International Climate Policy

Source: Luojie

ENG-410: Energy supply, economics and transition

8 April 2020

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A brief history of the UNFCCC (1/3)

- Precursors
  - 1979 World Climate Conference in Geneva
  - 1988 Intergovernmental Panel on Climate Change (IPCC)

- UN Framework Convention on Climate Change (UNFCCC)
  - 1992 as part of the «Rio Conventions»
  - goal to „prevent dangerous anthropogenic interference with the climate system"
  - principle of „common, but differentiated responsibilities"

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A brief history of the UNFCCC (2/3)

- Kyoto Protocol
  - 1997 as Protocol under the Convention
    - Assigned Amounts for Annex I (industrialised countries)
    - 1. Commitment Period 2008-2012
    - Flexible Mechanisms
  - 2001 Marrakesh Accords: rules for the Kyoto Protocol
  - 2005 Kyoto Protocol enters into force (without US ratification)

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A brief history of the UNFCCC (3/3)

- A period with very little progress
  - 2007 Bali Roadmap: 2 negotiation tracks to Copenhagen 2009
  - 2010 Cancún Agreements (pledges for 2020, institutions)
  - 2011 Durban: Goal to achieve a post-2020 agreement by 2015, Canada withdraws from the Kyoto Protocol
  - 2012 Doha: 2. Commitment Period of the Kyoto Protocol, but without Russia, Canada, Japan and New Zealand
- Paris Agreement
  - 2015 Agreement within the Convention
  - „well below" 2° / „pursue efforts" for 1.5°
  - (Intended) Nationally Determined Contributions (NDCs) for 2030
  - global stocktake: more ambitious NDCs every 5 years (due 2020)

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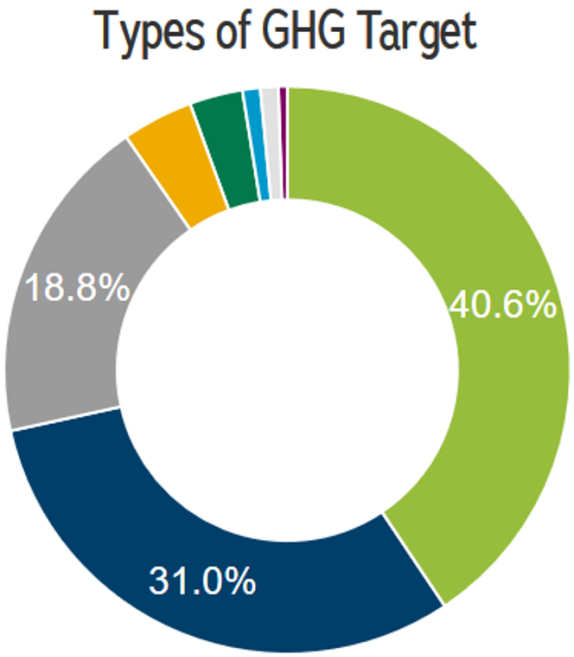
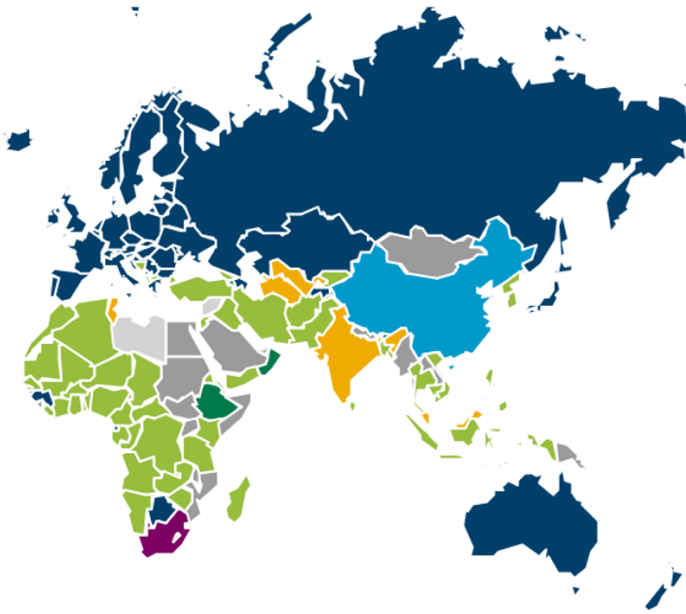
Types of (I)NDC targets





Base year target | Fixed level target | Baseline scenario target | Intensity target | Trajectory target | Intensity target and Trajectory target | Not Applicable | No Document Submitted

CAIT Climate Data Explorer, http://cait.wri.org/indc/, 24 March 2020

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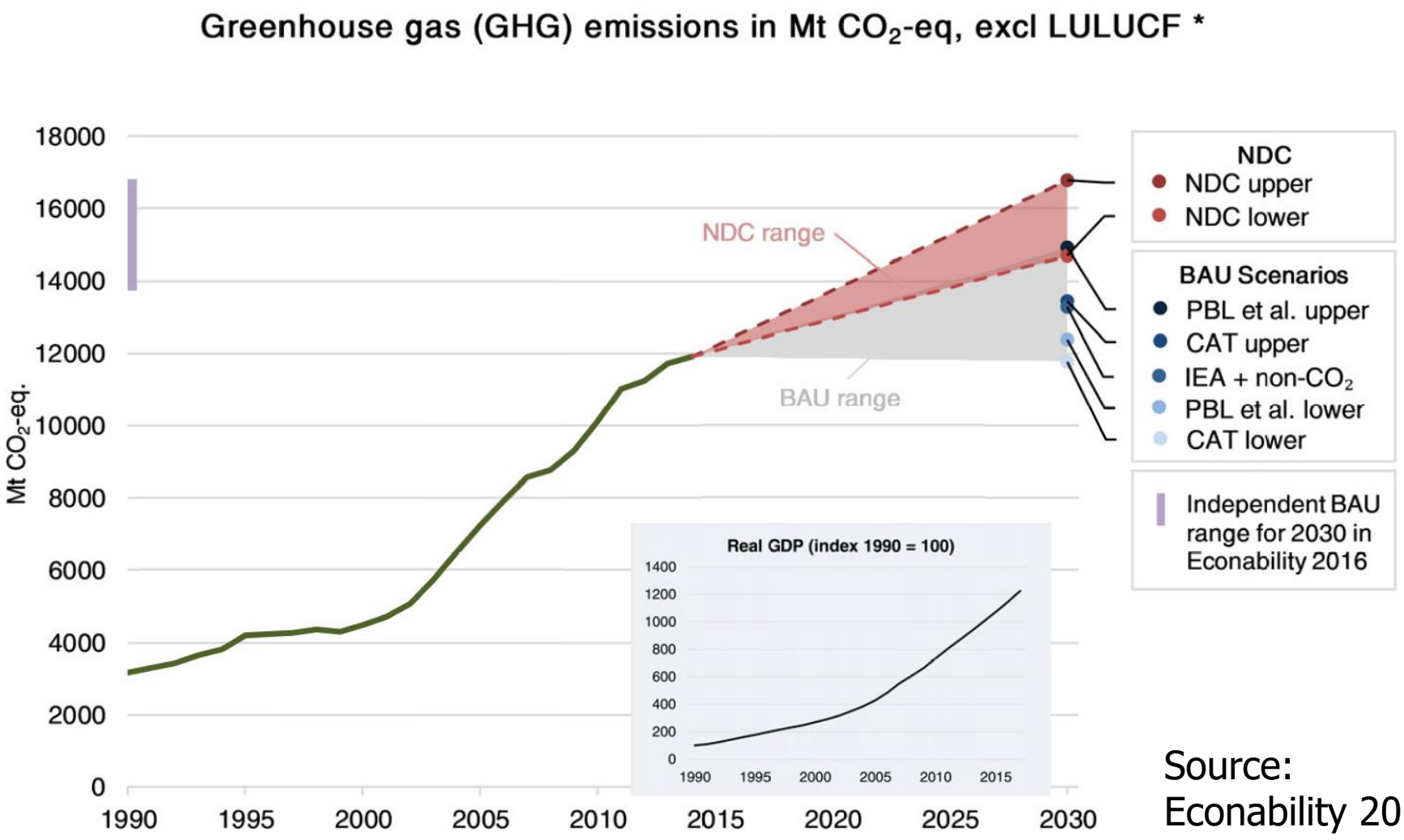
China's NDC

