

Macao: information on national emissions, population and GDP, and mitigation targets

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TODO

- Table with info on target (main and reclass; emissions from NDC; target quantis + plot).
- GWP: NDC emissions converted from AR2 to AR4 by national conversion factor (2010–2017, PRIMAP-hist v2.1).
- References!

1 Emissions and socio-economic data

With national emissions of 2.1 Mt CO₂eq, Macao contributed 0.004% to global emissions in 2017, while in 2030 its share is estimated to increase to 0.006% (Table ??). The estimates for 2030 are based on the downscaled SSP2 Middle of the Road marker scenario (dmSSP2), in which Macao is estimated to emit 3.4 Mt CO₂eq in 2030. That change in emissions would constitute a substantial increase of 62.0% compared to 2017. The pathways dmSSP1–5 show a range of 3.4–3.4 Mt CO₂eq in 2030, and 4.9–4.9 Mt CO₂eq in 2050. The country’s global rank in terms of total emissions per unit of GDP was 198 in 2017, and 123 regarding the per-capita emissions (198 and 106 in 2030). In terms of accumulated historical emissions, Macao contributed to the global 1850–2017 emissions by 0.002%. When only accounting for the years 1990–2017, its contribution increases to 0.004%. All of the emissions are presented following GWP AR4, and exclude emissions from LULUCF (exclLU), and bunkers fuels emissions (exclBunkers).

Table 1: National emissions (dmSSP2), GDP and population for Macao, together with the emissions per unit of GDP and per capita emissions (all for 2017 and 2030). Additionally, the global share and its rank are displayed.

	Year	Total	Unit	Glob. share	Rank
Emissions	2017	2.1	Mt CO ₂ eq	0.004%	169
	2030	3.4	Mt CO ₂ eq	0.006%	164
GDP	2017	59.3	Billion 2011 GK\$	0.05%	101
	2030	83.3	Billion 2011 GK\$	0.04%	110
Emissions per GDP	2017	35.5	t CO ₂ eq / Million 2011 GK\$	0.03%	198
	2030	41.0	t CO ₂ eq / Million 2011 GK\$	0.05%	198
Population	2017	622.6	Thousand Pers	0.008%	165
	2030	700.1	Thousand Pers	0.008%	165
Emissions per capita	2017	3.4	t CO ₂ eq / Pers	0.2%	123
	2030	4.9	t CO ₂ eq / Pers	0.3%	106

For Macao, in 2017 the main emissions share on sectoral level (Fig. ??) came from the Energy sector (91.9%), followed by Waste (7.1%) The Kyoto GHG with the highest emissions in 2017 was CO₂, constituting as much as 75.1% of the national emissions. Second largest contributor was CH₄ (23.8%) The total of F-gasesonly represented 0.0%. The total CO₂ emissions are expected to be 79.1% of the national Kyoto GHG emissions in 2030 (dmSSP2).

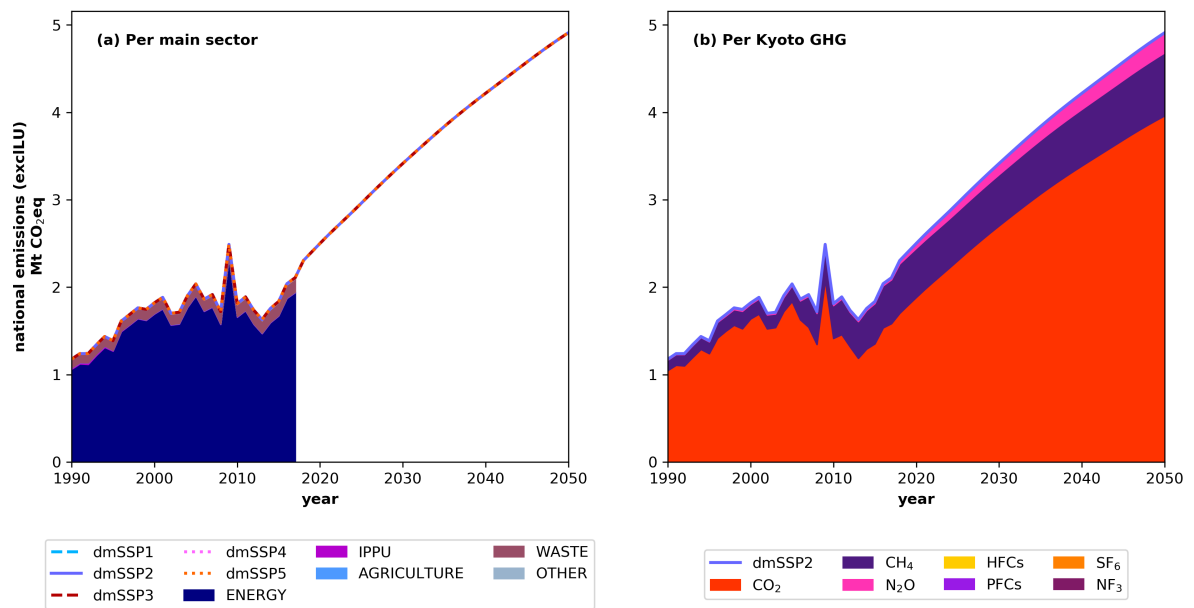


Figure 1: 'Stacked' timeseries of national emissions (exclLU) per main-sector (a) and Kyoto GHG (b). No information available on the sectoral contributions after 2017.

