management in the HTA sectors – **DEFOSSILIZATION** instead of Decarbonization (2/4)



Comprehensive (circular) Carbon Management (cCM)

5 Merkmale industriell-*technosphärischer* CO₂-to-Hydrocarbon Konversion

(1) **Industrielle Skalierbarkeit** existierender Konversionstechnologien:

TRL 7-9 (bereits heute Konversionskette durchgängig TRL 9 möglich)

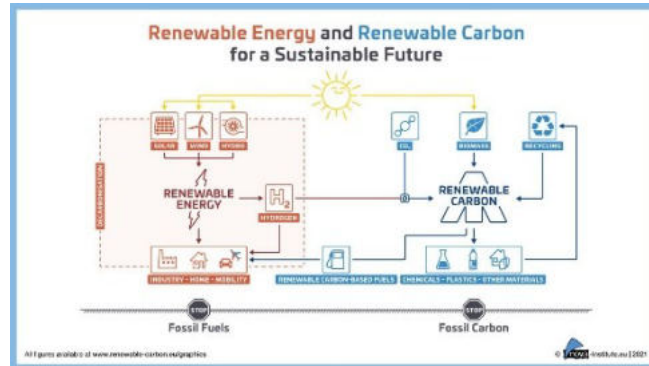
TRL: Technology Readiness Level

(2) **Nutzung bestehender Infrastruktur** für Transport & Speicherung
(Adaptierungen & Ergänzungen jedoch erforderlich)

(3) **Energieeffizienz:** industriell-*technosphärische* Konversion übertrifft
natürlich-*biosphärische* Konversion um Faktor >10 (flächendichtemäßig)

Comprehensive (circular) Carbon Management (cCM)

Closing the Loop | Navigating the CCU conversion pathways [nova-Institute, 2023]



CCU process/product pathways with 2023 **technology readiness levels (TRL)**

[and industrial stakeholders]

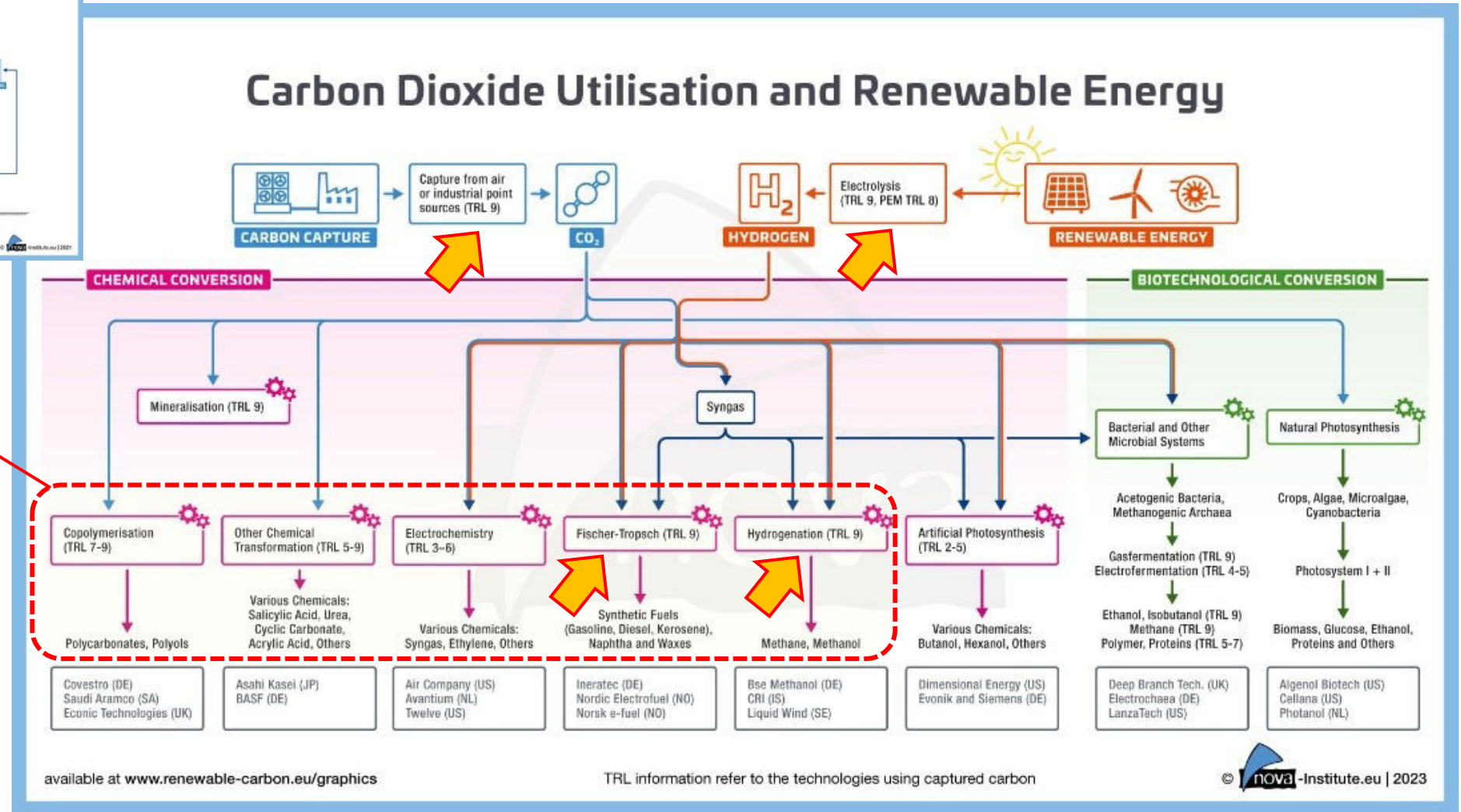
TRL: 6(3) – 9!

Source:

