

Toward a framework for an “ambition index” and online calculator

Sivan Kartha

Stockholm Environment Institute

2nd Working Group Meeting, Globally-networked Carbon Markets

Paris, Wednesday 12 February 2014

Caveats:

“*Toward*...”: Merely preliminary!

“...a *framework* for...”: Not intended to generate one set of definitive numbers. Key choices and parameters are user-specified.

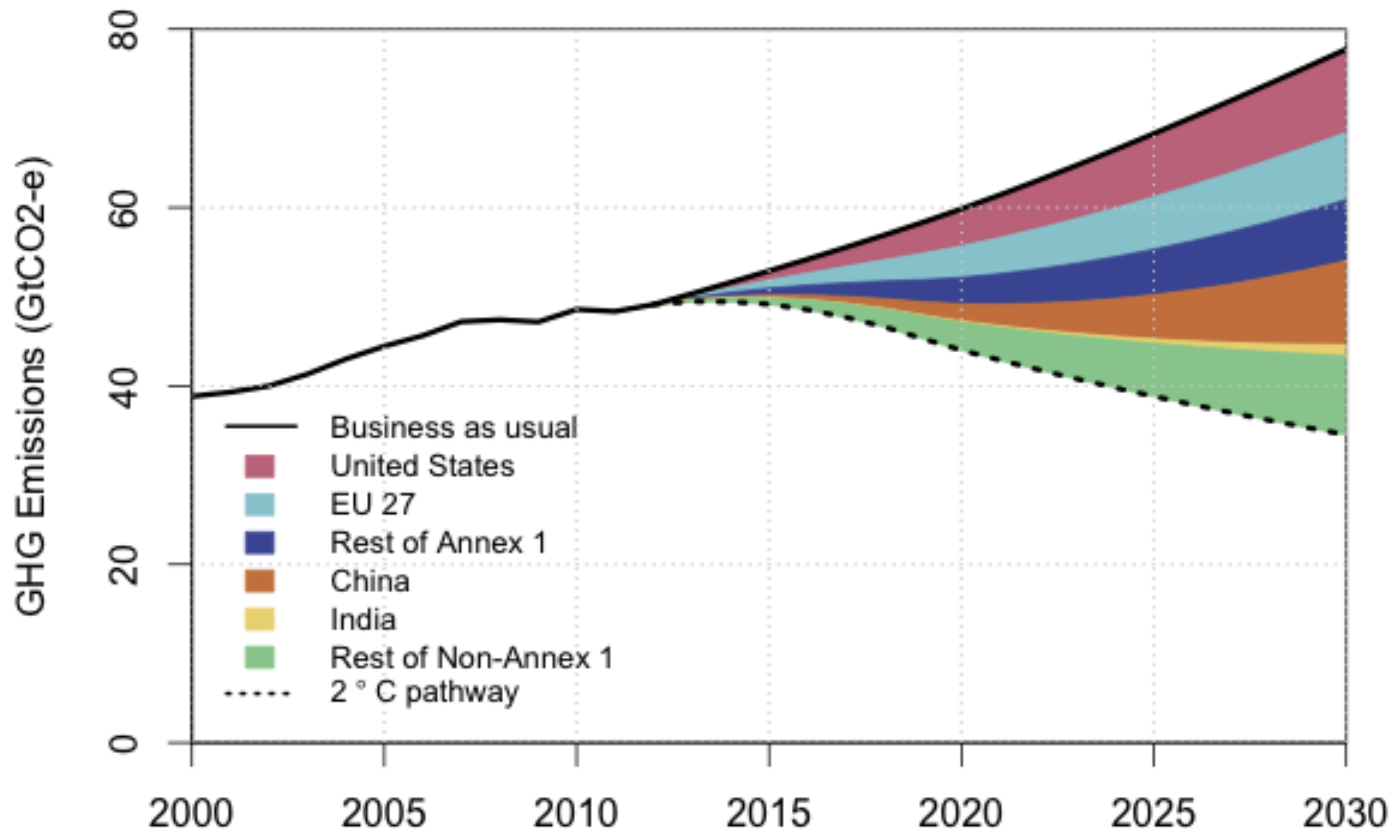
“...*an* ...”: Could certainly be others, though this one aims to be quite flexible and encompassing.

“...*ambition index*...”: A.k.a. “equity reference framework”, “cost-sharing method”, “fair shares approach”, etc.

“...and *online calculator*”: A data-driven, quantitative exercise, but... rests on fundamentally normative, value-laden choices..

Two broad approaches to “fair shares”:

- **Resource-sharing**: share the available carbon budget in accordance with specified equity principles
- **Effort-sharing**: share the required effort (tons of reductions, cost) in accordance with specified equity principles.



Underlying principles

Key design principles

- **Effectiveness** – consistent with a specified environmental objective
- **Efficiency** – consistent with minimizing cost, (i.e., equal marginal cost of GHG reductions).
- **Parsimony** – simple but defensible (Einstein's dictum)

Key equity principles

- **Capability**
- **Responsibility**

Principles, Article 3.1, UNFCCC, 1992

“The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities.”

Principle 7, Rio Declaration, 1992

*“In view of the different contributions to global environmental degradation, States have **common but differentiated responsibilities**. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of **the pressures their societies place on the global environment and of the technologies and financial resources they command.**”*

Allow a progressive definition of capacity:
e.g., exemption up to a specified income level

Traditional poverty line? \$1/day? ...\$2/day?

(“destitution line” and “extreme poverty line” of World Bank, UNDP, etc.)

LDC threshold?

