NEW ZEALAND COLLEGE
OF PUBLIC HEALTH MEDICINE

Supplement One
NZCPHM Climate Change Policy Statement
Background to the NZCPHM's Stance on Setting National GHG Emissions Targets

EXECUTIVE SUMMARY

This supplement to the New Zealand College of Public Health Medicine (NZCPHM)'s policy statement on Climate Change describes the approaches and values behind the NZCPHM's stance that New Zealand needs to rapidly reduce its greenhouse gas (GHG) emissions, substantially more than its targets in international commitments to date.

There are a number of different approaches to countries setting targets for GHG emissions reductions[1], in order to keep within global emissions budgets[2,3,4,5,6]. This is where least developed and developing nations are disproportionately affected by climate change[7], which they have not caused and have least capacity to adapt.

Established economies, like New Zealand, historically have had high greenhouse gas emissions and have benefited from activities that cause high emissions. Consequently, they are in a position, and have a responsibility, to mitigate past actions and contribute rapidly and proportionately more reductions than nations with historically lower emissions.

Within overall limits for established economies, approaches that consider per capita emissions (which can include historical cumulative emissions) and affordability calculate markedly higher targets than what New Zealand has committed to.

The Greenhouse Development Rights (GDR) framework (GDRf)[8] would expect New Zealand to reduce its emissions by 41% by 2020 on 1990 levels.

New Zealand's 5% target for 2020[9] and its 50% target for 2050[10] are much lower than needed under the GDR and similar frameworks.

Targets calculated using the GDR framework are based on fair and equitable approaches to the allocation of emissions reduction amongst countries. Therefore, New Zealand's targets for 2020 and 2050 need to be higher in order to fairly and equitably contribute to limiting global warming to 2°C by 2050.

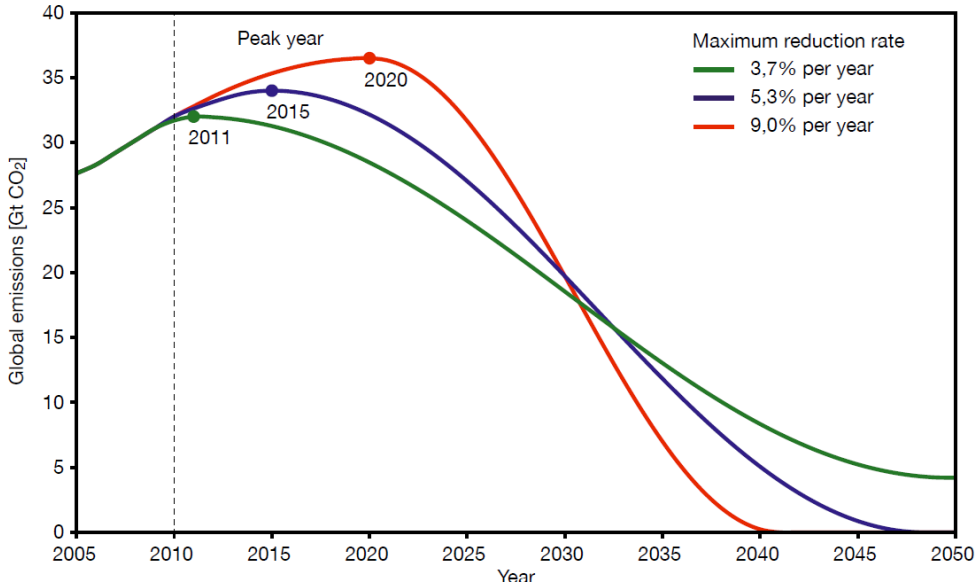
GLOBAL EMISSIONS BUDGETS

Limiting global warming to 2°C (endnote ‡)[11,12] can only realistically occur if a limit is set on the total amount of CO_2 emitted globally between now and 2050 (the CO_2 global budget)[2,3,4]. In a 2050 world of perhaps nine billion people, meeting necessary emission reduction targets means per capita emissions will need to be about two tonnes of CO_2 per annum or less[13].

The 'carbon budget' concept helps quantify the scale of emissions reductions needed. Global emissions budgets are totals set according to the global amount of greenhouse gases that may be emitted between now and 2050 to keep within the 2°C limit (guard rail), distributed among the world's population per capita[2,3,8,14]. For example, the German Advisory Council on Climate Change (WBGU) in 2009 calculated a budget of 110 tonnes remaining per person between 2010 and 2050 (based on 660-750 billion tonnes CO_2 globally to have a 2/3rds to 3/4rs chance of keeping within 2°C warming)[3,4].

The WBGU analysis[3] (shown in Figure 1, below) depicts how the reversal of the emissions trend must start as soon as possible where, in view of the very limited CO_2 budget, delays will result in almost unachievable reduction requirements:

Figure 1. Necessary emissions pathways – WBGU calculations (2009)[3]: Global emission pathways for the period 2010-2050 with global CO_2 emissions capped at 750 Gt during this period



Key:
Capping global CO_2 emissions at 750 billion tonnes (gigatonnes, Gt) during 2010-2050 would confer a 67% probability of achieving compliance with the 2°C limit (guard rail). The figure shows variants of a global emissions trend with different peak years: 2011 (green), 2015 (blue) and 2020 (red). In order to achieve compliance with these curves, annual reduction rates of 3.7% (green), 5.3% (blue) or 9.0% (red) would be required in the early 2030s (relative to 2008).
Green line (bottom – refers to '2011' peak year): with a reversal of the trend (and the emissions peak being crossed) by 2010, global emissions would need to fall to 50-80 % below the 1990 baseline by 2050, with further reductions towards zero emissions being achieved thereafter.
Blue line (middle– refers to '2015' peak year): postponing the peak year to 2015 would trigger annual global emissions reduction requirements of up to 5% (relative to 2008) – the world needing to meet annual emissions reduction targets equivalent to those established by the Kyoto Protocol for a full two decades.[1]
Red line (top – refers to '2020' peak year): delaying the peak year to 2020 could necessitate global emissions reduction rates of up to 9% per year – with technological and social changes "on a scale comparable to those of the Allied mobilisation during the World War 2"[3] (see Figure 1).
source: *Figure 3.2-1 of WBGU 2009[3] (http://www.wbgu.de/en/special-reports/sr-2009-budget-approach/) pp 15-16. Reproduced in the NZ Medical Journal[29] with permission of the German Advisory Council on Climate Change (WBGU).*

Other estimates suggest ranges of emissions targets and trajectories[15,16,17,18], including a 75% chance of remaining within the 2°C limit requiring global emissions to peak by 2015 then reduce at a rate of 5% per annum[18].

Similarly and most recently, the Intergovernmental Panel on Climate Change (IPCC)'s Fifth Assessment report[5,6] says that to give a >66% chance of staying below 2°C, the maximum amount of CO_2 the world can cumulatively emit over the industrial period is about 3.67 trillion tonnes (tCO_2)[i]. Factoring the warming effects of non-CO_2 greenhouse gases reduces this all-time CO_2 budget to about 2.90 trillion tonnes[5]. By 2011 the world had already used 2/3rds of that budget, using 1.89 [1.63-2.15][i] trillion tonnes – with a residual 1.0 trillion tonne remaining CO_2 budget[5]. At the current annual rate of CO_2 emissions, this remaining budget will likely be exhausted by mid-century.

ANNUAL AND CUMULATIVE PER CAPITA EMISSIONS AND THE NEED FOR ALLOCATION MODELS

Per capita emissions at present vary widely from country to country. For example, people in the USA emit over 20 tonnes CO_2-equivalents each, in the European Union about 10 tonnes, in China about 8 tonnes, and in India under 2 tonnes[19].

Established economies like New Zealand (industrialised nations[ii], see endnotes †, §[iii]) have six times the income and triple the GHG emissions per capita of less-established economies[19]. Established economies have been responsible for much of emissions already[13], having 1/8th of the world's population but causing 3/5ths of the world's cumulative CO_2 emissions since 1850[13,19,20] (see following Table 1 and later additional graphs and Table 5).

Table 1. Established vs. less-established economies' current and historic emissions[19,21]

countries	population 2010 (x10^6)	GDP-PPP 2010 ($b)	per capita GDP-PPP 2010	GHGe 2010 (Mt CO_2-e)	cuml CO_2 1850-2008 (Mt CO_2)	per capita GHGe 2010 (tonnes CO_2-e)	per capita cuml CO_2 1850-2008 (tonnes CO_2)
Annex II	911.5	$31,798.4	$34,887	13,693.1	696,092.9	15.0	773.0
nonAnnex II	5,963.3	$35,445.3	$5,944	30,274.1	507,996.5	5.1	87.4
no country-specific data*	41.4			575.4	4,913.0		
world*	6,916.2	$67,243.7	$9,723	44,542.7	1,209,002.4	6.4	179.0
% Annex II/world	13%	47%		31%	58%		
rate ratio Annex II/nonAnnex II			**5.9**			**3.0**	**8.8**

Key:
* data unavailable for some small countries; total world population in 2010 was 6.92 billion, hence data available for 99.4% of total world population
Endnote § provides definitions of UNFCCC country groupings;
UNFCCC Annex II countries comprise Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, United States of America. Excluding Turkey, per capita GDP-PPP in 2010 for these countries ranged between $21,762 and $68,553. By contrast, Turkey's per capita GDP-PPP in 2010 was $12,671;
for the purposes of this analysis, "Annex II countries" therefore excludes Turkey.