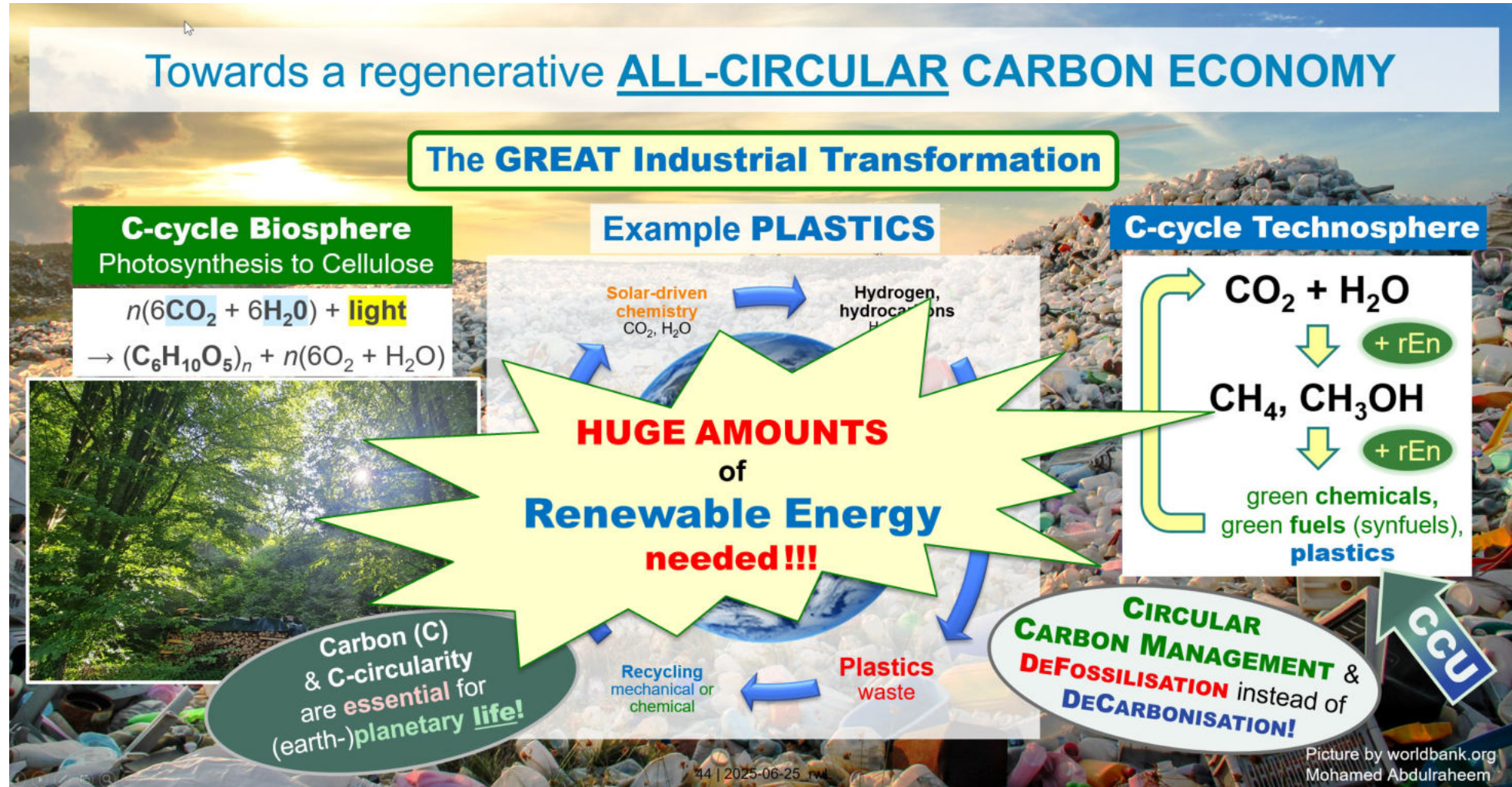
nova-Institute 2024

Courtesy of M. Carus

<https://nova-institute.eu/>



VISION: A **NEW BioEconomy** based on comprehensive Carbon Management in the HTA sectors – **DEFOSSILIZATION** instead of Decarbonization (3/4)



These 2: Zur Unabdingbarkeit künftiger **internationaler Zusammenarbeit** (‘Think BIG’)

Warum **transnationale & transregionale** Partnerschaften unverzichtbar sind:

Angesichts der **enormen Mengen an erneuerbarer Energie**, die für eine **technosphärische Kohlenstoffzirkularität** erforderlich sind, ist ein **„Neuer Grüner Deal“** zwischen **Afrika/Naher Osten (MENA)** und **Europa (Österreich)** unabdingbar **!!!**



NEW GREEN DEAL **AFRICA-EUROPE**
in transdisciplinary
partnership at eye-level!

SOLAR RESOURCE MAP

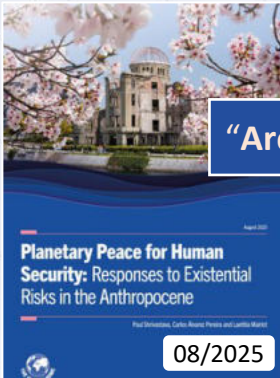
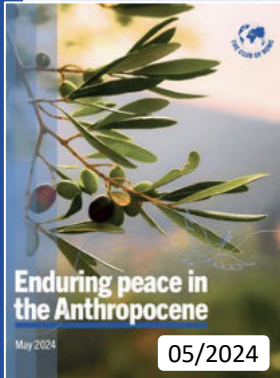
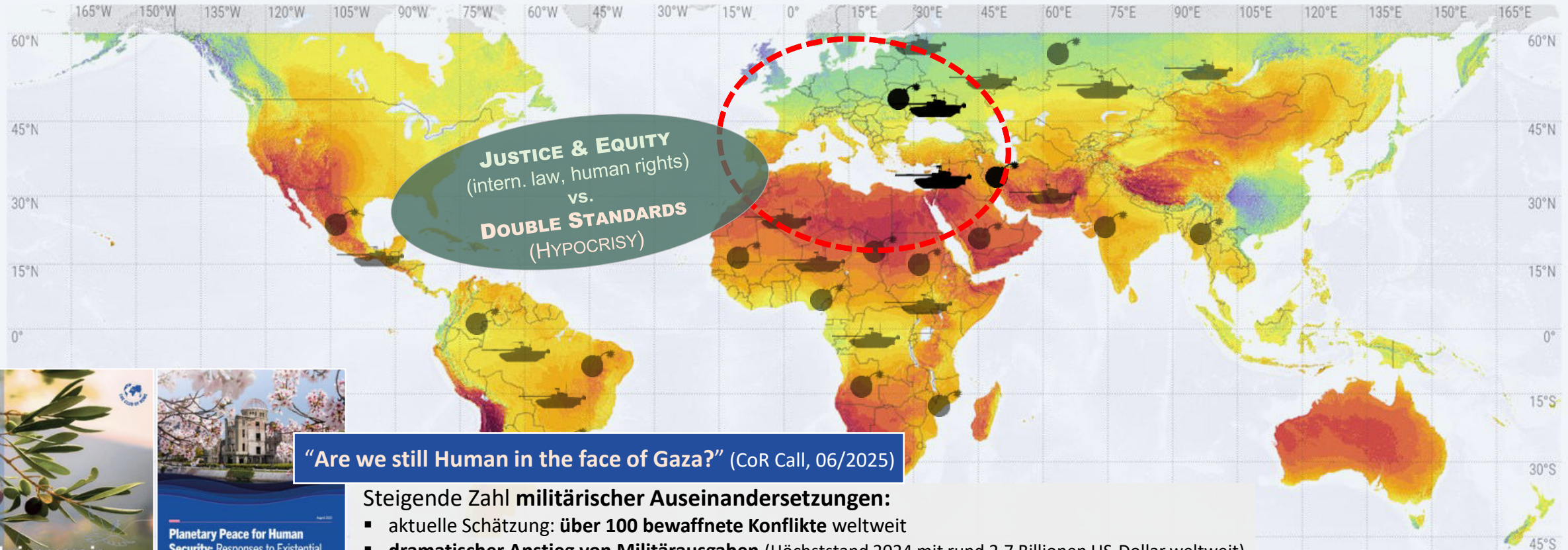
PHOTOVOLTAIC POWER POTENTIAL



WORLD BANK GROUP

ESMAP

SOLARGIS



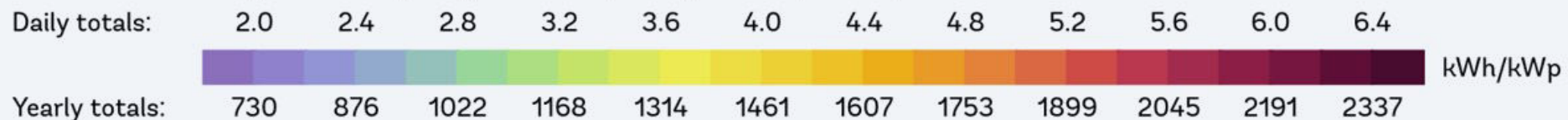
“Are we still Human in the face of Gaza?” (CoR Call, 06/2025)

Steigende Zahl militärischer Auseinandersetzungen:

- aktuelle Schätzung: **über 100 bewaffnete Konflikte** weltweit
- **dramatischer Anstieg von Militärausgaben** (Höchststand 2024 mit rund 2,7 Billionen US-Dollar weltweit)
- **9 Staaten mit Atomwaffen** mit **über 12.000 Atomsprengköpfen** (USA, Russland, China, Frankreich, UK | Indien, Pakistan, Nordkorea | Israel)

© 2019 The World Bank
Source: Global Solar Atlas 2.0
Solar resource data: Solargis

Long-term average of photovoltaic power potential (PVO_{UT})





Against all Odds:
Transformative Change!