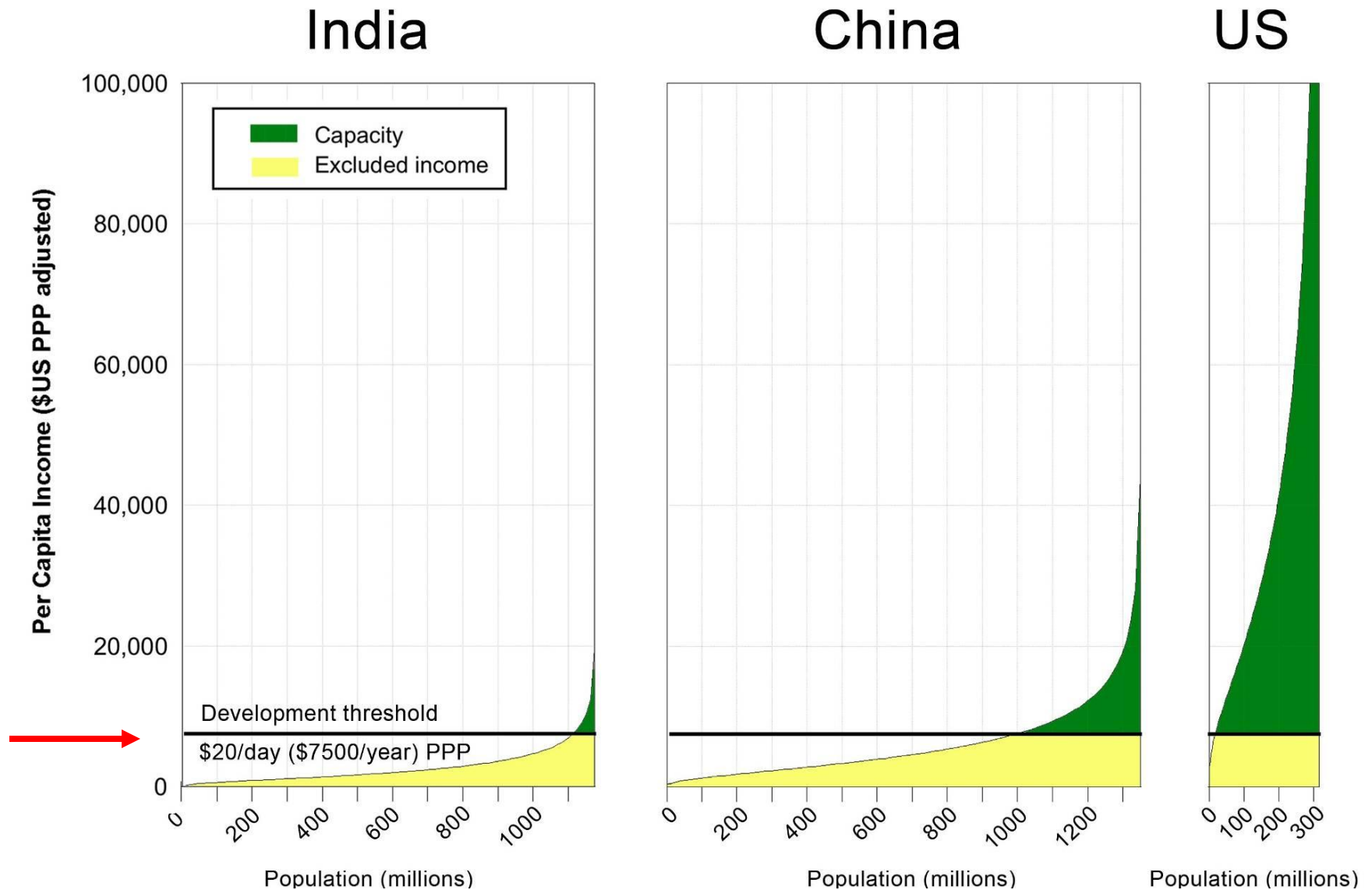
Empirical analysis? \$16/day?

(“global poverty line,” after Pritchett (World Bank (2006))

For indicative calculations, consider development threshold 25% above global poverty line

⇒ about **\$20/day** (\$7,500/yr; PPP-adjusted)

Income, exemption and capacity: distributions within countries



Data: IMF, UNU-WIDER, Pritchett (World Bank/Harvard Kennedy School)

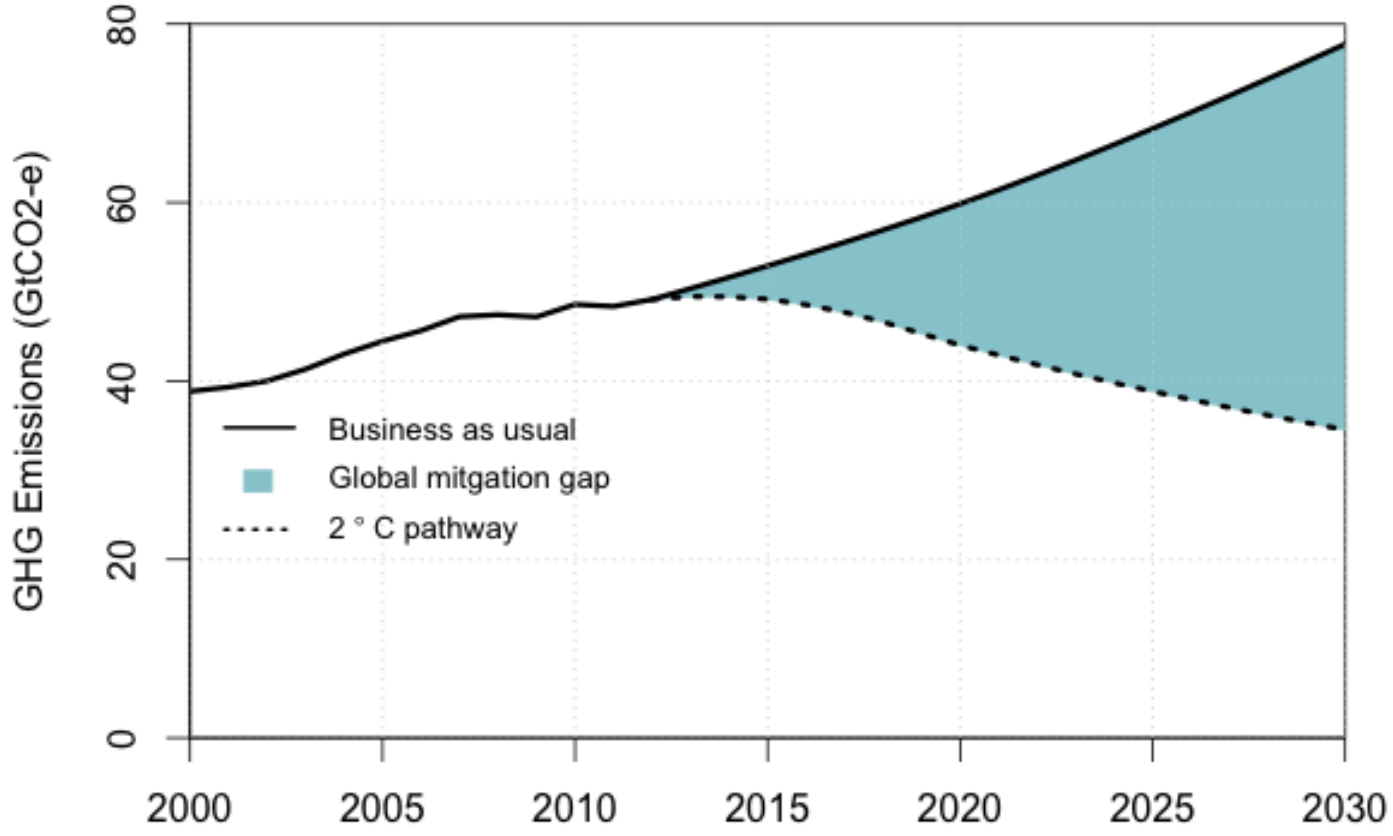
National “responsibility and capacity index”

