



Climate Change Graz
Field of Excellence
University of Graz

Folienset • FORSITE Fachtagung Keynote Klima • Graz • 10.03.2022
Weblink Science informing the National Climate Committee & further infos (DE):
<http://ccca.ac.at/refnekp> Infos of the CCCA on the Referenz-NEKP der Wissenschaft etc.
Weblinks-News: Carbon Management to achieve Paris-compliant climate goals:
<http://www.carbmanage.earth>, <https://news.uni-graz.at/en/detail/article/uni-graz-zeigt-vor>
Anmerkung: dieses Folienset ist nur für persönliche Nutzung und beschränkte Weitergabe zur persönl. Info; eine offene Onlinestellung/Veröffentlichung (außer FORSITE) ist nicht gestattet.

Herausforderungen im Klimawandel und Wege aus der Klimakrise

Gottfried Kirchengast

Founding Director & Lead Scientist [Wegener Center for Climate and Global Change](#) (WEGC) and Head Atmospheric and Climate Physics/Institute of Physics, University of Graz, Austria
Speaker [Field of Excellence Climate Change Graz](#) and EO & Climate Strategies, [University of Graz](#)
Commission Climate & Air Quality of the Austrian Academy of Sciences (ÖAW)
Representative of Science in the Austrian National Climate Committee (NKK)

Klimawandel und Nachhaltige Transformation im Fokus

Uni Graz Profilbildender Bereich Climate Change Graz: *We work for tomorrow*

Climate Change Graz



ODER
WISSENSCHAFTLICHER
GEFRAGT:

Wie können wir den Übergang zu einer nahezu treibhausgasfreien und klimarobusten Gesellschaft in der Zeit bis 2050 schaffen?

Wie viel Fieber hat die Erde und wie stoppen wir es?

Wir wissen dazu schon viel, doch es ist so wichtig noch viel mehr zu wissen.

Über das Klima im Wandel und Nachhaltiges Handeln.
Über Daten, Fakten und die Physik der Änderungen.
Über Gefahren, Gerechtigkeit, Skepsis und Risiken.
Über Entscheidungen, Lösungen und Chancen.

Wir arbeiten Heute für Morgen. Wir sind über hundert Forscherinnen und Forscher an der Universität Graz. Wir sind Climate Change Graz.

Wir sind neugierig und wissenschaftlich und als Team erfolgreicher. Als Menschen sind wir betroffen. Als Wissenschaftler sachlich und klar.

Wir sagen was ist und was voraussichtlich kommt nach bestem Wissen und Gewissen. Wir forschen und leben im Heute und wirken für die Zukunft.

We are Climate Change Graz
We work for tomorrow.

We work for tomorrow



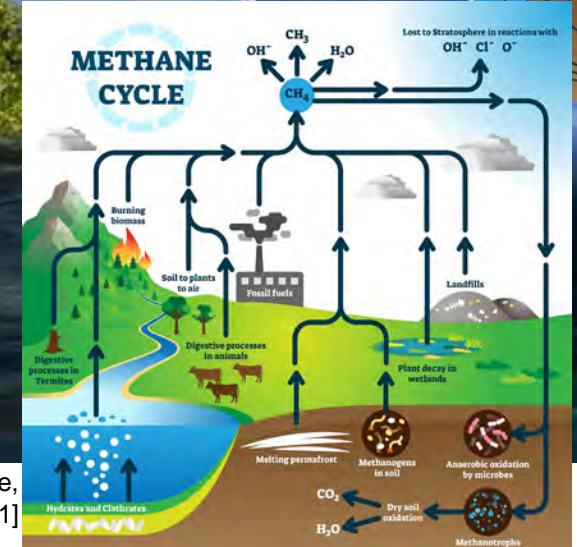
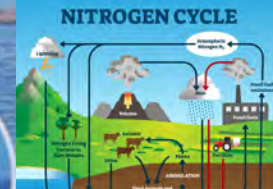
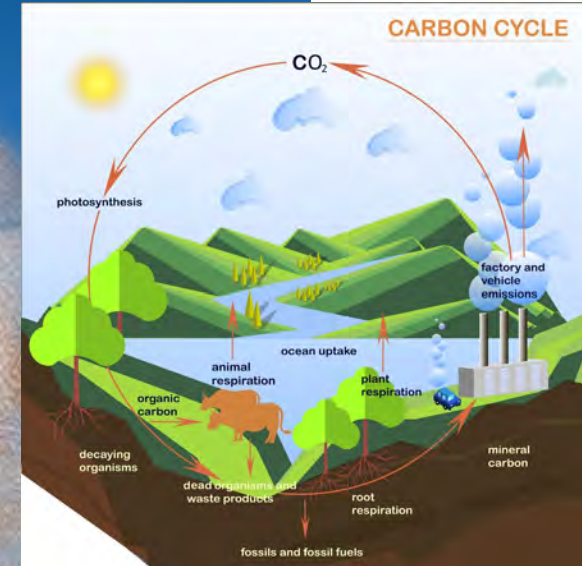
(UniGraz P&K, draft 3/2019)

Climate Change Graz

Field of Excellence
University of Graz



Low Carbon Transition – a planetary management challenge 2021 to 2050...



[Kaushik et al., Carbon Cycle & Changing Climate, EOS, 2020; insert figs: dreamstimepics-dl.2021]



Wegener Center
RESEARCH BRIEFS
1 | 2021

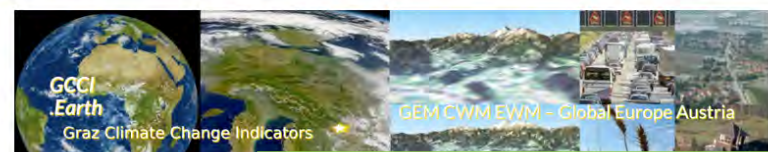
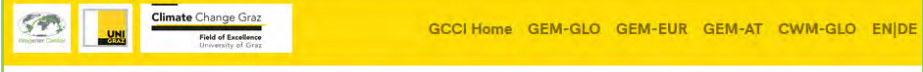
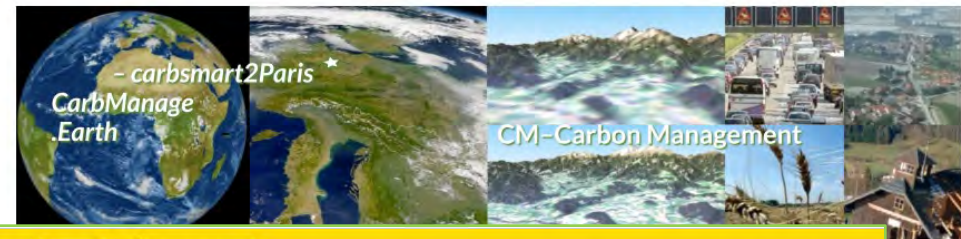
Carbon Management: a new approach to achieve Paris-compliant climate goals and Uni Graz Institutional Carbon Management as a role model

Gottfried Kirchengast, Julia Danzer, Stefanie Hölbling

April 2021



[Kirchengast et al., CM/WEGC, 2021; **CM online** (hub): www.carbmanage.earth,
PCM: www.pubcarb.earth, **ICM**: www.wecarb.earth, **pCM**: www.youcarb.earth]



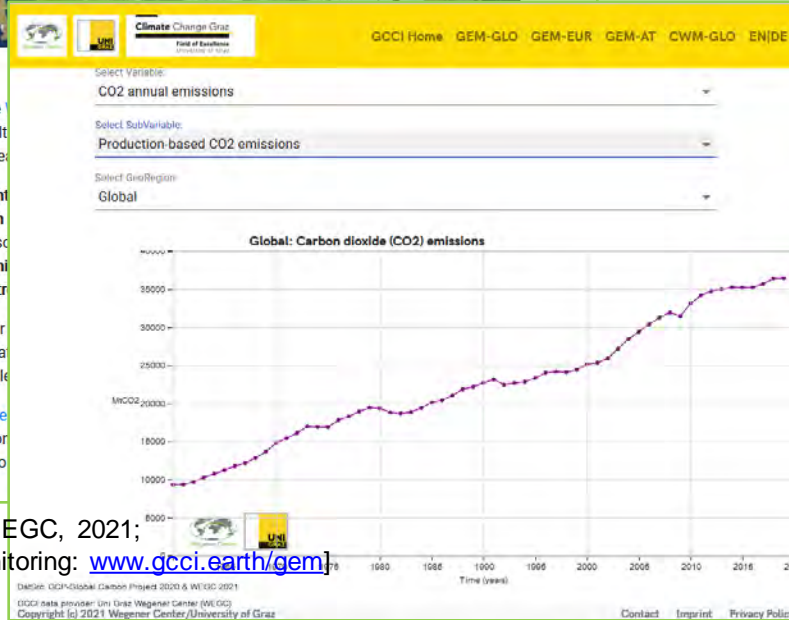
Welcome to GCCI.Earth!

This data portal is powered by the Excellence [Climate Change Graz](#). It More content and features are rele

GCCI.Earth provides reliable **recent Paris-compliant future projection** 1990 and 2020 to 2050. In doing so **Monitoring**), global climate warmi terms of **weather and climate extr**

Dive in through the Menu on top or charts are made to be self-explana data-source references, see this file

Welcome to visit also [CarbManage](#) context information. Learn there or institutional, and personal levels to of the Paris Agreement.

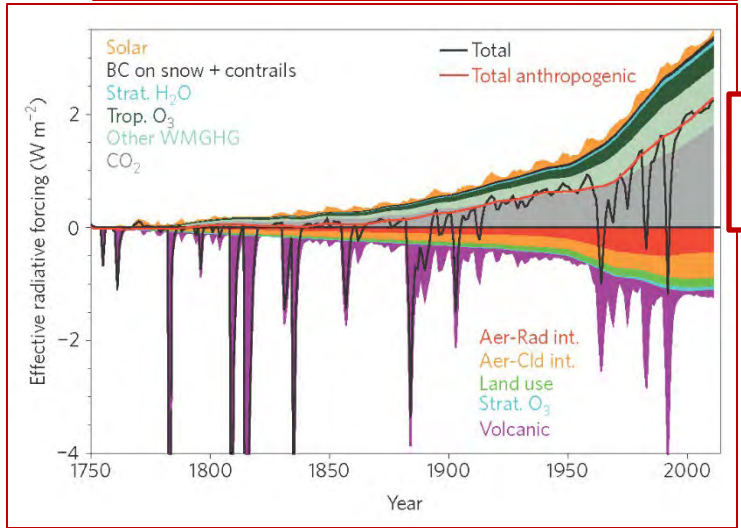
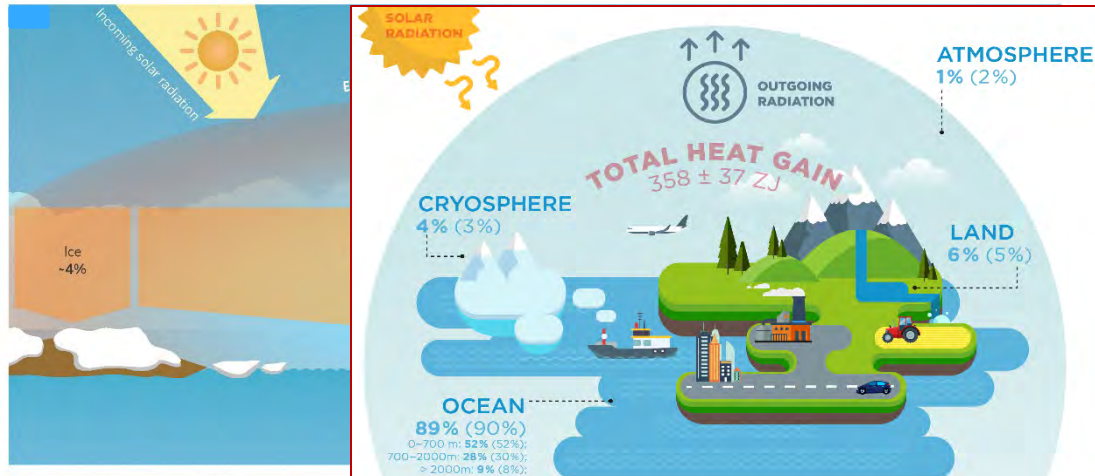
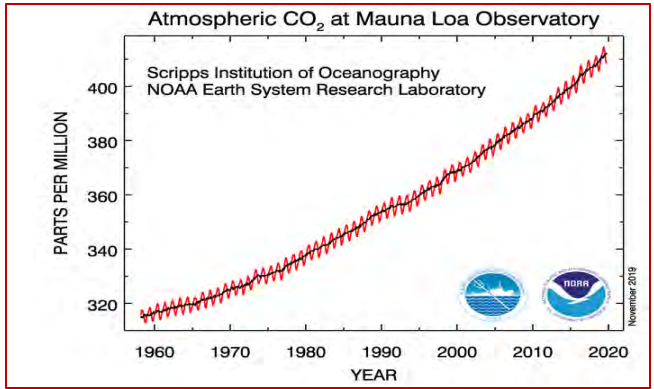


[Kirchengast et al., GCCI/WEGC, 2021; GCCI-GHG Emissions Monitoring: www.gcci.earth/gem]

Why care? – Hard physics facts from rising GHGs via Earth’s Energy Imbalance to **Global Warming** and Climate Change...

GHG drivers, radiative forcing, Earth’s energy imbalance (EEI), global warming, climate change,...

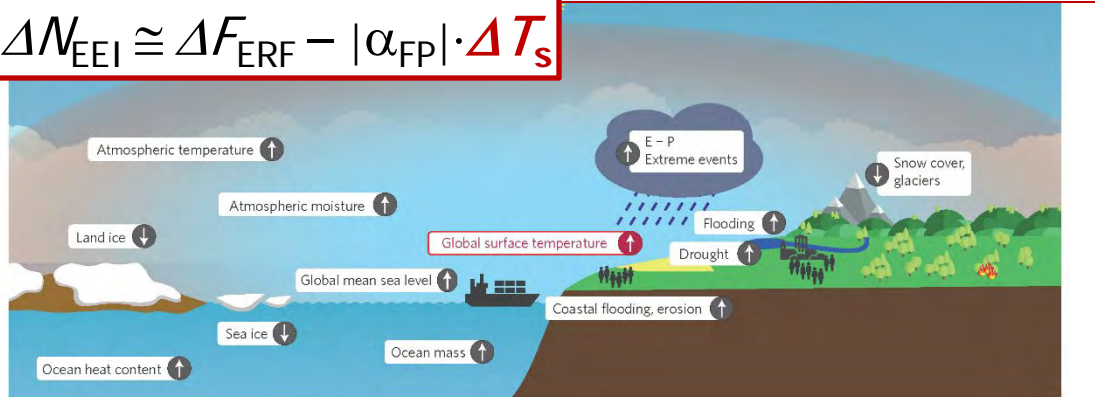
Where does the Energy go? – the excess energy of $\sim 0.8 \text{ Jm}^{-2}\text{s}^{-1}$ ($\sim 13 \text{ ZJ/yr}$) due to the EEI ?



Core—the TOA imbalance:

$$\Delta N_{EEI} \cong \Delta F_{ERF} - |\alpha_{FP}| \cdot \Delta T_s$$

1971–2018 (2010–2018)

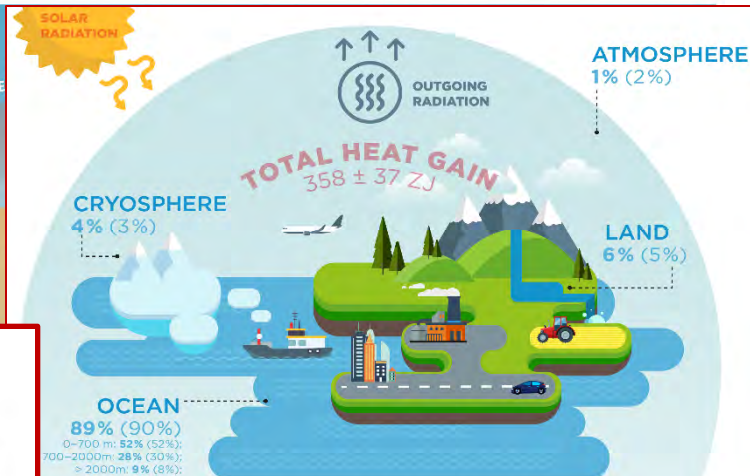
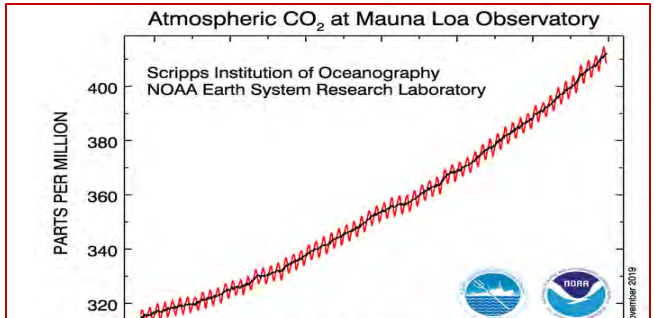


[upper left: NOAA, 2020; other panels: v.Schuckmann et al., 2016 & 2020; insert equ.: Kirchengast, WEGC, 2020; more info online > Kirchengast et al., WEGC, 2021 - GCCI-Climate Warming Monitoring: www.gcci.earth/cwm]

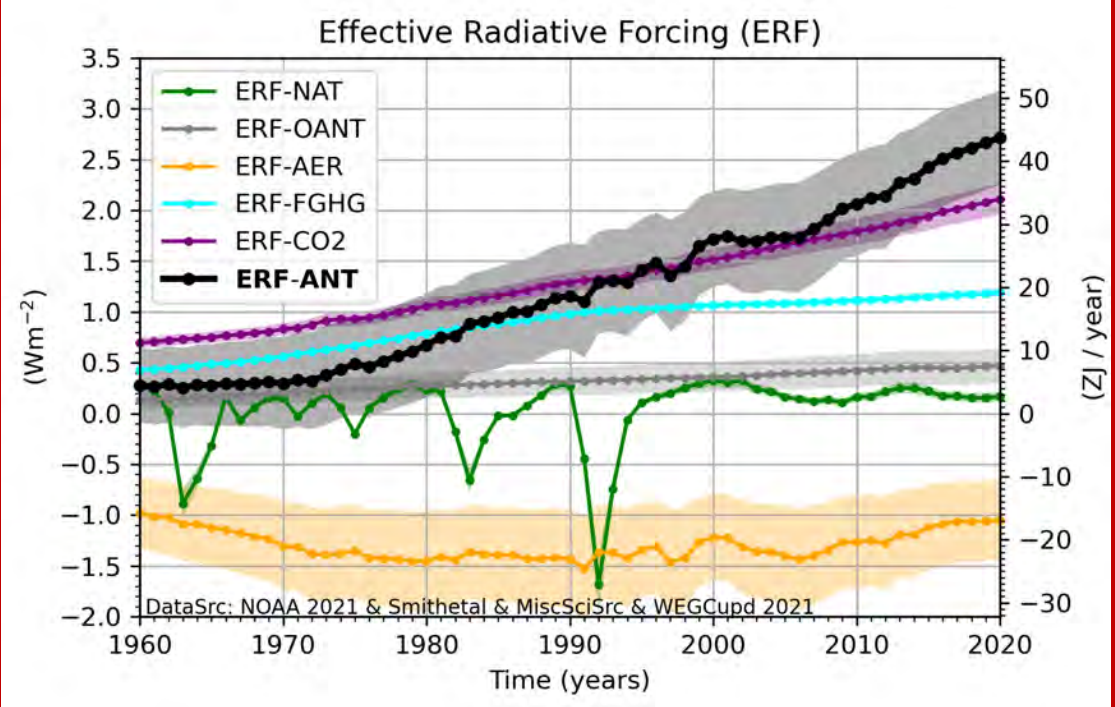
Why care? – Hard physics facts from rising GHGs via Earth's Energy Imbalance to **Global Warming** and Climate Change...