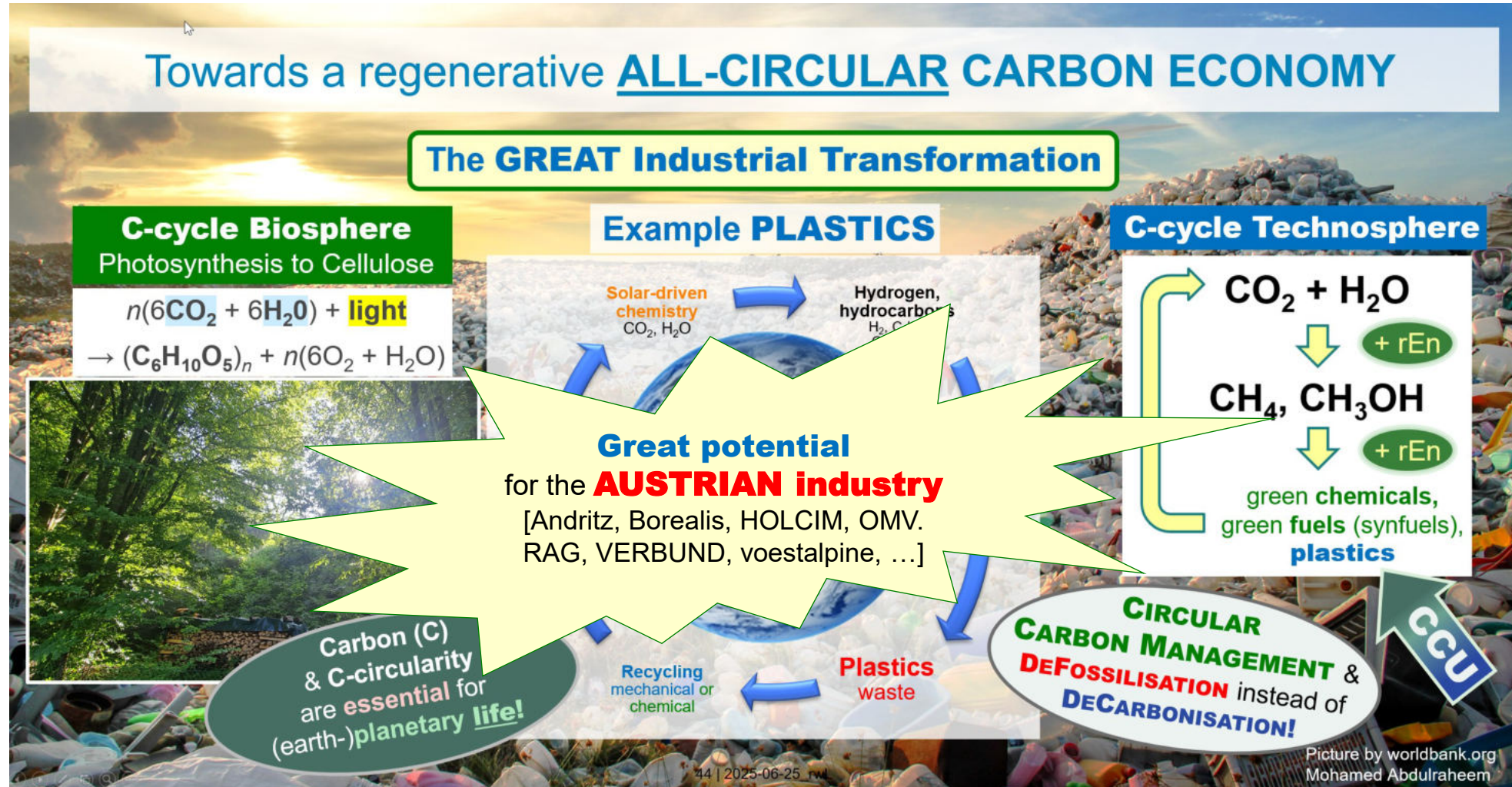
comprehensive Carbon Management | cCM

Die Umsetzung: CoR-AT 'NEXT LEVEL' Forum Series 2025/26

3 Impuls-Veranstaltungen zum Schwerpunktthema **"cCM | NEXT LEVEL"**

- CoR-AT NEXT LEVEL FORUM 1: **cCM in der INDUSTRIE** [1. Dez. 2025]
- CoR-AT NEXT LEVEL FORUM 2: **cCM in LAND- & FORSTWIRTSCHAFT** [Juni 2026]
- CoR-AT NEXT LEVEL FORUM 3: **cCM – STRATEGIES & POLICIES, CARBON ACCOUNTING & PRICING** [Herbst 2026]

VISION: A **NEW BioEconomy** based on comprehensive Carbon Management in the HTA sectors – **DEFOSSILIZATION** instead of Decarbonization (4/4)



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(Adaptierungen & Ergänzungen jedoch erforderlich)

(3) **Energieeffizienz:** industriell-technosphärische Konversion übertrifft
natürlich-biosphärische Konversion um Faktor >10 (flächendichtemäßig)

(4) **Österreich** hat beste Voraussetzungen für Technologieführerschaft:

- starke, hoch-innovative **HTA-Industrie**
- beispielhafte cCM-Projektinitiativen: **C2PAT, HCMA**

C2PAT: Carbon-to-Product Austria

HCMA: Hydrogen & Carbon Management Austria

Masterplan Stmk (10 Punkte inkl. CCU/S)

Comprehensive (circular) Carbon Management (cCM)

Möglichkeiten industriell-technosphärischer CO₂-to-Hydrocarbon Konversion

Potential cross-sectoral 'circular' Carbon FLAGSHIP-CLUSTER/HUB Initiatives:

- **"STEEL & PLASTICS"**

e.g. voestalpine, Borealis, VERBUND, RAG, N.N.

- **"CEMENT & PLASTICS"**

e.g. Lafarge, Borealis, OMV, VERBUND, N.N.

- **"WASTE MANAGEMENT"**

e.g. Wien Energie, Linz AG, ARA, Saubermacher, Borealis, N.N.

- **"GREEN ENERGY INFRASTRUCTURE"**

e.g. OMV, VERBUND, RAG, N.N.

MEDIA & PRESS RELEASE: 24 JUNE 2020
MOU: LAFARGE/OMV/VERBUND/BOREALIS
"Carbon2ProductAustria" [short: **C2PAT**]

AUGUST 2021

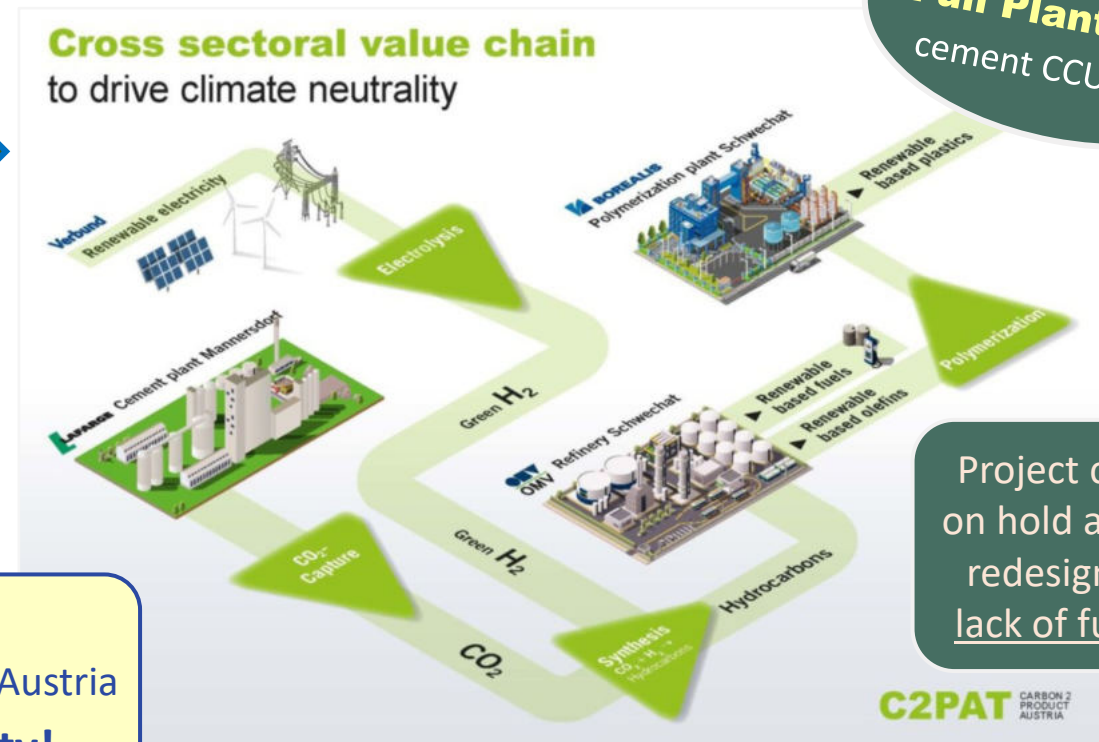
C2PAT GmbH

Worldwide first
"Full Plant-Scale"
cement CCU effort!

Project currently
on hold and under
redesign due to
lack of funding !?