[i] CO_2 emissions reported in tonnes CO_2 (tCO_2). CO_2 emissions are measured in units of either carbon (eg tonnes carbon, tC) or CO_2 (eg tonnes CO_2, tCO_2). 1 tonne CO_2 corresponds to 0.273 tonnes carbon (where 1 tC = 3.667 tCO_2, the molar mass of carbon (1 atom) is 12.01 g/mol, CO_2 (1+2 atoms) 44.01 g/mol). The IPCC AR5 WG1[5,6] reported in carbon units as the primary metric, with CO_2 units secondary.
Corresponding IPCC AR5 WG1[5] carbon budget results expressed in carbon (tC) were ~1.0 trillion tC for the all-time CO_2 budget, ~790 billion tC for the CO_2 budget with non-CO_2 warming, and 515 [445 to 585] billion tC for the CO_2 budget used already by 2011. The remaining CO_2 budget was therefore the 275 billion tCO_2 (1.0 trillion tCO_2) residual (790b −515b = 275b tCO_2).
[Numeric ranges] for the CO_2 budget used already by 2011 (cumulative CO_2 emissions 1850-2011) are 90% uncertainty intervals.

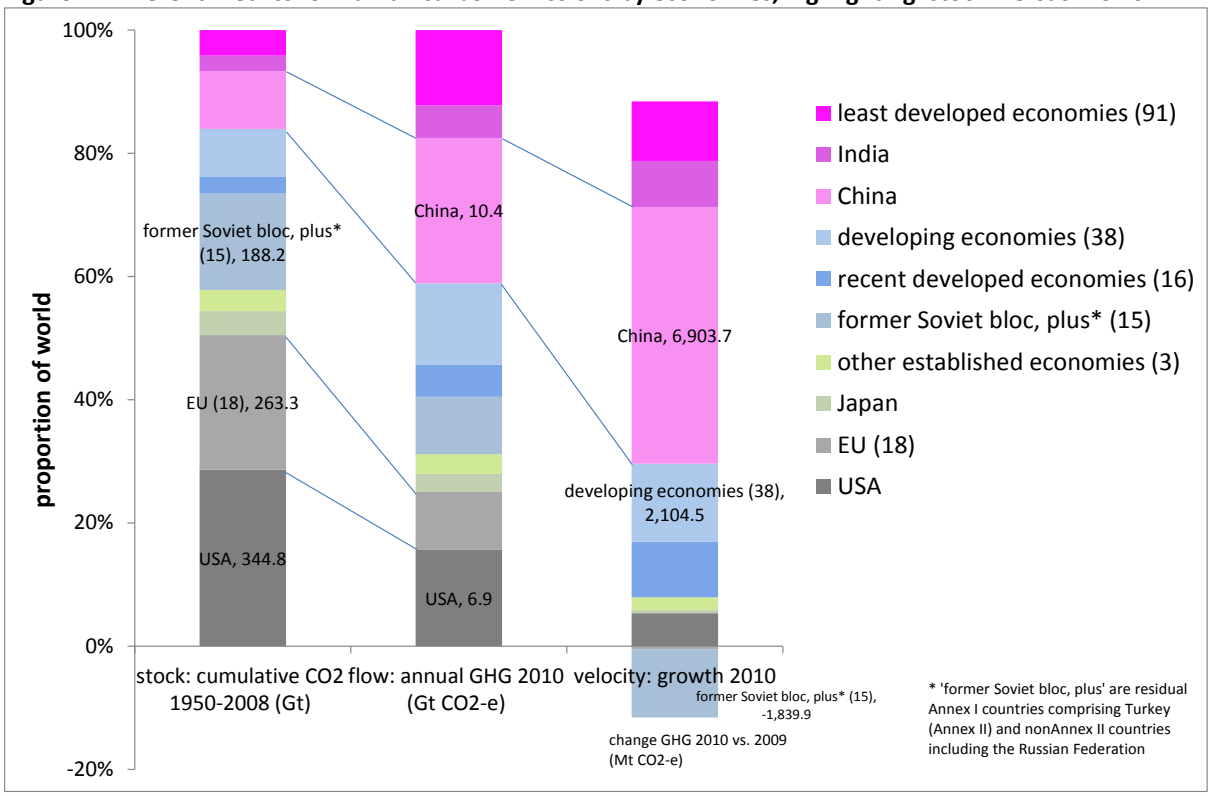
[ii] In this supplement, 'established economies', 'industrialised nations' = developed countries, 'less-established economies' = developing countries. According to the United Nations Statistics Division, there is no established convention for designating "developed" and "developing" countries/areas in the UN system, and any designations are for statistical convenience alone, not describing countries' stages in the development process. In common practice, Japan (Asia), Canada and the United States (northern America), Australia and New Zealand (Oceania), and Europe are considered "developed" regions/areas (http://unstats.un.org/unsd/methods/m49/m49regin.htm).
In turn, in the New Zealand context, this supplement uses the term 'established economies' not 'industrialised nations'. This reflects over half of New Zealand's GHG emissions being non-CO_2 agrarian emissions, rather than long-standing CO_2-emitting industries.

[iii] UNFCCC Annex II countries excluding Turkey: United States of America, European Union, Japan, Australia, Canada, New Zealand (see http://unfccc.int/parties_and_observers/items/2704.php, http://unfccc.int/parties_and_observers/parties/annex_i/items/2774.php).

Converting the required target for global average per capita annual emissions into binding emissions entitlements per person across each country is complex. It potentially involves issues of historical responsibility as well as the time required to eliminate the current differences between countries[13].

Figure 2 below further illustrates differences in emissions across countries according to various metrics, potentially affecting how future emissions might be allocated. There are three metrics: historical emissions (cumulative since the onset of the industrial age); current gross emissions[iv]; and current speed of change, i.e. emissions' growth (velocity). In the figure, New Zealand is included in 'other established economies', and developing countries are segregated into categories by per capita gross domestic product (GDP) thresholds ('developing economies', 'least-developed economies', etc.), catalogued in endnote †.

Figure 2. Different metrics for human carbon emissions by economies, highlighting 'stock' versus 'flows'[19,21]



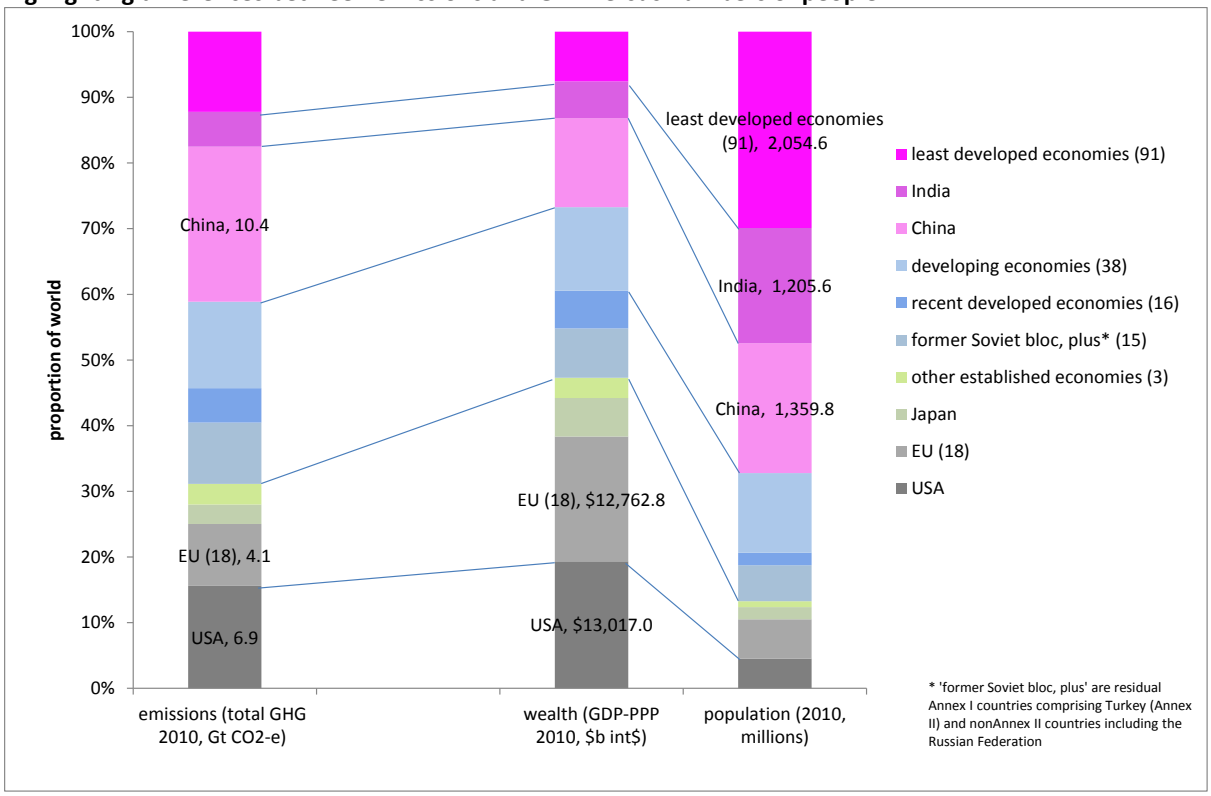
Key:
country groupings and criteria are catalogued in endnote †
Column 1 'stock' is the cumulative gross emissions from 1850 to 2008. It is these stocks of CO_2 in the atmosphere that are largely driving observed climate change.
Column 2 'flux' is the flow rate of gross human greenhouse gas emissions into the atmosphere in 2010.
Column 3 'growth' is the annual rate in 2010 by which the flows of greenhouse gases into the atmosphere were growing.
GHG and CO_2 emissions measured in gigatonne (Gt) CO2-equivalents (billions tonnes, = Mt x 1000)
source: *update of Richardson et al. 2009*[13] *(http://climatecongress.ku.dk/pdf/synthesisreport/) p24 fig 11;*
updated data from World Resource Institute (WRI) CAIT 2.0 beta for 1990-2010[19]*, CAIT v.9.0 CO_2 data for 1850-2008*[21]

Figure 2 shows how patterns across countries – and therefore each country's contribution to global totals, and consequent potential responsibilities to mitigate – vary widely across the three metrics.