-60 to -65% of CO_2 emissions intensity of GDP relative to 2005 by 2030

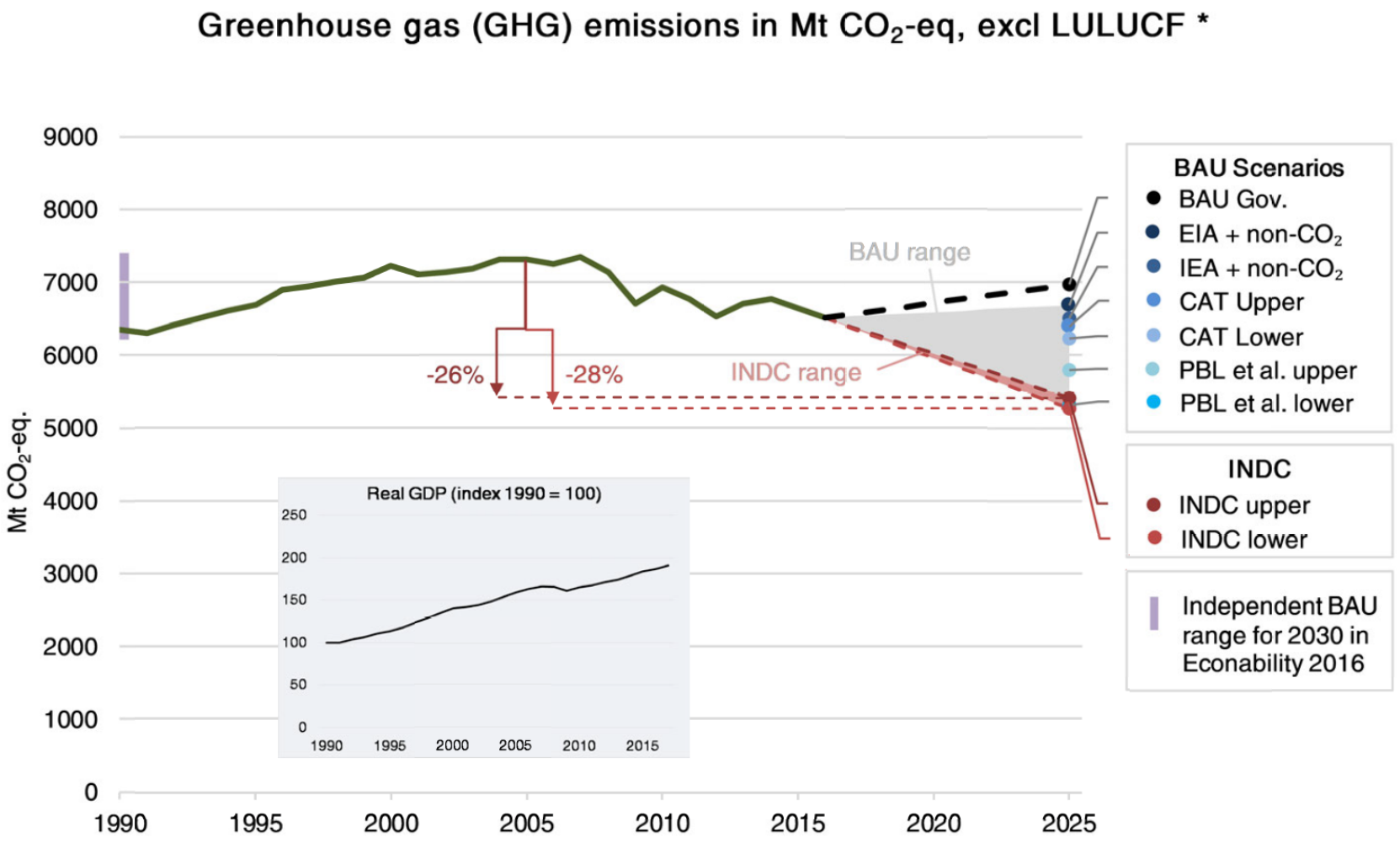


Source: Econability 2019

* The emissions of the NDC target are calculated using the GDP growth assumptions as stated for China in the World Energy Outlook 2017 by IEA. Growth assumptions may differ for the different BAU scenarios. The NDC target only refers to CO_2 emissions. In this graph, however, other GHG emissions are included. This graph excludes emissions from LULUCF, even though the NDC target includes them. For sources of BAU projections see "Sources for Country Fact Sheet Information"

USA's INDC

-26 to -28% GHG emissions relative to 2005 levels in 2025



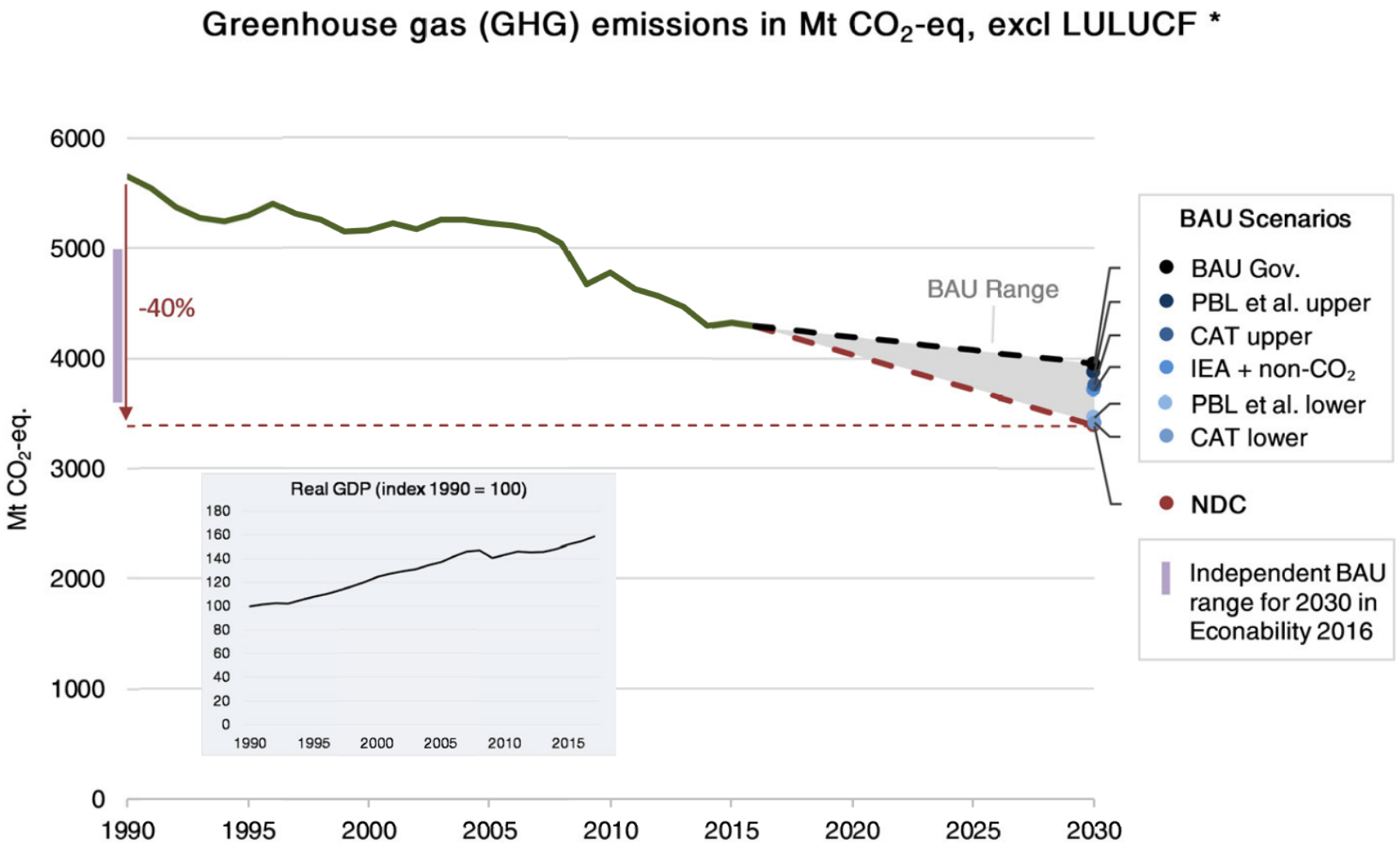
* Government BAU scenario as included in the 6th National Communication (2014) to the UNFCCC. This graph excludes emissions from LULUCF, even though the INDC target includes them. For sources of BAU projections see "Sources for Country Fact Sheet Information"

Source: Econability 2019

International climate policy

EU's NDC

-40% GHG emissions relative to 1990 levels by 2030 domestically

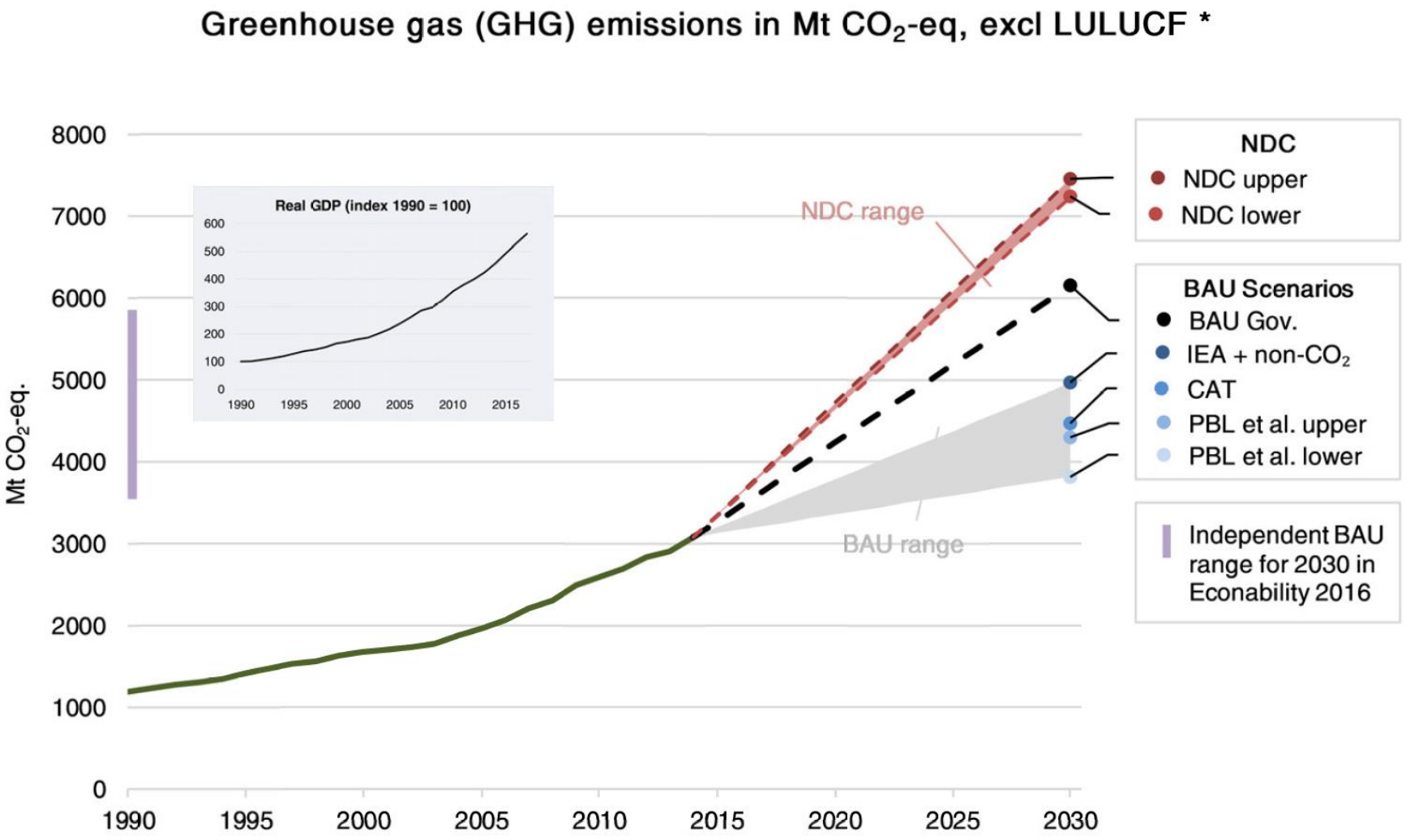


* This graph excludes emissions from LULUCF, even though the NDC target includes them. For sources of BAU projections see "Sources for Country Fact Sheet Information"