Aim 2030 (C2PATplus)

- **750.000 t** of CO₂ sequestration in Austria
- demonstration of **global scalability!**



Aktuelle Entwicklungen als Chance nutzen!

Österreichisches Regierungsprogramm 2025 | Der OMV/ADNOC Deal

 JETZT DAS
RICHTIGE TUN.
Für Österreich.

27. Feb. 2025

Koalition
ÖVP, SPÖ und NEOS
präsentiert
Regierungsprogramm

CO₂-Emissionen von
hard-to-abate (HTA)
Industrien
Österreich: ~30%
[Faktor 2(!) zu EU
Durchschnitt]

Klima- und Umweltschutz (S.153ff)

Kohlenstoffmanagement (S.155)

- „Umsetzung der nationalen **Carbon Management Strategie** zur Dekarbonisierung von **“Hard-to-abate“-Industriezweigen** und **Forcieren des Hochlaufs einer Kohlenstoffwirtschaft.**“
- ...

— Regierungsprogramm 2025-2029 —

<https://www.bundestkanzleramt.gv.at/bundestkanzleramt/die-bundesregierung/regierungsdokumente.html>

OMV und Adnoc einigen
sich auf Fusion ihrer
Petrochemietöchter

03. März 2025

Die Presse

Borealis und Borouge werden fusioniert. Es soll eine gemeinsame Joint-Venture-Gesellschaft entstehen.

OMV und ADNOC
formen einen
Weltkonzern [USD 60+ Mrd.] mit
Unternehmenssitz **Österreich:**
Borouge Group International



Archivbild von Borealis in Schwechat. IMAGO

03.03.2025 um 21:48

Die Presse

<https://www.diepresse.com/19430059/omv-und-adnoc-einigen-sich-auf-fusion-ihrer-petrochemietoechter>

COP28 and fresh Impulses from Industry (2 examples)



Alfred Stern | CEO of OMV (since Sept. 2021)
OMV Capital Markets Day (16 March 2022)



Source: <https://www.omv.com/en/news/220316-omv-strategy-2030>

New OMV Strategy 2030

(16 March 2022)

- Fundamental shift from linear towards circular business approach:
OMV aims to become a leading, integrated sustainable fuels & materials company with a **strong focus on circular economy** solutions
- **Net-zero** (Scope 1, 2 and 3) to be reached by **no later than 2050!**



The Guardian

13 July 2023

President-Designate of COP28
Sultan Al Jaber | CEO ADNOC

UAE Plan for COP28 [Nov./Dec. 2023]

- The 1.5°C goal
- National plans (“global stocktake”)
- **Phase out or phase down?**
- Clean energy
(double energy efficiency, triple renewable energy capacity by 2030)
- **Role of fossil fuel companies**
- ‘All emissions, everywhere’
- Climate finance
- Inclusivity



UAE: the first country in the Gulf region to pledge **net-zero emissions by 2050!**

Musabbeh Al Kaabi [Interview | S&P Global, 17 Aug. 2023]

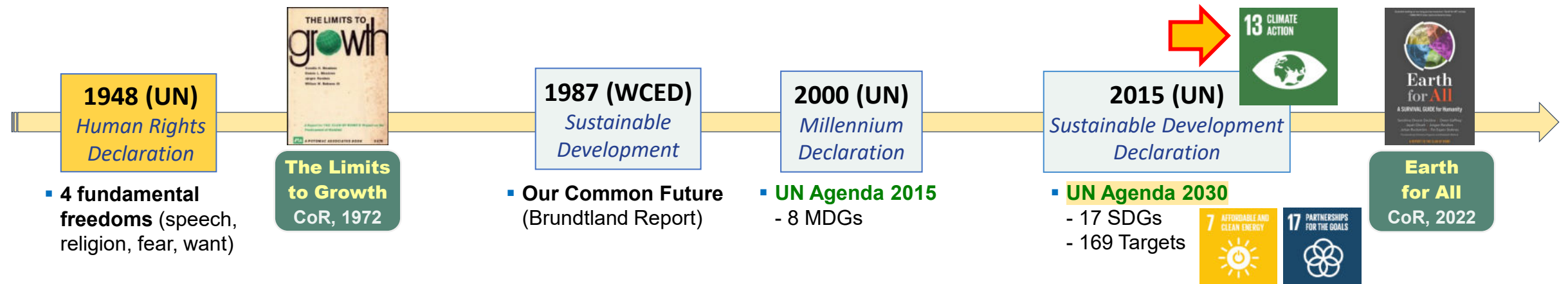
ADNOC Executive Director of Low Carbon Solutions & International Growth

"The **[CCUS] target** ... around a minimum of 5 million t/year [by 2030], ... I see a possibility that we will increase that target as we speak, ... we need to firm up a few parameters.

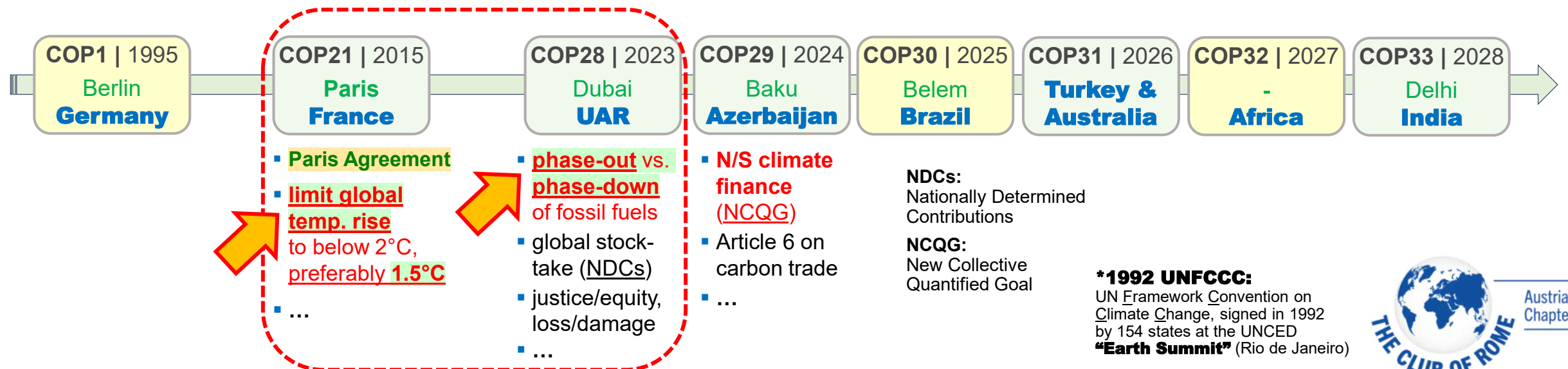
"I see a future where ... **with carbon capture to become carbon neutral.**"

The Human Enterprise: **Redefining** the Limits to Growth?!

Pillars of human civilization on JUSTICE, EQUITY, INCLUSION & PROSPERITY for all:



Timeline, hosts & key themes of Climate COPs (Conferences of Parties under the 1992 UNFCCC*):



Key moments at COP28

Phase-out vs. phase-down of (unabated) fossil fuels?

DRAFT TEXT by the COP28 President
on First global stocktake under the Paris Agreement
11 Dec. 2023 | 16:30

39. ... recognizes the need for **deep, rapid and sustained reductions in GHG emissions** and calls upon Parties to take actions that could include, inter alia:

- (a) Tripling renewable energy capacity globally and doubling the global average annual rate of energy efficiency improvements by 2030;
- (b) Rapidly phasing down unabated coal and limitations on permitting new and unabated coal power generation;
- (d) Accelerating zero and low emissions technologies, including, inter alia, ... **removal technologies**, including such as **carbon capture and utilization and storage**;
- (e) **Reducing both consumption and production of fossil fuels**, in a just, orderly and equitable manner so as to **achieve net zero by, before, or around 2050 in keeping with the science**;

.....