	Population %	GDP per capita (\$US PPP)	Capacity %	Responsibility %	RCI (obligations) %
EU 27	7.3	30,472	28.8	22.6	25.7
- EU 15	5.8	33,754	26.1	19.8	22.9
- EU +12	1.5	17,708	2.7	2.8	2.7
Norway	0.07	52,406	0.54	0.26	0.40
United States	4.5	45,640	29.7	36.4	33.1
China	19.7	5,899	5.8	5.2	5.5
India	17.2	2,818	0.66	0.30	0.48
South Africa	0.7	10,117	0.6	1.3	1.0
LDCs	11.7	1,274	0.11	0.04	0.07
Annex I	18.7	30,924	75.8	78.0	76.9
Non-Annex I	81.3	5,096	24.2	22.0	23.1
High Income	15.5	36,488	76.9	77.9	77.4
Middle Income	63.3	6,226	22.9	21.9	22.4
Low Income	21.2	1,599	0.2	0.2	0.2
World	100%	9,929	100 %	100 %	100 %

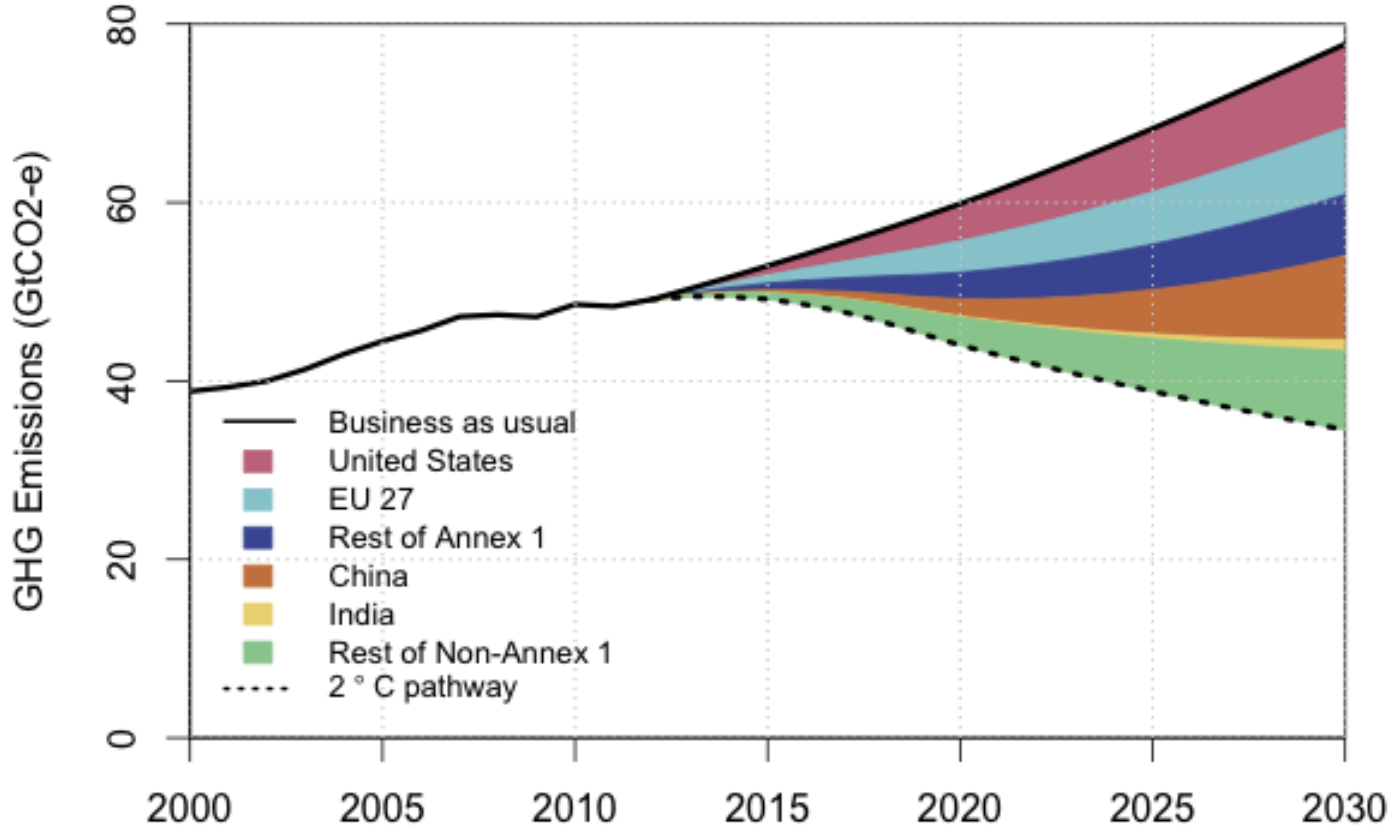
National “responsibility and capacity index”

	2010					2020	2030
	Population (% of global)	GDP per capita (\$US PPP)	Capacity (% of global)	Responsibility (% of global)	RCI (% of global)	RCI (% of global)	RCI (% of global)
EU 27	7.3	30,472	28.8	22.6	25.7	22.9	19.6
- EU 15	5.8	33,754	26.1	19.8	22.9	19.9	16.7
- EU +12	1.5	17,708	2.7	2.8	2.7	3.0	3.0
Switzerland	0.11	39,181	0.60	0.27	0.44	0.37	0.30
United states	4.5	45,640	29.7	36.4	33.1	29.1	25.5
Japan	1.9	33,422	8.3	7.3	7.8	6.6	5.5
Russia	2.0	15,031	2.7	4.9	3.8	4.3	4.6
China	19.7	5,899	5.8	5.2	5.5	10.4	15.2
India	17.2	2,818	0.66	0.30	0.5	1.2	2.3
South Africa	0.7	10,117	0.6	1.3	1.0	1.1	1.2
Mexico	1.6	12,408	1.8	1.4	1.6	1.5	1.5
LDCs	11.7	1,274	0.11	0.04	0.07	0.10	0.12
Annex I	18.7	30,924	75.8	78.0	77	69	61
Non-Annex I	81.3	5,096	24.2	22.0	23	31	39
High Income	15.5	36,488	76.9	77.9	77	69	61
Middle Income	63.3	6,226	22.9	21.9	22	30	38
Low Income	21.2	1,599	0.2	0.2	0.2	0.3	0.5
World	100%	9,929	100 %	100 %	100 %	100 %	100 %