Source: Econability 2019

India's NDC

-33 to -35% of emissions intensity of GDP relative to 2005 by 2030

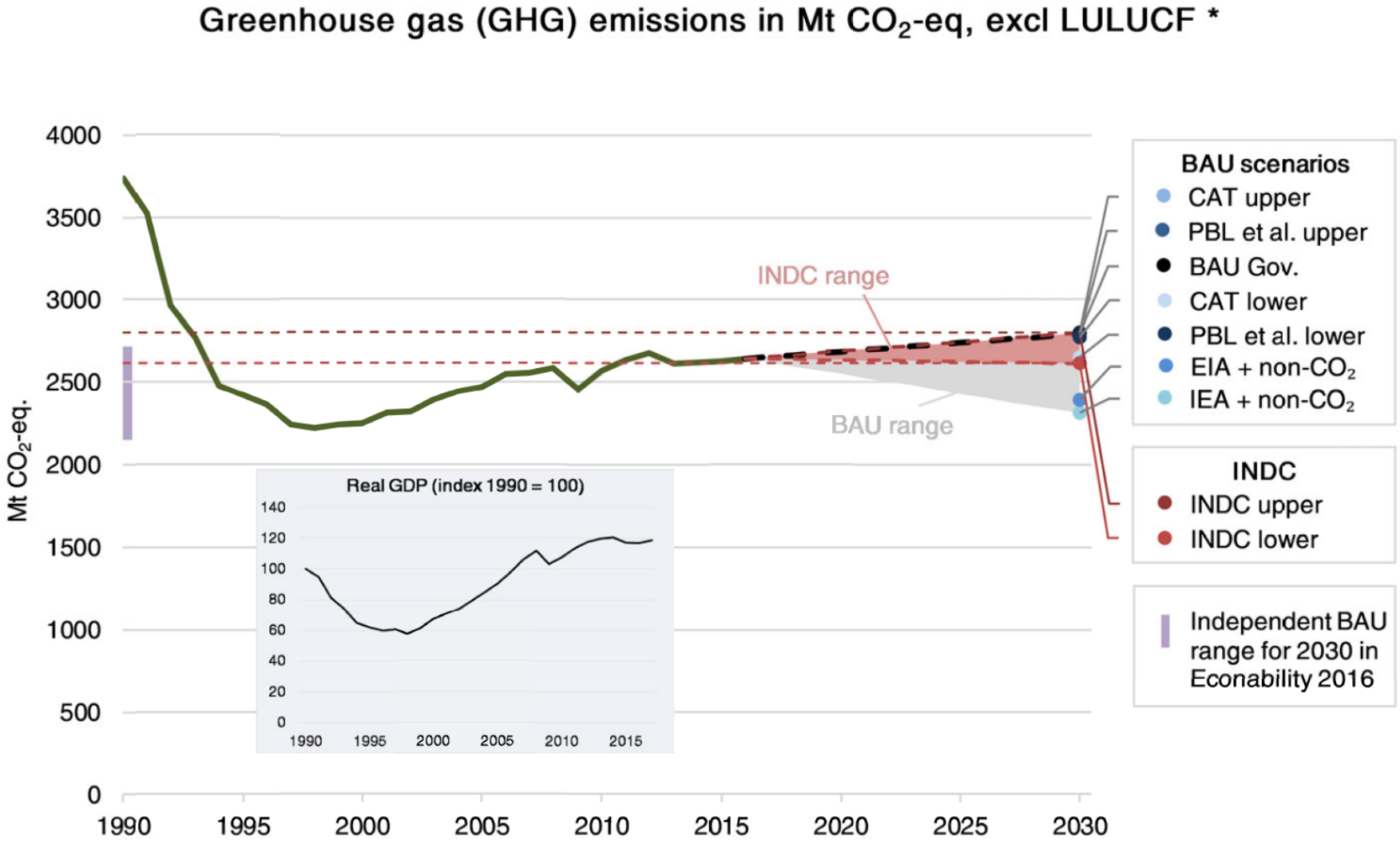


* The emissions of the NDC target are calculated using the GDP growth assumptions as stated for India in the World Energy Outlook 2017 by IEA. Growth assumptions may differ for the different BAU scenarios.
For sources of BAU projections see "Sources for Country Fact Sheet Information"

Source: Econability 2019

Russia's NDC

-25 to -30% GHG emissions relative to 1990 levels by 2030

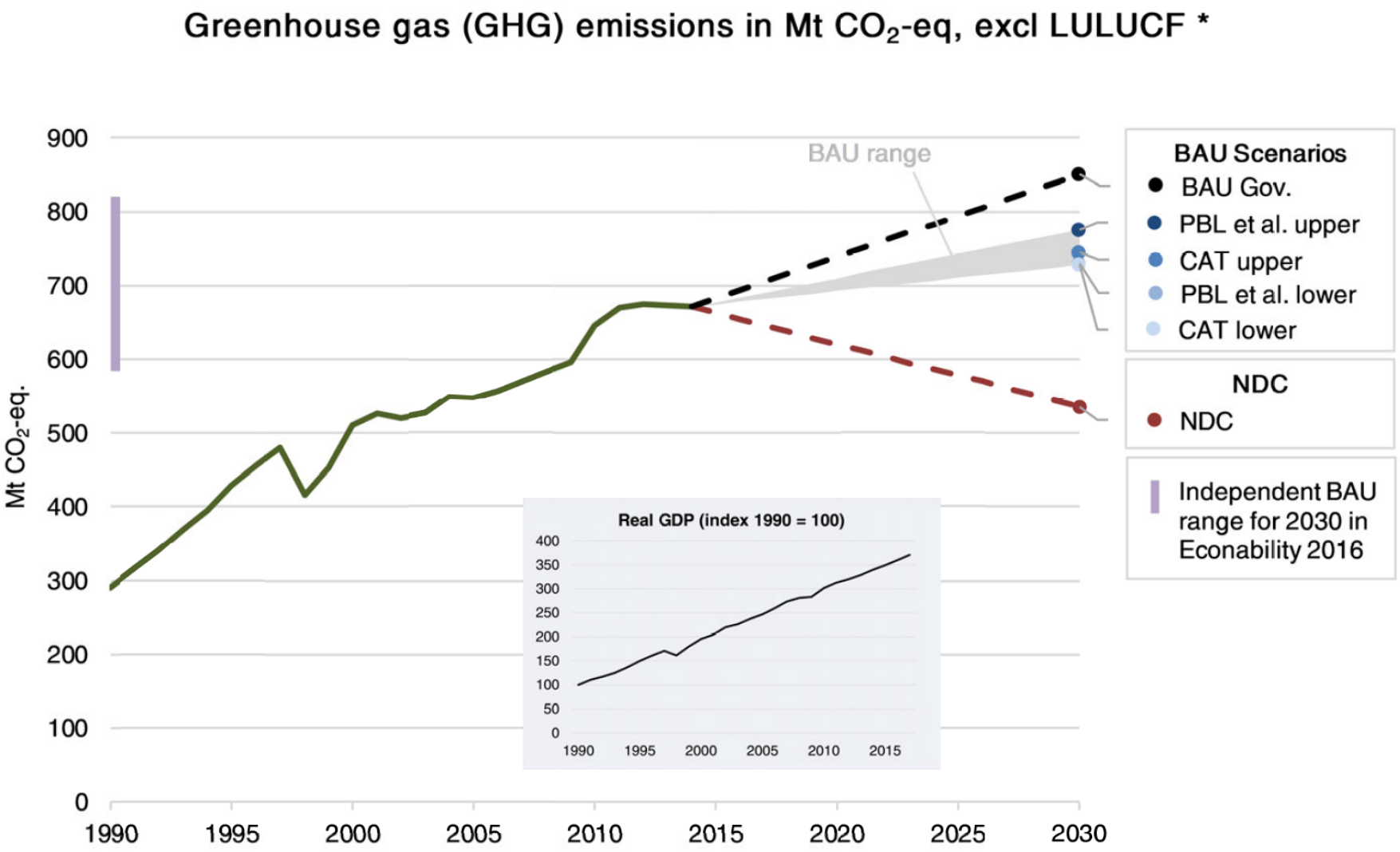


* This graph excludes emissions from LULUCF, even though the NDC target includes them.
For sources of BAU projections see "Sources for Country Fact Sheet Information"

Source: Econability 2019

South Korea's NDC

-37% GHG emissions relative to a business as usual scenario

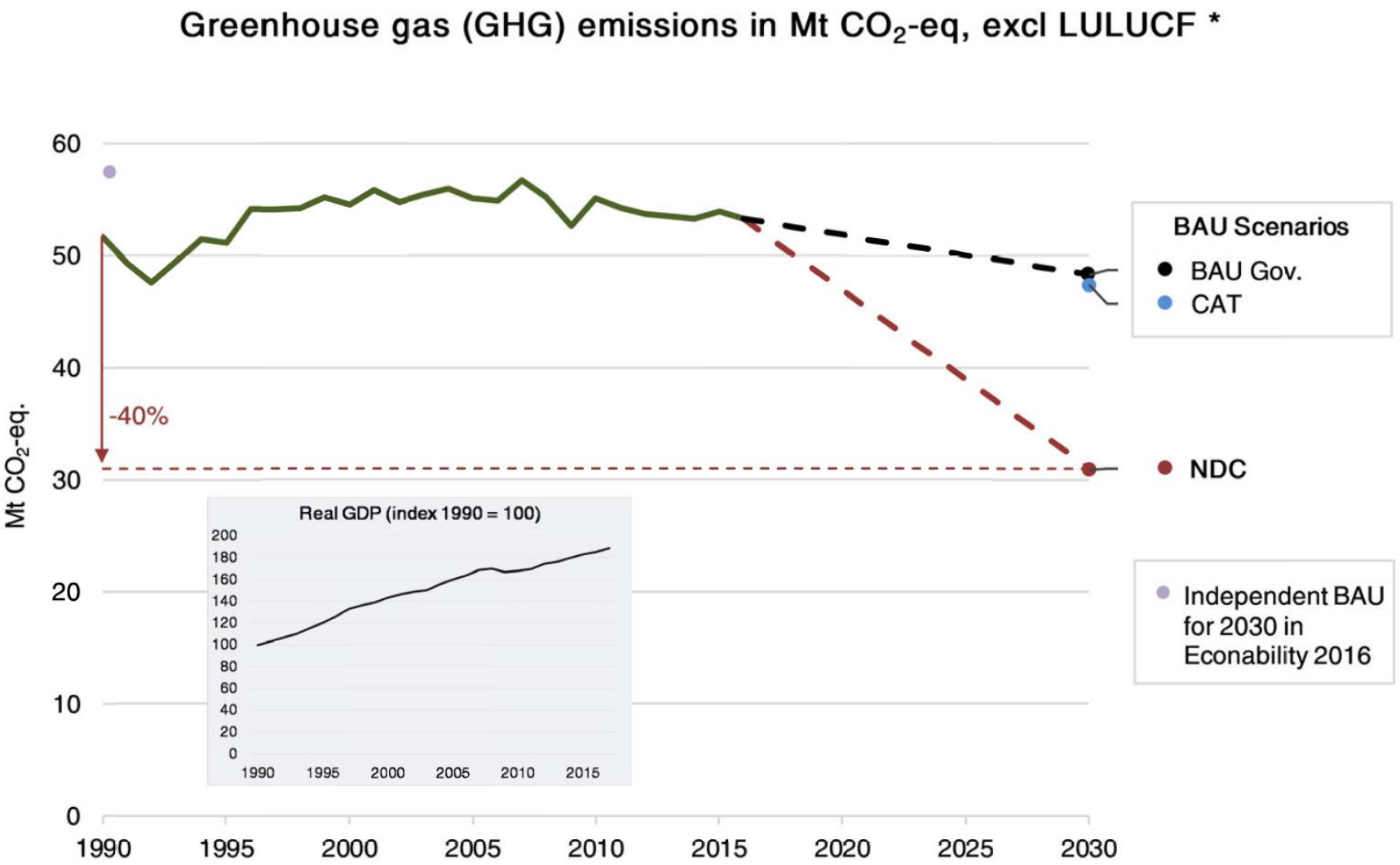


* For sources of BAU projections see "Sources for Country Fact Sheet Information"