OUTCOME: First global stocktake
Proposal by the COP28 President
13 Dec. 2023

28. ... recognizes the need for **deep, rapid and sustained reductions in greenhouse gas emissions in line with 1.5 °C pathways** and calls on Parties to contribute to ...:

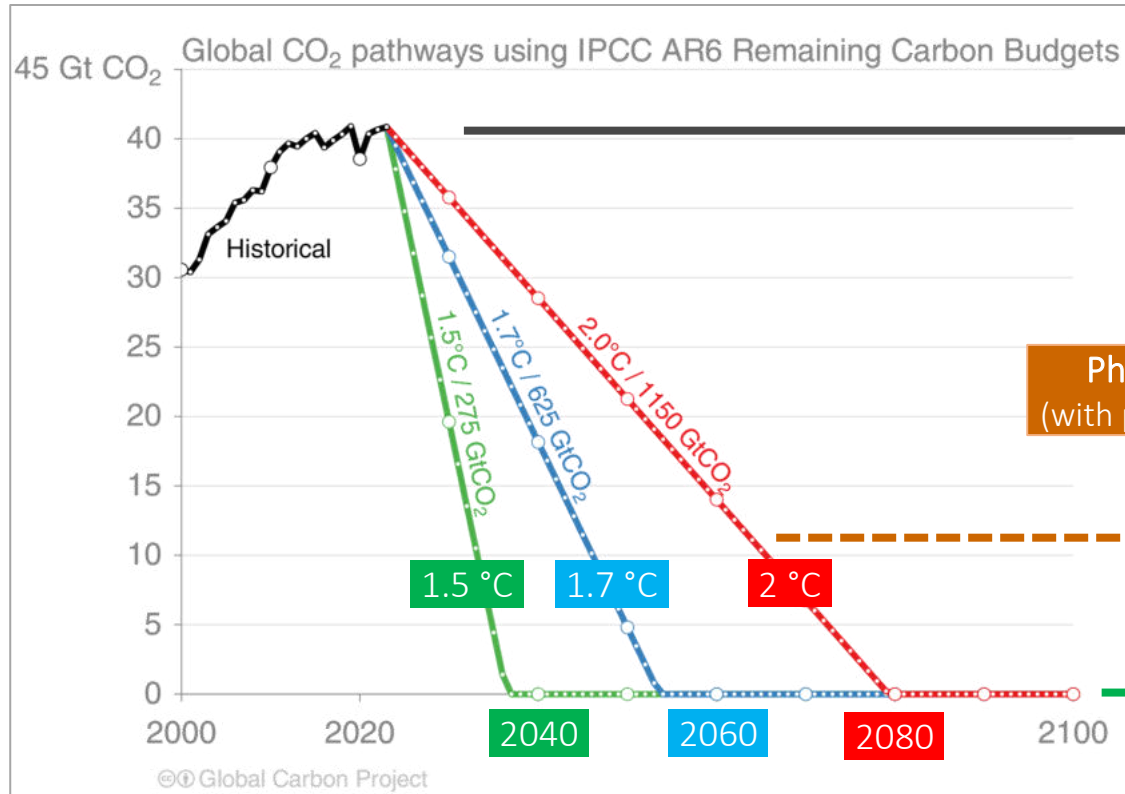
- (a) Tripling renewable energy capacity globally and doubling the global average annual rate of energy efficiency improvements by 2030;
- (b) Accelerating efforts towards the **phase-down of unabated coal power**;
- (d) **Transitioning away from fossil fuels in energy systems**, in a just, orderly and equitable manner, **accelerating action in this critical decade**, so as to **achieve net zero by 2050 in keeping with the science**;
- (e) Accelerating zero- and low-emission technologies, including, inter alia, ... **removal technologies** such as **carbon capture and utilization and storage**, particularly in HTA sectors ...



The Net-Zero Transition & comprehensive Carbon Management

Emerging pathways based on Climate COPs and EU policies

Global CO₂ net-zero pathways for 1.5 – 2 °C



From aims
without pathway(s),
to **target-oriented
roadmaps!**

Tackling Scope 1/2/3 emissions
based on COP28

“Potential” net-zero pathways:
**phase-out vs. phase-down
of (unabated) fossil fuels?**

-70%

Phase-down of fossil fuels
(with phase-out of coal as priority)

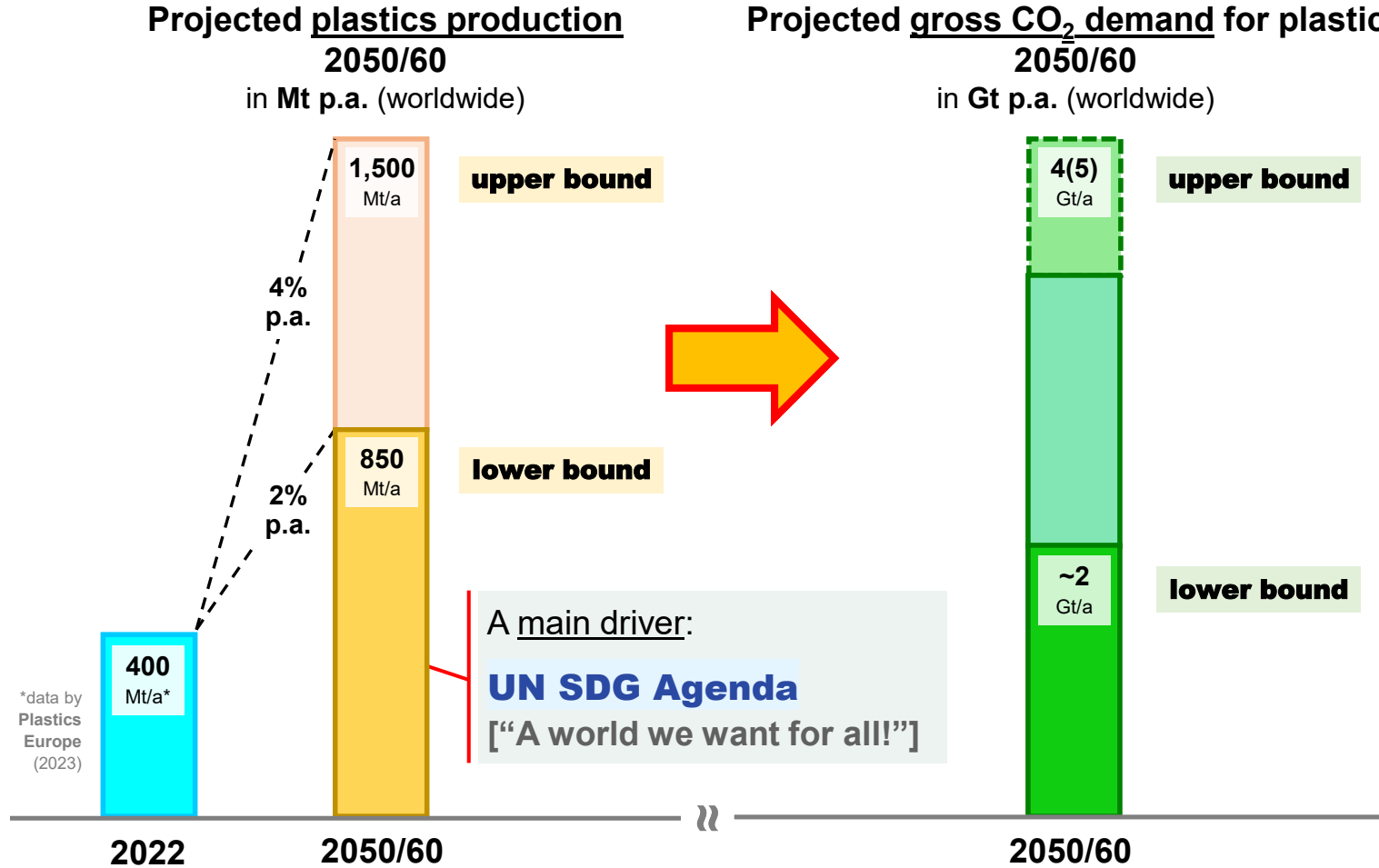
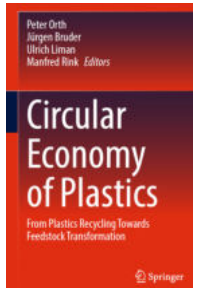
ca. 30% | Carbon Management
(CCU, CCS, DAC | HTA industries/traffic)

0 %

~15%
for circular
carbon
management
via **CCU**

Back-of-envelope scenario assessments by Lang/Schleicher

[published in “Circular Economy of Plastics”, ed. by P. Orth, U. Liman et al.; Springer 10/2025]



Take-away message:

ca. 15 % of
**current global or regional
CO₂ emissions**

are required by the
carbon dependent industry
at around 2050/60.