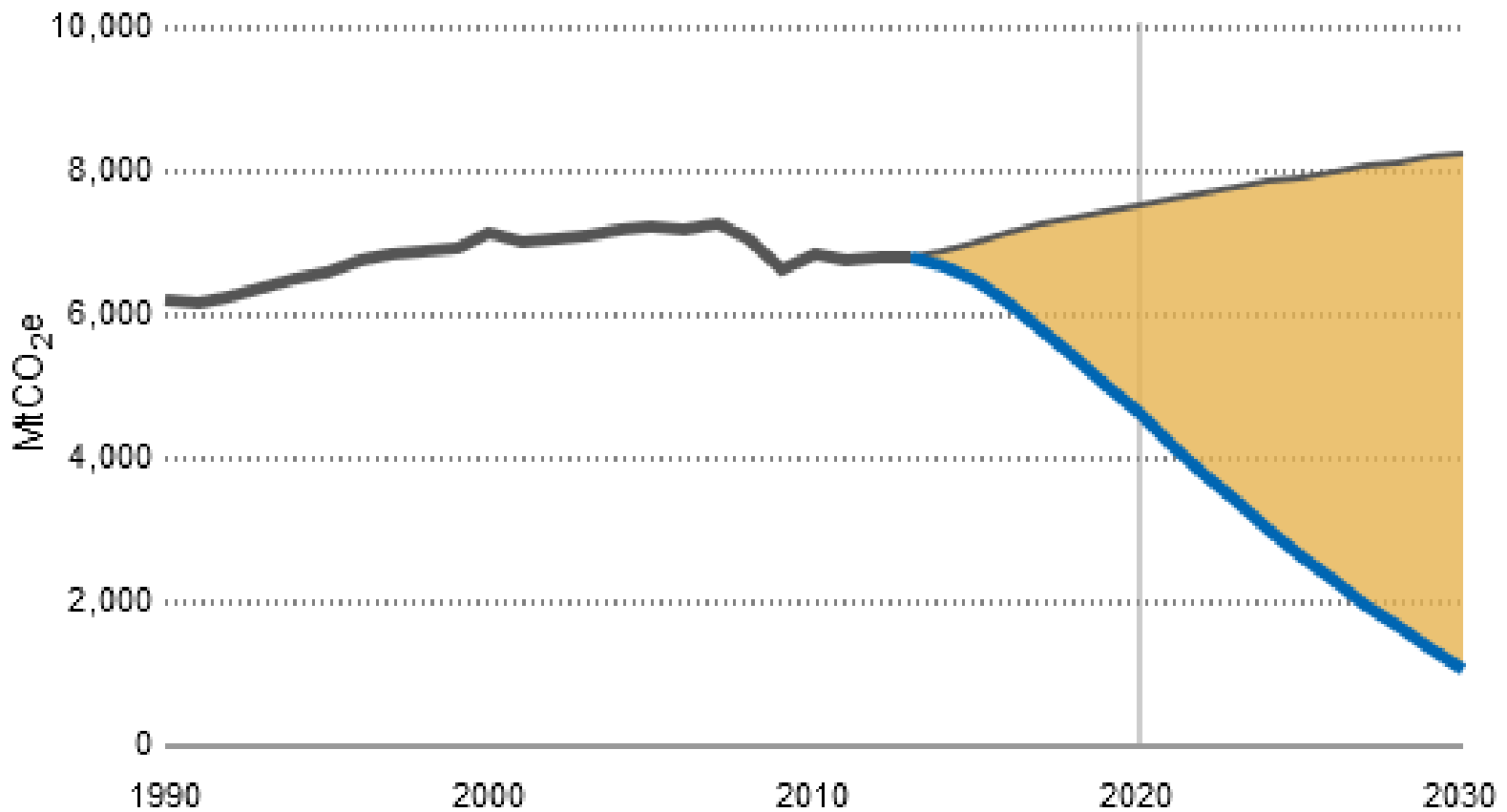
Allocating global mitigation obligations among countries according to “RCI”



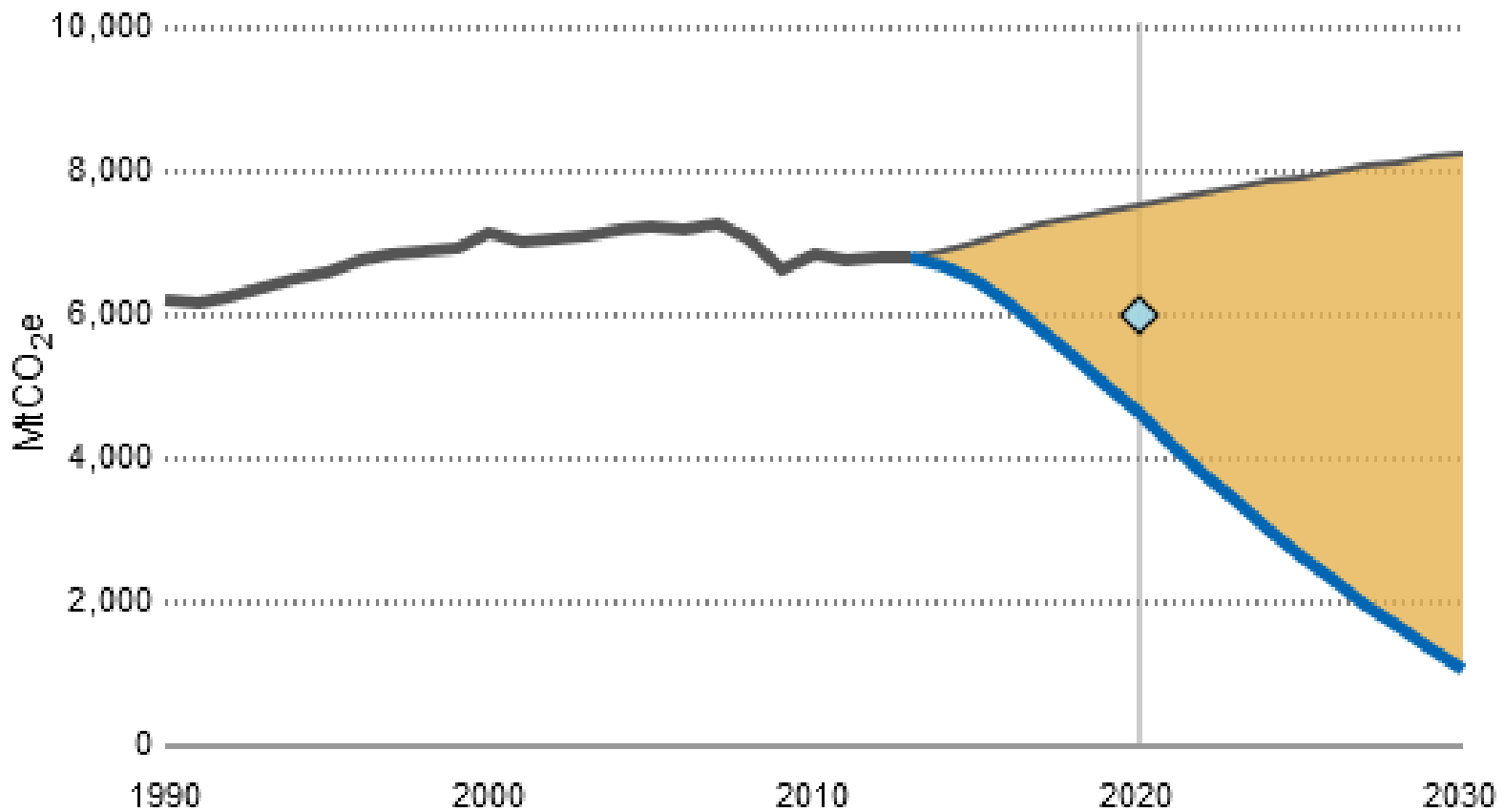
Allocating global mitigation obligations among countries according to “RCI”