Source: Econability 2019

Norway's NDC

at least -40% GHG emissons relative to 1990 levels



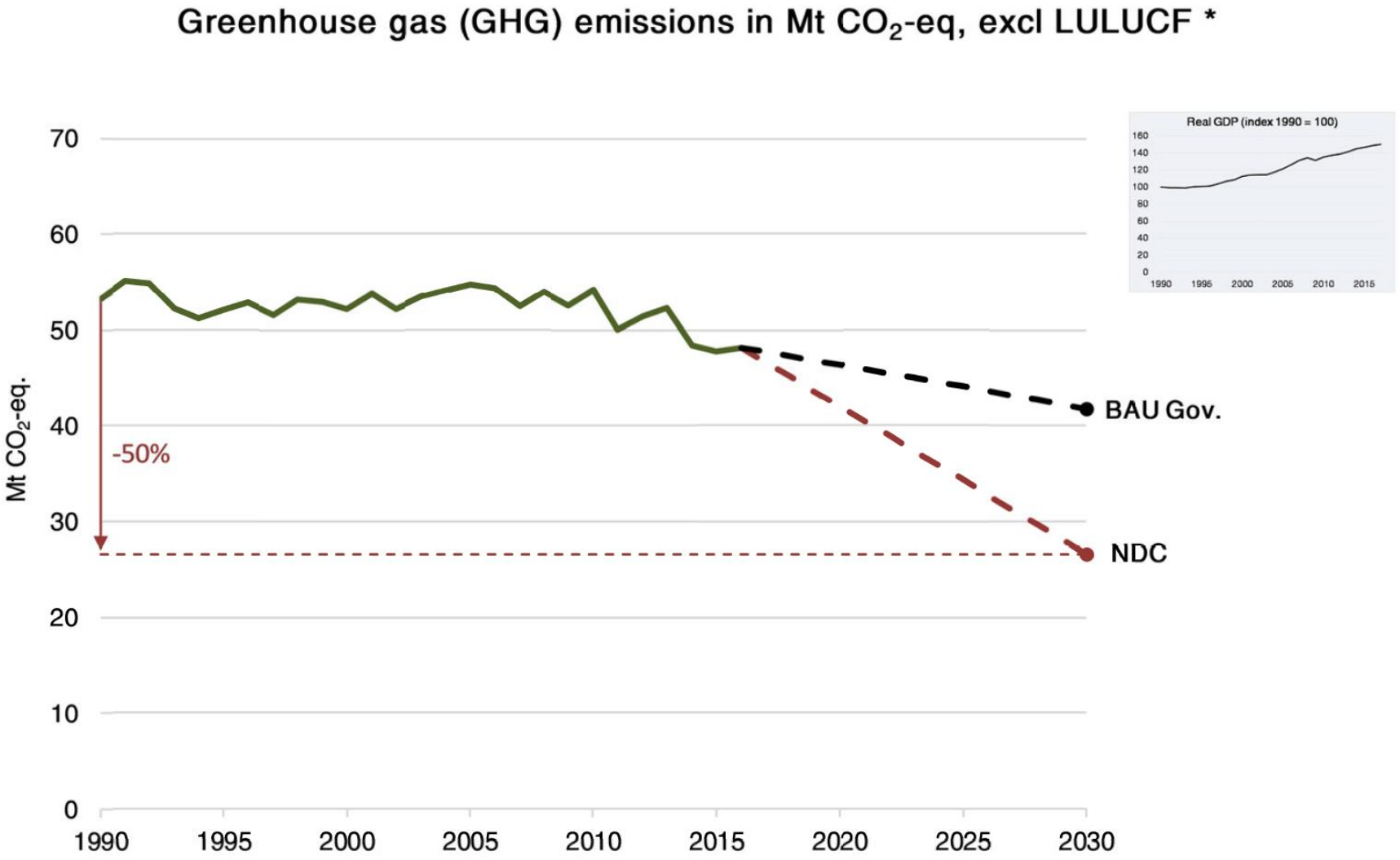
* This graph excludes emissions from LULUCF, even though the NDC target includes them. For sources of BAU projections see "Sources for Country Fact Sheet Information"

Source: Econability 2019

International climate policy

Switzerland's NDC

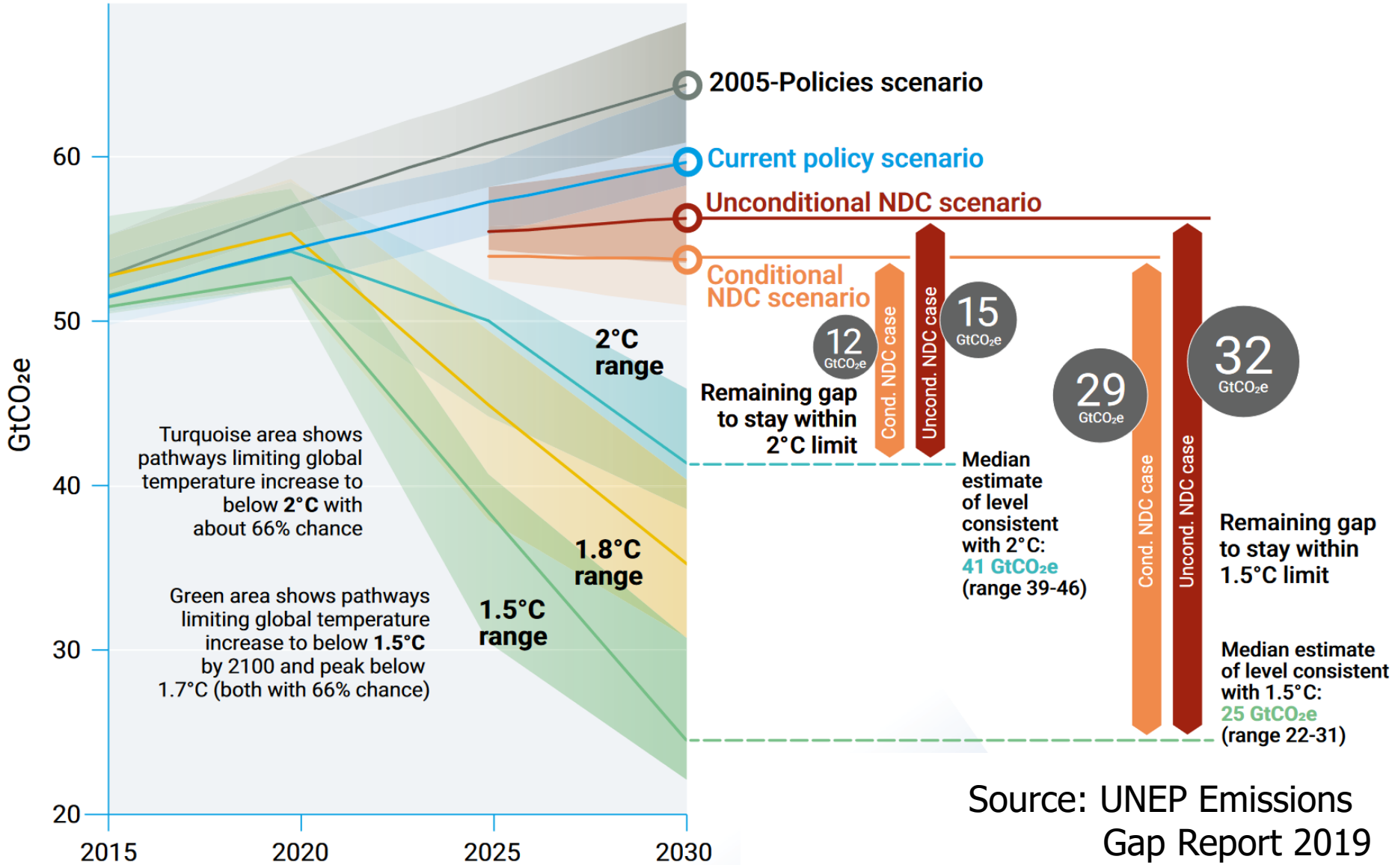
-50% GHG emissions relative to 1990 levels by 2030



* This graph excludes emissions from LULUCF, even though the NDC target includes them. For sources of BAU projections see "Sources for Country Fact Sheet Information"

Source: Econability 2019

The emissions gap



Source: UNEP Emissions Gap Report 2019

Reminder: carbon budgets

CO_2eq Concentrations in 2100 [ppm CO_2eq] Category label (concentration range)[9]	Subcategories	Relative position of the RCPs[5]	Cumulative CO_2 emissions[3] [$GtCO_2$]		Change in CO_2eq emissions compared to 2010 in [%][4]		Temperature change (relative to 1850–1900)[5, 6]				
			2011–2050	2011–2100	2050	2100	2100 Temperature change [°C][7]	Likelihood of staying below temperature level over the 21st century[8]			
								1.5 °C	2.0 °C	3.0 °C	4.0 °C
< 430	Only a limited number of individual model studies have explored levels below 430 ppm CO_2eq										
450 (430–480)	Total range[1, 10]	RCP2.6	550–1300	630–1180	−72 to −41	−118 to −78	1.5–1.7 (1.0–2.8)	*More unlikely than likely*	*Likely*	*Likely*	*Likely*
500 (480–530)	No overshoot of 530 ppm CO_2eq		860–1180	960–1430	−57 to −42	−107 to −73	1.7–1.9 (1.2–2.9)	*Unlikely*	*More likely than not*		
	Overshoot of 530 ppm CO_2eq		1130–1530	990–1550	−55 to −25	−114 to −90	1.8–2.0 (1.2–3.3)		*About as likely as not*		
550 (530–580)	No overshoot of 580 ppm CO_2eq		1070–1460	1240–2240	−47 to −19	−81 to −59	2.0–2.2 (1.4–3.6)		*More unlikely than likely*[12]		
	Overshoot of 580 ppm CO_2eq		1420–1750	1170–2100	−16 to 7	−183 to −86	2.1–2.3 (1.4–3.6)				
(580–650)	Total range	RCP4.5	1260–1640	1870–2440	−38 to 24	−134 to −50	2.3–2.6 (1.5–4.2)				
(650–720)	Total range		1310–1750	2570–3340	−11 to 17	−54 to −21	2.6–2.9 (1.8–4.5)		*Unlikely*	*More likely than not*	
(720–1000)[2]	Total range	RCP6.0	1570–1940	3620–4990	18 to 54	−7 to 72	3.1–3.7 (2.1–5.8)	*Unlikely*[11]		*More unlikely than likely*	
>1000[2]	Total range	RCP8.5	1840–2310	5350–7010	52 to 95	74 to 178	4.1–4.8 (2.8–7.8)		*Unlikely*[11]	*Unlikely*	*More unlikely than likely*