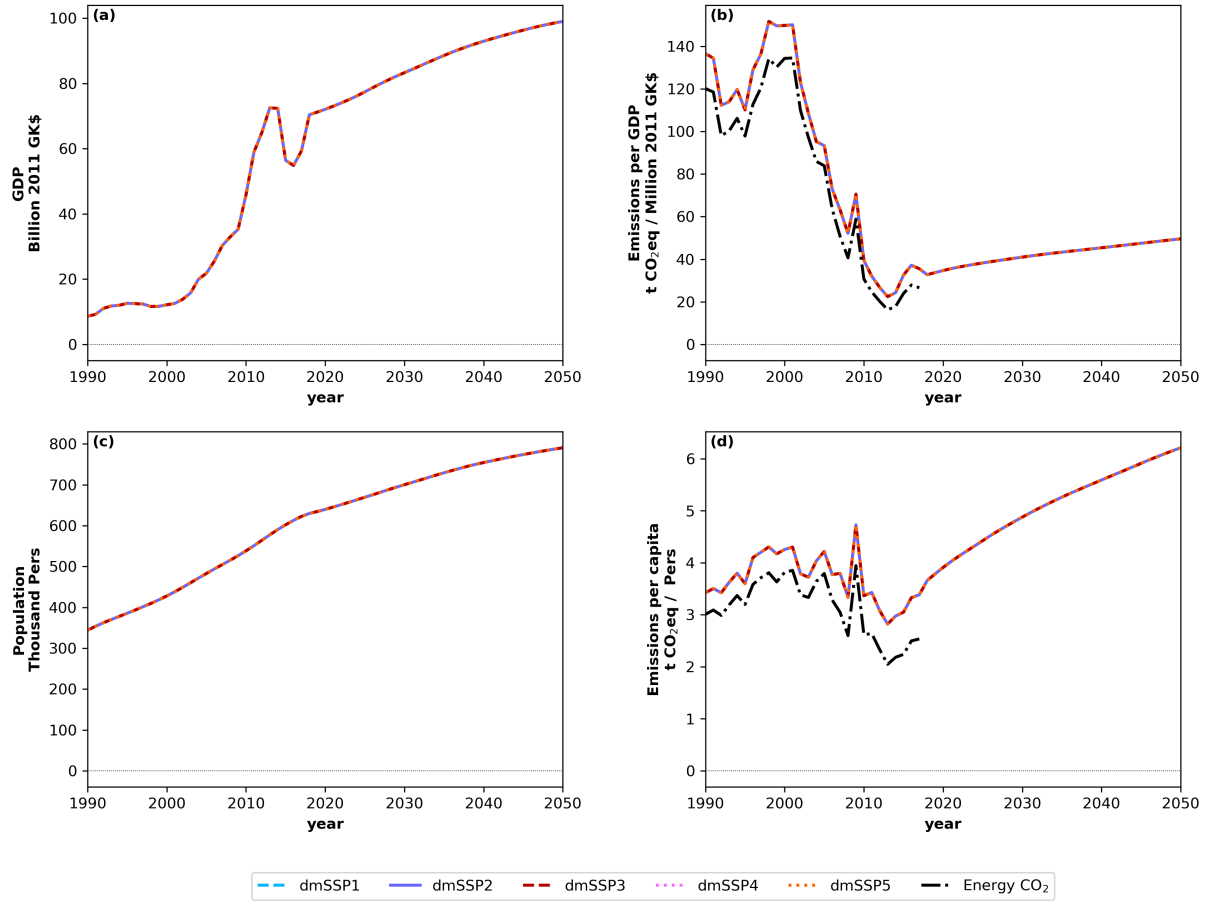


Figure 2: Timeseries of national GDP (a) and population (c), and Kyoto GHG emissions (exclLU, exclBunkers) per unit of GDP (b) or per capita (d).

The national GDP increased in recent years, and the emissions per unit of GDP had a similar trend (Fig. ??). The population increased, while the per capita emissions were on the rise. Following dmSSP2, the GDP is projected to increase towards 2050. The emissions per GDP are estimated to rise towards 2050. Macao's population is assumed to grow towards 2050, and the per capita emissions are expected to increase towards 2050. No LULUCF data are available for Macao from the following sources: CRF (2019), CRF (2018), BUR (3rd), BUR (2nd), BUR (1st), UNFCCC (2019), FAO (2019).

2 Mitigation targets (NDC)

Give the %cov for the base and target year (and 2017).

Global share for 2030 for the mitigated pathways and % reduction relative to 1990 and 2017.