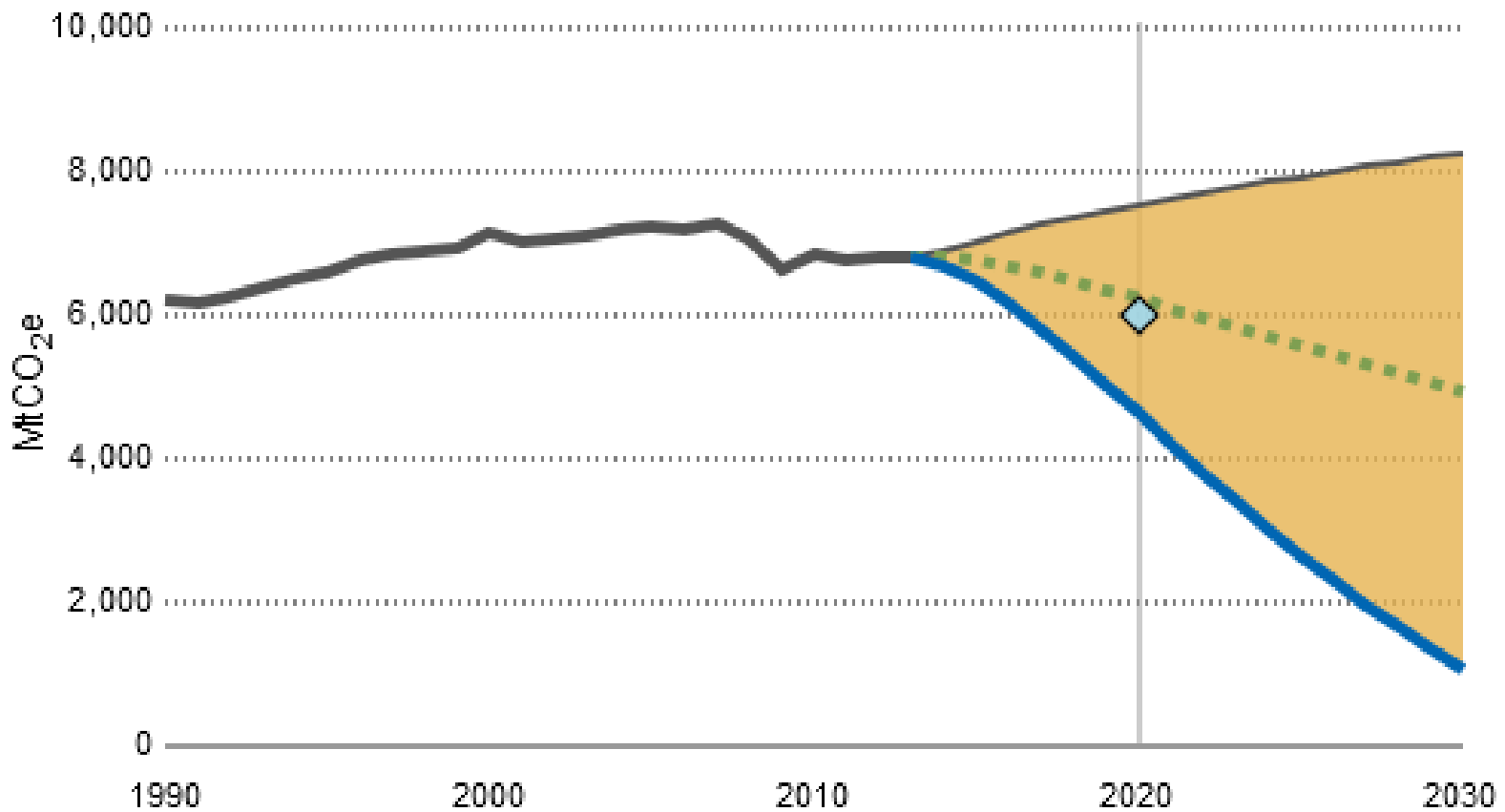
Example: United States



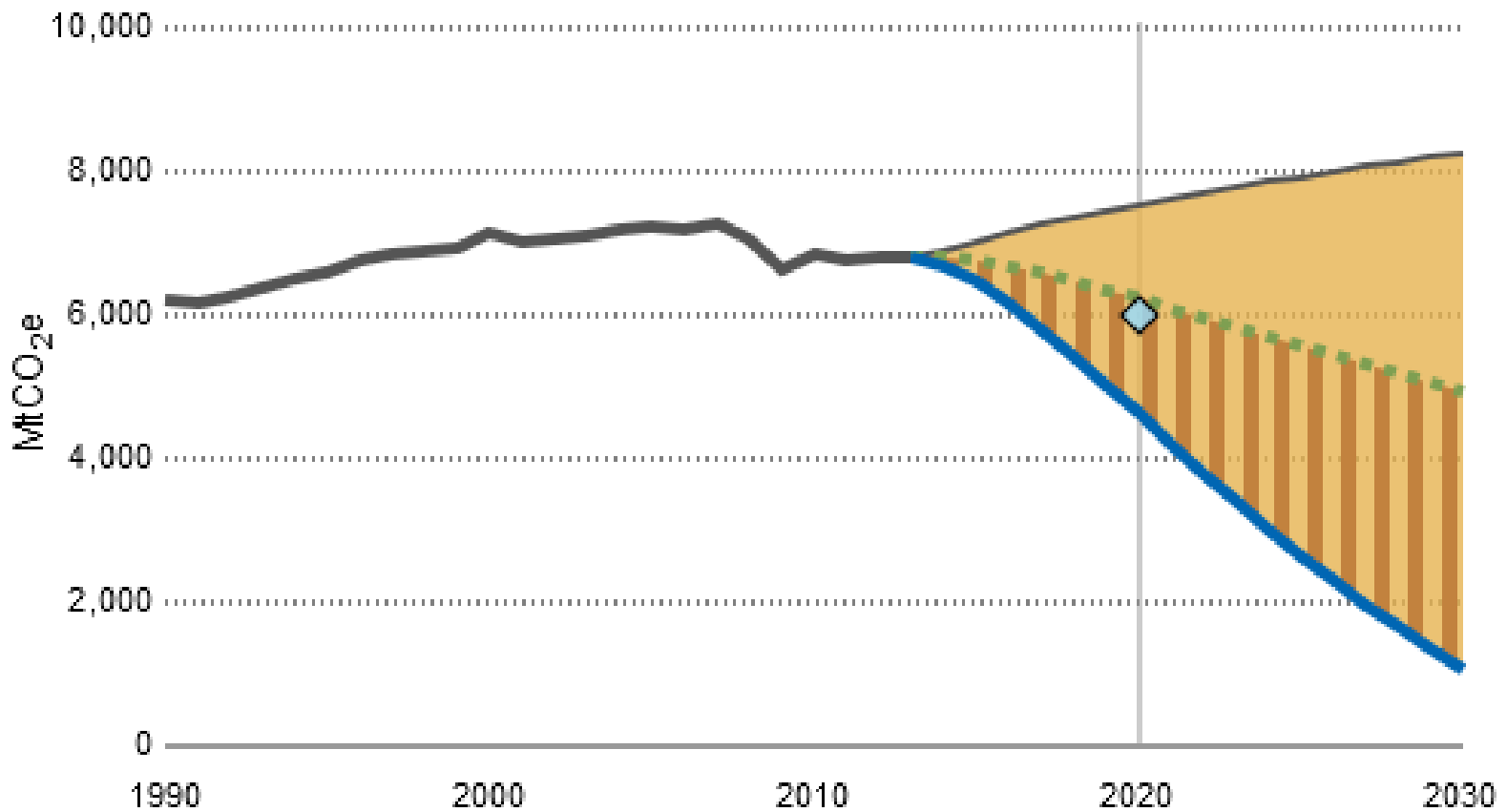
Example: United States



Example: United States



Example: United States



Online calculator: initial choices

The screenshot shows a web browser window with the URL www.gdrights.org/calculator_dev/index.php. The page title is "Climate Equity Reference Calculator" and it is marked as "beta". The page features the "EcoEquity" logo and the "SEI STOCKHOLM ENVIRONMENT INSTITUTE" logo. A sidebar on the left contains sections for "About the Calculator", "Display settings", and "Calculator settings". The main content area is a "Equity Settings" dialog box with the following sections:

- Level of Global Ambition**
 - Select a mitigation pathway:
 - Strong 2°C pathway (Good odds of limiting warming to 2°C. Undefined odds of limiting warming to 1.5°C)
 - Weak 2°C pathway (This pathway would have been considered strong before the 2013 IPCC Fifth Assessment Report)
 - G8 pathway (An even weaker pathway, one consistent with the 2009 G8 Declaration in L'Aquila)
- Common but Differentiated Responsibilities and Capacities**
 - Responsibility vs. Capacity, relative weight**
 - 100% Responsibility
 - 50% Responsibility / 50% Capacity
 - 100% Capacity
 - Progressivity, between and within countries**
 - \$2,500 development threshold (actually, a poverty threshold)
 - \$7,500 development threshold
 - \$7,500 development threshold, plus additional progressivity factors
- Historical Responsibility Start Date**
 - Calculate responsibility based on emissions cumulative since:

The "Responsibility vs. Capacity, relative weight" section includes a 3x3 grid diagram. The top row is labeled "Responsibility given more weight" and the bottom row is labeled "Capacity given more weight". The left column is labeled "More regressive" and the right column is labeled "More progressive". The center cell of the grid is highlighted in dark blue, representing the selected 50% Responsibility / 50% Capacity option.

Online calculator: overview (195 countries)

Climate Equity Reference Calculator *beta* **EcoEquity** **SEI** STOCKHOLM ENVIRONMENT INSTITUTE

[About the Calculator](#) | [Climate Equity Pledge Scorecard](#) | [About Greenhouse Development Rights](#) | [EcoEquity](#) | [SEI](#)

▼ **Select regions and countries**

Current list [Edit list](#)

▼ **Display settings**

Table view: Overview

Year to display: 2020

Decimal places: 1

▼ **Calculator settings**

Global mitigation pathway: G8 pathway

Cumulative since: 1990

Include land-use emissions

Include non-CO₂ gases