Quelle: IPCC 5AR TS WG3

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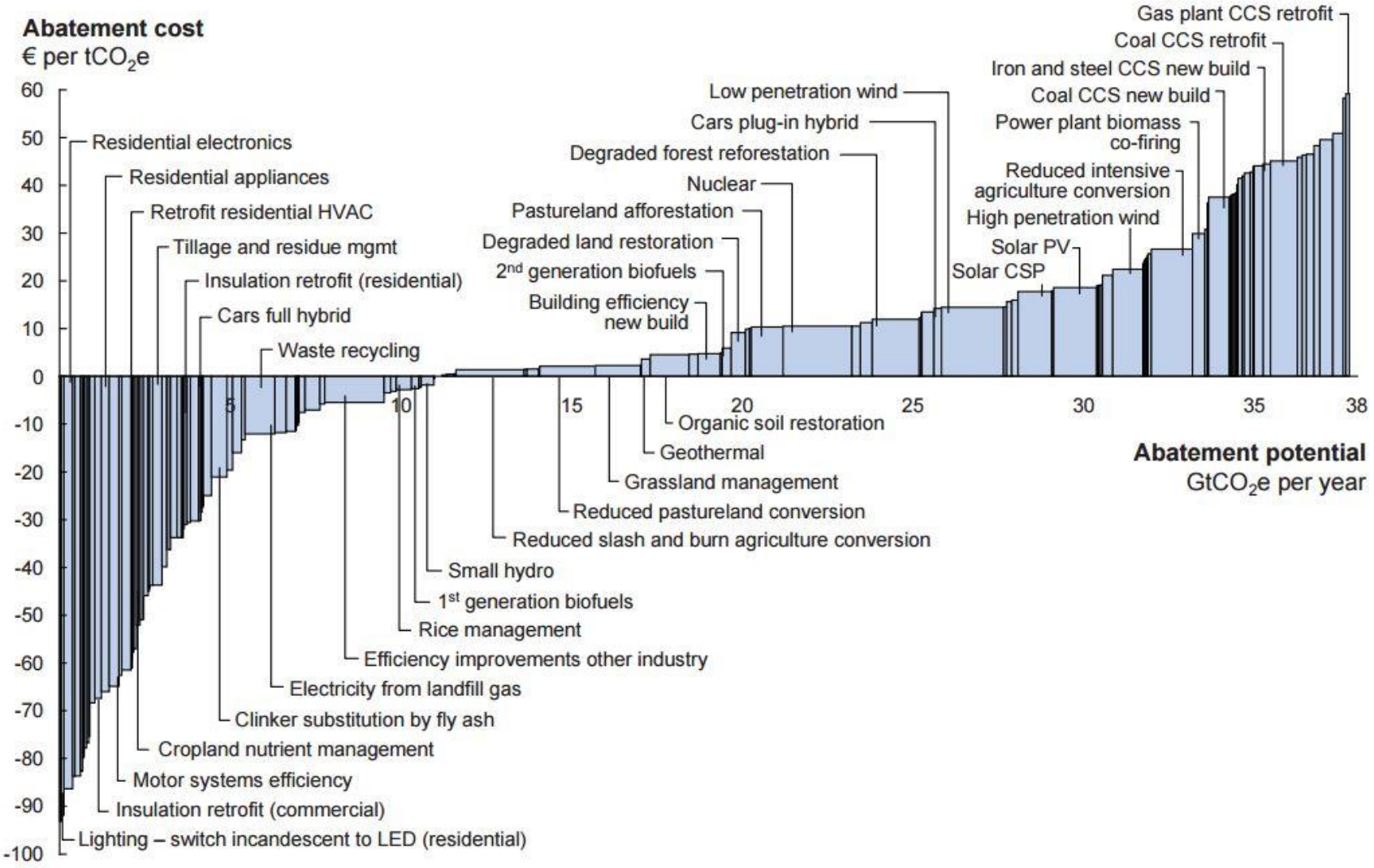
Abatement measures

Global GHG abatement cost curve beyond business-as-usual – 2030



Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €60 per tCO_2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.
Source: Global GHG Abatement Cost Curve v2.0

Source: McKinsey 2013

Cost of mitigation

	Consumption losses in cost-effective scenarios[1]						Increase in total discounted mitigation costs in scenarios with limited availability of technologies			
	[% reduction in consumption relative to baseline]			[percentage point reduction in annualized consumption growth rate]			[% increase in total discounted mitigation costs (2015–2100) relative to default technology assumptions]			
Concentration in 2100 [ppm CO_2eq]	2030	2050	2100	2010 –2030	2010 –2050	2010 –2100	No CCS	Nuclear phase out	Limited Solar/ Wind	Limited Bioenergy
450 (430–480)	1.7 (1.0–3.7) [N: 14]	3.4 (2.1–6.2)	4.8 (2.9–11.4)	0.09 (0.06–0.2)	0.09 (0.06–0.17)	0.06 (0.04–0.14)	138 (29–297) [N: 4]	7 (4–18) [N: 8]	6 (2–29) [N: 8]	64 (44–78) [N: 8]
500 (480–530)	1.7 (0.6–2.1) [N: 32]	2.7 (1.5–4.2)	4.7 (2.4–10.6)	0.09 (0.03–0.12)	0.07 (0.04–0.12)	0.06 (0.03–0.13)	N/A	N/A	N/A	N/A
550 (530–580)	0.6 (0.2–1.3) [N: 46]	1.7 (1.2–3.3)	3.8 (1.2–7.3)	0.03 (0.01–0.08)	0.05 (0.03–0.08)	0.04 (0.01–0.09)	39 (18–78) [N: 11]	13 (2–23) [N: 10]	8 (5–15) [N: 10]	18 (4–66) [N: 12]
580–650	0.3 (0–0.9) [N: 16]	1.3 (0.5–2.0)	2.3 (1.2–4.4)	0.02 (0–0.04)	0.03 (0.01–0.05)	0.03 (0.01–0.05)	N/A	N/A	N/A	N/A

Source: IPCC 5AR TS WG3

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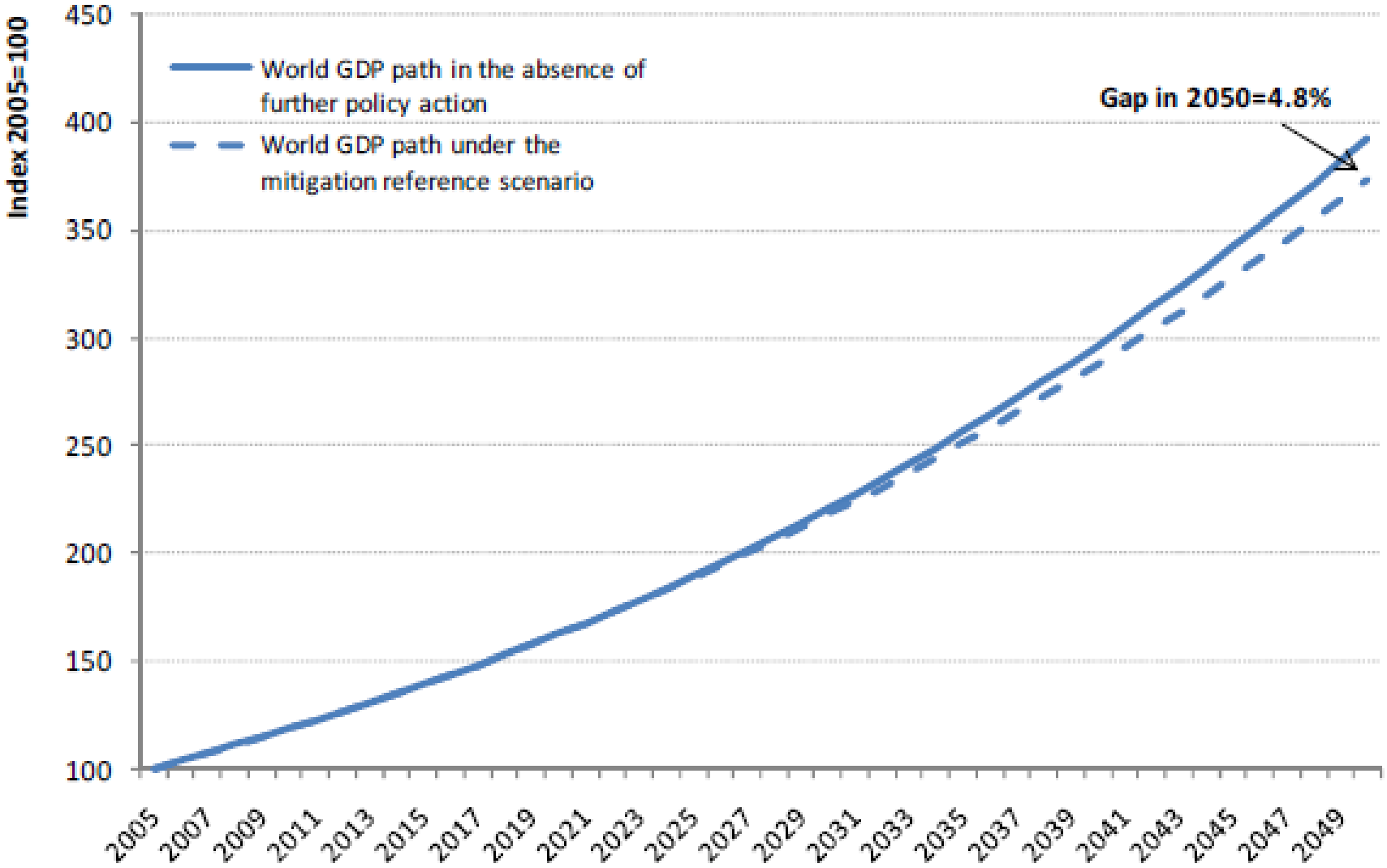
Economic growth and abatement costs



Source: OECD 2008

Theory of market failure (1/2)

- starting point: decentralized allocation through markets is usually more efficient than central planning
  - motivation (decisions are taken by those concerned)
  - information
    - about preferences

      (private households know best what they want or need)
    - about costs
      - firms have a strong incentive and sufficient inside information to control their costs
      - if they don't, they are driven out of the market
    - market prices reveal information about preferences and marginal costs

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Theory of market failure (2/2)

- reasons for market failure
  - external effects & public goods
  - economies of scale (market power)
  - asymmetric information
- public action only
  - if there is market failure and
    public action is able to improve on the situation
  - to correct undesired distributional effects of market allocation

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GHG abatement as a public good

- characteristics of a public good
  - non-rival
  - non-excludable

- contribution to a public good
  - socially optimal to consider, next to own costs, everyones benefit (Samuelson condition)
  - individually rational to consider only own costs and benefits => free riding (Prisoner's Dilemma)