GHG drivers, radiative forcing, Earth's energy imbalance (EEI), global warming, climate change,...

Where does the Energy go? – the excess energy of $\sim 0.8 \text{ Jm}^{-2}\text{s}^{-1}$ ($\sim 13 \text{ ZJ/yr}$) due to the EEI ?

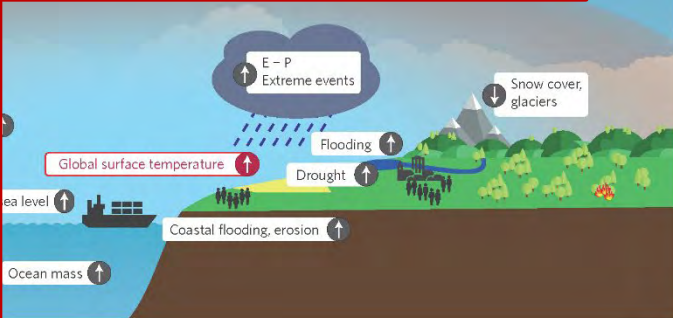


[Kirchengast & Thalassinos, AGU Pres, 2021]



Core—the TOA imbalance:

$$\Delta N_{EEI} \approx \Delta F_{ERF} - |\alpha_{FP}| \cdot \Delta T_s$$

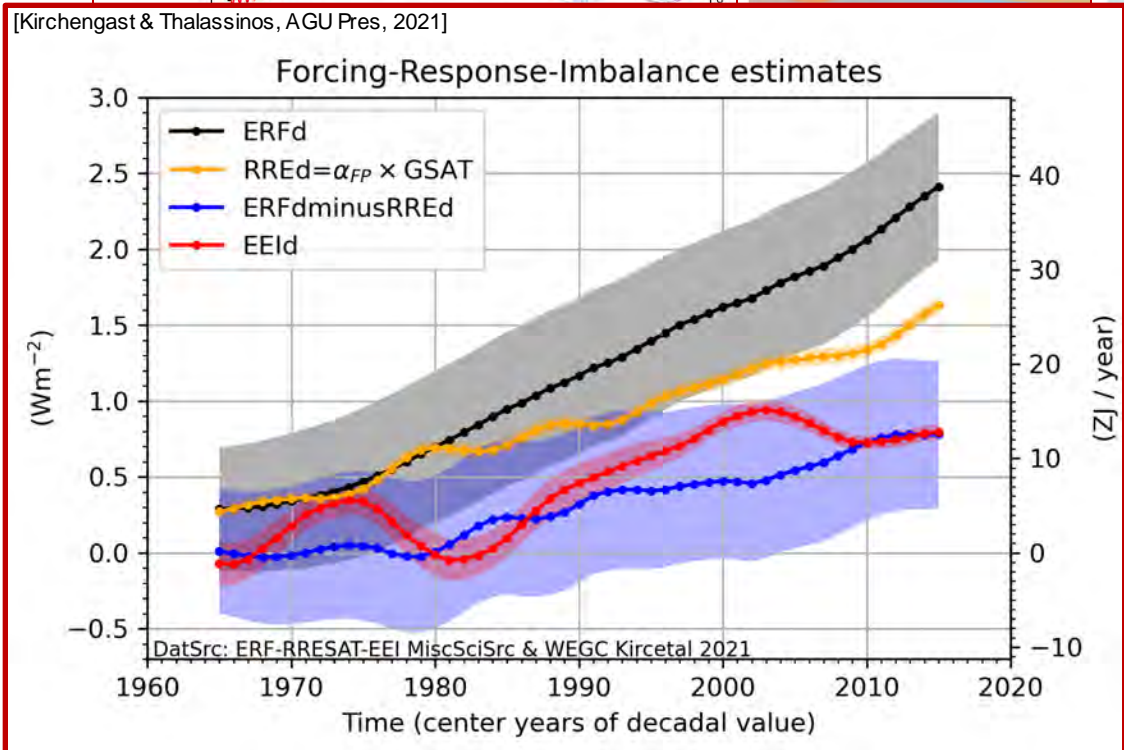
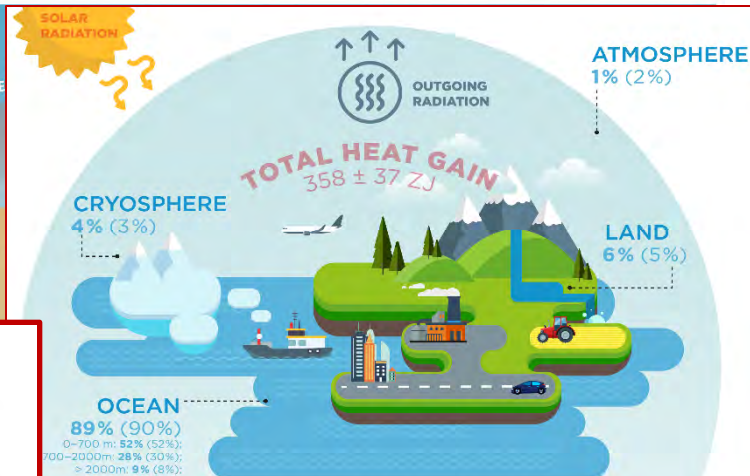
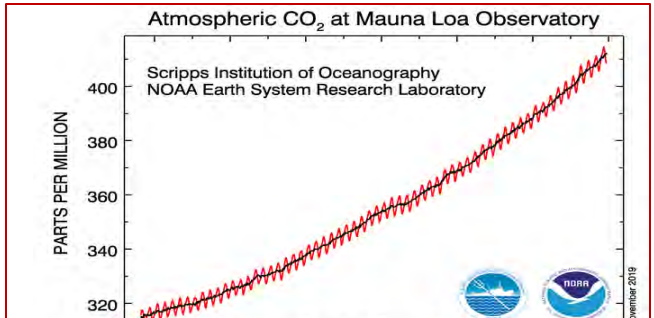


et al., 2016 & 2020; insert equ.: Kirchengast, WEGC, 2020; GCCI-Climate Warming Monitoring: www.gcci.earth/cwm

Why care? – Hard physics facts from rising GHGs via Earth's Energy Imbalance to **Global Warming** and Climate Change...

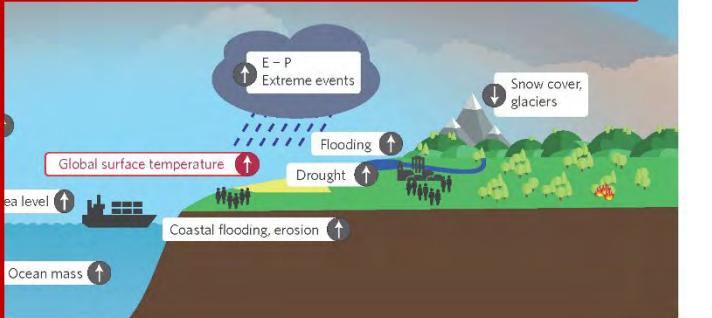
GHG drivers, radiative forcing, Earth's energy imbalance (EEI), global warming, climate change,...

Where does the Energy go? – the excess energy of $\sim 0.8 \text{ Jm}^{-2}\text{s}^{-1}$ ($\sim 13 \text{ ZJ/yr}$) due to the EEI ?



Core—the TOA imbalance:

$$\Delta N_{EEI} \approx \Delta F_{ERF} - |\alpha_{FP}| \cdot \Delta T_s$$

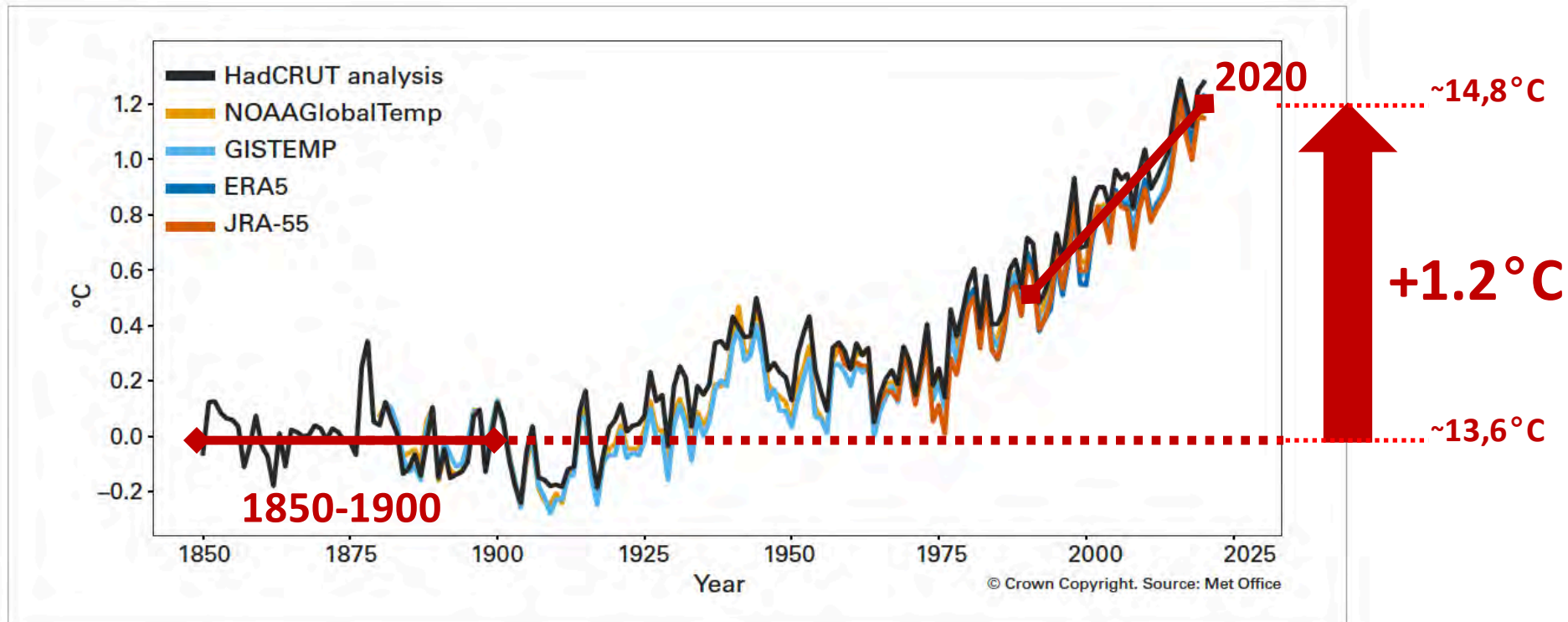


et al., 2016 & 2020; insert equ.: Kirchengast, WEGC, 2020; GCCI-Climate Warming Monitoring: www.gcci.earth/cwm

Facts—climate change is going on and on strongly...

Memorable year 2020: global warming ΔT_s reaches $\sim 1.2^\circ\text{C}$

- **Global Warming:** Increase of the **global mean surface-air temperature ΔT_s** by $\sim 1.2^\circ\text{C}$ in 2020 relative to preindustrial times (represented by Mean[1850–1900])

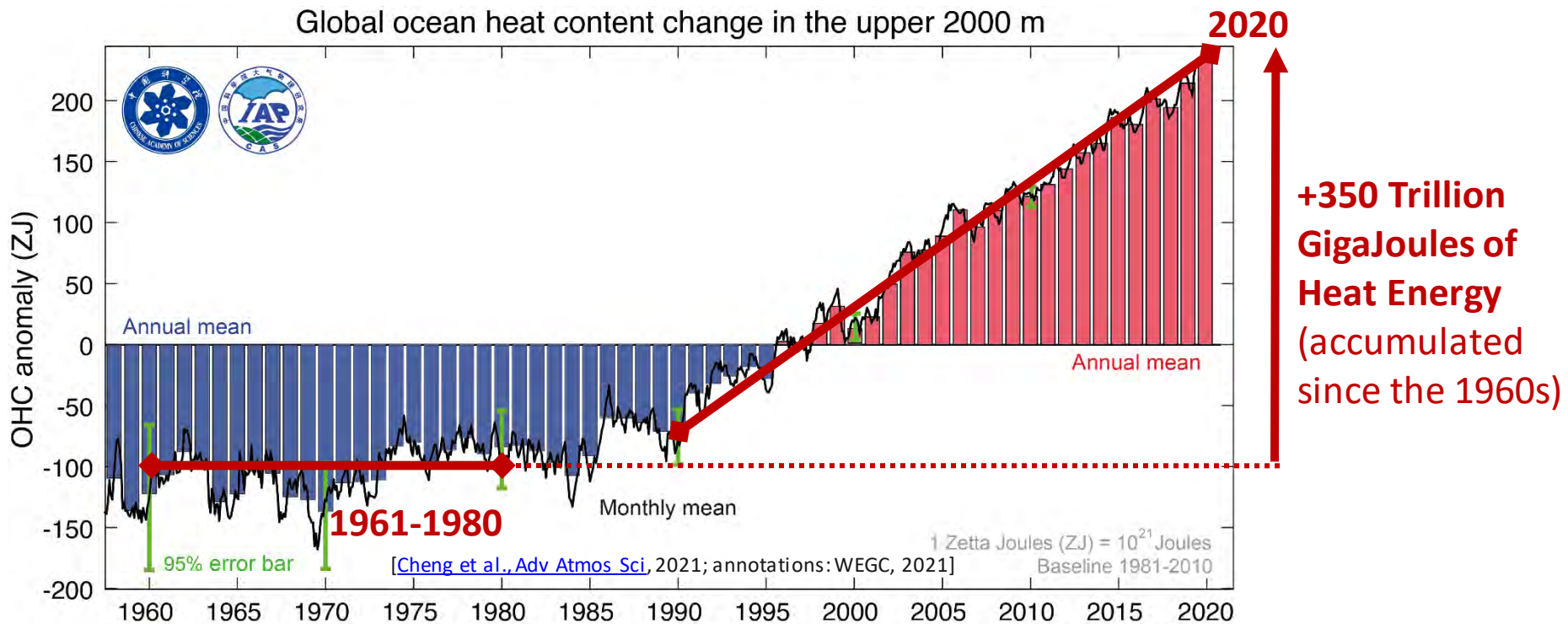


(based on <https://public.wmo.int/en/our-mandate/climate/wmo-statement-state-of-global-climate>, WMO, 2021; annotations, WEGC, 2021)

Facts—the clearest fingerprint of climate change...