Include emissions embodied in trade

Responsibility weight: 0.5

Mitigation cost as % GWP: 1.0

Use the controls to the left to change the parameter values and see the implications for national obligations.

[Open Climate Equity Pledge Scorecard with these settings \(but no country selected\)](#)

REVIEW EQUITY SETTINGS

[Download complete Excel table](#) **COPY VIEW TO NEW WINDOW**

Overview in 2020

[Show settings](#)

Country or Group	Population (million)	Population (% of global)	GDP (billion 2010 \$US MER)	GDP (% of global)	Income (2010 \$US MER/cap)	Income (2005 \$US PPP/cap)	Capacity (billion 2010 \$US MER)	Capacity (% of global)	Responsibility (% of global)	RCI	Population above dev. thresh. (% pop)	Population above lux. thresh. (% pop)
(1) World	7,686.6	100.0	88,155.1	100.0	11,468.7	12,953.9	60,436.1	100.0	100.0	100.0	39.8	1.2
(2) High Income	1,100.0	14.3	51,839.5	58.8	47,126.9	40,502.0	42,220.2	69.9	64.4	67.1	97.5	7.6
(3) Upper Middle Income	659.2	8.6	8,170.8	9.3	12,394.4	17,115.7	5,042.4	8.3	13.8	11.1	69.9	0.3
(4) Lower Middle Income	4,124.8	53.7	26,025.6	29.5	6,309.6	9,551.0	13,031.0	21.6	21.6	21.6	35.2	0.2
(5) Low Income	1,802.6	23.5	2,119.2	2.4	1,175.7	2,407.6	142.5	0.2	0.2	0.2	4.0	0.0

Online calculator: select global mitigation level

The screenshot shows the Climate Equity Reference Calculator interface. The browser address bar displays www.gdrights.org/calculator_dev/. The page title is "Climate Equity Reference Calculator" with a "beta" label. Logos for "EcoEquity" and "SEI STOCKHOLM ENVIRONMENT INSTITUTE" are visible. Navigation links include "About the Calculator", "Climate Equity Pledge Scorecard", "About Greenhouse Development Rights", "EcoEquity", and "SEI".

The left sidebar contains three main sections:

- Select regions and countries:** Includes a "Current list" field and an "Edit list" button.
- Display settings:** Includes a "Table view" dropdown set to "Overview", a "Year to display" dropdown set to "2020", and a "Decimal places" dropdown set to "1".
- Calculator settings:** Includes a "Global mitigation pathway" dropdown menu with options: "G8 pathway", "Strong 2°C pathway", "Weak 2°C pathway", and "G8 pathway" (highlighted). Below this are three checkboxes: "Include land-use emissions", "Include non-CO₂ gases", and "Include emissions embodied in trade". At the bottom, there is a "Responsibility weight" dropdown set to "0.5" and a "Mitigation cost as % GWP" dropdown set to "1.0".

The main content area contains the following text:

Use the controls to the left to change the parameter values and see the implications for national obligations.