[with a margin of around
plus/minus 5% depending on
the region and remaining uncertainties]

Robust lower/upper-bound scenario assumptions for 2050/2060 (worldwide):

- plastics growth rates p.a. 2/4 %; non-CCU plastics recycling rates p.a. 10/30/50 %
- carbon-to-plastics conversion factor of 0.72 [Kähler 2023]; CO₂/carbon losses in CCU process chain and polymerization of 28% [Markowitsch 2023] and 3% [Paulik 2024], respectively.

Note: This range overlaps/aligns well with the remaining CO₂ emissions of sectors considered to be not abatable after all decarbonization efforts are applied.

These 3: Die Rolle (& Verpflichtung!) der HTA-Sektoren – Sektorübergreifende Allianzen sind unerlässlich!

Mit ihren besonderen **Management-Fähigkeiten** und ihrer **fachlichen wie organisatorischen Kompetenz** müssen die **“Hard-to-Abate”-Sektoren**

[HTA-Industrien: Stahl, Zement, Kunststoffe & Chemie, Müllverbrennung und
HTA-Mobilität/Transport: Schwerverkehr, Schiffs- & Luftfahrt, Verteidigung]

– durch sektorübergreifende Allianzen & Kooperation – eine **Führungsrolle**
bei der Entwicklung und dem **groß-skaligen** (globalen!) **Einsatz von CCU-Technologien** übernehmen.

How to achieve & accelerate industrial-scaled deployment of **comprehensive Carbon Management** (cCM)?

What is **most urgently** needed, is a
sustainable, integrated & coherent
Energy, Climate & Circular Economy strategy
along with a
consistent, coherent & science/evidence based
POLICY framework
on a global, regional and national level that
accounts for regional/national differences in terms of
intra-/intergenerational EQUITY & JUSTICE.*

* This is a bold but not an unrealistic demand; essentially it corresponds to the current approach in the UN Climate Summits (i.e., annual COPs for Climate) and the UN efforts towards a Global Treaty for Plastics and Plastics Pollution, currently, however, in a not sufficiently integrated, consistent and coherent, science/evidence based manner.

4 essential attributes
for industrial Carbon Management
[comprehensive/all-inclusive/'net-zero']:

- **comprehensive**
- **cross-sectoral**
- **circular/regenerative**
(well-designed CCU/CCS/CDR)
- **transnational**



Rapid implementation requires
▪ **target-oriented policies & incentive measures**

From aims
without pathway(s),
to **target-oriented**
roadmaps!

These 4: Zielorientierte Enabling-Policies als Motor für robuste strategische Allianzen

Der wichtigste
Hebel!

Takeaway #1

Dringendst benötigt wird eine **nachhaltige, integrierte und kohärente Energie-, Infrastruktur-, Klima- und Kreislaufwirtschaftsstrategie** auf **EU und nationaler Ebene**, ergänzt durch einen **konsistenten, wissenschaftlich und evidenzbasierten** sowie **incentivierenden politischen Rahmen** ("**Incentive Policies**").

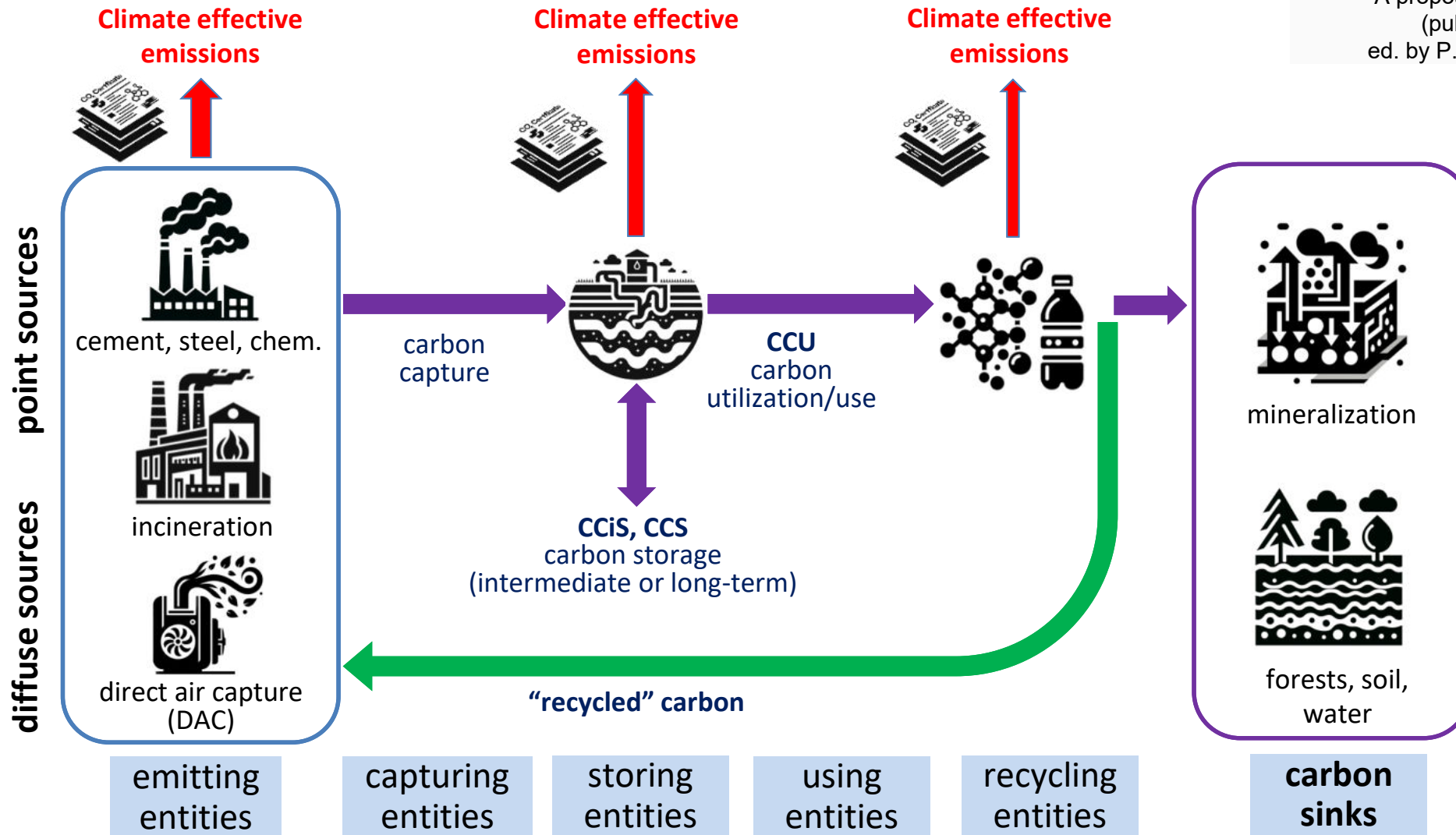
Besonderer **Reformbedarf** auf **EU Ebene** besteht im Bereich **Carbon Accounting & Pricing** (z.B. EU ETS) sowie bei **stofflichen Wiederverwertungsstrategien/-regularien** (z.B. EU PPWR).

Dazu bedarf es eines **sektorübergreifenden Dialogs** der "*Hard-to-Abate*"-Sektoren **HTA-Industrien & HTA-Mobilität/Transport**, mit dem Ziel einer **wirksamen Agenda-Setting-Power**.

Comprehensive (& circular) Carbon Management (cCM)

A **NEW** comprehensive Carbon Accounting (cCA) for cCM*

* A proposal by R. W. Lang and S. P. Schleicher
(published in "Circular Economy of Plastics"
ed. by P. Orth, U. Liman et al.; Springer 10/2025)



A simplified approach
spanning various
sectors & activities
(while remaining
flexible & scalable)

Features & attributes:

- **3 components**
 - carbon flows
 - carbon registries
 - responsible entities
- integrates **all industrial C-flows**
- distinguishes C-flows
 - **emitted** vs. **captured**
 - circular (CCU) & non-circular (CCS/sinks)

Comprehensive (circular) Carbon Management (cCM)

5 Merkmale industriell-technosphärischer CO₂-to-Hydrocarbon Konversion

(1) **Industrielle Skalierbarkeit** existierender Konversionstechnologien:

TRL 7-9 (bereits heute Konversionskette durchgängig TRL 9 möglich)

Redefining the
Limits to Growth

(2) **Nutzung bestehender Infrastruktur** für Transport & Speicherung
(Adaptierungen & Ergänzungen jedoch erforderlich)

(3) **Energieeffizienz:** industriell-technosphärische Konversion übertrifft
natürlich-biosphärische Konversion um Faktor >10 (flächendichtemäßig)

Carbon (C) &
C-regeneration/circularity
are essential for all
(earth-)planetary life!