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Solving the Prisoner's Dilemma

- some insights from game theory
  - repeating the same game doesn't help
  - carbon leakage aggravates the issue (race to the bottom)
  - issue linking
  - self-enforcing designs for climate agreements
  - experiments: norms do play a role
    - e.g.: voluntary contributions to public goods
    - e.g.: punishment at the expense of own losses

- some solutions in politics
  - domestically: elections -> tax-financed government action
  - globally: norms and appeals, treaties, issue linking, gradualism and assurance

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Self-enforcing agreements

Table 2 Stable Coalition Structures Under Different Transfer Schemes*

	N°	Membership	Size	Welfare	Concentration	Cumulative Emissions
	1	Grand Coalition (Full Cooperation)	6	100.00	100.00	100.00
OPTS	5	USA,EU,CHN,ROW	4	94.50	81.96	83.18
	7	EU,CHN,FSU,ROW	4	91.17	72.26	73.61
	8	JPN,EU,CHN,ROW	4	89.41	69.75	71.53
	9	USA,CHN,FSU,ROW	4	87.31	64.08	65.75
	10	USA,JPN,CHN,ROW	4	85.99	61.80	63.91
	13	JPN,CHN,FSU,ROW	4	78.28	50.29	52.58
	15	USA,EU,FSU,ROW	4	68.96	61.02	62.01
	18	USA,JPN,EU,ROW	4	66.80	59.47	60.54
	19	JPN,EU,FSU,ROW	4	66.12	53.62	54.78
	21	USA,JPN,FSU,ROW	4	64.67	48.90	50.21
	58	Only Singleton Coalitions (No Cooperation)	1	0.00	0.00	0.00

Source: Carraro, Eyckmans, Finus (2006)

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Equity principles (according to Lange et al. 2006)

- egalitarian rule
  - same amount of emission rights for everyone
- sovereignty rule
  - equal percentage emissions reduction
- polluter pays principle
  - e.g. share in abatement cost = share of emissions
- ability to pay principle
  - e.g. abatement cost proportional to GDP
- poor losers rule
  - exempt countries with low per capita GDP below a certain threshold
- stand alone rule
  - emission entitlements not higher than business as usual emissions

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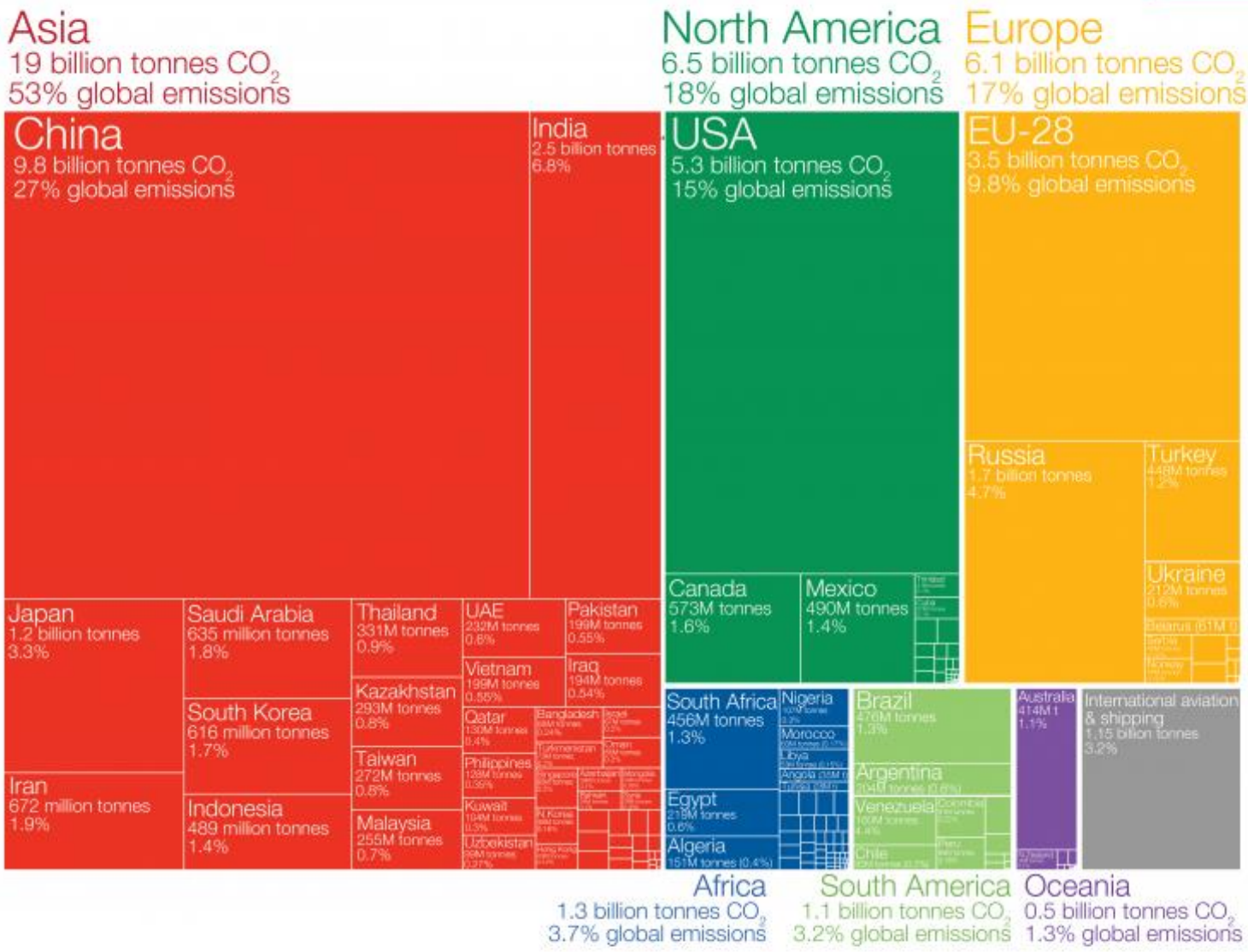
Who emits the most CO_2?

Global carbon dioxide (CO_2) emissions were 36.2 billion tonnes in 2017.

Our World in Data



Shown are national production-based emissions in 2017. Production-based emissions measure CO_2 produced domestically from fossil fuel combustion and cement, and do not adjust for emissions embedded in trade (i.e. consumption-based).

Figures for the 28 countries in the European Union have been grouped as the 'EU-28' since international targets and negotiations are typically set as a collaborative target between EU countries. Values may not sum to 100% due to rounding.

Data source: Global Carbon Project (GCP).

This is a visualization from OurWorldinData.org, where you find data and research on how the world is changing.

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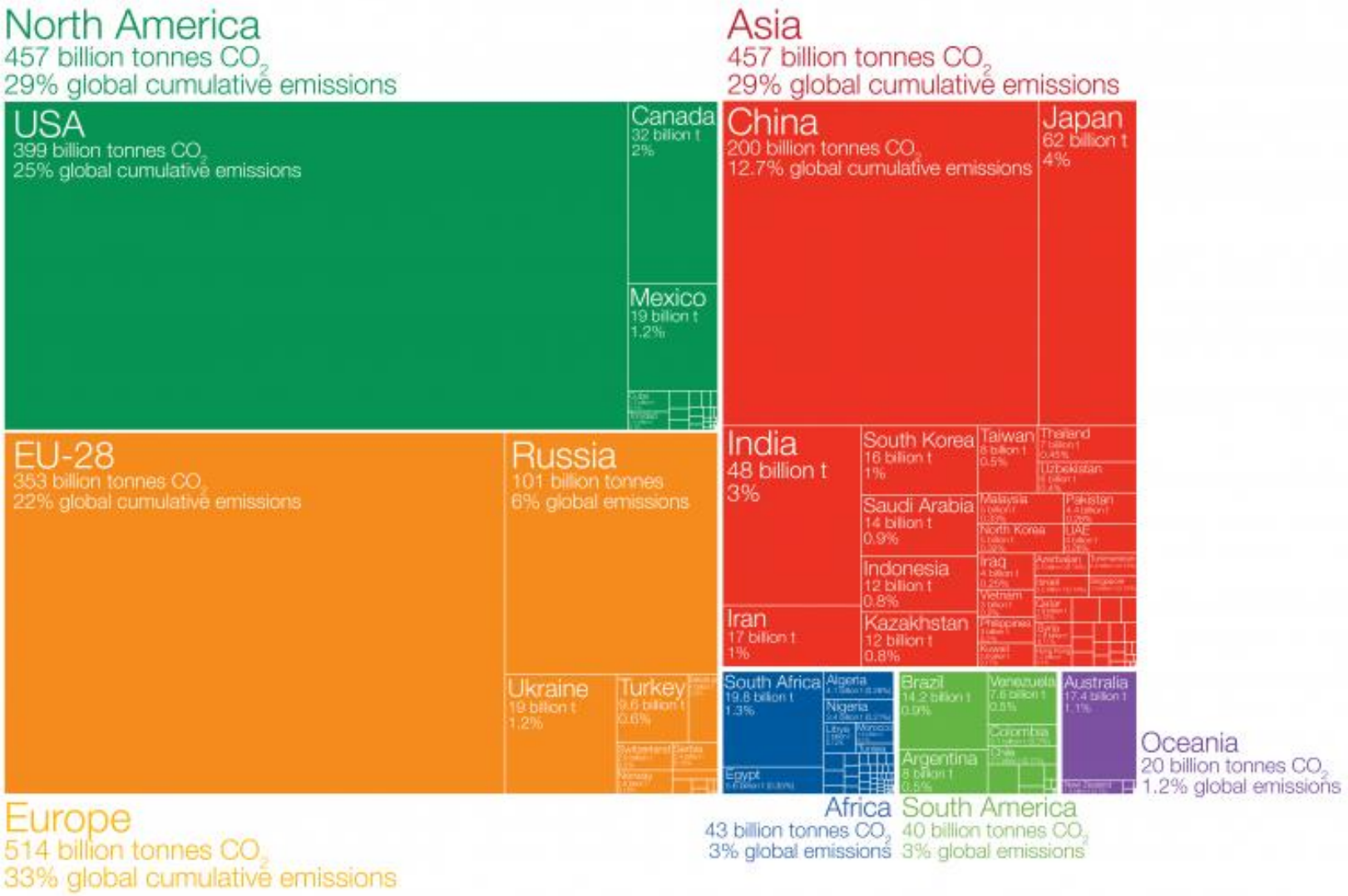
Who has contributed most to global CO_2 emissions?

Our World in Data

Cumulative carbon dioxide (CO_2) emissions over the period from 1751 to 2017. Figures are based on production-based emissions which measure CO_2 produced domestically from fossil fuel combustion and cement, and do not correct for emissions embedded in trade (i.e. consumption-based). Emissions from international travel are not included.