[Open Climate Equity Pledge Scorecard with these settings \(but no country selected\)](#)

REVIEW EQUITY SETTINGS

[Download complete Excel table](#) **COPY VIEW TO NEW WINDOW**

Overview in 2020

[Show settings](#)

Country or Group	Population (million)	Population (% of global)	GDP (billion \$US MER)	GDP (% of global)	Income (2010 \$US MER/cap)	Income (2005 \$US PPP/cap)	Capacity (billion \$US MER)	Capacity (% of global)	Responsibility (% of global)	RCI	Population above dev. thresh. (% pop)	Population above lux. thresh. (% pop)
(1) World	7,686.6	100.0	88,155.1	100.0	11,468.7	12,953.9	60,436.1	100.0	100.0	100.0	39.8	1.2
(2) High Income	1,100.0	14.3	51,839.5	58.8	47,126.9	40,502.0	42,220.2	69.9	64.4	67.1	97.5	7.6
(3) Upper Middle Income	659.2	8.6	8,170.8	9.3	12,394.4	17,115.7	5,042.4	8.3	13.8	11.1	69.9	0.3
(4) Lower Middle Income	4,124.8	53.7	26,025.6	29.5	6,309.6	9,551.0	13,031.0	21.6	21.6	21.6	35.2	0.2
(5) Low Income	1,802.6	23.5	2,119.2	2.4	1,175.7	2,407.6	142.5	0.2	0.2	0.2	4.0	0.0

Online calculator: select year

The screenshot shows the Climate Equity Reference Calculator interface. A dropdown menu is open for the 'Year to display' field, showing years from 1850 to 2010. The year 1990 is currently selected. The interface includes navigation links, a 'REVIEW EQUITY SETTINGS' button, and a table of data for the year 2020.

Climate Equity Reference Calculator *beta* **EcoEquity** **SEI** STOCKHOLM ENVIRONMENT INSTITUTE

[About the Calculator](#) | [Climate Equity Pledge Scorecard](#) | [About Greenhouse Development Rights](#) | [EcoEquity](#) | [SEI](#)

Use the controls to the left to change the parameter values and see the implications for national obligations.
[Open Climate Equity Pledge Scorecard with these settings \(but no country selected\)](#)

REVIEW EQUITY SETTINGS

[Download complete Excel table](#) **COPY VIEW TO NEW WINDOW**

Overview in 2020
[Show settings](#)

Country or Group	Population (million)	Population (% of global)	GDP (billion 2010 \$US MER)	GDP (% of global)	Income (2010 \$US MER/cap)	Income (2005 \$US PPP/cap)	Capacity (billion 2010 \$US MER)	Capacity (% of global)	Responsibility (% of global)	RCI	Population above dev. thresh. (% pop)	Population above lux. thresh. (% pop)
(1) World	7,686.6	100.0	88,155.1	100.0	11,468.7	12,953.9	60,436.1	100.0	100.0	100.0	39.8	1.2
(2) High Income	1,100.0	14.3	51,839.5	58.8	47,126.9	40,502.0	42,220.2	69.9	64.4	67.1	97.5	7.6
(3) Upper Middle Income	659.2	8.6	8,170.8	9.3	12,394.4	17,115.7	5,042.4	8.3	13.8	11.1	69.9	0.3
(4) Lower Middle Income	4,124.8	53.7	26,025.6	29.5	6,309.6	9,551.0	13,031.0	21.6	21.6	21.6	35.2	0.2
(5) Low Income	1,802.6	23.5	2,119.2	2.4	1,175.7	2,407.6	142.5	0.2	0.2	0.2	4.0	0.0

Online calculator: select country (e.g., United States)

The screenshot shows a web browser window with the URL www.gdrights.org/calculator_dev/index.php. The browser tabs include "Google Calendar" and "Climate Equity Reference Calculator".

Display settings:

- Table view: Country/region report
- Year to display: 2020
- Country or region to display: United States

Calculator settings:

- Global mitigation pathway: G8 pathway
- Cumulative since: 1990
- Include land-use emissions
- Include non-CO₂ gases
- Include emissions embodied in trade
- Responsibility weight: 0.5
- Mitigation cost as % GWP: 1.0
- Global average mitigation cost is \$135 per ton CO₂ in 2020
- Adaptation cost as % GWP: 1.0
- Progressivity
- Kyoto obligations
- Mitigation smoothing

REVIEW EQUITY SETTINGS

[Download complete Excel table](#) **COPY VIEW TO NEW WINDOW**

Country/region report in 2020 for United States

[Show settings](#)

Year	Historical Emissions (MtCO ₂)	G8 Pathway (MtCO ₂)	Kyoto Pathway (MtCO ₂)
1990	5,000	-	-
2000	5,800	-	-
2010	5,500	5,500	5,500
2020	5,000	5,000	5,000
2030	1,800	1,800	4,500

[Show graph](#)

RESET TO DEFAULT VALUES

Online calculator: select country (e.g., United States)

www.gdrights.org/calculator_dev/index.php

Google Calendar Climate Equity Reference Calculator

▼ Display settings

Table view: Country/region report

Year to display: 2020

Country or region to display: United States

▼ Calculator settings

Global mitigation pathway: Weak 2°C pathway

Cumulative since: 1990

Include land-use emissions

Include non-CO₂ gases

Include emissions embodied in trade

Responsibility weight: 0.5

Mitigation cost as % GWP: 1.0

Global average mitigation cost is \$52 per ton CO₂ in 2020

Adaptation cost as % GWP: 1.0

► Progressivity

► Kyoto obligations

► Mitigation smoothing

RESET TO DEFAULT VALUES

Use the controls to the left to change the parameter values and see the implications for national obligations.

[Open Climate Equity Pledge Scorecard with these settings \(but no country selected\)](#)

REVIEW EQUITY SETTINGS

[Download complete Excel table](#) **COPY VIEW TO NEW WINDOW**

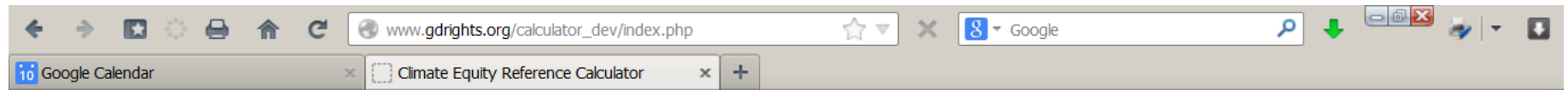
Country/region report in 2020 for United States

[Show settings](#)

Year	Historical Emissions (MtCO ₂)	Projected Emissions (MtCO ₂)
1990	5,000	5,000
2000	6,000	6,000
2010	5,500	5,500
2020	5,000	5,000
2030	-1,000	3,000

Show graph

Online calculator: select country (e.g., United States)



Display settings

Table view:

Year to display:

Country or region to display:

Calculator settings

Global mitigation pathway:

Cumulative since:

Include land-use emissions

Include non-CO₂ gases

Include emissions embodied in trade

Responsibility weight:

Mitigation cost as % GWP:

Global average mitigation cost is \$46 per ton CO₂ in 2020

Adaptation cost as % GWP:

[Progressivity](#)

[Kyoto obligations](#)

[Mitigation smoothing](#)

RESET TO DEFAULT VALUES

Use the controls to the left to change the parameter values and see the implications for national obligations.