[iv] Gross emissions do not include carbon sinks of land use, land-use change, and forestry (LULUCF), which is included in net emission calculations.

For further context, the following graph (Figure 3) depicts grouped countries' current gross GHG emissions, overall GDP (as an arguable, if contentious/poorly-valid[v], proxy for economic wealth) and numeric populations. Patterns again vary widely - for example, the 91 countries with 'least developed economies' accounting for 12% of global GHG emissions in 2010, only 8% of world GDP but 30% of the world's population; conversely the USA accounted for 16% of global emissions, 19% of GDP but only 5% of population.

Figure 3. International distributions of current GHG emissions, wealth and population by economies – highlighting differences between emissions and GDP versus numbers of people[19,21]



Note the above comparisons are for current emissions and patterns are even more pronounced with historical emissions. For example 'least developed economies' accounted for just 4% of cumulative GHG emissions from 1950-2010, while the USA accounted for 29%.

In Figure 3, 'other established economies' (New Zealand included) account for 3.2% and 3.1% of global GHG emissions in 2010 and world GDP respectively, but just 0.9% of world population. Such variations again affect potential responsibilities to mitigate climate change. Table 2 (next page) provides source data.

[v] See: http://www.stiglitz-sen-fitoussi.fr/en/index.htm, http://mises.org/daily/770, http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf, http://en.wikipedia.org/wiki/Genuine_progress_indicator, http://www.thebrokeronline.eu/Articles/The-virtues-of-ignoring-GDP, http://www.nytimes.com/2010/05/16/magazine/16GDP-t.html

Table 2. Broad economies' current and historic emissions[19,21]

groups of economies	population 2010 (x10^6)	% of world	GDP-PPP 2010 ($b)	% of world	per capita GDP-PPP 2010	cf world	GHGe 2010 (Mt CO_2-e)	% of world	cuml CO_2 1850-2008 (Mt CO_2)	% of world	per capita GHGe 2010 (tonnes CO_2-e)	cf world	per capita cuml CO_2 1850-2008 (tonnes CO_2)	cf world
USA	312.2	4.5%	$13,017.0	19.4%	$41,688	4.3	6,866.9	15.4%	344,769.2	28.5%	22.0	3.4	1,124.3	6.3
EU (18 countries)	411.0	5.9%	$12,762.8	19.0%	$31,054	3.2	4,136.2	9.3%	263,273.7	21.8%	10.1	1.6	646.4	3.6
Japan	127.4	1.8%	$3,946.6	5.9%	$30,989	3.2	1,298.9	2.9%	46,865.8	3.9%	10.2	1.6	368.1	2.1
other established economies (3)	60.9	0.9%	$2,072.1	3.1%	$34,025	3.5	1,391.1	3.1%	41,184.2	3.4%	22.8	3.5	694.6	3.9
former Soviet bloc, plus* (15)	377.6	5.5%	$5,055.7	7.5%	$13,389	1.4	4,101.4	9.2%	188,199.7	15.6%	10.9	1.7	499.8	2.8
recent developed economies (16)	131.9	1.9%	$3,861.9	5.7%	$29,280	3.0	2,306.5	5.2%	33,634.6	2.8%	17.5	2.7	264.9	1.5
developing economies (38)	833.8	12.1%	$8,554.4	12.7%	$10,260	1.06	5,784.5	13.0%	92,717.8	7.7%	6.9	1.08	113.6	0.63
China	1,359.8	19.7%	$9,122.2	13.6%	$6,708	0.69	10,385.5	23.3%	113,144.4	9.4%	7.6	1.19	84.3	0.47
India	1,205.6	17.4%	$3,763.5	5.6%	$3,122	0.32	2,326.2	5.2%	30,428.5	2.5%	1.9	0.30	25.9	0.14
least developed economies (91)	2,054.6	29.7%	$5,087.4	7.6%	$2,476	0.25	5,370.0	12.1%	49,871.5	4.1%	2.6	0.41	25.2	0.14
no country-specific data*	41.4	0.6%		0.0%			575.4	1.3%	4,913.0	0.4%				
world*	6,916.2	100%	$67,243.7	100%	$9,723	1.00	44,542.7	100%	1,209,002.4	100%	6.4	1.00	179.0	1.00

Key:

'**cf world**' columns compare group economies' values with world total, as rate ratio of [group economy] ÷ [world]

* '**former Soviet bloc, plus**' row comprises 15 countries, which include Turkey (UNFCCC Annex II) and nonAnnex II countries including the Russian Federation

* '**no country-specific data**', '**world**' rows do not have data available for some small countries; total world population in 2010 was 6.92 billion, hence data available for 99.4% of total world population

ALLOCATION APPROACHES FOR PER CAPITA EMISSIONS

Within such overall limits, there are a number of ways to allocate countries' individual emissions targets. Such approaches have been catalogued internationally[1,3,22,23,24,25,26], often based on defined global emissions budgets (the global amount of tolerable emissions over a period of time)[3] after which the available emission rights can be divided among countries according to different rules (see endnote ‡ in this supplement)[3,8,14].

Approaches to defining such 'comparable efforts' include[1]:

Equal future burden

- Equal percentage reduction of emissions below base year
- Equal percentage reduction below a reference scenario
- Proportional to simple criteria for differentiating reductions
- Equal marginal abatement costs
- Equal total abatement costs per unit of GHG reduced
- Equal total abatement costs per GDP
- Equal total abatement costs per capita
- Equal macroeconomic burden

Equal endpoint

- Equal per capita emissions at a future endpoint
- Achieving equal efficiency levels per sector
- Triptych approach (a method that shares emission allowances among a group of countries, based on sectoral considerations)

These allocative approaches are described in detail in den Elzen et al. 2008[1], available at http://www.pbl.nl/en/publications/2009/Exploring-comparable-post-2012-reduction-efforts-for-Annex-I-countries.

ALLOCATION APPROACHES THAT INCLUDE RESPONSIBILITY AND CAPABILITY

The 2007 IPCC assessment suggested emissions reductions for developed countries (i.e. established economies) of at least 25-40% of 1990 levels by 2020, leading to 80-95% reduction by 2050, would be required to stay below the 2°C 'guardrail' limit[11]. About 100 countries, with a total population of nearly one billion people but who produce less than 3% of the global emissions, will suffer the effects of climate change impacts in the near term[23]. Established economies have greater economic capability to make the adjustments that are needed to reduce emissions[23].

The NZCPHM's core values include equity[27] and this supports parallel approaches that account for fairness in the face of fixed limits[11,3,28]. Decision makers and governments select targets from an array of philosophies and decision criteria, according to what they consider important to meeting their core objectives. Professional bodies such as the NZCPHM are similarly value-driven and support targets in line with their values, while recognising the presence of other approaches and options.

Established economies, like New Zealand, have historically had high GHG emissions and have benefited from activities that cause high emissions[ii,vi]. Consequently, they are in a position, and have

[vi] see positive correlations between cumulative emissions and current GDP in 'Additional graphs and table' figures 11 and 12 'Relationships between historical CO_2 emissions and current GDP'

a responsibility, to mitigate past actions and contribute rapidly and proportionately more reductions than nations with historically lower emissions.

Measures of responsibility and capability globally include the Greenhouse Development Rights (GDR) framework[8]. Part of the GDR framework (GDRf) is the Responsibility and Capability index (RCI) approach[8,23]. The RCI is one of many approaches that incorporates both science-based overall caps and attempts at 'fairness' within those caps – using how much countries have emitted already, and what they can afford – and has been highlighted in the New Zealand context[29].

- The RCI combines (1) the gross emission reductions needed globally to limit warming to 2°C with, (2) assumed countries' responsibilities (i.e. their cumulative gross emissions) and, (3) their assumed capability to mitigate (using wealth as a proxy for the capability for action) (see endnotes §, ** and ††).

- The GDR framework[8] has previously allocated more than three quarters of the total required global effort to developed countries (established economies) in 2010. Assuming a 2°C pathway, this has meant significantly stronger obligations[23] for established economies than the above IPCC 25-40% range for relatively wealthy-country reductions by 2020[11].

- New Zealand's RCI had been 0.34% of UNFCCC Annex I (§) countries' overall target. This has equated to a **40.6% reduction by 2020 on 1990 levels** (with 40.0% for Annex I countries overall).

The following table (Table 3) explains New Zealand's and other countries' 2020 targets under the GDRf.