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Data source: Calculated by Our World in Data based on data from the Global Carbon Project (GCP) and Carbon Dioxide Analysis Center (CDIAC).
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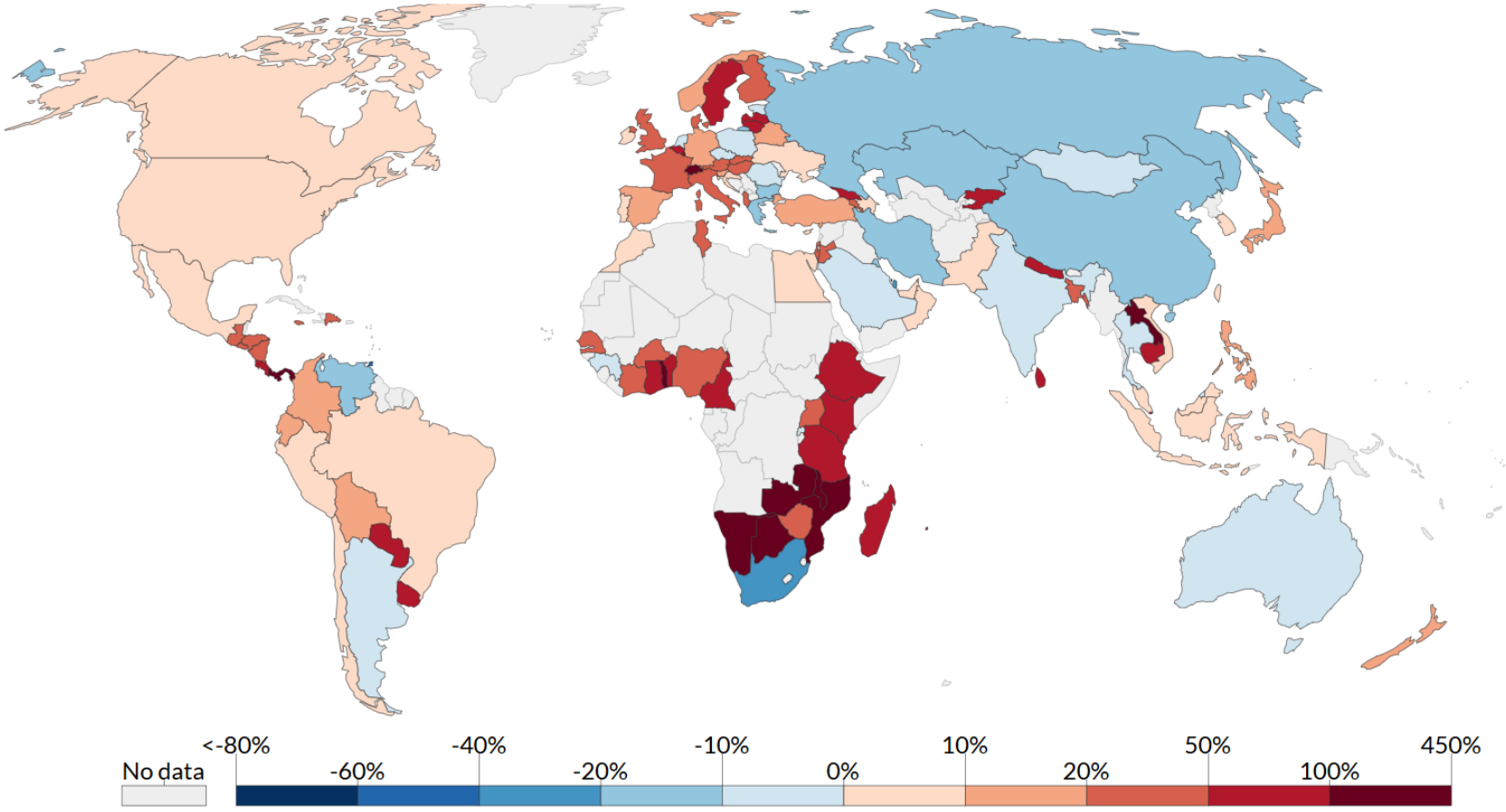
CO_2 emissions embedded in trade, 2016

Share of carbon dioxide (CO_2) emissions embedded in trade, measured as emissions exported or imported as the percentage of domestic production emissions. Positive values (red) represent net importers of CO_2 (i.e. "20%" would mean a country imported emissions equivalent to 20% of its domestic emissions). Negative values (blue) represent net exporters of CO_2.

Our World in Data



Source: Peters et al. (2012 updated); Global Carbon Project (2018)

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY

1990 2016

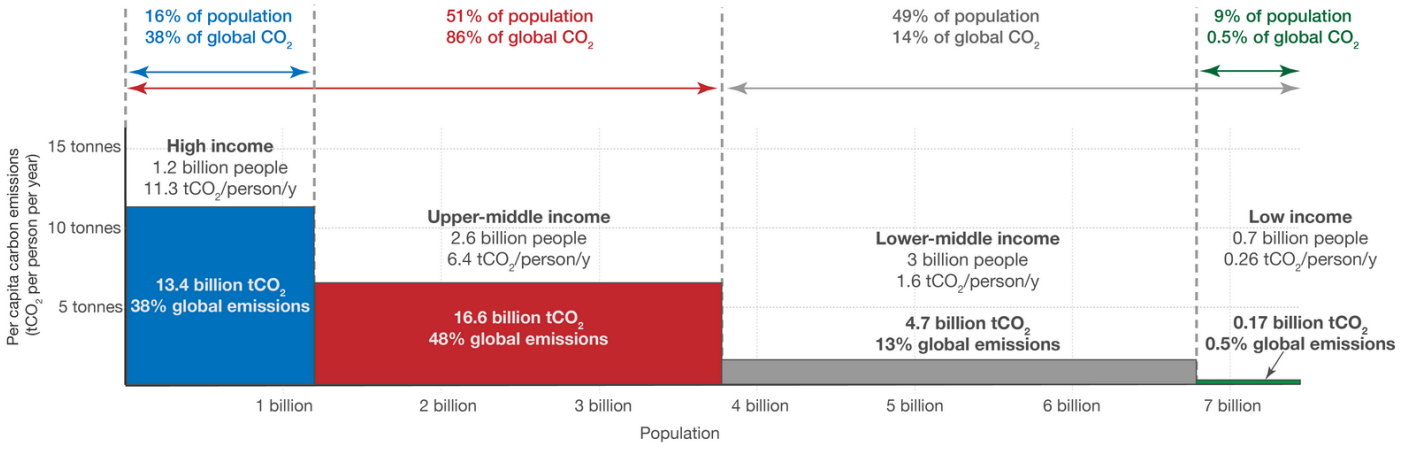
Global CO_2 emissions by income and region

Our World in Data

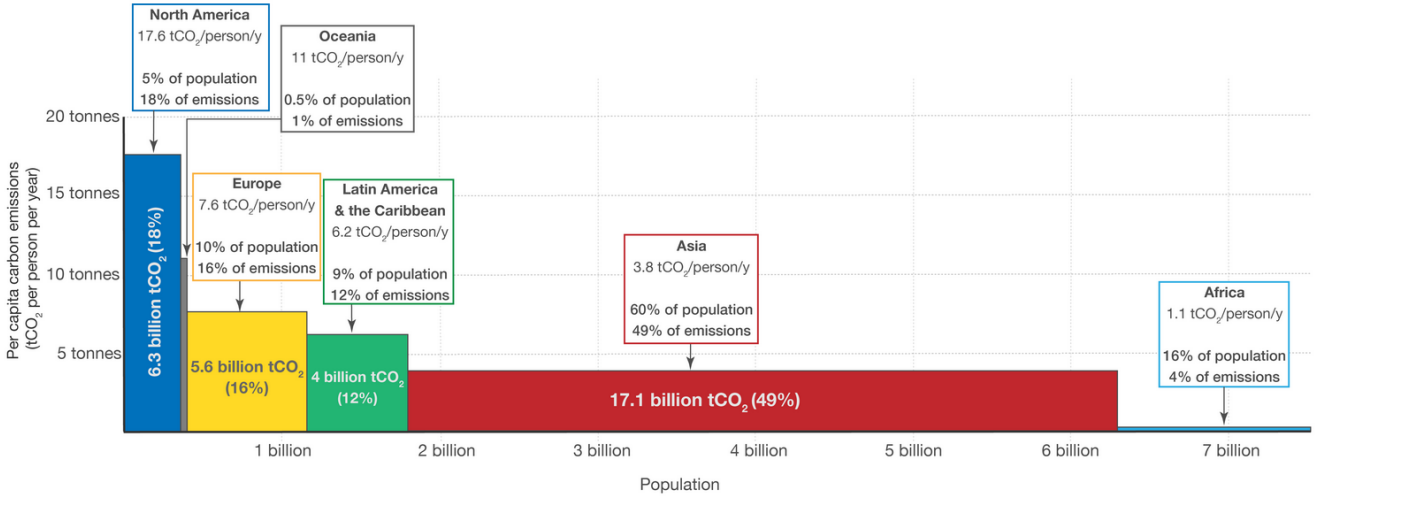
Breakdown of global carbon dioxide (CO_2) emissions in 2016 by World Bank income group (top) and world region (bottom). This is shown based on average per capita emissions (y-axis) and population size (x-axis), with the area of the box representing total annual emissions in 2016.

- Emissions represent domestic production (not accounting for embeddded emissions in traded products), and do not include cross-boundary emissions such as international aviation & shipping.
- Aggregation by income is based on the total emissions of countries within each of the World Bank's income groupings. It reflects average national incomes rather than the distribution of incomes within countries. E.g. 'Low income' reflects the total emissions of all countries defined as low income, rather than the emissions of global individuals defined as low income. If defined on the basis of individuals (without country contexts), the global inequality would be even larger.