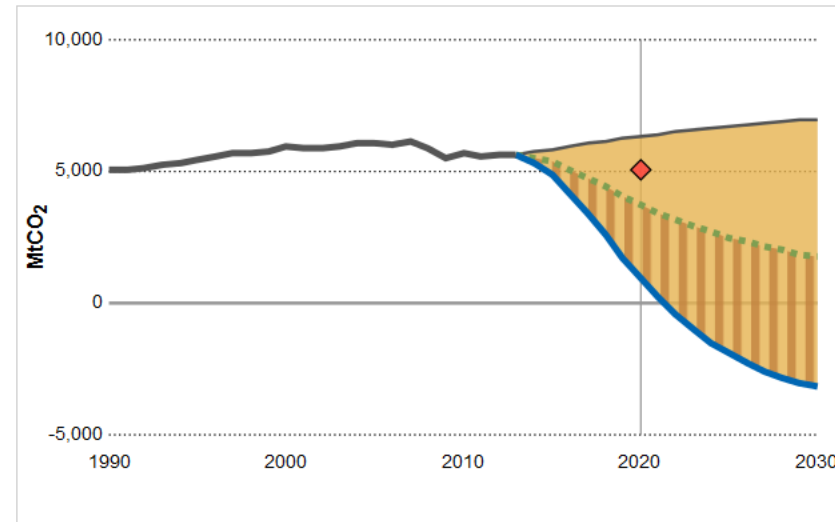
[Open Climate Equity Pledge Scorecard with these settings \(but no country selected\)](#)

REVIEW EQUITY SETTINGS

[Download complete Excel table](#) **COPY VIEW TO NEW WINDOW**

Country/region report in 2020 for United States

[Show settings](#)



[Show graph](#)

Online calculator: country details (e.g., United States)

www.gdrights.org/calculator_dev/index.php

Google Calendar | Climate Equity Reference Calculator

Mitigation smoothing

RESET TO DEFAULT VALUES

[Show graph key](#)

Mitigation obligation and pledges

United States baseline emissions, projected to 2020		6,331 MtCO ₂
Global mitigation requirement below baseline, projected to 2020	(A)	6,506 MtCO ₂
United States share of global Responsibility Capacity Index, projected to 2020	(B)	28%
United States mitigation obligation, projected to 2020	(A × B)	
as tons below baseline		1,828 MtCO ₂
as tons per capita		5.3 tCO ₂ /cap
as percent below baseline		29%
as per-capita climate tax (assuming global mitigation and adaptation costs = 2.0% of global GWP)		\$1,431
<hr/>		
United States 1990 emissions		5,092 MtCO ₂
United States emissions allocation, projected to 2020		
as tons		4,503 MtCO ₂
as tons per capita		13.0 tCO ₂ /cap
as percent of 1990 emissions		88%
as percent below 1990 emissions		12%
<hr/>		
United States unconditional pledge: reduce total emissions by 17% compared to 2005 by 2020		
in tons below baseline		1,269 MtCO ₂
in tons per capita		3.7 tCO ₂ /cap
as percent below baseline		20%
as Climate Equity Pledge Scorecard -style score		-1.6 tCO ₂ /cap

Tax table (illustrative, assuming global mitigation and adaptation costs as currently specified)

Income level (2010 \$US MER/cap)	Income level (2005 \$US PPP/cap)	"Tax rate" (% income)	Population above tax level (% pop.)	Annual per-capita obligation	
				as 2010 \$US MER/cap	as tCO ₂ /cap
8,291	7,500	0	96	0	0
16,582	15,000	1.0	82	167	0.62
33,165	30,000	1.5	55	502	1.9
44,219	40,000	1.6	42	725	2.7
66,329	60,000	1.8	26	1,172	4.3
110,549	100,000	1.9	11	2,064	7.6
114,223	103,323 (global one percent)	1.9	10	2,139	7.9

Data version: 6.6.2 (last change to database: 3 Feb 2014 00:23:20 PST) Calculator version: 2.0.3

United States share of global responsibility capacity index, projected to 2020	(C)	20%
United States mitigation obligation, projected to 2020	(A × B)	
as tons below baseline		1,828 MtCO ₂
as tons per capita		5.3 tCO ₂ /cap
as percent below baseline		29%
as per-capita climate tax (assuming global mitigation and adaptation costs = 2.0% of global GWP)		\$1,431
<hr/>		
United States 1990 emissions		5,092 MtCO ₂
United States emissions allocation, projected to 2020		
as tons		4,503 MtCO ₂
as tons per capita		13.0 tCO ₂ /cap
as percent of 1990 emissions		88%
as percent below 1990 emissions		12%
<hr/>		
United States unconditional pledge: reduce total emissions by 17% compared to 2005 by 2020		
in tons below baseline		1,269 MtCO ₂
in tons per capita		3.7 tCO ₂ /cap
as percent below baseline		20%
as Climate Equity Pledge Scorecard -style score		-1.6 tCO ₂ /cap

Tax table (illustrative, assuming global mitigation and adaptation costs as currently specified)

Income level (2010 \$US MER/cap)	Income level (2005 \$US PPP/cap)	"Tax rate" (% income)	Population above tax level (% pop.)	Annual per-capita obligation	
				as 2010 \$US MER/cap	as tCO ₂ /cap
8,291	7,500	0	96	0	0
16,582	15,000	1.0	82	167	0.62
33,165	30,000	1.5	55	502	1.9
44,219	40,000	1.6	42	725	2.7
66,329	60,000	1.8	26	1,172	4.3
110,549	100,000	1.9	11	2,064	7.6
114,223	103,323 (global one percent)	1.9	10	2,139	7.9

Data version: 6.6.2 (last change to database: 3 Feb 2014 00:23:20 PST) Calculator version: 2.0.3

final comments

1. An “ambition index” is not impossible. Very active discussions among some Parties, and within civil society.
2. An online tool is not impossible. The key tradeoff is between comprehensiveness and comprehensibility.
3. That said, such an index and tool necessarily involves normative and value-laden judgments. So, this is not a way to the bypass the normative discussion, but to structure it, make assumptions more transparent, and demonstrate the implications.

some questions

1. Through what process is such an index developed? Who convenes it? Who participates?
2. Is an ambition index applied to suppliers only, or also applied to buyers?
3. Is a widely shared common framework on ambition possible? If not, what are the alternatives?

Thank you

Online tool:

www.gdrights.org/calculator_dev

Please note:

This is a beta (preliminary) version, released for comment. Changes can be expected, and results should not yet be cited.

Please direct inquiries and provide feedback to:

skartha@sei-us.org