Table with the 'input' data and the resulting targets (like `ndcs_targets.csv`).

Macao does not have an (I)NDC. Therefore the assumed 'mitigated' emissions pathways used for global aggregates equal the baseline emissions (dmSSP1-5).

3 Data sources, additional information and references

PRIMAP-hist v2.1: emissions from PRIMAP-hist are data from the country reported data priority scenario (HISTCR).

dmSSPs: emissions, population and GDP data are PMSSPBIE data for the five marker scenarios.

SSPs Shared Socio-economic Pathways.

Narratives and challenges to mitigation and adaptation:

SSP1: Sustainability, Taking the Green Road (low / low);

SSP2: Middle of the Road (medium / medium);

SSP3: Regional Rivalry, A Rocky Road (high / high);

SSP4: Inequality, A Road Divided (low / high); and

SSP5: Fossil-fuelled Development, Taking the Highway (high / low).

GDP Gross Domestic Product.

Throughout this document the GDP is given as GDP PPP, with PPP being the Purchasing Power Parity.

GWP Global Warming Potential.

We use GWP values from the IPCC 4th Assessment Report (AR4). They reflect the forcing potential of one kilogram of a gas' emissions in comparison to one kilogram of CO₂ (GWP_{CO2} = 1). The GWPs correspond to a 100-yr period and are for CH₄: 25, for N₂O: 298, for SF₆: 22800, and for NF₃: 17200. For the basket of HFC-gases the GWPs from AR4 are in the range 4–14800, and for PFCs 7190–12200. To assess emissions of several GHGs, their emissions are weighted by their respective GWPs and presented in CO₂ equivalents (CO₂eq).

LULUCF Land Use, Land-Use Change and Forestry.

Emissions from LULUCF are excluded throughout the document, unless stated otherwise.

Bunkers fuels Emissions from international aviation and shipping.

Kyoto GHG Kyoto GHG (Greenhouse Gas) basket.

Carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF₆), and nitrogen trifluoride (NF₃).

F-gases Fluorinated gases.

Basket of HFCs, PFCs, and the gases SF₆ and NF₃. Some F-gases have very long atmospheric lifetimes and high Global Warming Potentials.

Target reclassification When a country has, e.g., an RBU target (relative reduction compared to Business-As-Usual), and the BAU emissions are provided, it can be quantified based on the given emissions, and is reclassified from type_main RBU to type_reclass ABS (absolute emissions target). Additionally, 'NGT' targets can be reclassified as 'ABU' (absolute reduction compared to Business-As-Usual) if absolute mitigation effects due to planned policies and measures are provided.

Quantification options Different quantification options were tested.

dmSSP1–5: down-scaled SSP marker scenarios;

type_reclass: external data prioritised (PRIMAP-hist, dmSSPs);

type_main: emissions data from within NDCs were prioritised;

100% coverage & estimated coverage;

constant emi: constant emissions after last target year (instead of constant relative difference to baseline);
baseline uncondi: baseline emissions as uncond. pathways for Parties without uncond. targets, even if baseline is better than cond. targets (instead of cond. pathway as uncond. pathways in these cases).

Links to additional information:

- [CLIMATEWATCH](#)
- [CarbonBrief: Clear on Climate](#)
- [China's carbon neutral pledge could curb global warming by 0.3°C - researchers](#) (23 September 2020)
- [Climate Action Tracker](#)
- [Coronavirus: Climate action cannot be another Covid victim - PM](#) (23 September 2020)
- [Countries' Climate Plans \(NDCs\) Are Missing a Big Opportunity: Reducing Food Loss and Waste](#) (3 July 2019)
- [Country resolved combined emission and socio-economic pathways based on the RCP and SSP scenarios](#) (February 2020)
- [Few countries living up to Covid 'green recovery' pledges - analysis](#) (23 September 2020)
- [Guest post: Calculating the true climate impact of aviation emissions](#) (September 2020)
- [IGES NDC Database](#)
- [IPCC \(The Intergovernmental Panel on Climate Change\)](#)
- [IPCC Special Report: Global Warming of 1.5°](#) (2018)
- [ISIMIP / ISIpedia](#)
- [Melting Antarctic ice will raise sea level by 2.5 metres - even if Paris climate goals are met, study finds](#) (23 September 2020)
- [NDC Explorer](#)
- [NDC PARTNERSHIP](#)
- [PBL Climate Pledge NDC tool](#)
- [SSP Database \(Shared Socioeconomic Pathways\) - Version 2.0](#) (December 2018)
- [The PRIMAP-hist national historical emissions time series \(1850-2017\)](#) (2019)
- [UNFCCC \(United Nations Framework Convention on Climate Change\)](#)
- [WORLD RESOURCES INSTITUTE](#)
- [Why the 2020 Atlantic hurricane season has spun out of control: Extra-warm ocean waters, boosted by climate change, and La Niña are key drivers in historic season.](#) (September 2020)
- [World's richest 1% cause double CO₂ emissions of poorest 50%, says Oxfam](#)
- [#showyourbudgets](#)