Memorable 2020: **Ocean Heat Content** (to 2 km depth) reaches **~350 ZJ**

- **Ocean warming:** 2020 again more than 13 ZJ excess heat added into the oceans; about 90% of the **excess energy ΔN_{EEI}** is stored in the oceans (near $400 \cdot 10^{21}$ Joule since 1960)

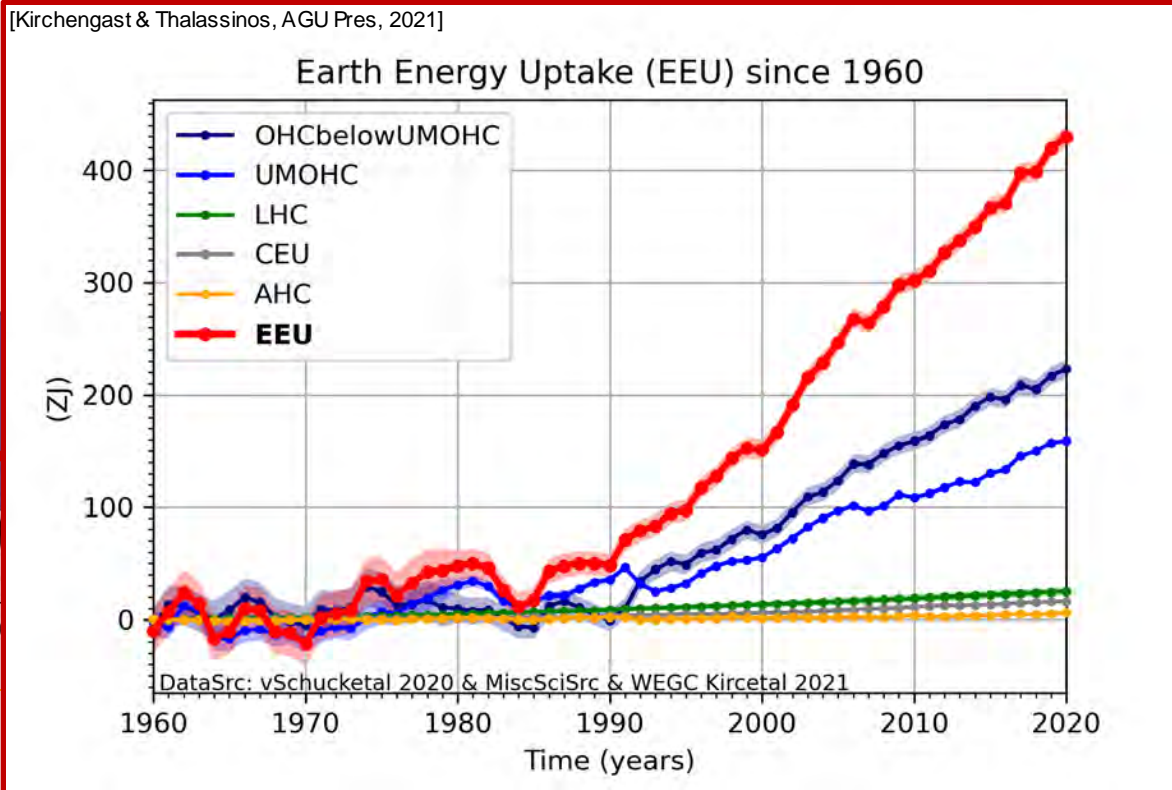
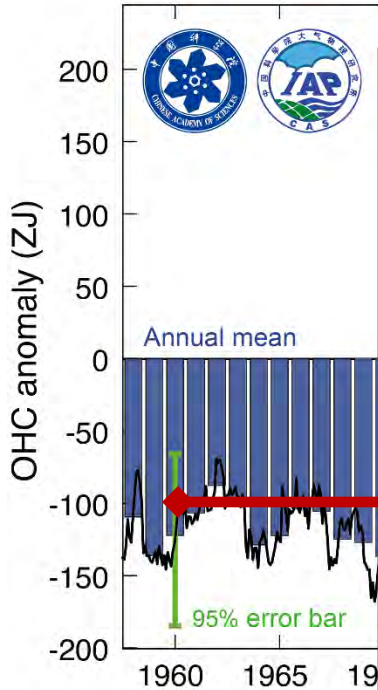


Facts—the clearest fingerprint of climate change...

Memorable 2020: **Ocean Heat Content** (to 2 km depth) reaches **~350 ZJ**

- **Ocean warming:** 2020 again more than 13 ZJ excess heat added into the oceans; about 90% of the **excess energy ΔN_{EEI} is stored in the oceans** (near $400 \cdot 10^{21}$ Joule since 1960)

Global ocean heat content change in the upper 2000 m



2020

400 Trillion Joules of Excess Energy accumulated since the 1960s

Main statement in recent IPCC(-AR6-WGI) assessment report (1)



[Credit: Yousuf Alkhatib / Unsplash]

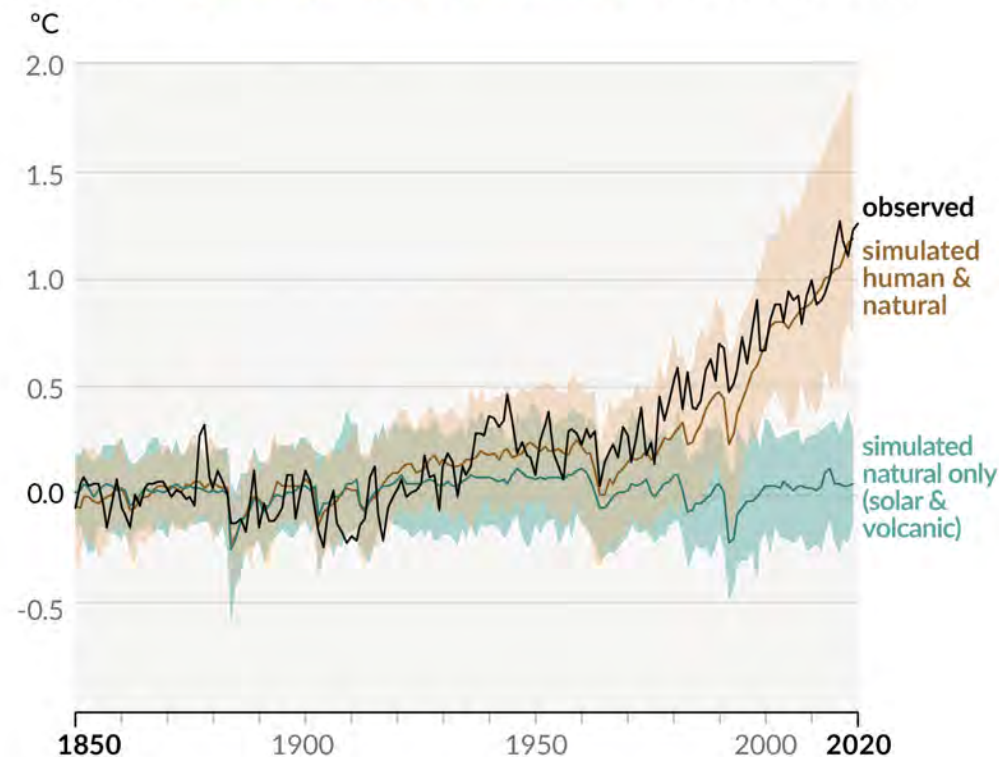
“ It is indisputable that human activities are causing climate change, making extreme climate events, including heat waves, heavy rainfall, and droughts, more frequent and severe.

Attribution of human influence – our influence clearly drives the change

Attribution fingerprints – characteristic patterns for different climate change drivers

- **Observed temperature change ΔT_s** (black) cannot be explained by natural causes only (green)
- **It can only be explained by including anthropogenic forcings** (greenhouse gases, aerosols) (brown)

b) Change in global surface temperature (annual average) as **observed** and simulated using **human & natural** and **only natural** factors (both 1850-2020)



(IPCC-AR6-WGI 2021, Fig. SPM.1)

Main statement in recent IPCC(-AR6-WGI) assessment report (2)



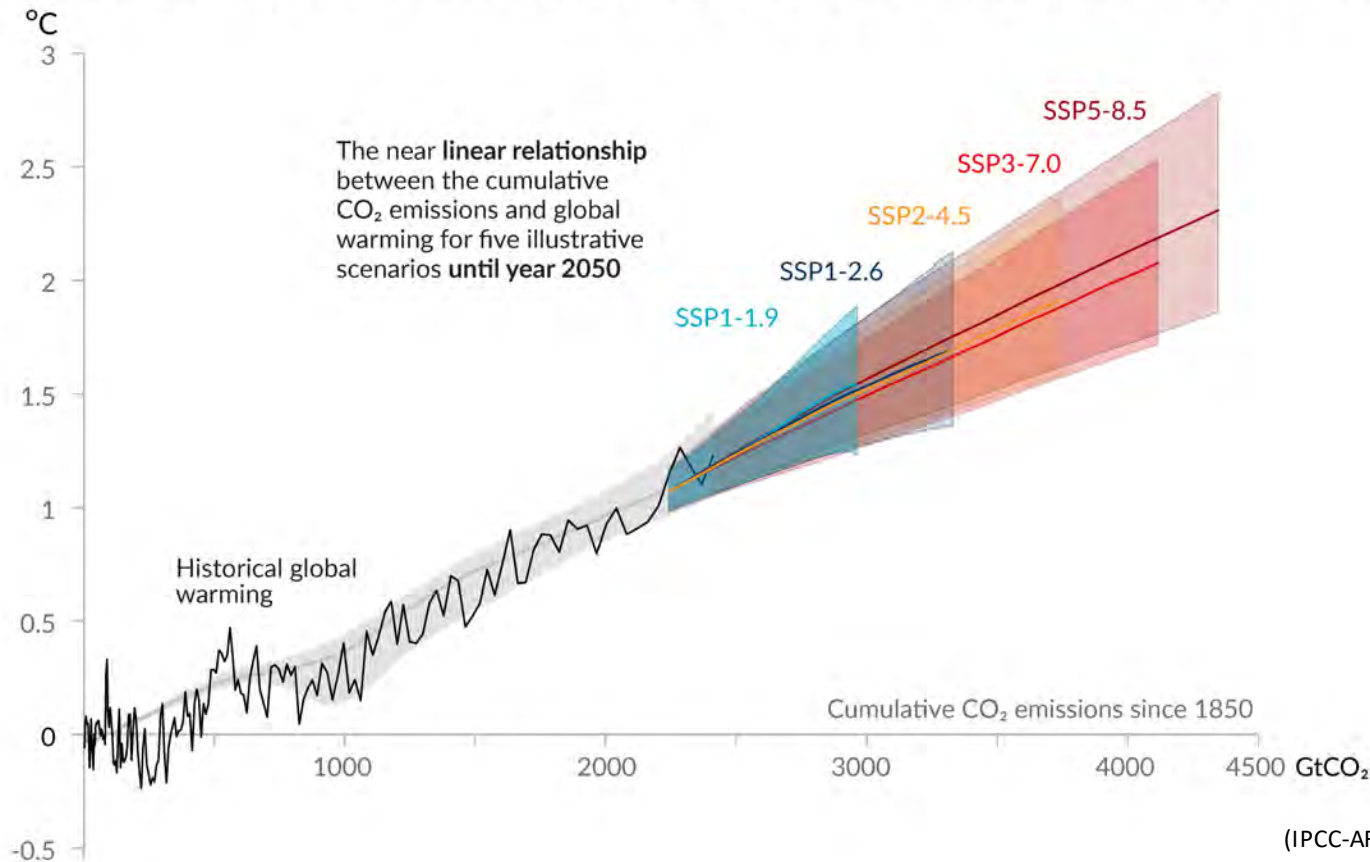
[Credit: Frank Jahn/Blackcode / iStock]

“ Unless there are immediate, rapid, and large-scale reductions in greenhouse gas emissions, limiting warming to 1.5°C will be beyond reach.

Time to act – Cumulation of CO₂ emissions needs to end near 2050

- **Every additional ton of CO₂ (and other GHG) emissions contributes to global warming**

Global surface temperature increase since 1850-1900 (°C) as a function of cumulative CO₂ emissions (GtCO₂)



(IPCC-AR6-WGI 2021, Fig. SPM.10)

Time to act

- Every addition

Global surface temperature

°C

3

2.5

2

1.5

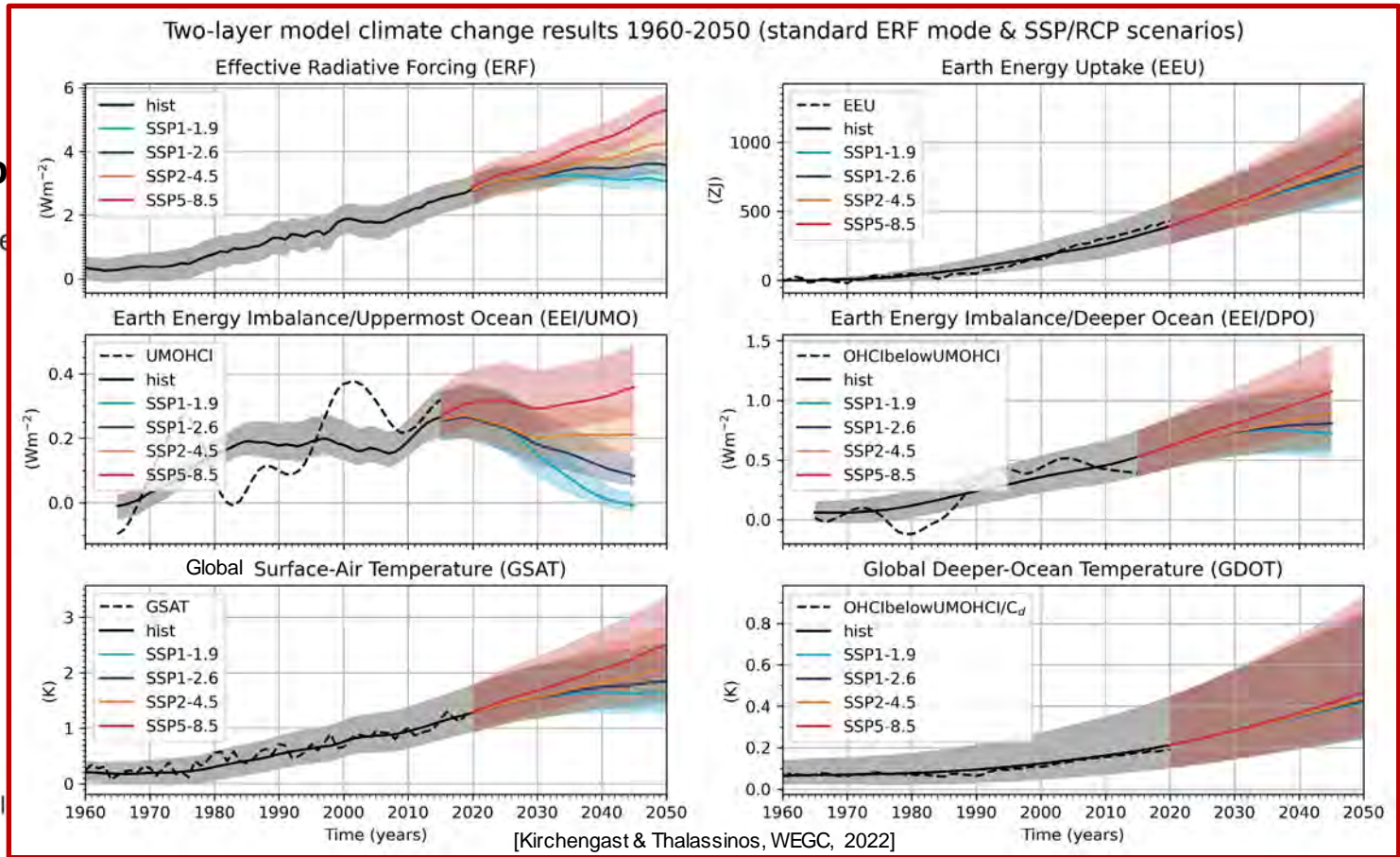
1

0.5

0

-0.5

Historical warming



Cumulative CO₂ emissions since 1850

1000

2000

3000

4000

4500 GtCO₂

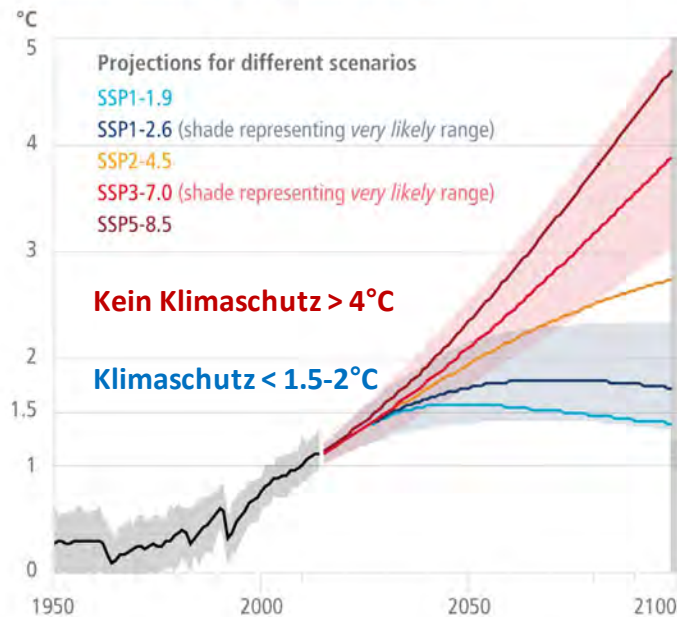
(IPCC-AR6-WGI 2021, Fig. SPM.10)

Time to act – Avoid High Risks and Irreversible Changes

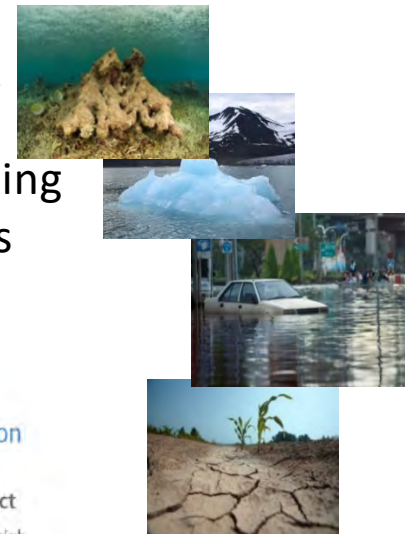
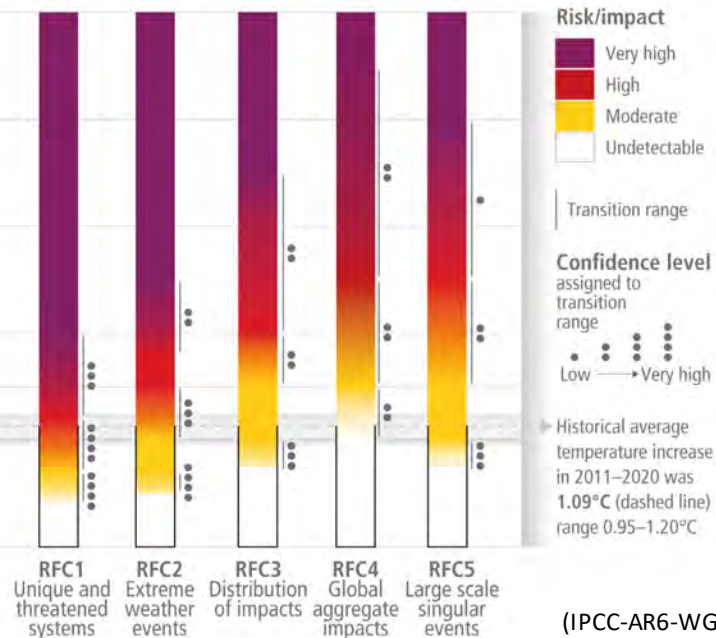
- **Paris 2015 Climate Agreement** – Countries pledge to keep global warming well below 2°C, aiming for 1.5°C to avoid risks & irreversible disruptions

Global and regional risks for increasing levels of global warming

(a) Global surface temperature change
Increase relative to the period 1850–1900



(b) Reasons for Concern (RFC)
Impact and risk assessments assuming low to no adaptation