(4) **Österreich** hat beste Voraussetzungen für Technologieführerschaft:

- starke, hoch-innovative **HTA-Industrie**
- beispielhafte cCM-Projektinitiativen: **C2PAT, HCMA**

(5) **Künftiger** industriell-technosphärischer **CO₂ Bedarf** (2050/60):

ca. 1-2 % der natürlich-biosphärischen Konversion pro Jahr

No Limits to
CARBON Regeneration!

These 1: Zur Bedeutung eines **umfassenden** (industriellen) **Kohlenstoffmanagements für Europa**

Takeaway #2

Wir in **Europa** (und Österreich) müssen an **Energietransformation** und an **Kreislaufwirtschaft** festhalten, weil es die **einzigste Zukunftsoption** für die **europäische INDUSTRIE** und für **globale PROSPERITÄT** ist, und ...

... weil es die **einzigste Option** ist, uns in Europa vor **nicht bewältigbaren, künftigen Migrationsströmen** (insbesondere aus Afrika und dem Nahen Osten) wirksam und humanitär vertretbar **zu schützen!**

Against all Odds:
Transformative Change!



Austrian
Chapter

CoR-AT NEXT LEVEL Forum Series 2025-2026

Redefining the Limits to Growth:

comprehensive Carbon Management (cCM)

WAS | WARUM | WIE ?

Some final remarks on our VISION: **A meta-level perspective and outlook**



The Remorse of Prometheus:
From the Gift of Fire to Global Arson

Die Reue des Prometheus
Von der Gabe des Feuers
zur globalen Brandstiftung

Peter SLOTERDIJK
Suhrkamp | [March 2023](#)



The 3 fundamental questions of Philosophy in context

Where do we come from?

Where are we headed?

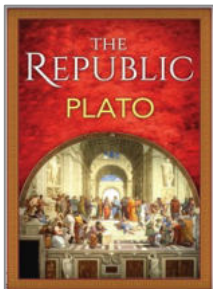
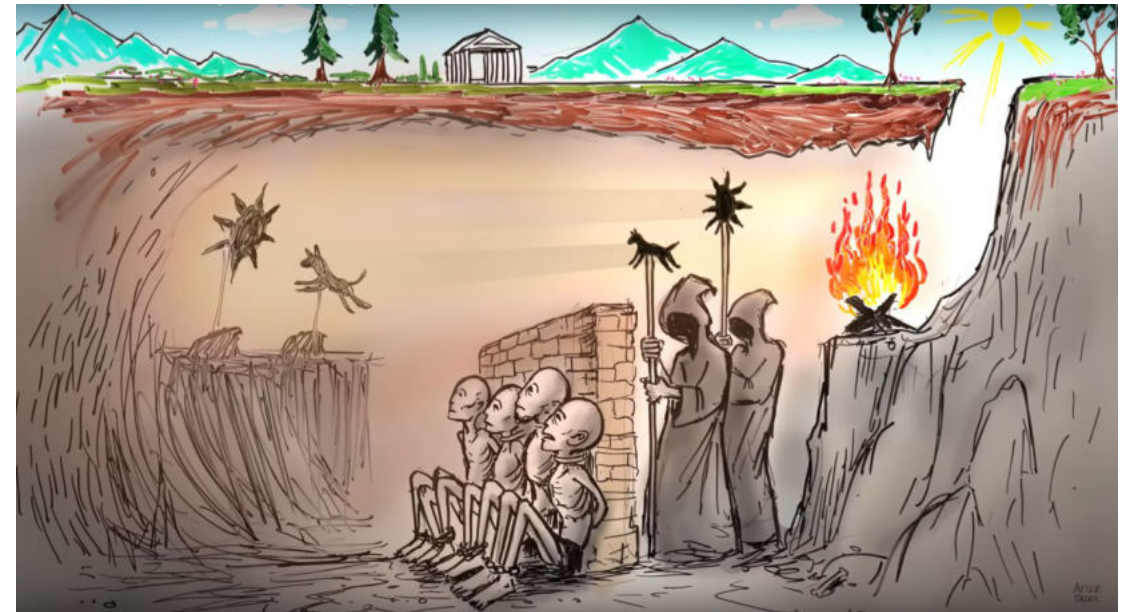
What is the meaning [or purpose] of life?



Some further reflections on advanced incineration/pyrolysis technologies and **comprehensive Carbon Management (cCM)** ...

The 'Myth of Prometheus' and Plato's 'Allegory of the Cave'

The Profound Meaning of **Plato's Allegory of the Cave** [from/after Skool: https://www.youtube.com/watch?v=4nHj3gL_JN0]



Plato's Allegory of the Cave | A common assessment

"... one of the **most influential philosophical Concepts** in the history of Western Philosophy.
... embedded are profound implications about the **nature of knowledge**
and the **transformative journey** of **gaining wisdom**."

A NEW BioEconomy? | The NEXT Great Transformation

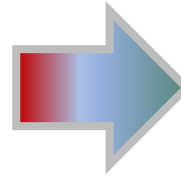
Where do we come from? | Where are we headed? | What is the meaning [or purpose] of life?

Navigating the NEXT Great Transformation:
From **decarbonization** to **defossilization!**



Leave
no one
behind!

From a **fossil-fuel energy** driven,
linear & resource depleting
prosperity model for a few, to ...



... a **renewable** (solar) **energy** driven,
circular & resource regenerative
prosperity model for all.

Carbon (C) &
C-regeneration/circularity
are essential for all
(earth-)planetary life!



A NEW BioEconomy? | Why industrial cCM – The EVOLUTION role model!

Where do we come from? | Where are we headed? | What is the meaning [or purpose] of life?

Michael Russell: **On the Emergence of Life** (05/2011)



The PURPOSE [ESSENCE] OF LIFE
is the
**HYDROGENATION OF
CARBON DIOXIDE**

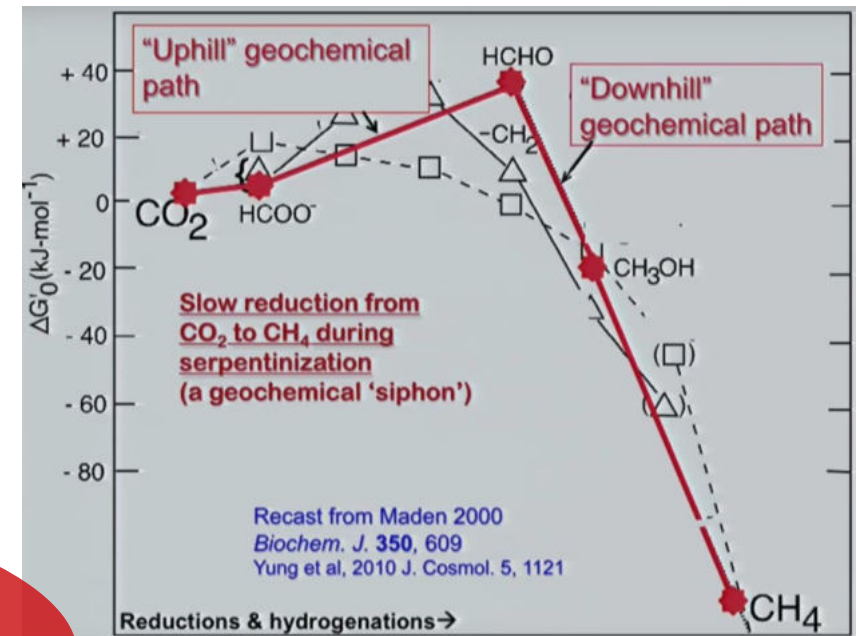
MICHAEL RUSSEL

*On the Emergence of Life Through
“Negative” Entropy Trapping*

*Molecular Frontiers Symposium
at the Royal Swedish Academy of Sciences, May 2011*

<https://www.youtube.com/watch?v=SF2uj0Oxqhg>

**Against all Odds:
Transformative Change!**



These 5: Warum eine umfassende Kohlenstoffzirkularität unverzichtbar ist? Eine **kategorische Aussage!**

Takeaway #3

Ohne industrielle Kohlenstoff/(CO₂)-Zirkularität,
kein umfassender Klimaschutz,
keine nachhaltige Kreislaufwirtschaft und
keine nachhaltige Entwicklung!