Table 3. Mitigation targets (2009)[23]: fair shares of overall Annex I†§ mitigation target (40% below 1990 levels by 2020)[29]

	1	2		3		4		5	
	RCI (fair share of Annex I target)	Emissions per capita (2005)		2020 mitigation targets, expressed as: Reduction per capita, relative to 2005 levels		Reduction below 1990 level (CO_2e excl. LUC)		Reduction below 2005 level (CO_2e excl. LUC)	
	%	tCO2e	Rank	tCO2e	Rank	%	Rank	%	Rank
Australia	2.29	25.9	1	13.4	1	39.7	9	51.6	8
Belarus	0.34	7.7	13	-2.7	15	19.7	16	-35.4	16
Bulgaria	0.31	9.0	10	-3.0	16	19.8	15	-33.6	15
Canada	3.51	23.4	3	12.8	3	43.0	7	54.7	4
Croatia	0.15	6.9	16	2.3	11	35.9	10	33.6	11
EU *	33.93	10.6	9	4.2	10	44.4	6	39.6	10
Iceland	0.03	14.2	6	7.6	6	48.9	4	53.8	5
Japan	9.71	10.6	8	6.3	7	56.2	3	59.0	3
Liechtenstein	0.00	8.6	12	4.4	9	27.1	11	51.4	9
Monaco	0.00	3.1	17	0.7	12	21.2	13	21.2	12
New Zealand	0.34	18.7	4	9.8	4	40.6	8	52.3	7
Norway	0.48	11.7	7	8.6	5	71.4	2	73.7	2
Romania	0.72	7.1	15	-1.9	14	21.4	12	-27.1	14
Russian Federation	8.21	14.9	5	-1.8	13	20.2	14	-12.0	13
Switzerland	0.59	7.2	14	6.0	8	82.3	1	82.6	1
Ukraine	1.67	8.8	11	-8.3	17	13.3	17	-94.3	17
USA	37.80	24.5	2	12.8	2	44.6	5	52.4	6
Total: Annex I	100.00	14.2		5.46		40.0		38.4	

Metrics: *fair share of emissions reductions for selected Annex I countries (endnotes †, §), calculated using both countries' partial history of past emissions (cumulative emissions for 1990–2005[38] for responsibility, see endnote **), and their current levels of income (total income above a 'development threshold' for capability, endnote ††).*

Key:

Column 1 shows fair shares of any aggregate Annex I mitigation target for individual Annex I countries, based on a responsibility-capability index (RCI); New Zealand's RCI had been 0.34% (its fair share of the Annex I target).

Column 2 is per capita gross emissions in greenhouse gases (GHG) in 2005;
New Zealanders emitted on average 18.7 tonnes CO_2-equivalent gross GHGs for each person that year, ranking it fourth highest at that time.

Column 3 is 2020 emissions-reductions targets for individual Annex I countries (based on respective fair shares of the total combined minimum reductions target of 40% below 1990 levels for Annex I as a whole), presented in terms of per capita gross reductions relative to 2005 levels;
New Zealand's target had been a 9.8 tonne CO_2-equivalent reduction for each person by 2020 compared with 2005.

Column 4 is total reductions relative to each country's 1990 emissions;
New Zealand's target had been a 40.6% reduction in CO_2-equivalents for each person by 2020 compared with 1990. This ranked eighth out of the 17 countries listed in terms of percentage emission reductions necessary.

Column 5 is total reductions relative to each country's 2005 emissions;
New Zealand's reduction by 2020 therefore translated to 52% compared with 2005 (ranked seventh).

LUC is Land Use Change.

source: *Table 4 of Oxfam International 2009[23] http://policy-practice.oxfam.org.uk/publications/hang-together-or-separately-how-global-cooperation-is-key-to-a-fair-and-adequat-114525 pp 10-11,28,30-31. Reproduced in the NZ Medical Journal[29] with permission of Oxfam New Zealand.*

The poorest and most exposed countries in particular will need help in adapting to the changing climate[30]. The World Bank has stated that advanced countries, which until recently have produced most of the GHG emissions of the past, must cut their emissions aggressively; and the bank has called for collective action, noting that no one nation can take on the interconnected challenges posed by climate change[30].

NEW ZEALAND'S EMISSIONS TARGETS

Within this context, New Zealand's gross domestic product (GDP) per capita currently ranks 27th-32th in the world[31,32]. New Zealand has the fifth highest per capita GHG emissions amongst established economies and has experienced a 22% increase in gross emissions since 1990[vii,33,34], and per capita has made disproportionately large historic contributions to the atmospheric CO_2 load[35,36].

New Zealand has set a target for reducing GHG emissions to 5% below 1990 levels by 2020[9], with a long term target of a 50% reduction by 2050[10]. This is less than the previous target of 10-20% below 1990 levels[10], where that target had been conditional[viii] (New Zealand being one of few established economies that did not have unconditional targets[37,38]).

The new 5% net emissions[ix] reduction target for 2020[9] in effect is a nil reduction in gross emissions (due to temporary forest offsets)[x,29,10], as are targets that are conditional on future international action to reduce emissions. Thus, in effect New Zealand has no gross[29] emissions'[xi] reduction targets at present.

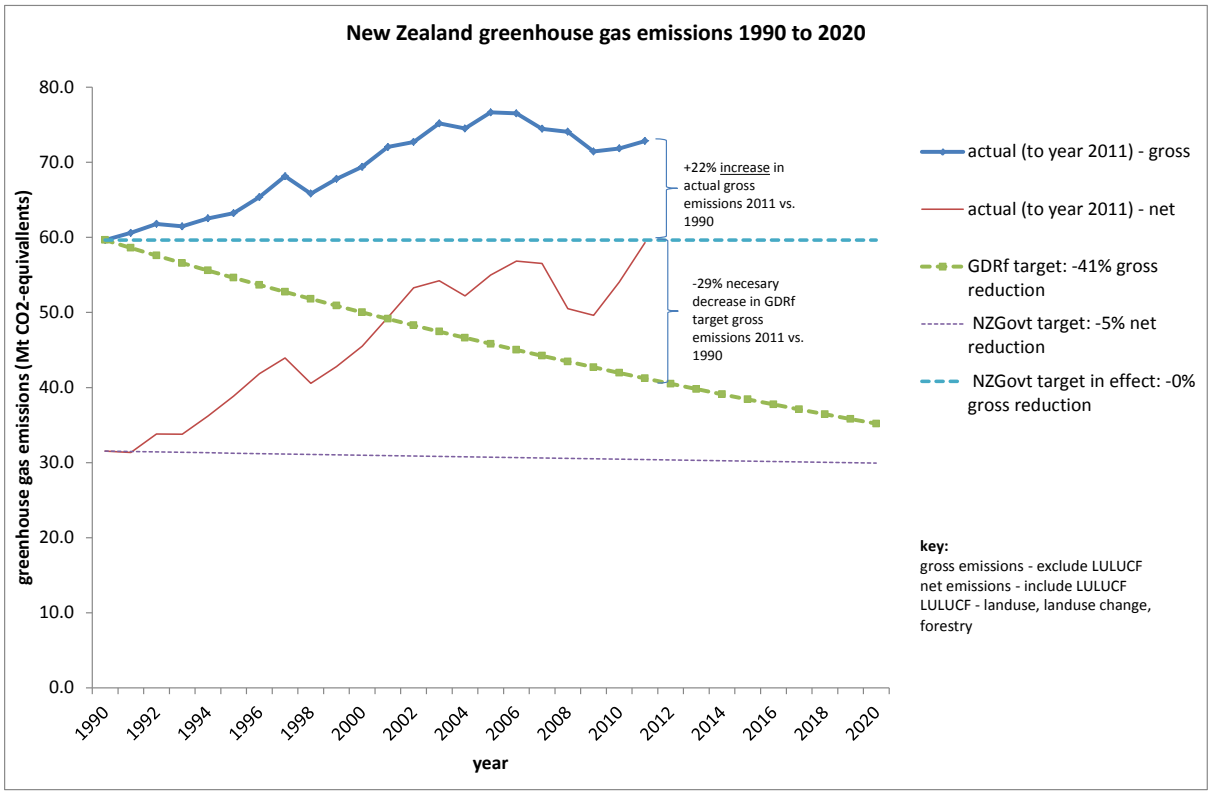
[vii] Of UNFCCC Annex I countries in 2011, in terms of per capita total (gross) GHG emissions, New Zealand emitted 17.0 gross tonnes CO_2-equivalents per person, ranking fifth of the 42 established economies in Annex I. New Zealand emitted in total 72.8 gross Mt CO_2-equivalents in 2011, a +22% change compared with 1990 (56.9 gross Mt CO_2-e).
[viii] Conditional targets/pledges are those that are conditional on other countries, i.e. 'the extent of future international action to reduce emissions'.
[ix] Net emissions include carbon sinks of land use, land-use change, and forestry (LULUCF), which is excluded in gross (total) emission calculations.
[x] Differences between gross and net emissions for New Zealand have been largely due to the effects of forestry tree planting, but these accounting effects will largely disappear with the maturation of plantings later this decade, with a large increase in accounted net emissions reversing the trend in differences.
[xi] Gross emissions do not include carbon sinks of land use, land-use change, and forestry (LULUCF), which is included in net emission calculations.

These features are summarised in Table 4 and Figure 4 below (where Table 4 also includes progress towards the 2020 targets[9,10,35], described in section 2.2.3 'New Zealand's mitigation policies' of the main NZCPHM policy statement on climate change).

Table 4. New Zealand's greenhouse gas emissions by 2020 compared with 1990 levels – comparing targets with actuals

Target areas		NZ responsibilities under GDR framework	NZ's actual targets/commitments
reduction in GHG emissions cf 1990 levels	by 2020	-41% reduction in gross emissions	-5% reduction in net emissions = -0% effective reduction in gross emissions[xii]
	by 2050	-95% reduction	-50% reduction
progress on targets	2011 vs. 1990 GHG emissions	assumption that NZ is on track to meet 2020 targets, meaning a -29% reduction by 2011 on 1990 levels for GDRf (if decline linear).	+22% increase in 2011 on 1990 levels
	measures to reduce emissions[9,10,35]	all necessary steps to achieve targets and trajectories	New Zealand's emissions are rising; New Zealand has withdrawn from a second Kyoto Protocol commitment period; UNFCCC review finding that NZ's measures will not achieve 1/3rd of a 10% emissions reduction target; weakening of NZ's Emissions Trading Scheme since UNFCCC review

Figure 4. New Zealand's gross and net greenhouse gas emissions 1990 to 2020 – actuals and targets[ix,x,xi,xii,8,9,10,23,29]



[xii] due to temporary forest offsets for unconditional targets and a 0% reduction in effect due to other countries efforts for conditional targets. New Zealand's effective -0% reduction unconditional target for gross emissions in 2020 on 1990 levels is due to the temporary effects of forest offsets (waning by 2020) on the -5% unconditional target for net emissions, and then in effect nil reductions from conditional targets (-10% to -20% target with conditions), as these depend on other countries' efforts and are therefore not secure.