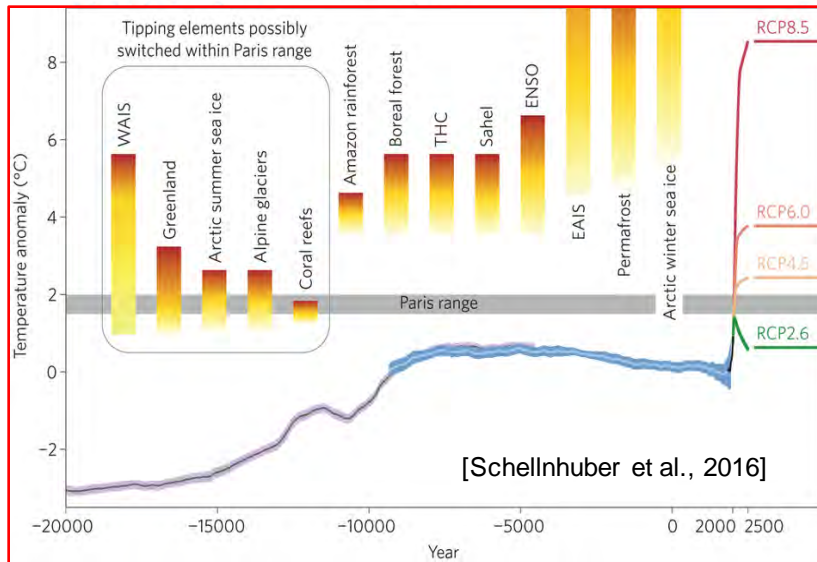


(IPCC-AR6-WGII 2022, Fig. SPM.3/1)

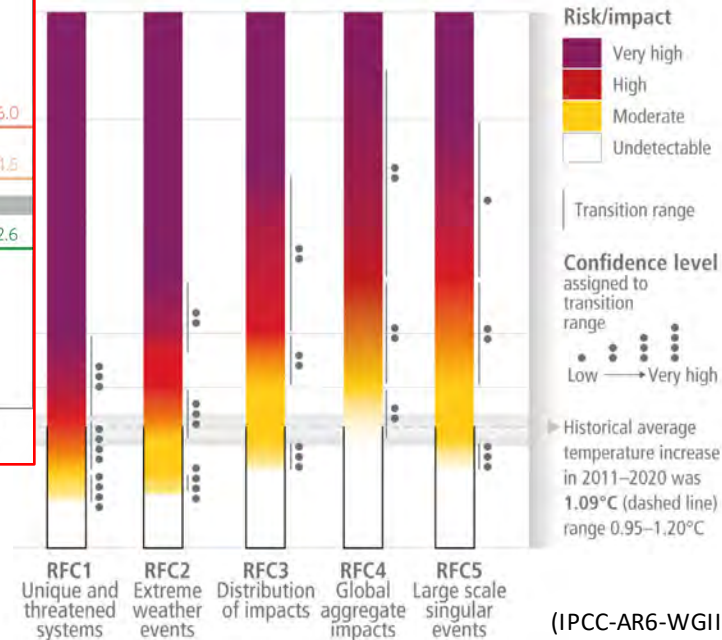
Time to act – Avoid High Risks and Irreversible Changes

- **Paris 2015 Climate Agreement** – Countries pledge to keep global warming well below 2°C, aiming for 1.5°C to avoid risks & irreversible disruptions

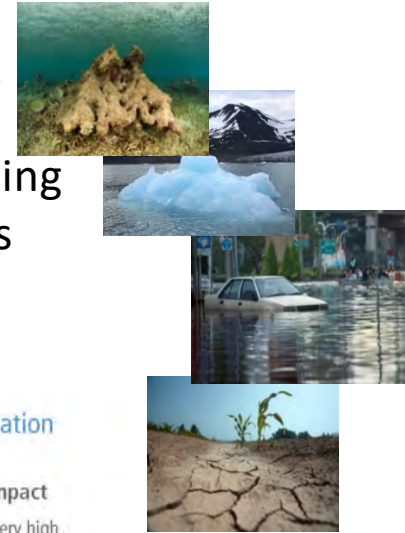
⇒ *Zahlreiche Studien unterstreichen diese Paris-Zielsetzung klar.*



Reasons for Concern (RFC)
Impact and risk assessments assuming low to no adaptation



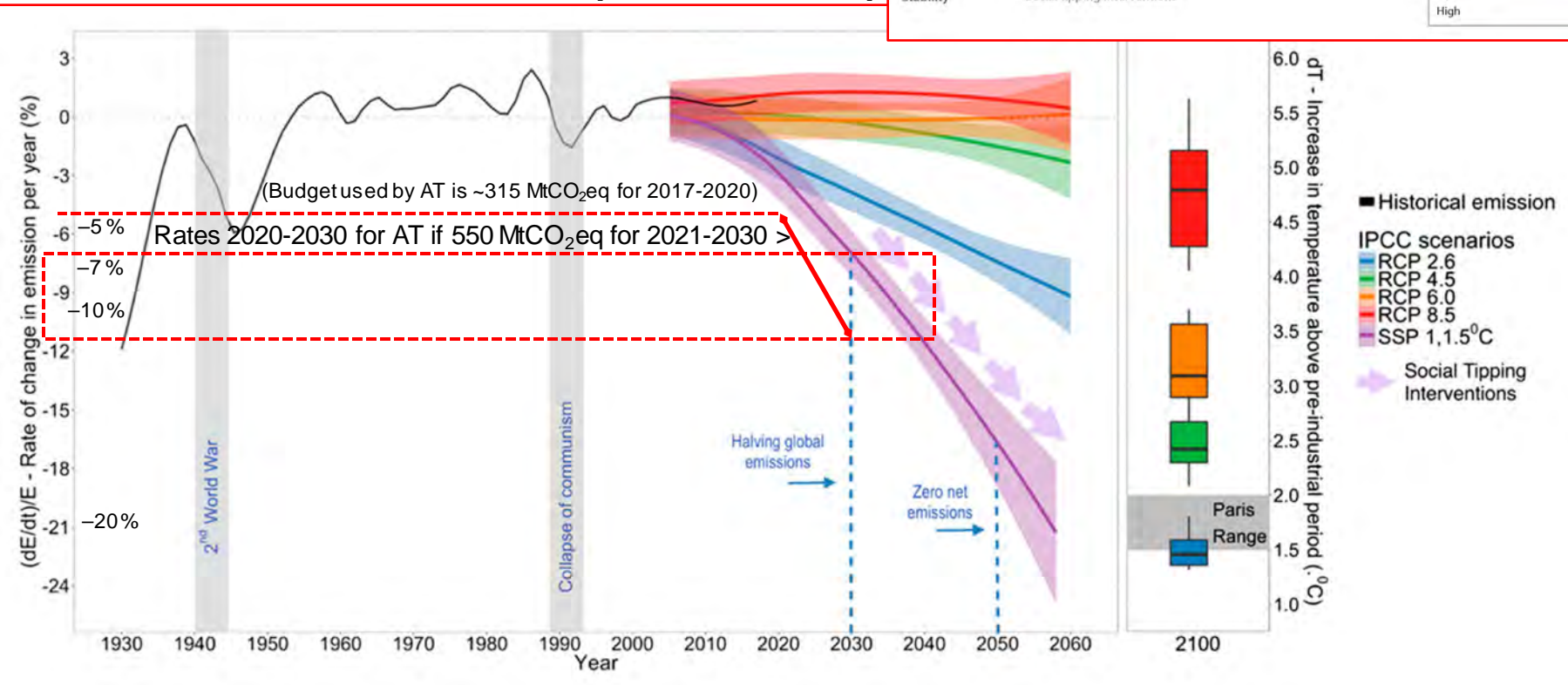
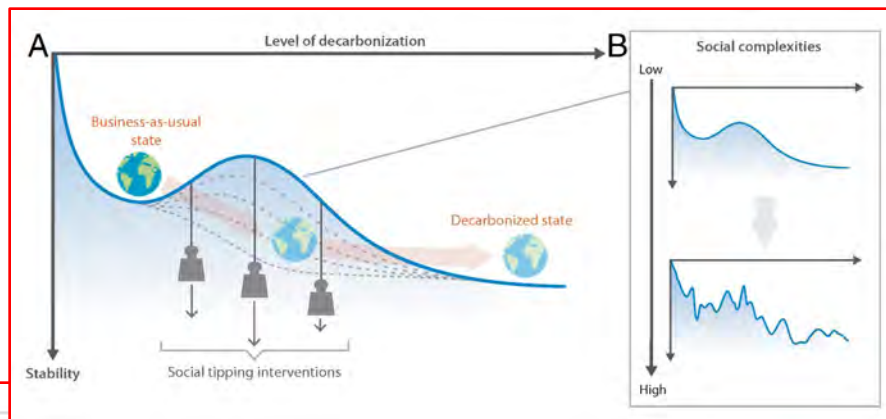
(IPCC-AR6-WGII 2022, Fig. SPM.3/1)



How to care? – Reach deep **reduction rates of at least 7%/year** *Demands “social tipping”, fast social&tech changes, Action,...*

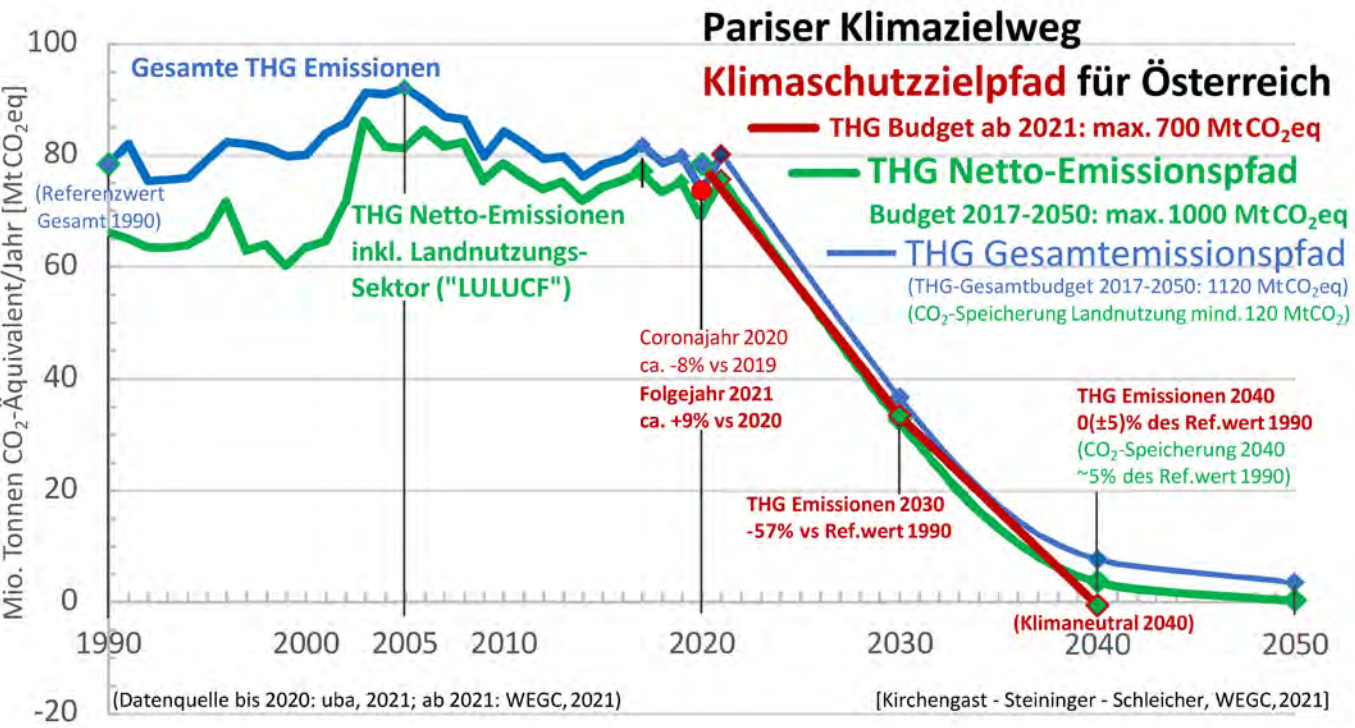
*...overplotted below, as a **country example**,
 a **reduction rate path for Austria** (red arrow)
 given 1000 MtCO₂eq as its total 2017-2050
 budget (550 MtCO₂eq over 2021-2030), which
 corresponds to at least “halving per decade”.*

[Otto et al., PNAS, 2020]




(Kirchengast et al. WEGC RB1-2021; online via www.carbmanage.earth,
 direct-link <https://doi.org/10.25364/23.2021.1>)

Turning to **Action**—example country **Austria**: Which reduction targets here? *The 1.5°C-oriented 1000 MtCO₂eq AT 2017-2050 budget requires at least “halving per decade” until 2030 and over 90% reduction to be achieved near 2040, in accordance with the European Green Deal climate goals...*



...im Einklang mit den Europäischen Zielen (Strategische Vision Klimaneutralität bis 2050)



European Commission

Our Vision for A Clean Planet for All

(European Commission, 2018)

Entwicklung der THG-Emissionen in einem EU Szenario mit 1,5°C Ziel
Quelle: Broschüre "Klimaneutralität bis 2050", Europäische Kommission, 2019)

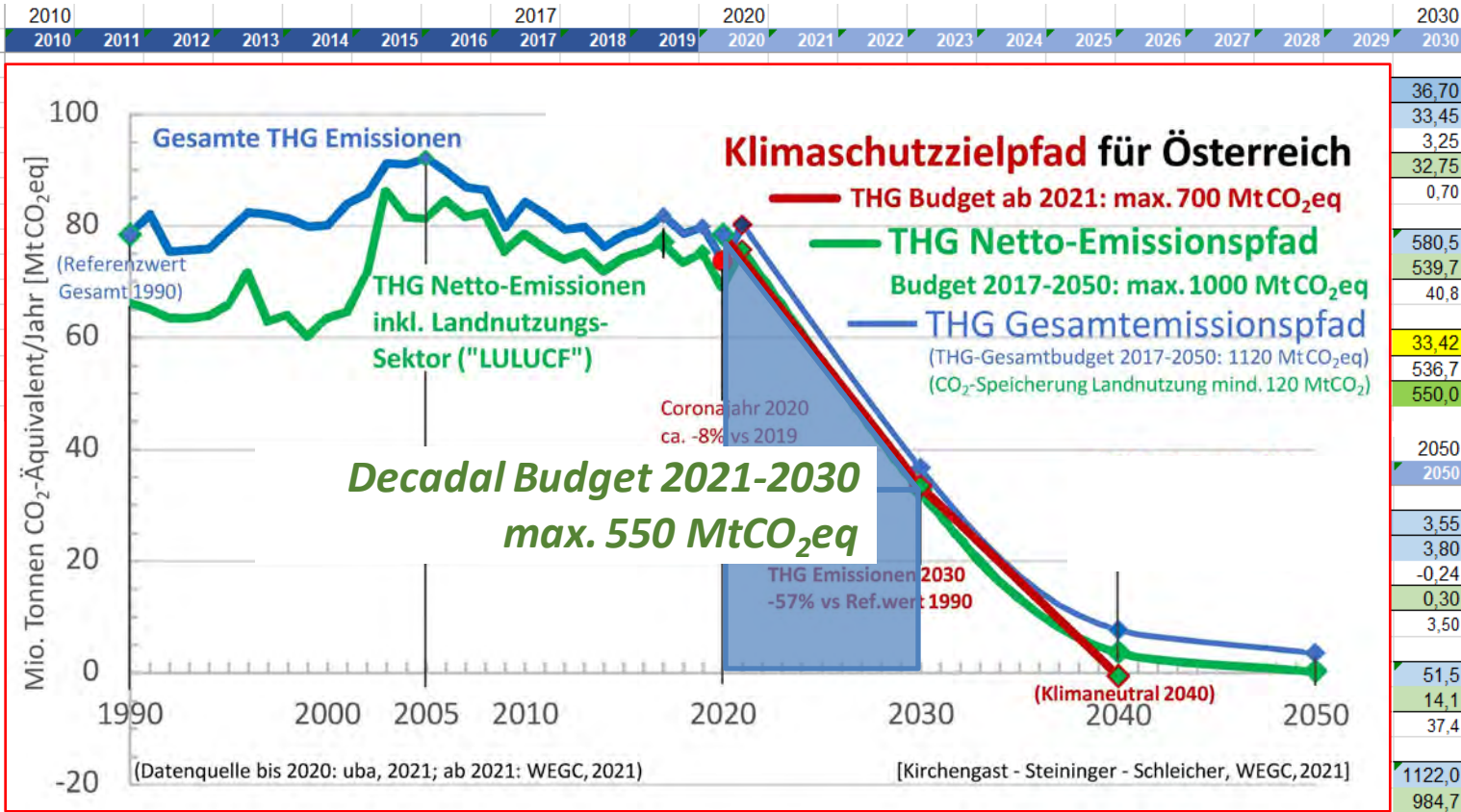
[Kirchengast et al., Ref-NEKP, 2019; online via <http://ccca.ac.at/refnekp>; 2021 update-statement online via www.wegcenter.at/downloads/2021] (Kirchengast et al. WEGC RB1-2021; online via www.carbmanage.earth, direct-link <https://doi.org/10.25364/23.2021.1>)

What can support effective Action in Austria and any other country?

Carbon Management (CM) at all public and private action levels

The 1000 MtCO₂eq AT total leads to manage a decadal 2021-2030 budget of max. 550 MtCO₂eq => reduction by at least 57% in 2030 vs Ref.2020.