By Income Group



By Region



Source: Our World in Data based on data from the Global Carbon Project, UN Population Division (2018) & World Bank income groups.
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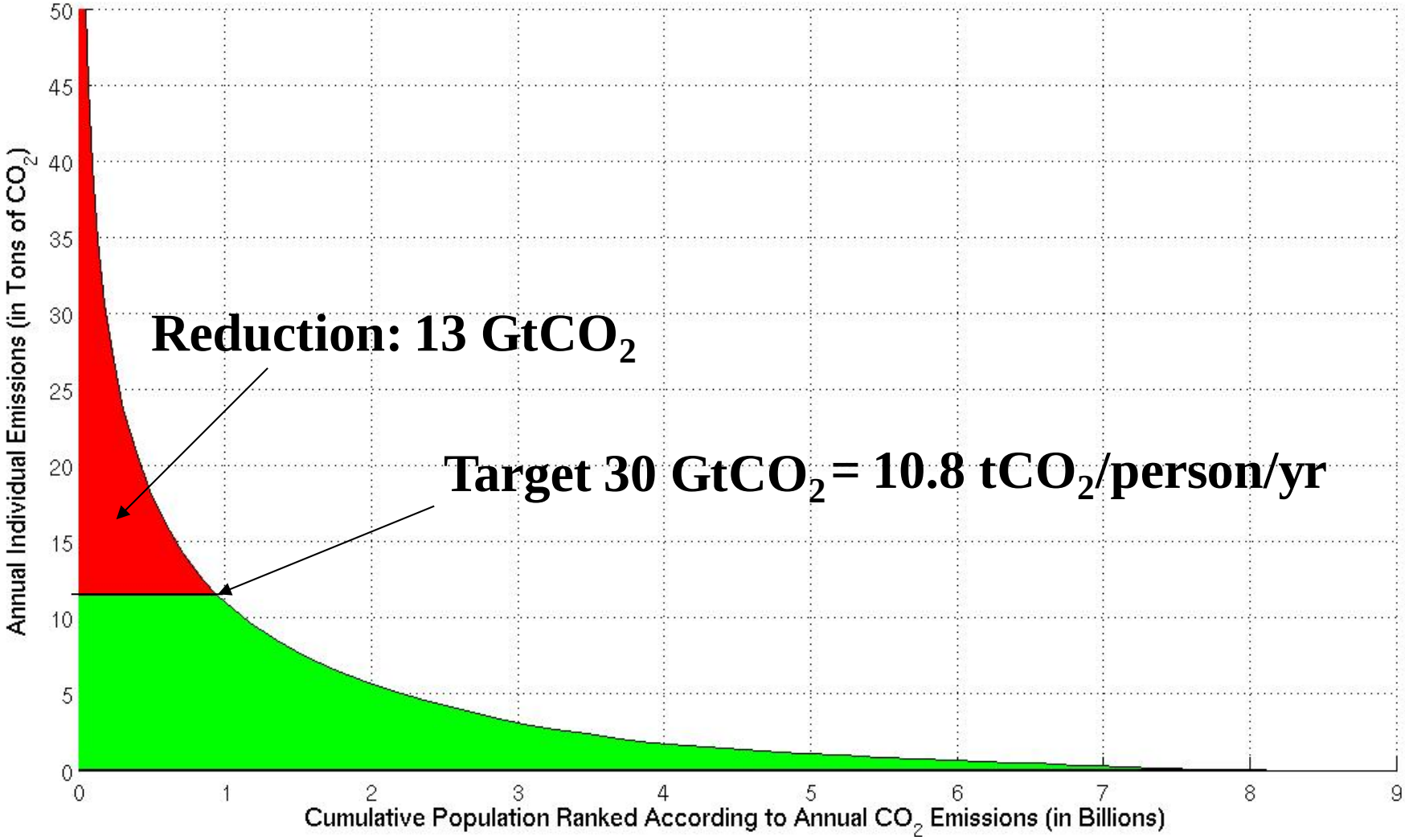
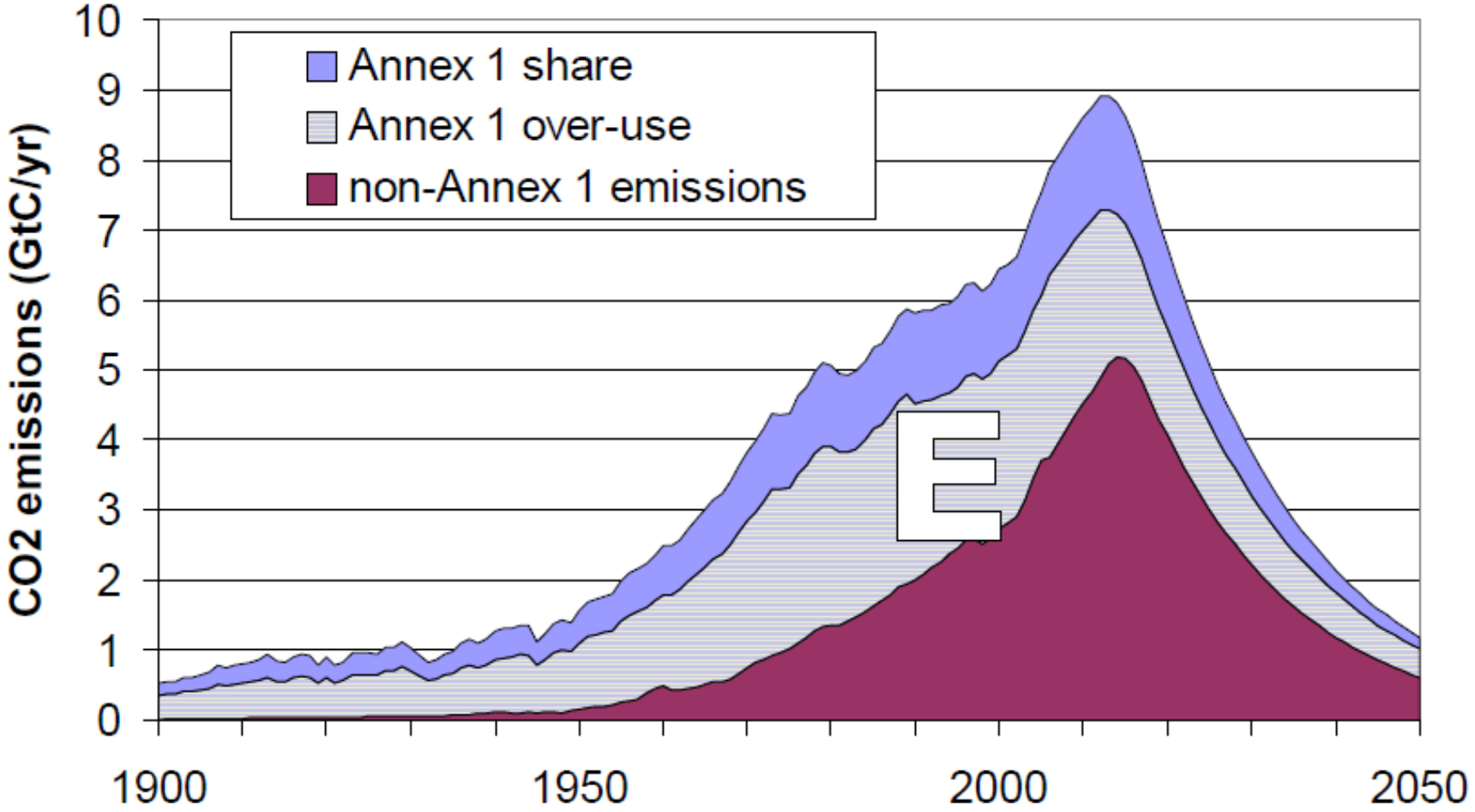
A CO_2 emissions target for 2030



Source: Chakravarty et al. (2009)

Climate debt (the Bolivian proposal)



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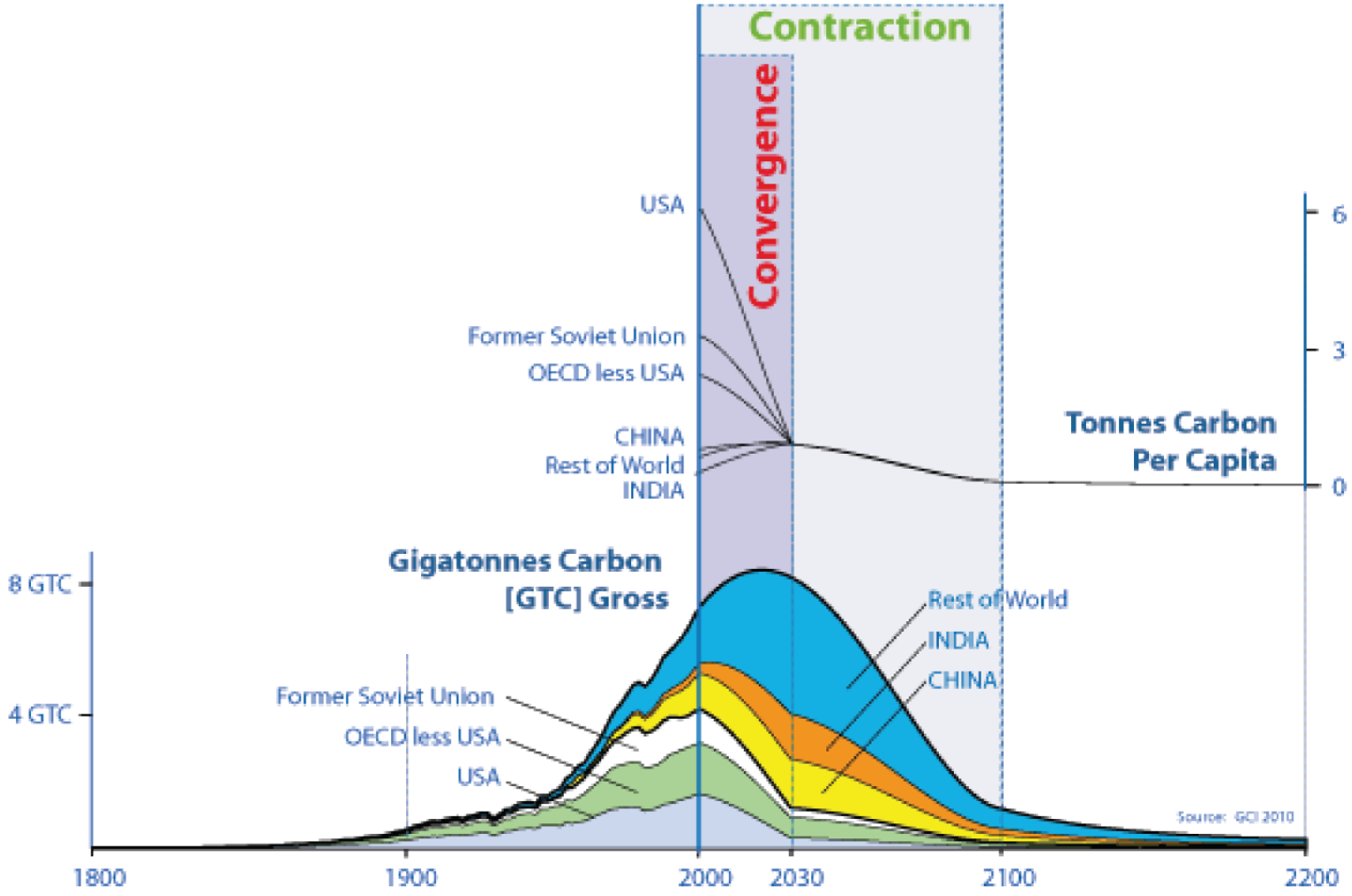
Contraction and convergence



This example shows regionally negotiated rates of C&C.
It is for a 450ppmv Contraction Budget, with Convergence by 2030. Source: Global Commons Institute

Conclusion

- so far and on aggregate: insufficient country pledges under the UNFCCC process
  - mitigation is a public good (incentives for free riding)
  - diverging perspectives on equity and fairness

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