By contrast, global cooperation is needed[3,30], and countries most responsible for past emissions and most able to help might arguably take a lead to cut emissions first and fastest[2,3,8,23,26,29].

Any approaches to the allocation of emissions reductions amongst countries, including New Zealand, need to include fairness and equity[27]. This includes where the Treaty of Kyoto[40], which until recently New Zealand was party to[9], acknowledged in effect some historic cumulative responsibility of established economies. Such principles of historic responsibility have some acceptance in the New Zealand setting with the Crown's redress of Treaty of Waitangi injustices through compensation within treaty settlements

In light of the many possible approaches[1], key considerations are:

- Developing countries are disproportionately affected by climate change[7,30] not of their making, and for which they are least prepared[30].

- The Kyoto Protocol's focus on established economies[40] underlines the arguable importance and equity implications of historic emissions – i.e. countries' cumulative emissions over time (beyond countries' recent emissions alone)[20,35,36].

- Using the GDR framework[8], New Zealand's targets are substantially below what might be necessary and equitable to be confident of avoiding 2°C global warming.

The GDR would expect New Zealand to reduce its emissions by 41% by 2020 on 1990 levels. Therefore, New Zealand's 5% target for 2020 and its 50% target for 2050 are lower than needed under the GDR and similar frameworks.

ADDITIONAL GRAPHS AND TABLE[19,21,33]

The following additional graphs (figures 5 to 12) and table (Table 5, after endnotes) show New Zealand's gross GHG emissions relative to comparable countries and international patterns overall (current and historical), including relationships between emissions and GDP.

Figure 5

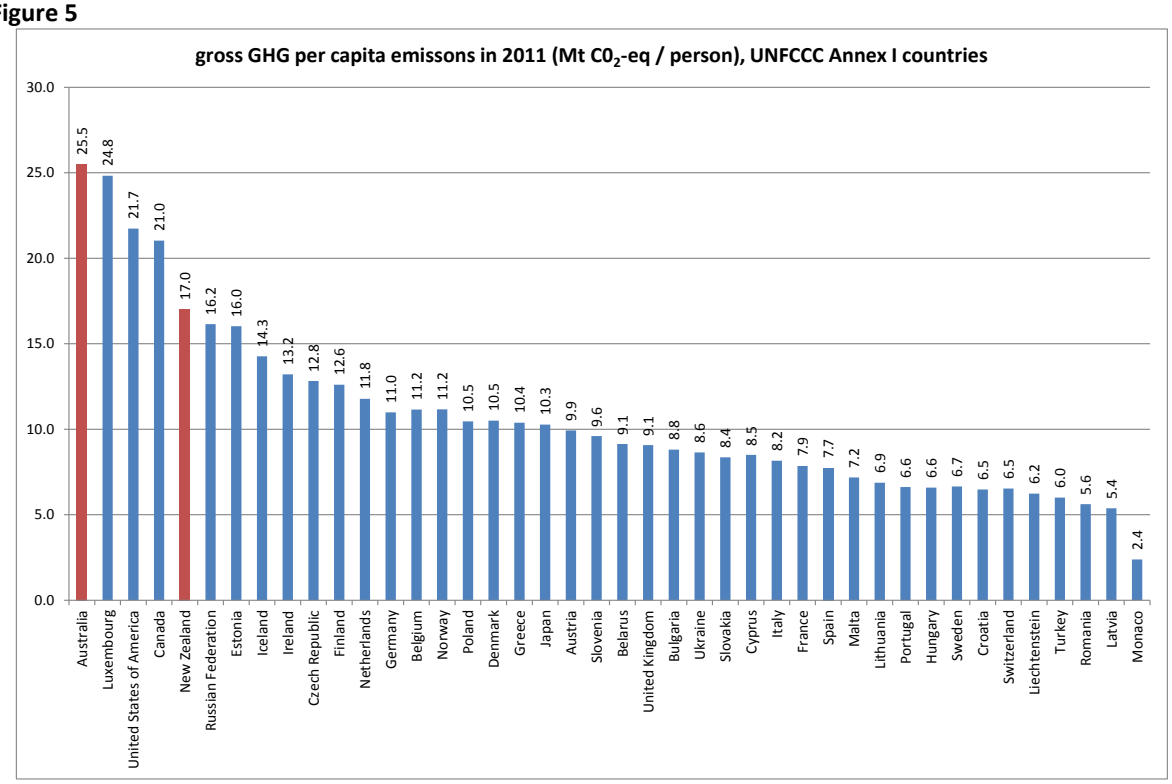


Figure 6

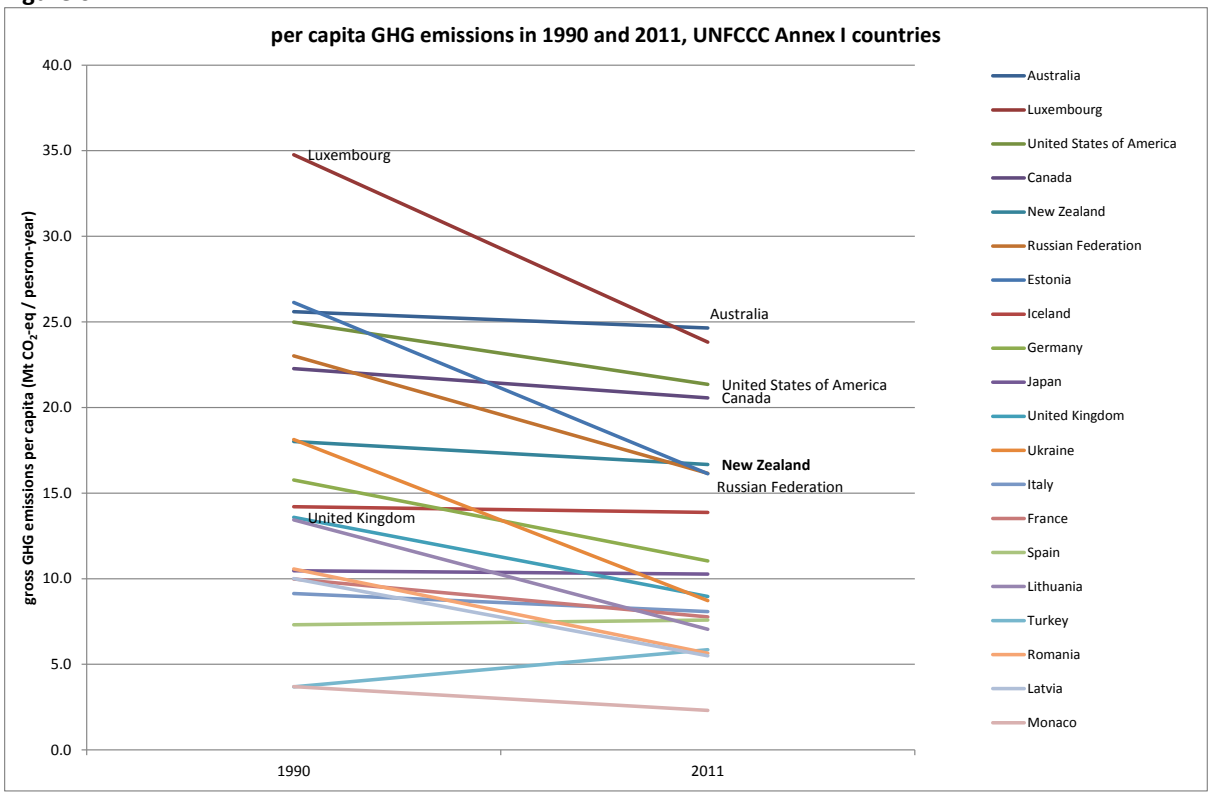
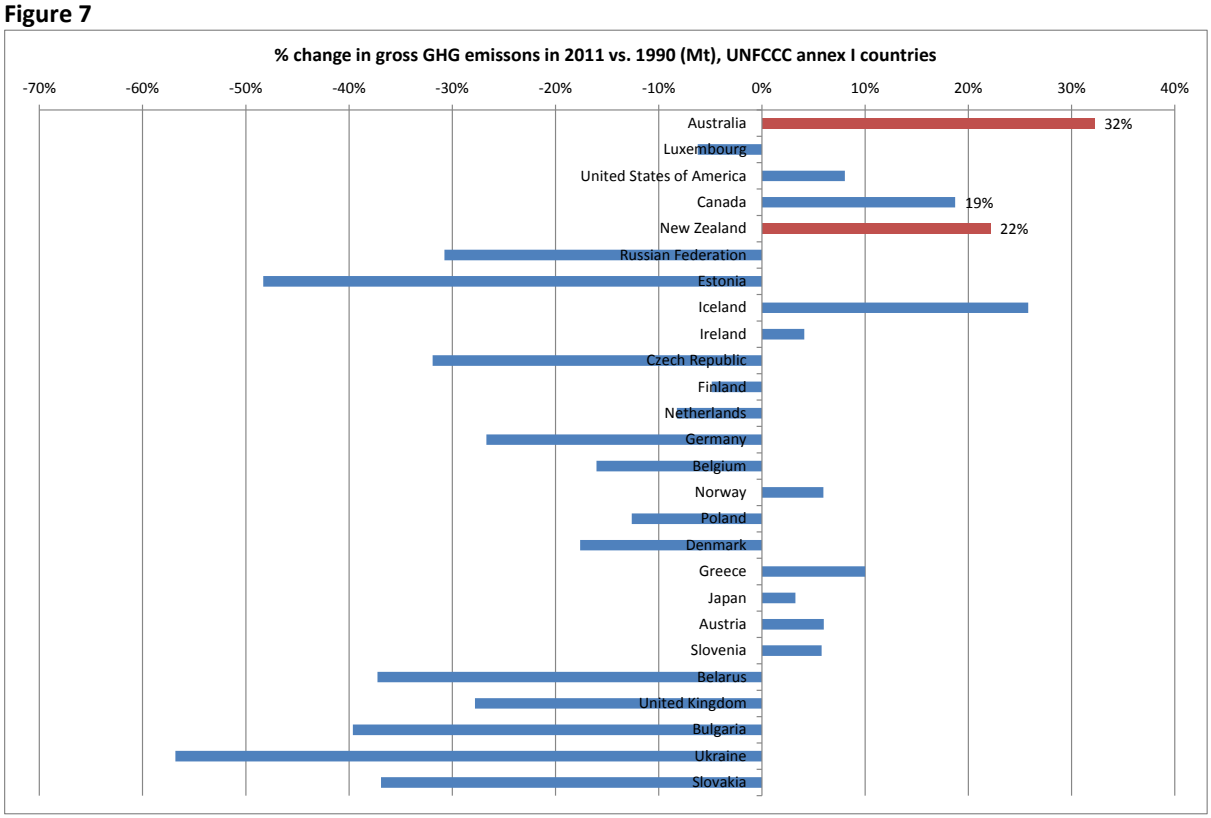
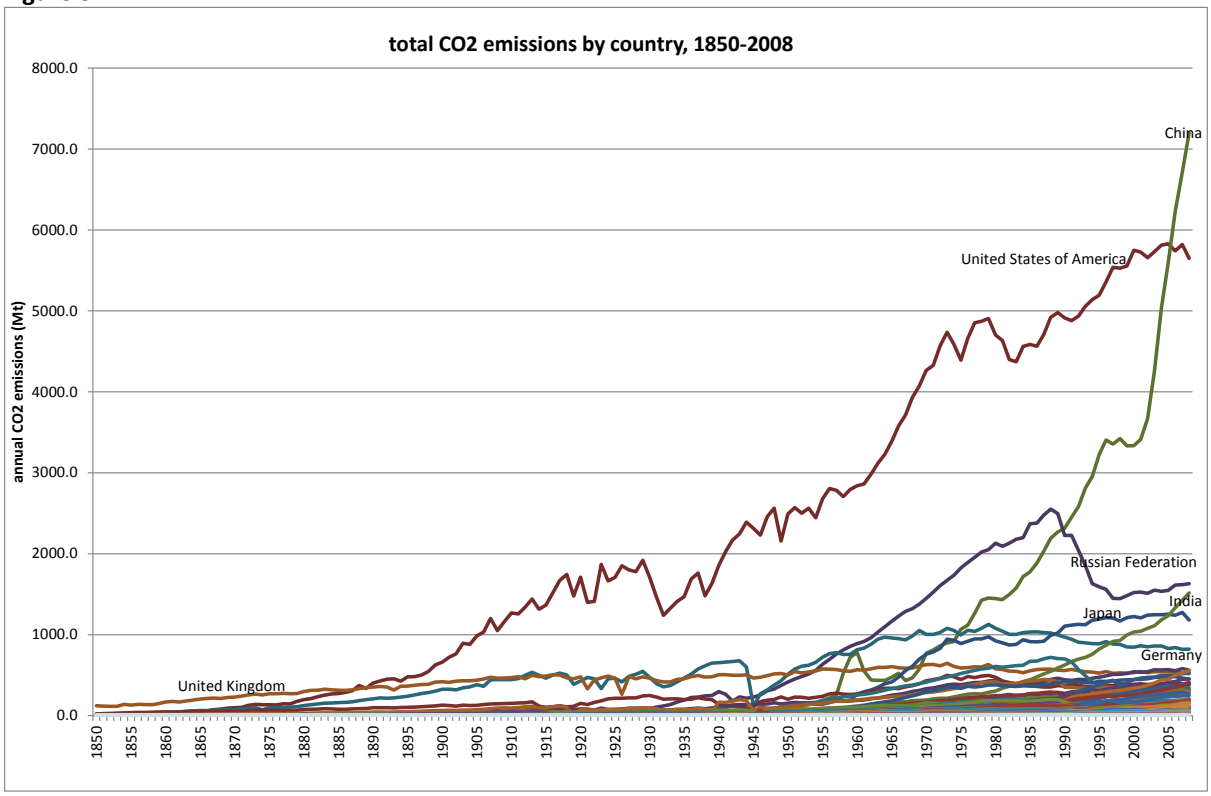