THG Emissionen Österreich	
inkl. Landnutzungssektor ("LULUCF")	[Millionen Tonnen CO ₂ eq / Jahr]
RefNEKP+ THG Gesamtemissionspfad	
THG Netto-Emissionspfad (inkl. LN)	
Differenz Gesamt-minus-Netto (=LN)	
THG Netto-Emissionspfad (inkl. LN+)	
C-Speicherung LN+ (Diff. d. LN LN+ Pfade)	
THG Gesamtbudgets (div. Zeitperioden)	
THG Nettobudgets (div. Zeitperioden)	
C-Speicherung LN (Differenz der Budgets)	
Linearpfad-Budget 2020er -4.5 Mt/Jahr und danach 2030er -3.4 Mt/Jahr	
Vorschlag Maximalbudget 2020er-Jahre	



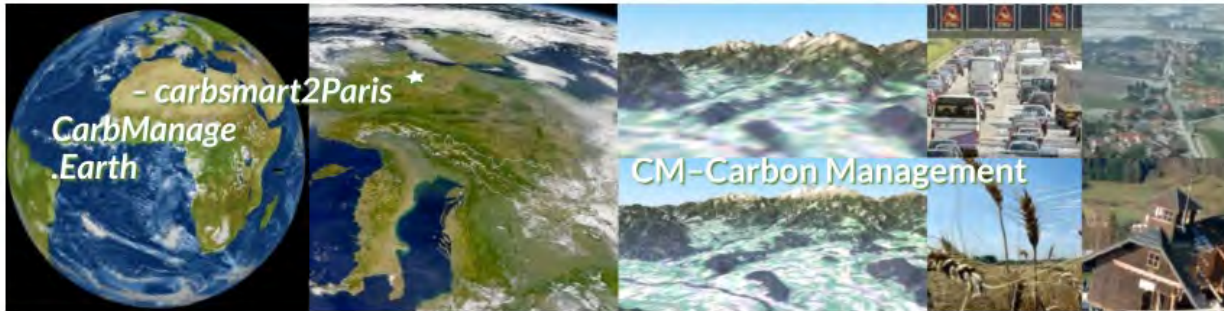
74,1 Maximalbudget 2020er-Jahre ist 74% des Budgets der 2010er-Jahre

C-Speicherung LN gesamt 2017-2050: 137,3

[Kirchengast-Steininger, WEGC, 2021; statement on THG budget at www.wegcenter.at/downloads/2021]

(Kirchengast et al. WEGC RB1-2021; online via www.carbmanage.earth, direct-link <https://doi.org/10.25364/23.2021.1>)

[Kirchengast et al., CM/WEGC, 2021; **CM online** (hub): www.carbmanage.earth, **PCM**: www.pubcarb.earth]



Carbon Management
*a solution framework
for effective climate
action compliant with
the Paris climate goals...*

Welcome to CarbManage.Earth!

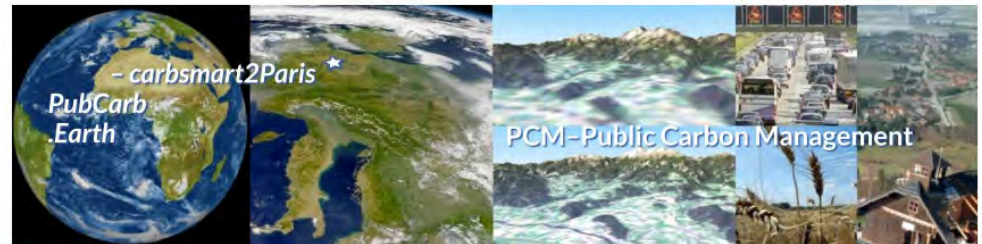
This webspace is powered by the Wegener Center of the University of Graz on behalf of its Field of Excellence Climate Change Graz. It serves as an **open platform to provide information and exchange on Carbon Management (CM)**, including guidance and tools supporting everybody from public entities such as countries and companies to families and individual persons to achieve Paris-compliant climate goals.

HOT NEWS – 29th April 2021: Release of the Wegener Center **Research Brief “Carbon Management – Paris-compliant climate goals”**, which provides the foundational introduction of CM (EN, Foreword & Executive Summary also DE) and watch the related **Presentation** on YouTube. Find the Press Release here.

Welcome to join and become empowered to share in your climate solution path, from carbsmart to Paris.

What Carbon Management is – in a nutshell:

Carbon Management is a new solution framework for meeting the challenge of climate change, the challenge of contributing towards limiting global warming to well below 2°C, with the Paris Agreement, international policy and whole countries worldwide but also at the sub-country and city levels, as well as down to household, family, and individual person levels.



Welcome to PubCarb.Earth!

This webspace is powered by the Wegener Center of the University of Graz on behalf of its Field of Excellence Climate Change Graz. It serves as an **open platform to provide information and exchange on Public Carbon Management (PCM)**, a new approach and related guidance and tools supporting countries, states, and other large public entities to achieve Paris-compliant climate goals.

Welcome to join and become empowered to share in your climate solution path, in the spirit of the PCM motto: *PubCarb – carbsmart to Paris*.

What Public Carbon Management is – in a nutshell:

Public Carbon Management (PCM) provides science-based knowledge, innovation, and services for public entities, including public governmental and corporation entities (such as countries, states, and districts and their governing and managing actors), for **supporting them in an actively managed goal-driven and solutions-oriented transition to a low carbon entity** until 2030 – 2040 – 2050, in accordance with the overarching goals of the Paris Climate Agreement of 2015 that require net-zero^(a) emissions and climate-neutral^(b) public entities earliest possible over this timeframe.

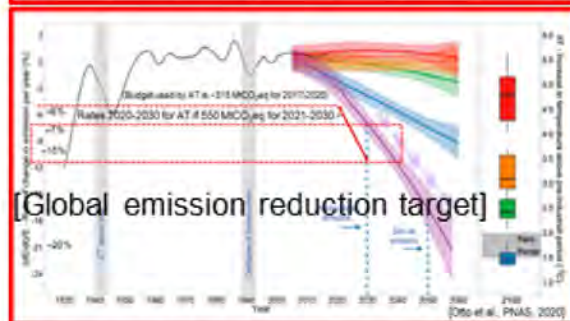
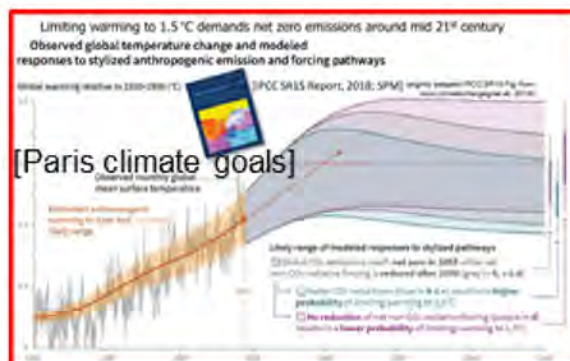
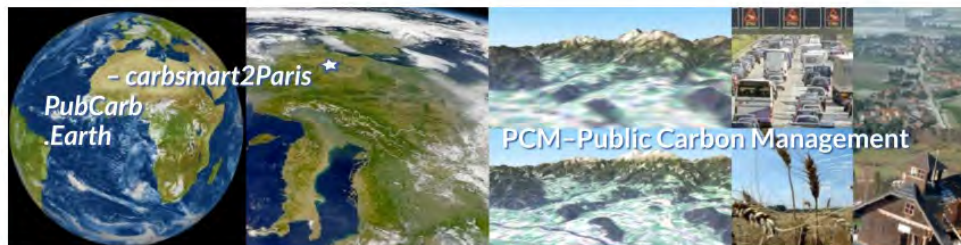
Carbon Management: a new approach to achieve Paris-compliant climate goals and Uni Graz Institutional Carbon Management as a role model

Gottfried Kirchengast, Julia Danzer, Stefanie Hölbling



Climate Change Graz
Field of Excellence
University of Graz

CM Home PCM ICM pCM Login Links EN | DE



PCM–Public Carbon Management provides science-based knowledge, innovation, and services for public entities, including public governmental and corporation entities (such as countries, states, and districts and their governing and managing actors), for supporting them in an actively managed goal-driven and solutions-oriented transition to a low carbon entity until 2030 - 2040 - 2050, in accordance with the overarching goals of the Paris Climate Agreement of 2015 that require net-zero^{a)} emissions and climate-neutral^{b)} public entities earliest possible over this timeframe.

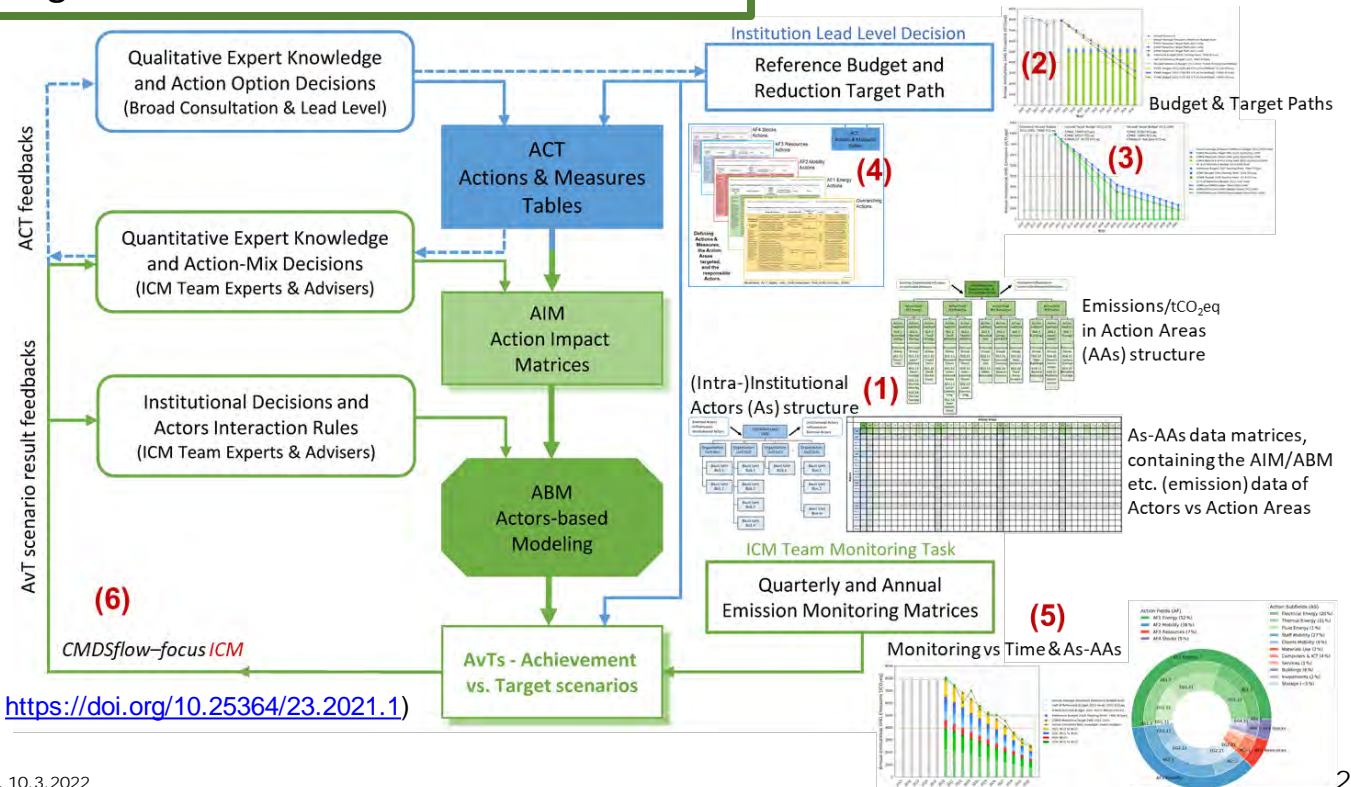
ICM–Institutional Carbon Management provides science-based knowledge, innovation, and services for institutional entities, including commercial and non-profit private and public institutions and organizations (such as companies, enterprises, corporations,

Carbon Management (CM) summary: intro explanations

The CM approach and overall Decision Support workflow (CMDSflow)

Carbon Management supports public and private entities to:

- (1) define Actors & Action Areas (country/states, emission sectors)
- (2) compute GHG Reference Budget (“Reference Budget 2020“)
- (3) adopt Reduction Target Path (setting 2030, 2040, 2050 goals)
- (4) prepare Actions & Measures and quantify them (“ACTs for AIMs“)
- (5) set up Quarterly & Annual Emissions Monitoring (aids decisions)
- (6) implement a dynamical Decision Support Workflow (CMDSflow) for integrated overall CM guidance

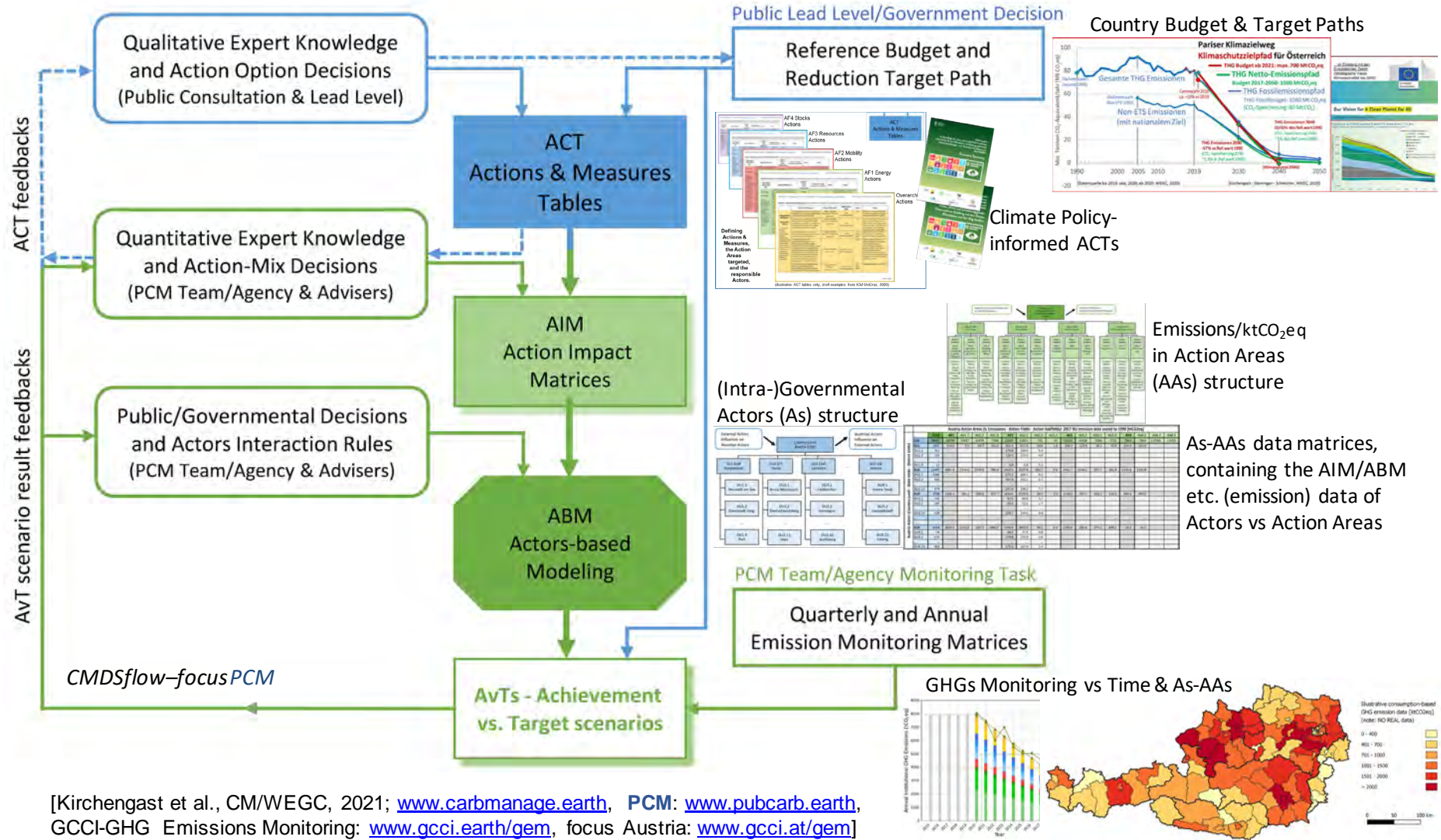


(Kirchengast et al. WEGC RB1-2021; link <https://doi.org/10.25364/23.2021.1>)

Summary of Carbon Management (CM) with focus on PCM

CM approach and PCM-focused Decision Support workflow (CMDStflow)

“PCM, ICM, pCM: PubCarb – carbsmart to Paris.” ☺

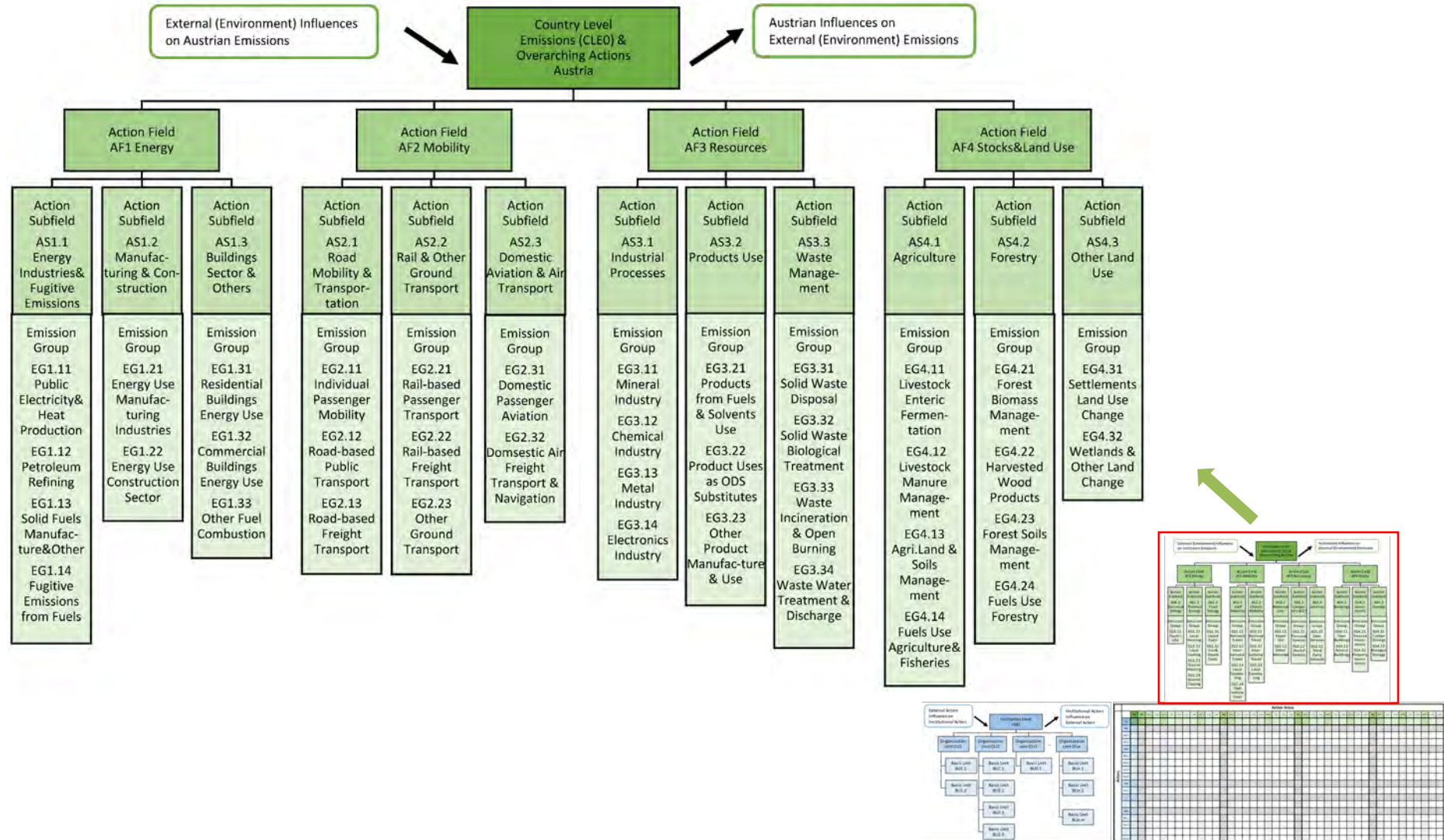


[Kirchengast et al., CM/WEGC, 2021; www.carbmanage.earth, PCM: www.pubcarb.earth, GCCI-GHG Emissions Monitoring: www.gcci.earth/gem, focus Austria: www.gcci.at/gem]

(Kirchengast et al. WEGC RB1-2021; online via www.carbmanage.earth, direct-link <https://doi.org/10.25364/23.2021.1>)

PCM Austria Action Areas (AAs) structure, CL-AF-AS-EG levels

Notes: CLE ... Austrian total emissions, PCM Austria adopted 12 AAs in the 4 AFs, with in total 38 EGs (subdivs not shown).