The
PURPOSE OF LIFE
is the
**HYDROGENATION OF
CARBON DIOXIDE**
(Michael Russel)

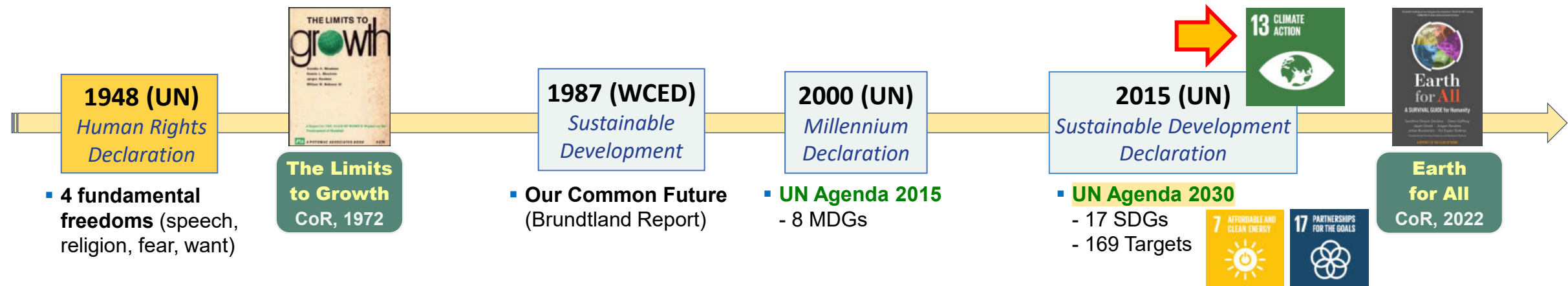
Against all Odds:
Transformative Change!



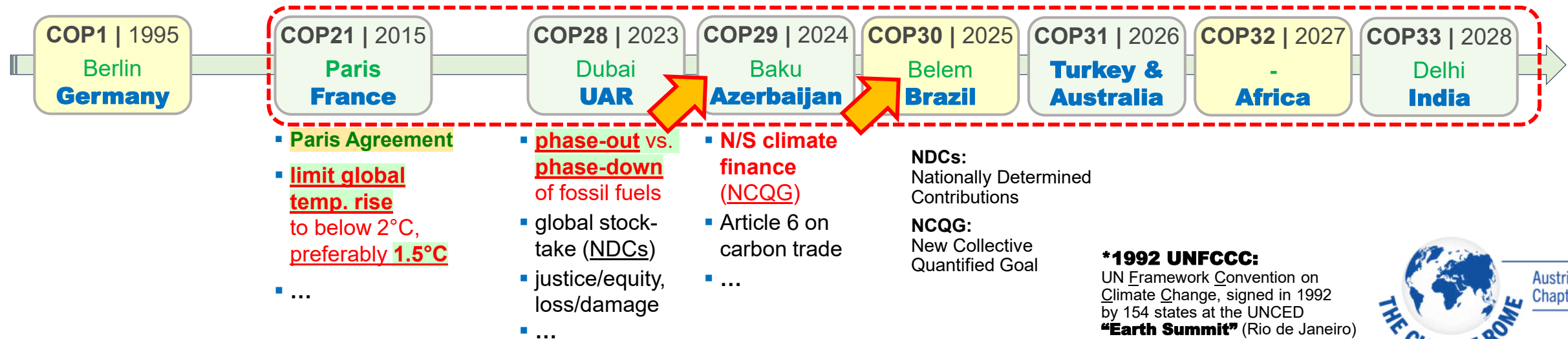
Austrian
Chapter

The Human Enterprise: **Redefining** the Limits to Growth?!

Pillars of human civilization on JUSTICE, EQUITY, INCLUSION & PROSPERITY for all:



Timeline, hosts & key themes of Climate COPs (Conferences of Parties under the 1992 UNFCCC*):



Learning, Hope & Equity in context: "We are many and they are few"

Fragments of opinions on 2nd last day of COP29 (21 Nov. 2024)

EVOLUTION in a nutshell:
IT'S ALL ABOUT
LEARNING & Adapting!
[striving for survival ...]

Key question as to the state of the world:
Are we (humans) learning fast enough?
[individually & collectively]

No Limits to Learning!
No Limits to Hope!



Omar Elmawi | Africa Climate Movement Building Space

"It's very wrong that the global north, the people that have contributed significantly to the problem, come here for the past 10 days and have discussions that are leading to nothing.

We are enraged. We are mortified, **but we are not hopeless.**

We know that we are many and they are few. We know we still have about two days to go [at Cop29], and we promise them they are going to see the full might of the Global South in these corridors.

In Africa, we have a saying that when a herd of cows is slow, the ones that are slowing them down are the ones at the front, but the ones that get caned are the ones at the back.

The global south is made up of over 130 countries that are [at the back]."



Jacobo Ocharan | Climate Action Network International Space

"The Global North must start repaying the overdue [climate] debt of trillions of dollars."

But the **ray of hope** is that everything is still open."

Source:

The Guardian | COP29 Live Blog
by **Damian Carrington**

<https://www.theguardian.com/environment/live/2024/nov/21/cop29-live-draft-texts-negotiations-climate-crisis>

Learning, Hope & Equity in context: “The Belém Declaration(s)”

From COP 28 (Dubai) to COP 30 (Belém) and beyond ...

Gastkommentar **Die Presse** | 15. Dez. 2023



Unsere **Kurzdiagnose** zur **COP 28** (Dubai 2023)

- Format dieser Konferenzen hat sich erschöpft:**
- Geschäftsordnung (**Einstimmigkeit**)
 - Geopolitische Verwerfungen (**nationale Interessen vs. multilaterale Kooperationen**)
 - **“Von weglosen Zielen zu zielorientierten Wegen!”**



21 November 2025

As COP30 text drops with no mention of fossil fuels, **Colombia and The Netherlands** announce co-hosting

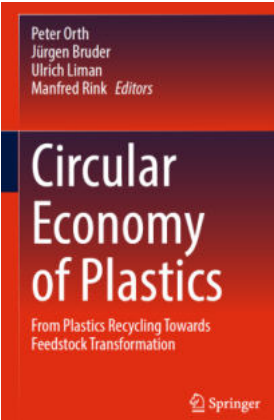
First International Conference on the Just Transition Away from Fossil Fuels

April 28-29, 2026 | Santa Marta, Colombia

[aims to create a roadmap for a just transition away from fossil fuels and operating in parallel with formal UN negotiations]

Against all Odds:
Transformative Change!

Making a Way
out of No Way !?



Chapter 15
Carbon Dioxide (CO₂)—The Ultimate Feedstock for an All-Circular and Climate-Neutral Carbon and Plastics Economy

Titel des Schlusskapitels

- **‘Making a Way out of No Way’**

Signatories of the Belém Declaration on the ‘Just Transition Away from Fossil Fuels’:

- **24 initial nations**
incl. Australia, Austria, Belgium, Canada, Colombia, Denmark, Finland, Ireland, Kenya, Netherlands, Mexico, Slovenia, Spain
- **over 80 nations in total**





As with **Science**,
Sustainable Development
is rooted in cultivating an appropriate
Mindset

**Mindset-Pillars
of the Western Tradition**
(often misunderstood):
Origins of the
Anthropocene

What's NEXT?
Building and strengthening
cross-sectoral & transnational
Collaboration

“I THINK, therefore I am.”

René Descartes (1637)

“Enrich YOURSELF.”

Adam Smith (1776)

“Survival of the FITTEST.”

Charles Darwin (1869)

**“I am because WE are;
and since WE are, therefore I am.”**

John Samuel Mbiti (1969)