Figure 7



Gross CO_2 emissions over time:

Figure 8



Relationships between current GDP and gross GHG emissions:

Figure 9

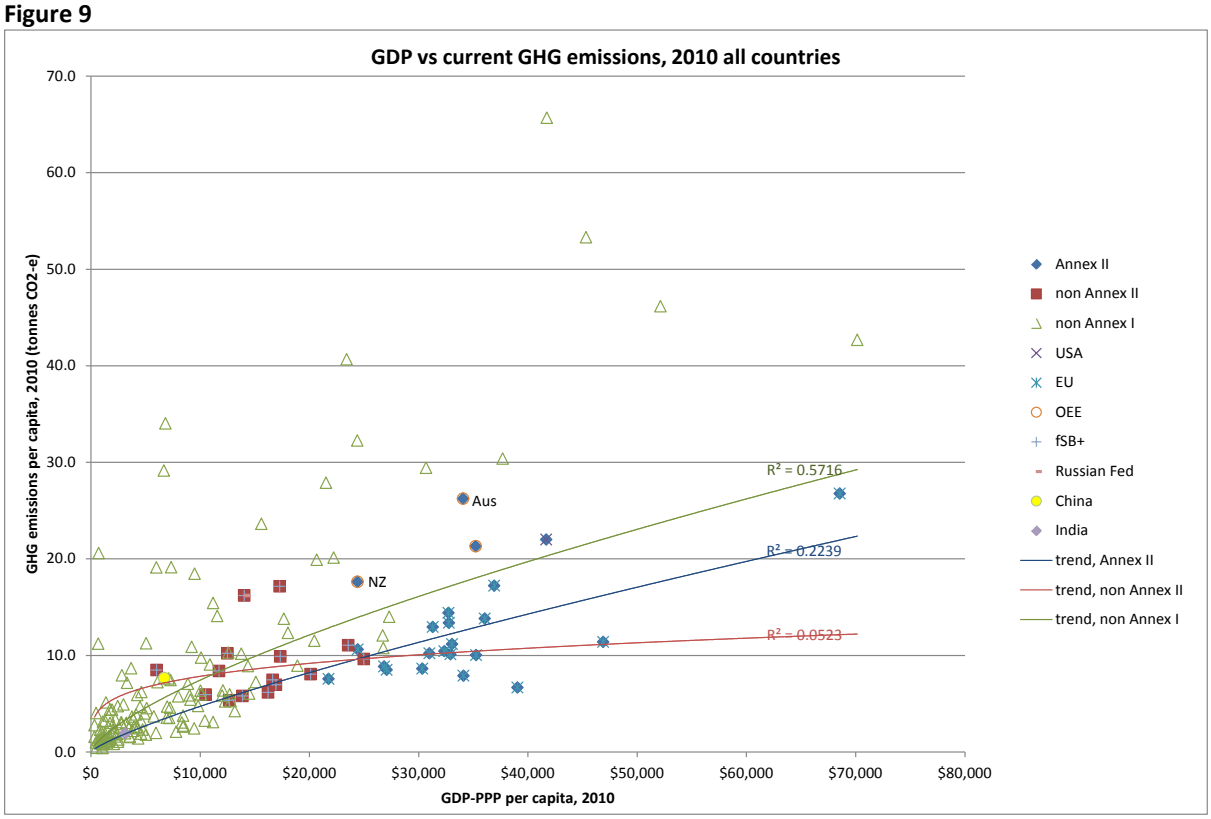
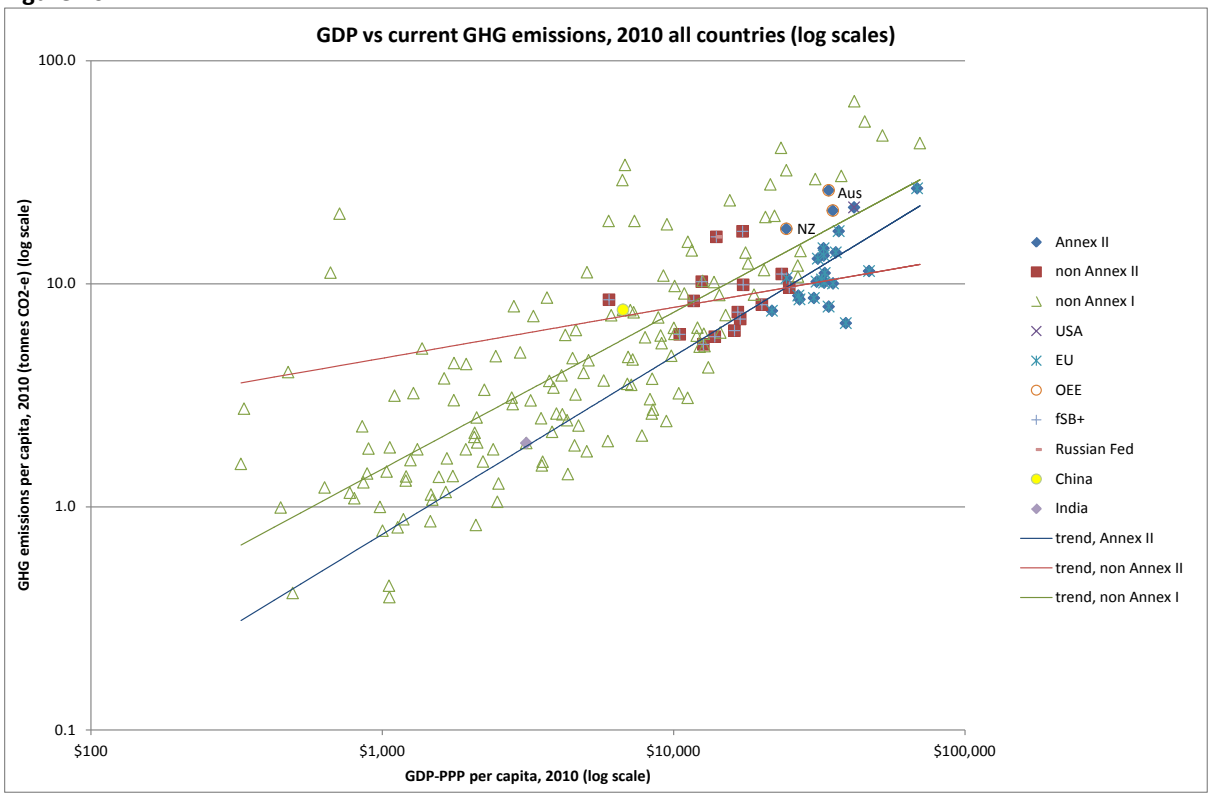