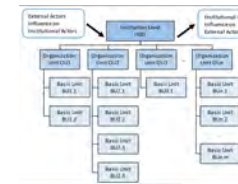
(Kirchengast et al. WEGC RB1-2021; online via www.carbmanage.earth, direct-link <https://doi.org/10.25364/23.2021.1>)

PCM Austria Actors vs. Action Areas (emission) data matrix

Notes: CLO-CLE0 Cell for Austrian total emissions, As x AAs detailed 126 x 55 matrix illustrated as EG-summed matrix.

		Austria Action Areas (IL Emissions - Action Fields - Action Subfields): 2017 BLI emission data scaled to 1990 [ktCO2eq]																
		CLE0	AF1	AS1.1	AS1.2	AS1.3	AF2	AS2.1	AS2.2	AS2.3	AF3	AS3.1	AS3.2	AS3.3	AF4	AS4.1	AS4.2	AS4.3
Austria Actors (Country Level - State Units - District Units)	CLO	78493	28799	10417	10478	7988	22597	21851	701	45	19233	14428	2080	2725	7864	7864	(-3714)	(-929)
	SU1	1811	414.6	9.9	89.7	315.0	902.4	872.6	28.0	1.8	258.9	123.9	58.1	76.9	234.9	234.9		
	DU1.1	351					174.8	169.0	5.4									
	DU1.2	259					129.3	125.0	4.0									
									
	DU1.9	12					6.0	5.8	0.2									
	SU2	13497	4987.8	1714.6	2276.8	996.4	3410.3	3297.8	105.7	6.8	3762.7	3144.2	255.7	362.8	1335.8	1335.8		
	DU2.1	1089					275.2	266.1	8.5									
	DU2.2	663					167.6	162.1	5.2									
									
	DU2.13	979					247.4	239.2	7.7									
	SU3	4508	1109.3	285.1	396.6	427.7	1630.4	1576.6	50.5	3.3	1118.0	547.7	416.1	154.2	649.9	649.9		
	DU3.1	242					87.5	84.6	2.7									
	DU3.2	147					53.3	51.5	1.7									
									
	DU3.10	428					154.7	149.6	4.8									
									
									
	SU9	8364	3829.3	2141.3	207.5	1480.5	3198.4	3092.9	99.2	6.4	1309.8	286.6	374.1	649.1	26.2	26.2		
	DU9.1	74					28.2	27.3	0.9									
	DU9.2	470					179.8	173.9	5.6									
									
	DU9.23	453					173.1	167.4	5.4									

Medium-detailed PCM Austria As-AAs Reporting Matrix example, containing illustrative Austrian production-based emission data (with no real data at DU level available) for exemplary Actors and Action Areas down to ASs. Proxy data source: uba, 2020.

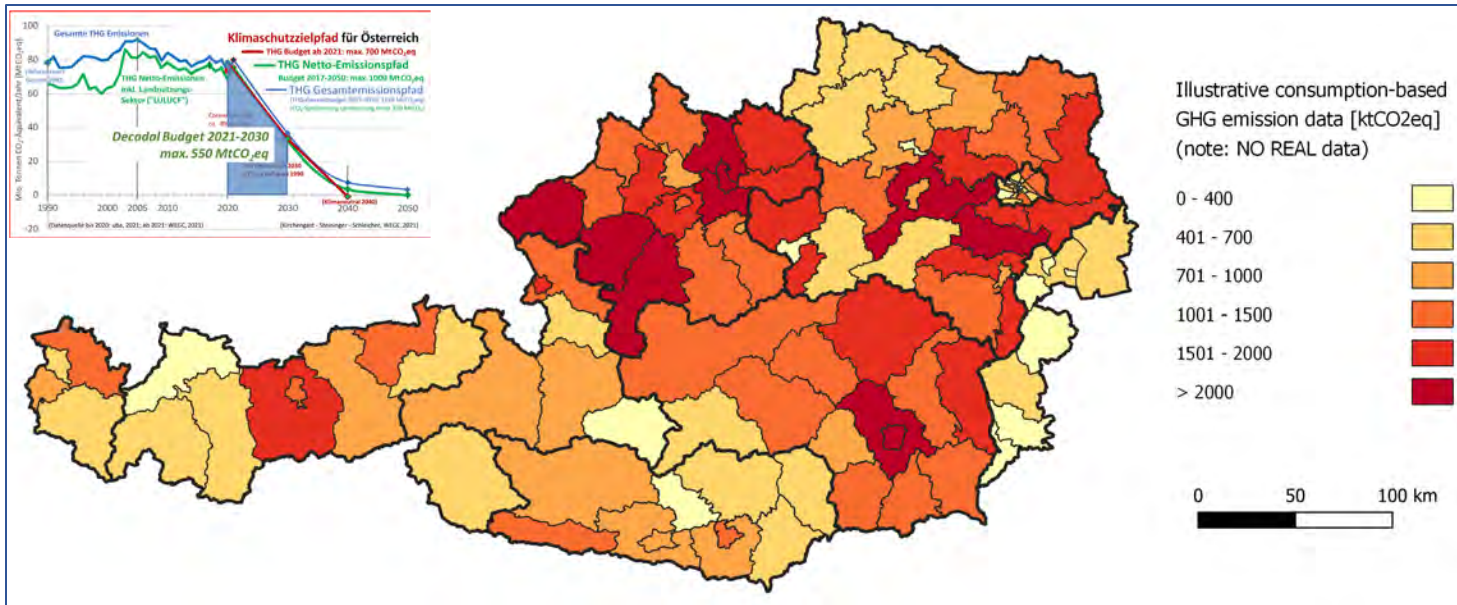


(Kirchengast et al. WEGC RB1-2021; online via www.carbmanage.earth, direct-link <https://doi.org/10.25364/23.2021.1>)

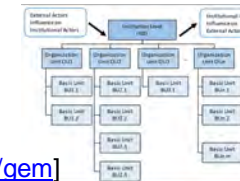
PCM Austria DU Actors geographic GHGs monitoring view



DataView: Austrian total emissions, proxy-distributed across the 116 DUs (districts) from the 9 SUs (states) of Austria.



Graphical DataView of illustrative PCM Austria CLEO column data as monitoring example, containing proxy emission data informing all Actors down to DUs. Proxy data source: STATA, 2020 (DUs population size data used for equal-per-person redistribution of CLEO 120 MtCO₂e_q AT total).



DU	DU Name	DU Population	DU GHG Emissions	DU CLEO
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116

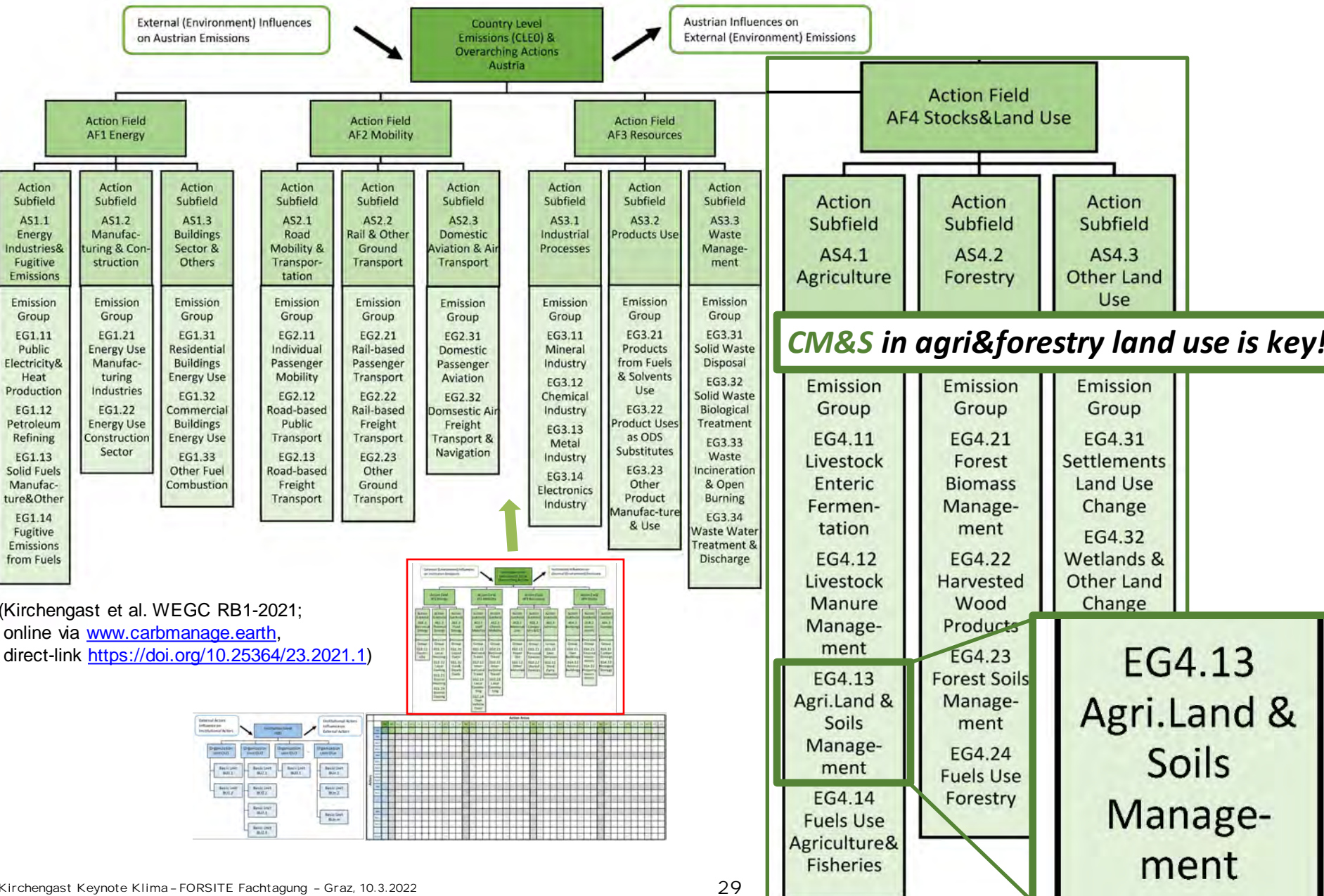
[Kirchengast et al./see also this data portal: GCCI-GHG Emissions Monitoring Austria www.gcci.at/gem]

(Kirchengast et al. WEGC RB1-2021; online via www.carbmanage.earth, direct-link <https://doi.org/10.25364/23.2021.1>)

PCM Austria Action Areas (AAs) structure—*Example Focus CM&S...*

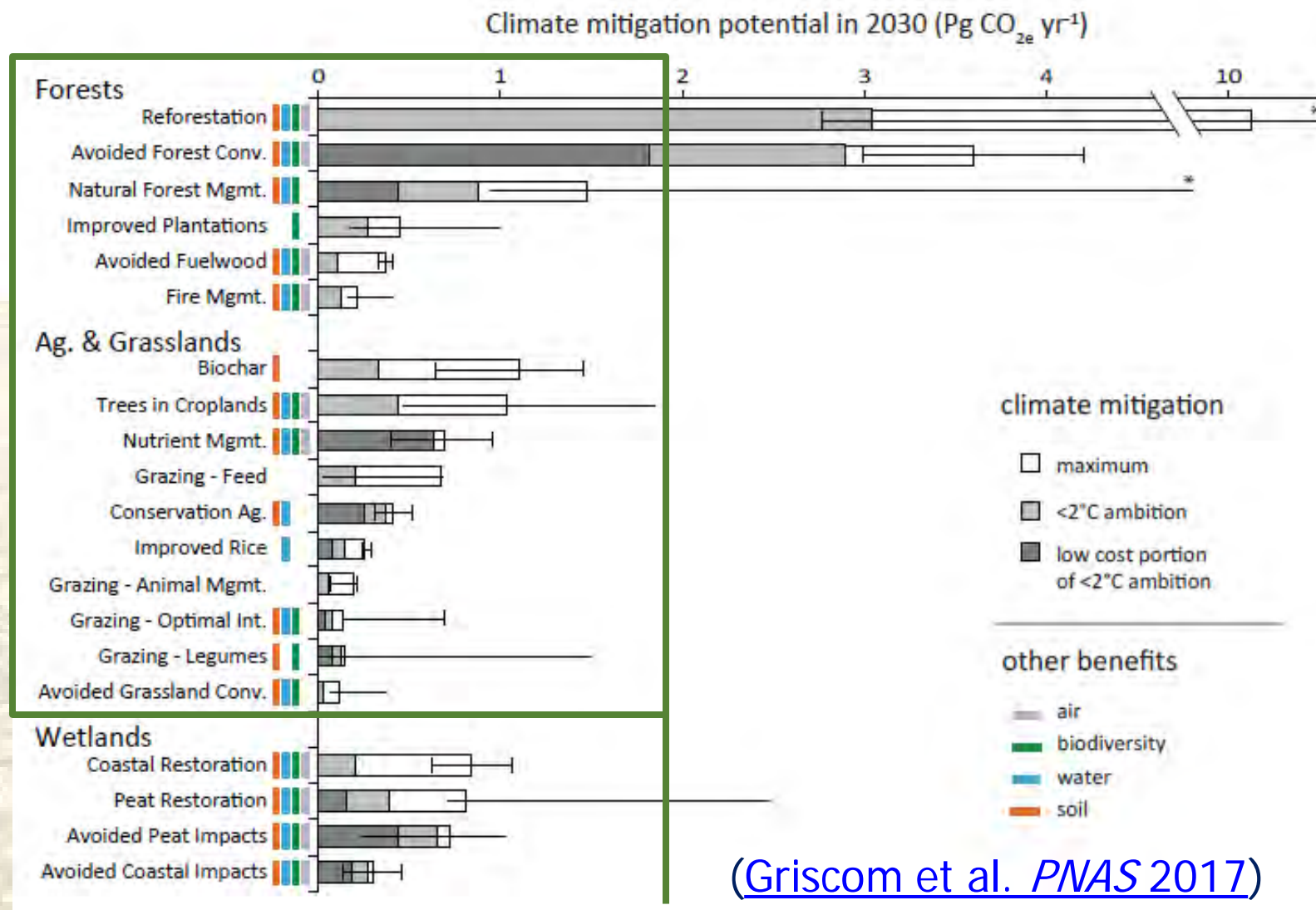


Notes: CLE ... Austrian total emissions, PCM AT shown with 12 AAs in the 4 AFs, with in total 38 EGs (subdivs not shown).



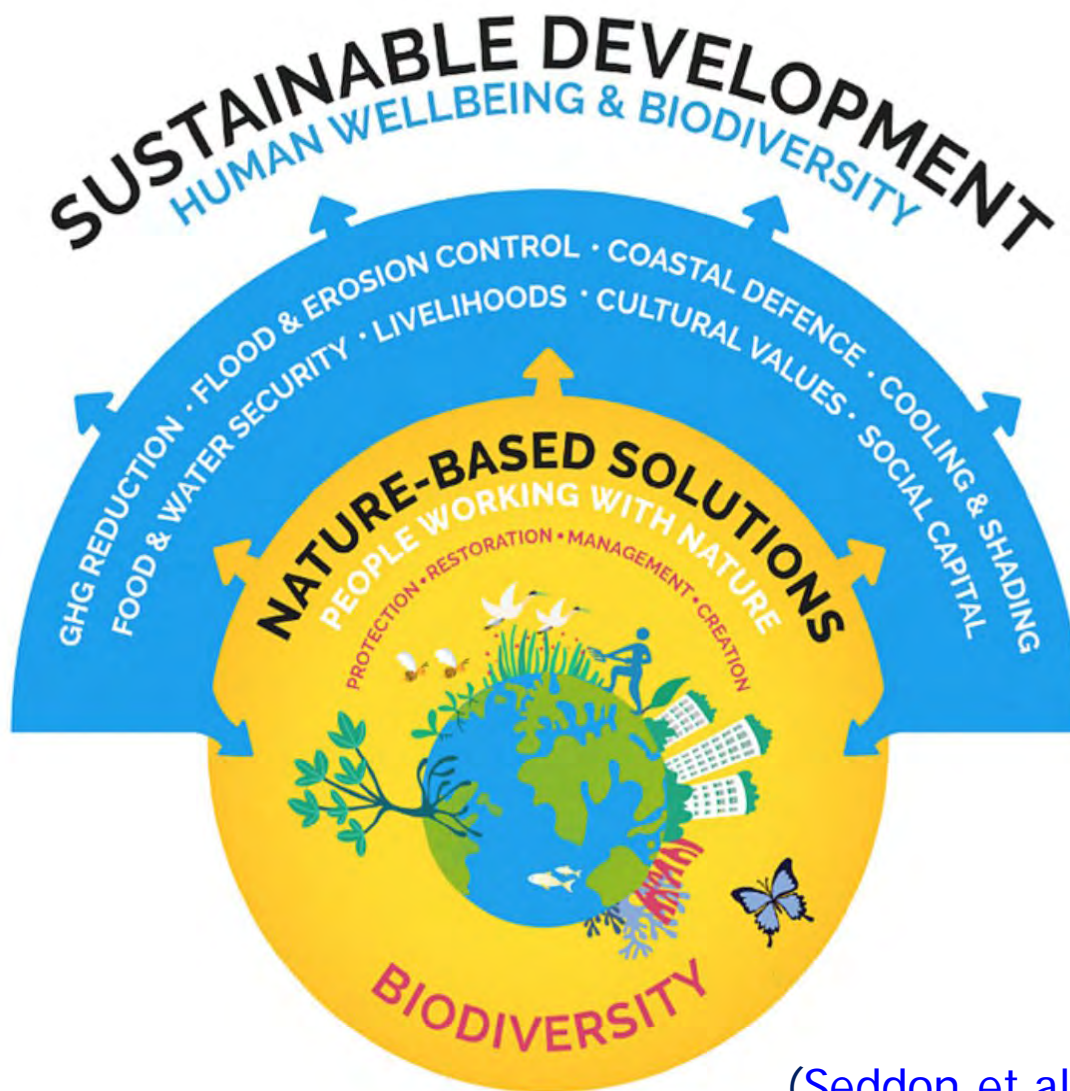
(Kirchengast et al. WEGC RB1-2021; online via www.carbmanage.earth, direct-link <https://doi.org/10.25364/23.2021.1>)

CM and Storage scientific basis (1): Which viable land-based GHG removal capacity do we have? => *Nature-based climate solutions*



[based on slide of P Smith, U Aberdeen, UK; from U Graz Keynote 2021]

CM and Storage scientific basis (2): Agriculture and Forestry, to be long-term sustainable, requires *CM&S by Nature-based Solutions*



Cautionary Remarks:

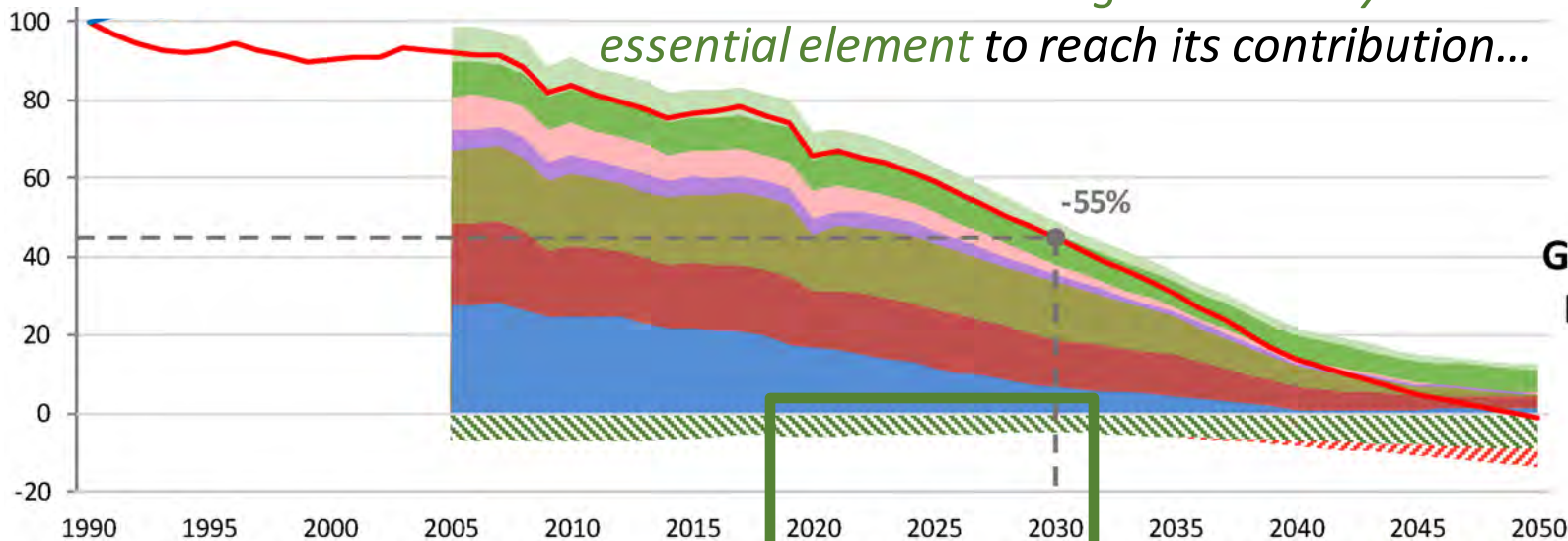
- Not all land-based GHG removal options are automatically Nature-based Solutions.
- Some are inherently not Nature-based, and some can be implemented in ways that do not constitute Nature-based Solutions
- Wherever possible, **land-based GHG removal options need be implemented in a way that constitutes Nature-based Solutions**

([Seddon et al. *Global Change Biology* 2021](#))

[based on slide of P Smith, U Aberdeen, UK; from U Graz Keynote 2021]

...from the **EU 2030 Climate Target Plan: the 'AFOLU sector' needs Agri & Forestry CM as essential element to reach its contribution...**

(100% corresponds to ~5000 MtCO₂eq in 1990)



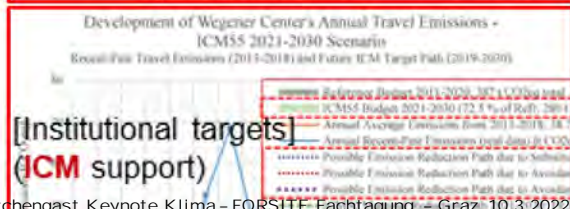
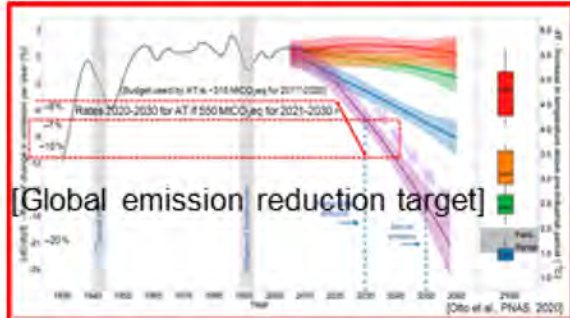
- Non-CO2 other
- Tertiary
- Power
- Net emissions
- Non-CO2 Agriculture
- Residential
- Transport
- Industry
- Carbon Removal Technologies
- Land use and forests

(EU Commission 09/2020-COM(2020) 562 final & Accompanying Docu. SWD(2020) 176 final)

CO₂ emissions and removals in the LULUCF sector



Source: UNFCCC inventories, GLOBIOM model



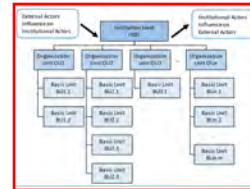
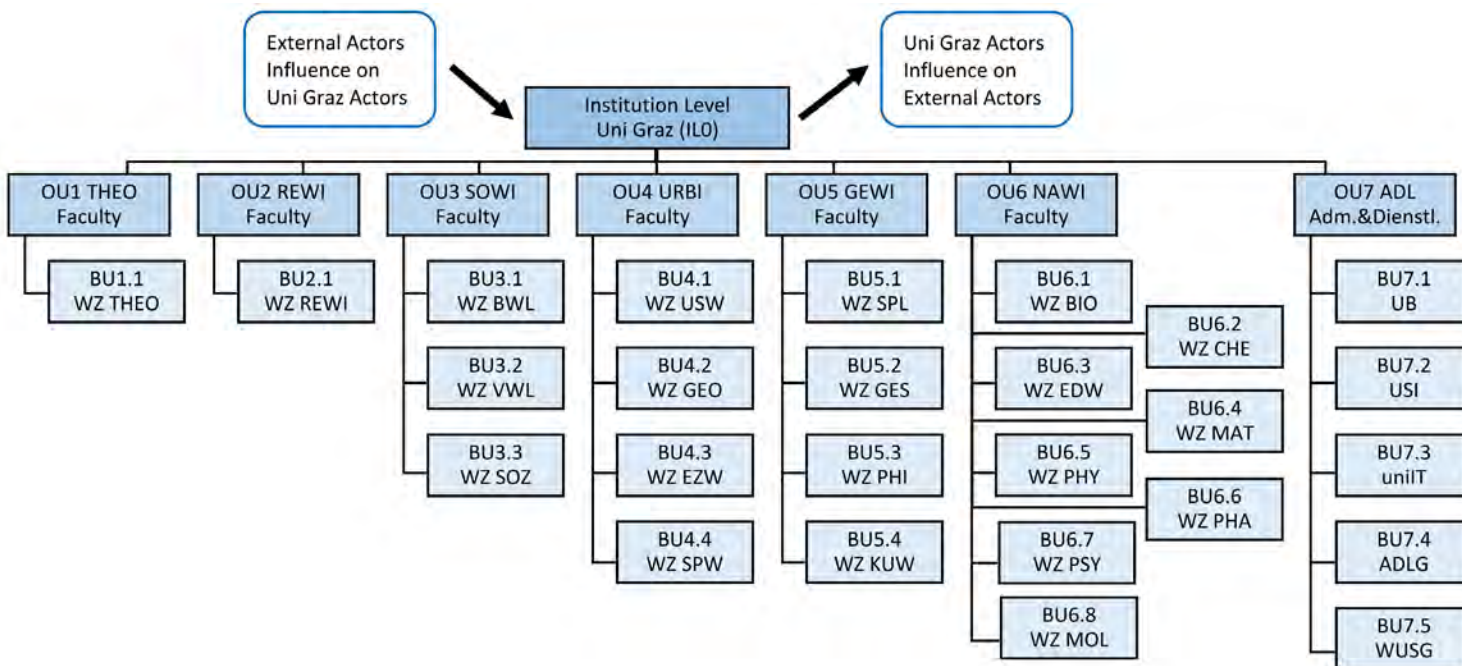
PCM—Public Carbon Management provides science-based knowledge, innovation, and services for public entities, including public governmental and corporation entities (such as countries, states, and districts and their governing and managing actors), for supporting them in an actively managed goal-driven and solutions-oriented transition to a low carbon entity until 2030 - 2040 - 2050, in accordance with the overarching goals of the Paris Climate Agreement of 2015 that require net-zero^{a)} emissions and climate-neutral^{b)} public entities earliest possible over this timeframe.

ICM—Institutional Carbon Management provides science-based knowledge, innovation, and services for institutional entities, including commercial and non-profit private and public institutions and organizations (such as companies, enterprises, corporations, associations, public-service institutions), for supporting them in an actively managed goal-driven and solutions-oriented transition to a low carbon institution until 2030 - 2040 - 2050, in accordance with the overarching goals of the Paris Climate Agreement of 2015 that require net-zero^{a)} emissions and climate-neutral^{b)} institutional entities earliest possible over this timeframe.

pCM—Personal Carbon Management provides science-based knowledge, innovation, and services for personal entities, including small personal-level communities of typically less than ten persons (such as households, families, individual persons), for supporting

ICM UniGraz Actors (As) structure definition, IL-OU-BU levels

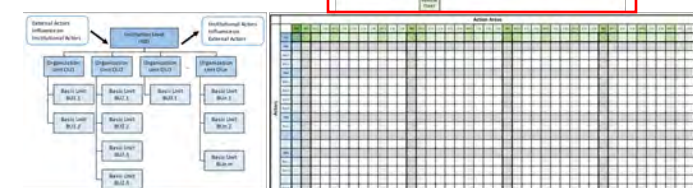
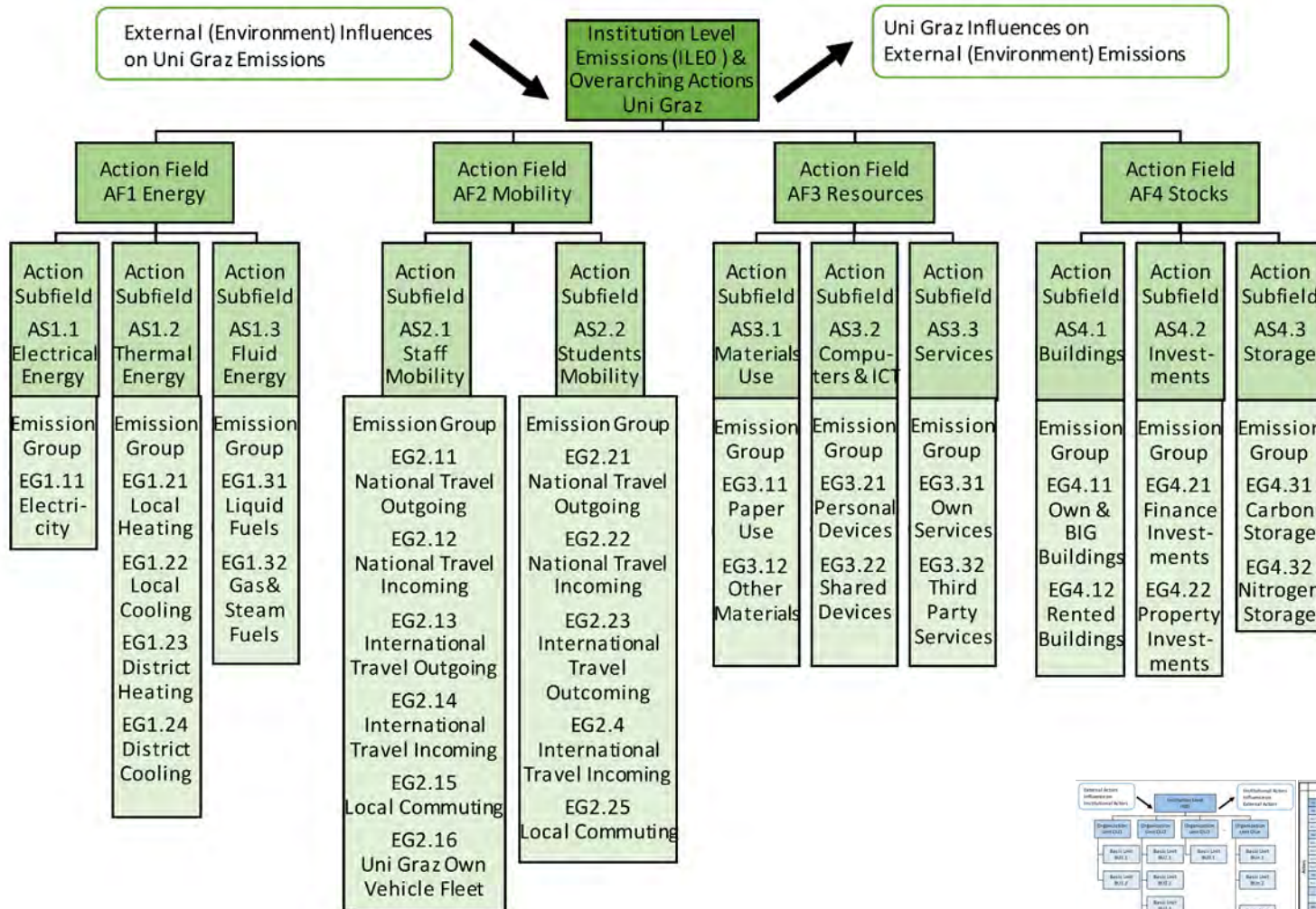
Notes: IL... Uni Graz total, OU... Organization Units (6 Faculties, 1 Adm.Dpt), BU... Basic Units (21 Sci.Branches, 5 Adm.Div.)



[Kirchengast et al., ICM UniGraz/WEGC, 2021]

ICM UniGraz Action Areas (AAs) definition, IL-AF-AS-EG levels

Notes: ILE ... Uni Graz total emissions, ICM UniGraz adopted 11 ASS in the 4 AFs, with in total 30 EGs (subdivs not shown).