Figure 10



Relationships between historical gross CO_2 emissions and current GDP:

Figure 11

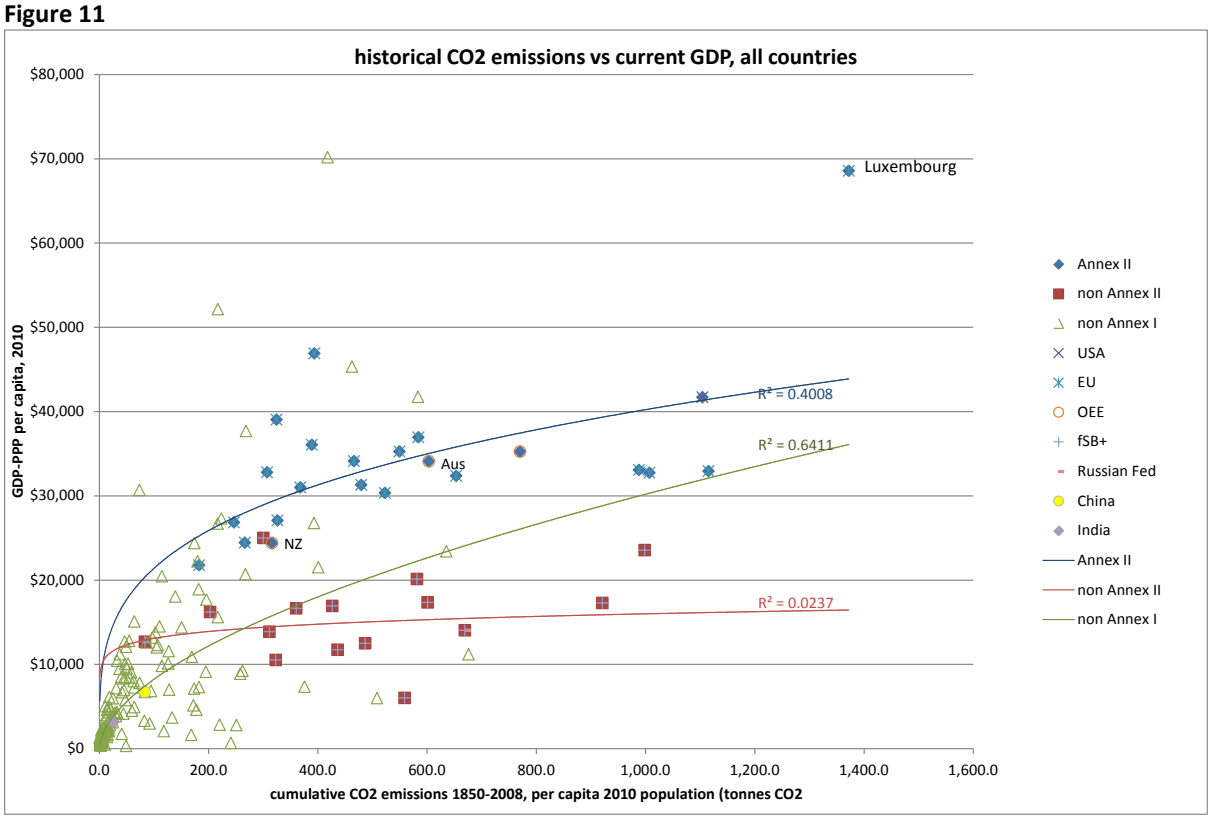
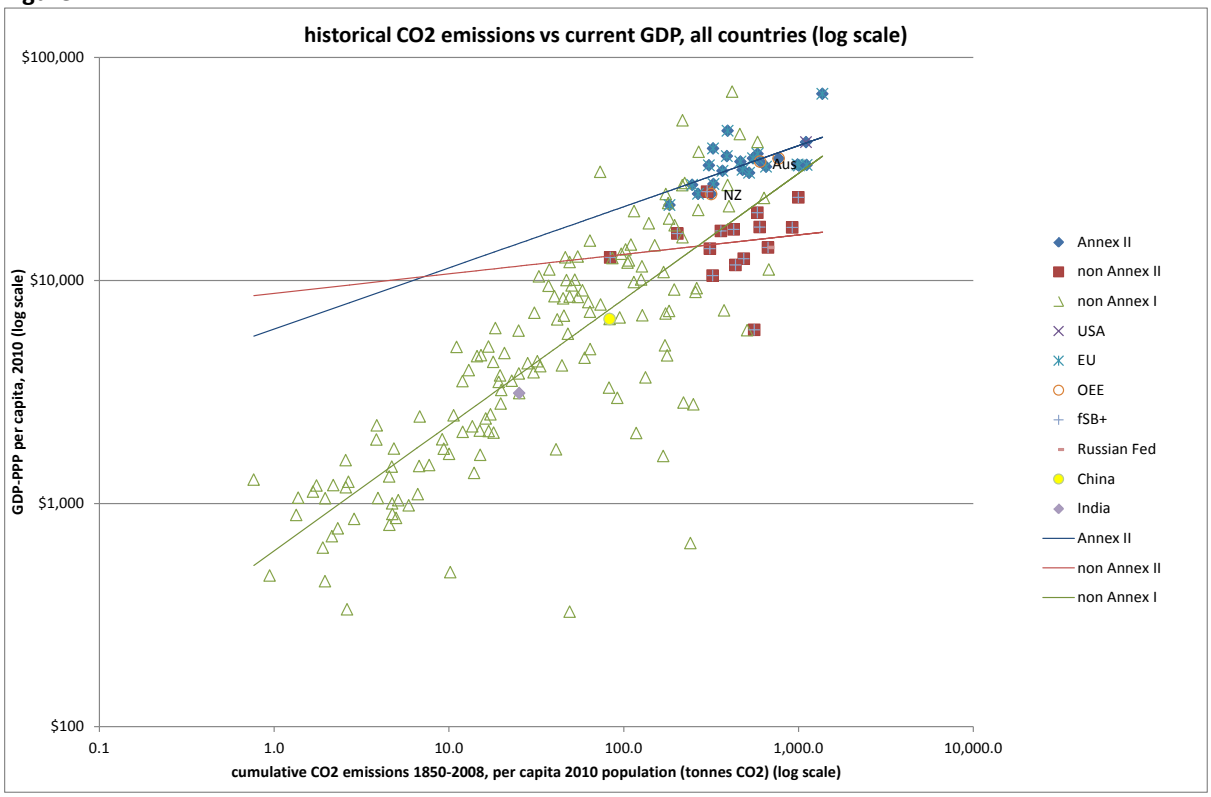


Figure 12



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ENDNOTES

† Country groupings and criteria in Table 2 and figures 2 and 3:
UNFCCC Annex II: USA: United States of America
UNFCCC Annex II: European Union (18 countries): Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom
UNFCCC Annex II: Japan
other UNFCCC Annex II, excluding Turkey: other established economies: Australia, Canada, New Zealand
other UNFCCC Annex I: former Soviet bloc, plus Turkey (recently developed and developing economies, 15 countries): Belarus, Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russian Federation, Slovakia, Slovenia, Turkey, Ukraine (note: $13,400 population-weighted mean per capita GDP-PPP in 2010)
non-Annex I: recently developed economies (GDP-PPP per capita $20,000+, 16 countries): Bahamas, Bahrain, Brunei, Equatorial Guinea, Israel, Korea (South), Kuwait, Malta, Oman, Qatar, Saudi Arabia, Seychelles, Singapore, Taiwan, Trinidad & Tobago, United Arab Emirates (note: $29,000 population-weighted mean per capita GDP-PPP in 2010)
non-Annex I: China (note: GDP-PPP per capita <$7500)
non-Annex I: India (note: GDP-PPP per capita <$7500)
non-Annex I: developing economies (GDP-PPP per capita $7500[8]-$19,999, 38 countries): Albania, Algeria, Antigua & Barbuda, Argentina, Azerbaijan, Barbados, Botswana, Brazil, Chile, Colombia, Cook Islands, Costa Rica, Cuba, Cyprus, Dominica, Dominican Republic, Gabon, Grenada, Iran, Kazakhstan, Lebanon, Libya, Macedonia, FYR, Malaysia, Mauritius, Mexico, Palau, Panama, Peru, Saint Kitts & Nevis, Saint Lucia, Saint Vincent & Grenadines, Serbia & Montenegro, South Africa, Thailand, Tunisia, Uruguay, Venezuela
non-Annex I: least developed economies (GDP-PPP per capita <$7500[8], 91 countries): Afghanistan, Angola, Armenia, Bangladesh, Belize, Benin, Bhutan, Bolivia, Bosnia & Herzegovina, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Congo, Dem. Republic, Cote d'Ivoire, Djibouti, Ecuador, Egypt, El Salvador, Eritrea, Ethiopia, Fiji, Gambia, Georgia, Ghana, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Indonesia, Iraq, Jamaica, Jordan, Kenya, Kiribati, Korea (North), Kyrgyzstan, Laos, Lesotho, Liberia, Madagascar, Malawi, Maldives, Mali, Mauritania, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Namibia, Nauru, Nepal, Nicaragua, Niger, Nigeria, Niue, Pakistan, Papua New Guinea, Paraguay, Philippines, Rwanda, Samoa, Sao Tome & Principe, Senegal, Sierra Leone, Solomon Islands, Sri Lanka, Sudan, Suriname, Swaziland, Syria, Tajikistan, Tanzania, Togo, Tonga, Turkmenistan, Uganda, Uzbekistan, Vanuatu, Vietnam, Yemen, Zambia, Zimbabwe
See UNSD[41] for further information on country groupings