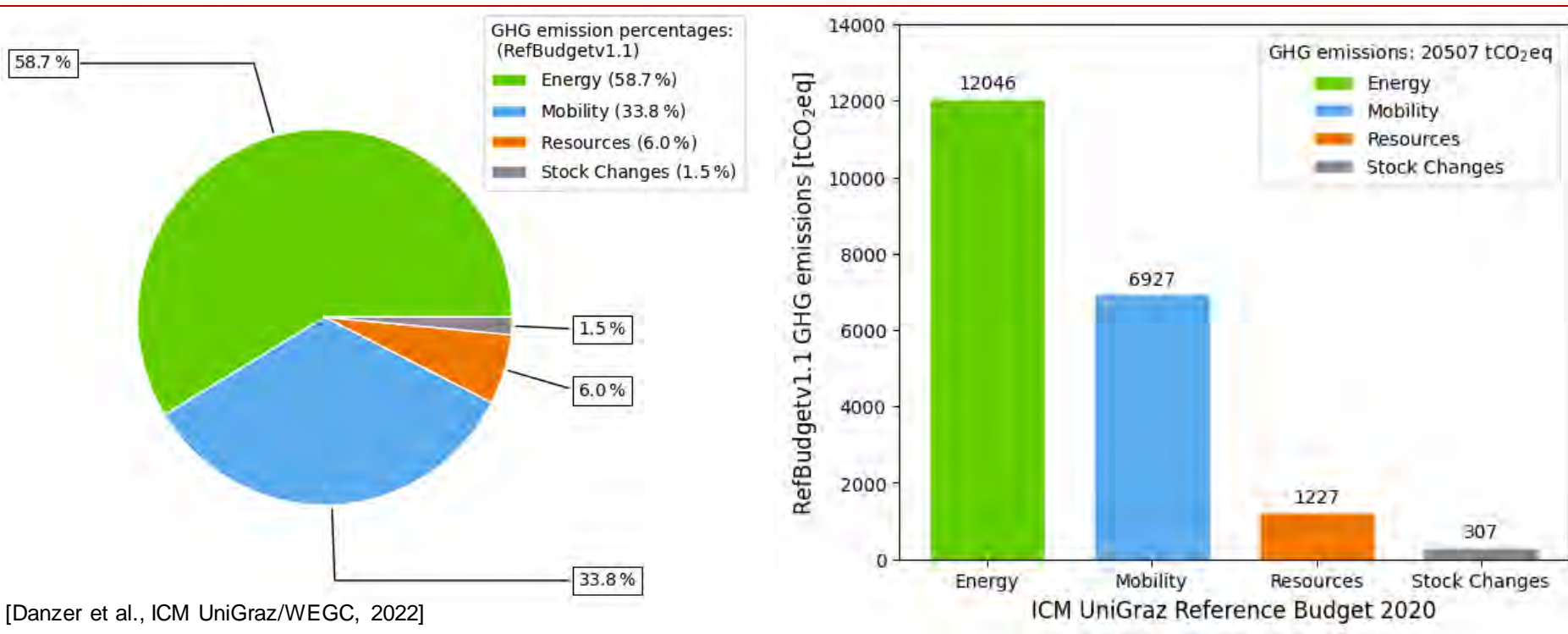


[Kirchengast et al., ICM UniGraz/WEGC, 2021]

ICM UniGraz CMRB2020-RefBudgetv1.1 IL total & AF results



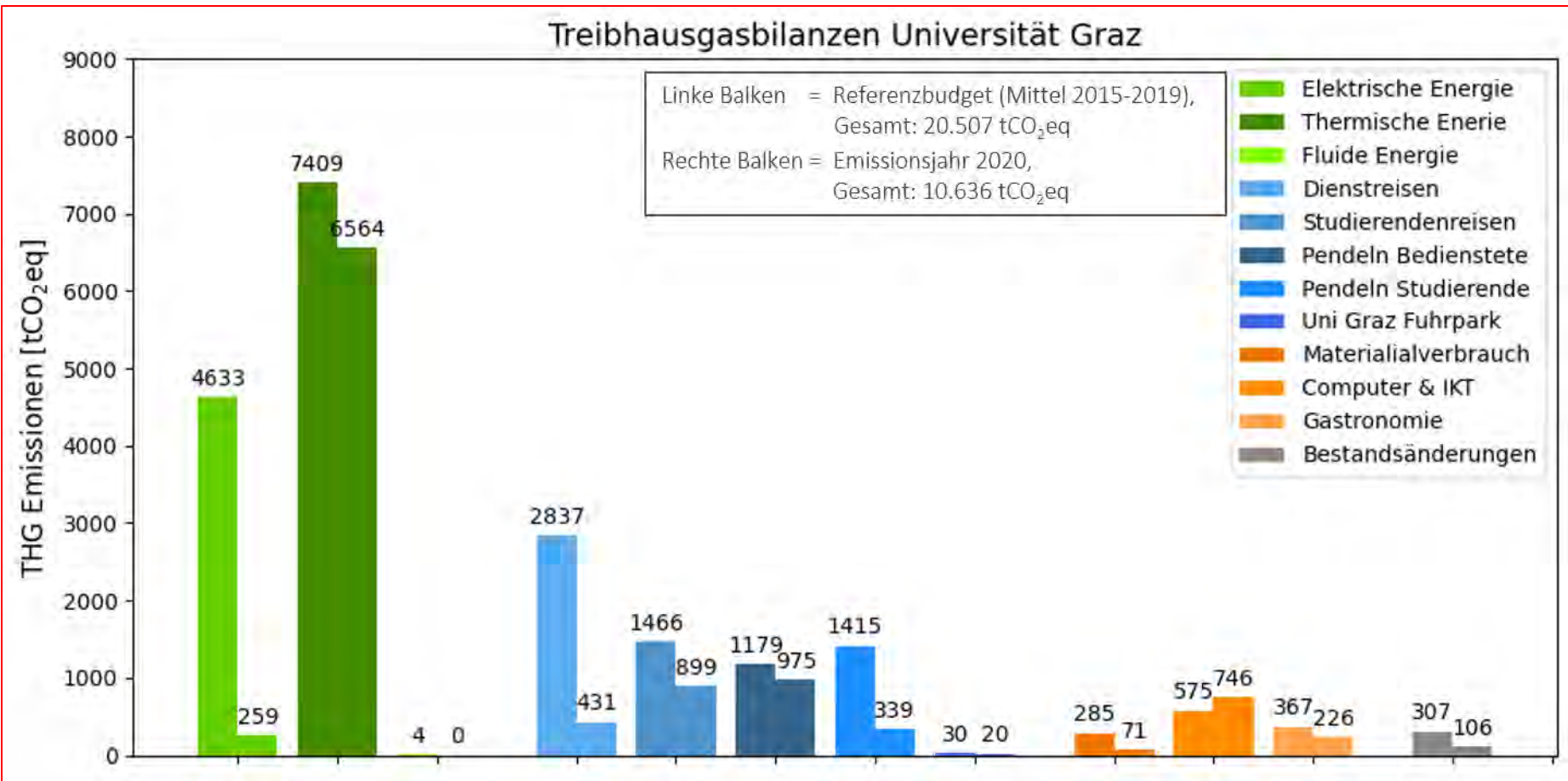
DataView: UniGraz total emissions, as partitioned across the four ILO AFs in percentages as well as absolute amounts



ICM UniGraz RefBudgetv1.1 & Emissions2020v1.1 Results



DataView: ILO UniGraz emissions, as aggregated from As-AAAs Summary Data Matrix (data for 11 main ASs/EGs & AF4)



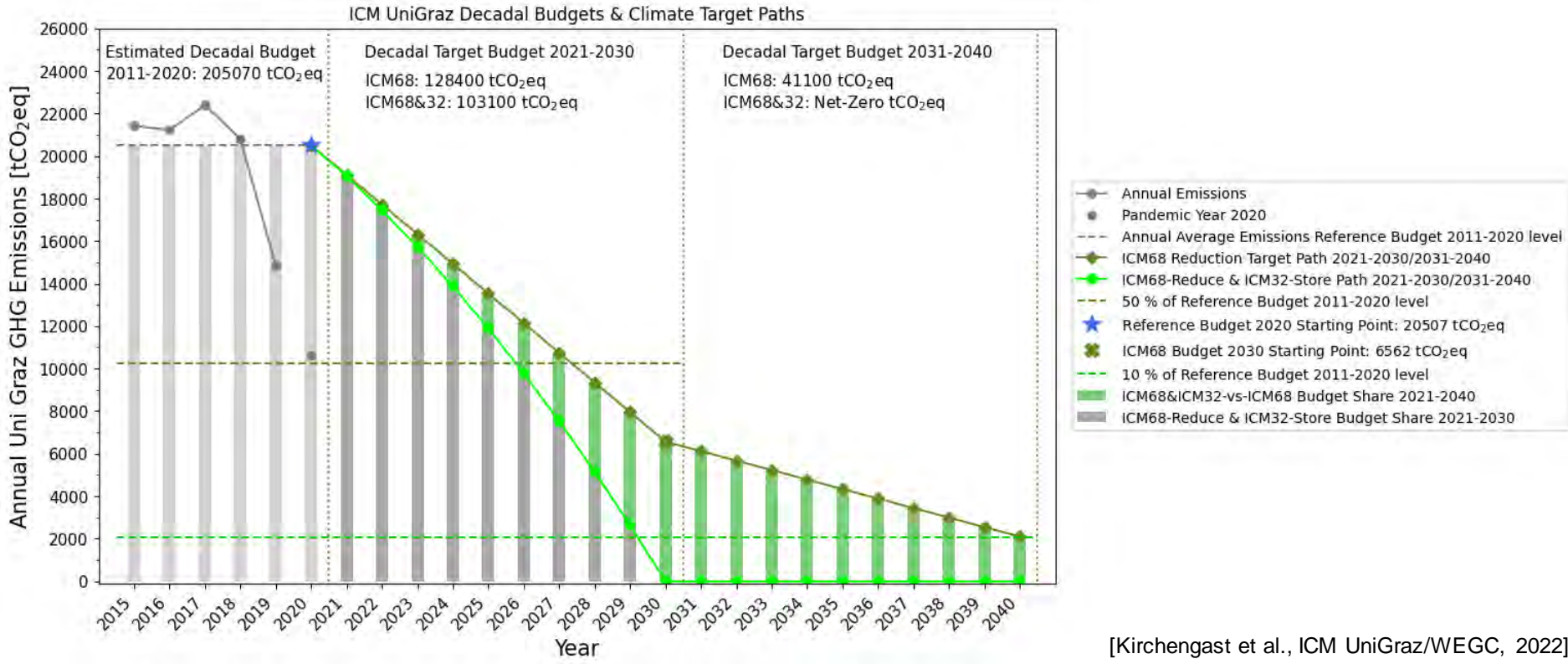
[Danzer et al., ICM UniGraz/WEGC, 2022]

UniGraz Action Areas (EU2020 - AfA - AfA)

Example of As-AAAs Summary Data Matrix focusing on high-level Action and Action Areas (no BUUs, EGs).

ICM UniGraz exemplary Reduction Target Paths to 2030, 2040

Climate-neutrality as of 2040 based on CM68-Reduce & ICM32-Store paths, starting from the CMRB2020-RefBudgetv1.1



[Kirchengast et al., ICM UniGraz/WEGC, 2022]

Wegener Center
RESEARCH BRIEFS
1 | 2021

Carbon Management: a new approach to achieve Paris-compliant climate goals and Uni Graz Institutional Carbon Management as a role model

Gottfried Kirchengast, Julia Danzer, Stefanie Hölbling

April 2021

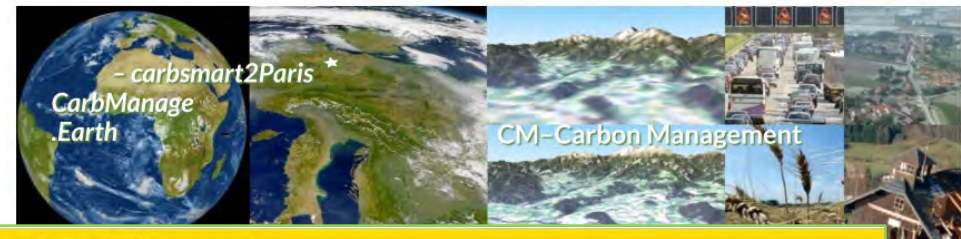
Climate Change Graz
Field of Excellence
University of Graz



Climate Change Graz
Field of Excellence
University of Graz

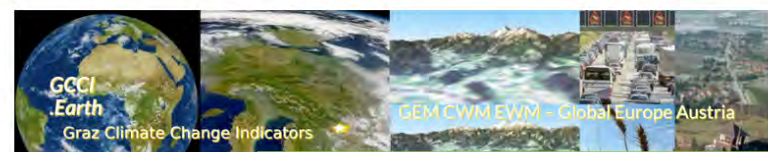
CMHome PCM ICM pCM Login Links EN|DE

[Kirchengast et al., CM/WEGC, 2021; **CM online** (hub): www.carbmanage.earth,
PCM: www.pubcarb.earth, **ICM**: www.wecarb.earth, **pCM**: www.youcarb.earth]



Climate Change Graz
Field of Excellence
University of Graz

GCCI Home GEM-GLO GEM-EUR GEM-AT CWM-GLO EN|DE



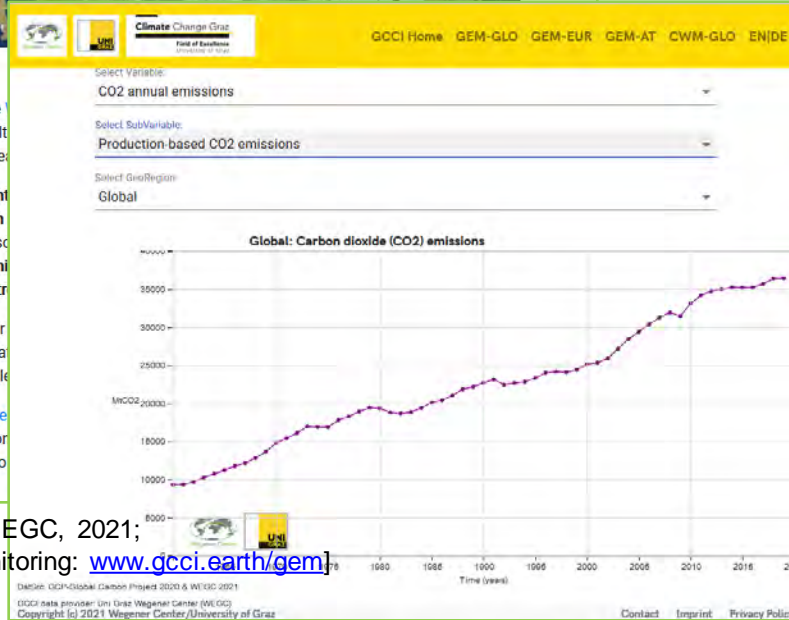
Welcome to GCCI.Earth!

This data portal is powered by the Excellence [Climate Change Graz](#). It More content and features are rele

GCCI.Earth provides reliable **recent Paris-compliant future projection** 1990 and 2020 to 2050. In doing so **Monitoring**), global climate warmi terms of **weather and climate extr**

Dive in through the Menu on top or charts are made to be self-explana data-source references, see this file

Welcome to visit also [CarbManage](#) context information. Learn there or institutional, and personal levels to of the Paris Agreement.



[Kirchengast et al., GCCI/WEGC, 2021; GCCI-GHG Emissions Monitoring: www.gcci.earth/gem]

Ich weiß einen Stern

Ich weiß einen Stern gar
wundersam, darauf man
lachen und weinen kann.
Mit Städten, voll von
Tausend Dingen. Mit Wäl-
dern, darin die Vögel singen.

Ich weiß einen Stern, drauf
Blumen blühen, drauf herrliche
Schiffe durch Meere ziehn. Er
trägt uns, er nährt uns wir
haben ihn gern: Erde, so
heißt unser lieber Stern.



Josef Guexerinos

(Gedicht ‚Erde... lieber Stern‘)

[Kirchengast, WEGC, 2016]

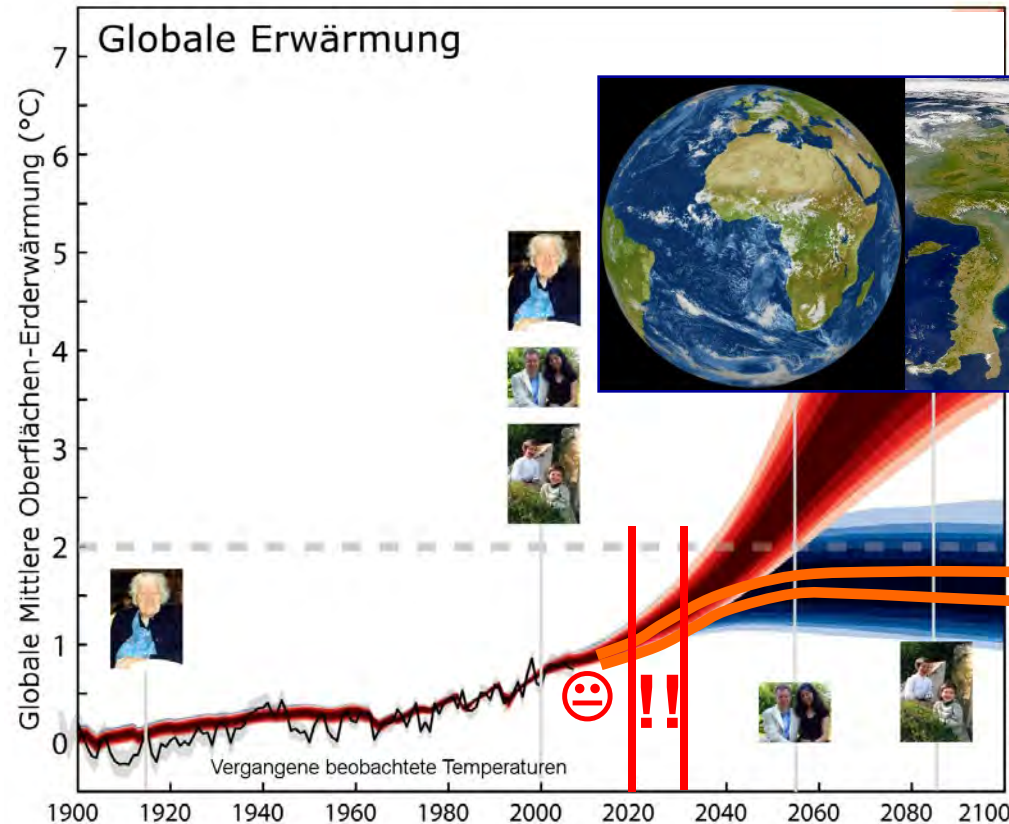
Kopie aus dem Gedichteheft von Felix (3. Klasse Volksschule)

Mögliche Motivation

Es gern tun, weil ich die Erde und die Menschen gern habe. Und weil die grosse Herausforderung eine grosse Chance auf eine bessere Zukunft für mich und uns alle zuhause und weltweit ist.

Unser Verstand und unser Herz sagen dann: Ja, gern!

Motivation—gern tun und das 1,5°C Ziel erreichen!



Wir alle brauchen Verstand, Mut und Herz. Meistens mehr davon. Gönnen wir uns gern mehr davon!

Danke für Ihre Aufmerksamkeit! 😊