‡ International consensus is that the world needs to contain the rise in global temperature to a maximum of 2°C above pre-industrial levels[11,12]. This limit is often referred to as 'the 2°C guardrail'. Even with temperature rises less than 2°C, impacts can be significant, although some societies could cope with some of these impacts through proactive adaptation strategies; but beyond 2°C, the possibilities for adaptation of society and ecosystems rapidly decline with an increasing risk of social disruption through health impacts, water shortages and food insecurity.

§ Signatories to the United Nations Framework Convention on Climate Change (UNFCCC) divide into three groups:
1. Annex I countries (industrialised countries);
2. Annex II countries (the subgroup of developed countries who pay for the costs of developing countries);
3. Developing countries.
Annex I countries have agreed to reduce their emissions of greenhouse gases to targets that are mainly set below their 1990 levels. They may do this by allocating reduced annual allowances to the major operators within their borders. These operators can only exceed their allocations if they buy emission allowances, or offset their excesses through a mechanism that is agreed by all the parties to the UNFCCC. Annex II countries are a subgroup of the Annex I countries, comprising the member countries of the OECD excluding those that were economies in transition in 1992. Developing countries (Annex III) are not expected to de-carbonise their economies unless developed countries (i.e. established economies) supply enough funding and technology. New Zealand is included in Annex II (and hence Annex I). Annex I countries (industrialised countries) comprise: Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, United States of America (40 countries and separately the European Union). See http://unfccc.int/parties_and_observers/items/2704.php, http://unfccc.int/parties_and_observers/parties/annex_i/items/2774.php.

** Responsibility under the Oxfam International calculations is based on emissions of all six greenhouse gases included in the UNFCCC, from 1990, when the first IPCC assessment report was published, to 2005, the then most recent year of internationally comparable data[39]. The measure excludes emissions from land use change and forestry. Responsibility is measured as cumulative emissions over the period 1990-2005[23].

†† Capability under the Oxfam International calculations is based on the absolute value of a country's gross national income (GNI) that accrues to the population living above a per capita income threshold of $9,000 per year[23].

Table 5: Countries' current and historic gross emissions[19,21]

Key:

country group#	country group	UNFCCC annex	country group	notes:
1	USA	Annex I	USA	Annex II excluding Turkey
2	EU	Annex I	EU	Annex II excluding Turkey
3	Japan	Annex I	Japan	Annex II excluding Turkey
4	OEE	Annex I	other established economies	Annex II excluding Turkey
5	fSb+	Annex I	former Soviet bloc, plus Turkey	nonAnnex II incl Russia, plus Turkey
6	RDE	non-Annex I	recent developed economies	$20,000+ per capita GDP-PPP in 2010 ($int)
9	DE	non-Annex I	developing economies	$7,500 to $19,999 per capita GDP-PPP in 2010 ($int)
7	China	non-Annex I	China	<$7,500 per capita GDP-PPP in 2010 ($int)
8	India	non-Annex I	India	<$7,500 per capita GDP-PPP in 2010 ($int)
10	LDE	non-Annex I	least developed economies	<$7,500 per capita GDP-PPP in 2010 ($int)

country group#	country group	country	population 2010 ('000)	total GHG 2010 (Mt CO2-e)	cumulative CO2 1950-2008 (Mt)	total CO2 2010 (Mt CO2-e)	GDP-PPP 2010 per capita	annual GHGe per capita	cumulative CO2 per capita	change GHG 2010 vs 1990 (Mt)	% change 2010 vs 1990
1	USA	United States of America	312,247.1	6,866.9	344,769.2	5,670.3	$41,688	22.0	1,104.2	884.3	15%
	USA Total		312,247.1	6,866.9	344,769.2	5,670.3	$41,688	22.0	1,104.2	884.3	15%
2	EU	Austria	8,401.9	84.3	4,617.9	71.4	$35,262	10.0	549.6	8.6	11%
		Belgium	10,941.3	157.6	11,018.9	140.1	$32,744	14.4	1,007.1	23.7	18%
		Denmark	5,551.0	57.9	3,628.1	47.1	$32,359	10.4	653.6	-9.3	-14%
		Finland	5,367.7	69.4	2,573.8	55.5	$31,285	12.9	479.5	-2.1	-3%
		France	63,230.9	545.2	33,053.5	397.8	$30,344	8.6	522.7	1.3	0%
		Germany	83,017.4	926.7	82,022.2	808.2	$33,064	11.2	988.0	-265.3	-22%
		Greece	11,110.0	117.8	2,960.7	100.4	$24,425	10.6	266.5	20.1	21%
		Iceland	318.0	4.2	97.7	3.3	$32,779	13.4	307.3	1.0	31%
		Ireland	4,467.6	61.7	1,738.6	40.7	$36,048	13.8	389.2	7.0	13%
		Italy	60,509.0	514.6	19,746.6	434.9	$27,071	8.5	326.3	27.0	6%
		Luxembourg	507.9	13.6	696.9	12.5	$68,553	26.8	1,372.1	1.9	16%
		Netherlands	16,615.2	285.8	9,704.6	256.2	$36,925	17.2	584.1	73.7	35%
		Norway	4,891.3	55.7	1,926.0	45.9	$46,887	11.4	393.8	9.9	22%
		Portugal	10,589.8	80.0	1,936.9	60.8	$21,762	7.6	182.9	22.1	38%
		Spain	46,182.0	408.0	11,394.0	337.3	$26,836	8.8	246.7	123.2	43%
		Sweden	9,382.3	74.0	4,375.9	60.6	$34,110	7.9	466.4	5.3	8%

		Switzerland	7,830.5	52.1	2,542.1	44.0	$39,044	6.7	324.6	-1.7	-3%
		United Kingdom	62,066.4	627.5	69,239.1	532.7	$32,917	10.1	1,115.6	-126.8	-17%
	EU Total		410,980.1	4,136.2	263,273.7	3,449.5	$31,054	10.1	640.6	-80.6	-2%
3	Japan	Japan	127,352.8	1,298.9	46,865.8	1,205.5	$30,989	10.2	368.0	89.0	7%
	Japan Total		127,352.8	1,298.9	46,865.8	1,205.5	$30,989	10.2	368.0	89.0	7%
4	OEE	**Australia**	**22,404.5**	**587.5**	**13,515.4**	**427.9**	**$34,078**	**26.2**	**603.2**	**160.6**	**38%**
		Canada	34,126.2	726.6	26,288.1	552.8	$35,223	21.3	770.3	159.1	28%
		New Zealand	**4,368.1**	**77.0**	**1,380.7**	**37.6**	**$24,399**	**17.6**	**316.1**	**19.0**	**33%**
	OEE Total		60,898.9	1,391.1	41,184.2	1,018.3	$34,025	22.8	676.3	338.7	32%

Note: New Zealand's cumulative CO_2 emissions 1850-2008 (1380.7 Mt, 316.1 tonnes per capita 2010 population) do not count the GHG load from non-CO2 GHGs (CH_4, NO_2 etc.), which comprise a substantial proportion of New Zealand's present GHG emissions.

country group#	country group	country	population 2010 ('000)	cumulative CO2 1950-2008 (Mt)	total CO2 2010 (Mt CO2-e)	total GHG 2010 (Mt CO2-e)	GDP-PPP 2010 per capita	cumulative CO2 per capita	annual GHGe per capita	change GHG 2010 vs 1990	% change 2010 vs 1990
5	fSb+	Belarus	9,491.1	96.9	4,619.9	66.6	$12,503	10.2	486.8	-68.3	-41%
		Bulgaria	7,389.2	61.9	3,225.1	46.6	$11,732	8.4	436.5	-44.7	-42%
		Croatia	4,338.0	26.7	880.4	19.6	$16,210	6.2	202.9	-24.4	-48%
		Czech Republic	10,553.7	116.6	10,536.8	96.4	$23,549	11.0	998.4	-76.3	-40%
		Estonia	1,298.5	22.3	1,195.9	19.3	$17,277	17.1	920.9	-21.8	-49%
		Hungary	10,014.6	69.6	4,270.6	52.9	$16,934	6.9	426.4	-25.5	-27%
		Latvia	2,090.5	12.1	651.6	7.8	$13,868	5.8	311.7	-14.5	-55%
		Lithuania	3,068.5	22.9	1,106.9	15.0	$16,640	7.5	360.7	-24.9	-52%
		Poland	38,198.8	377.3	22,968.4	312.7	$17,341	9.9	601.3	-76.6	-17%
		Romania	21,861.5	129.5	7,061.4	79.8	$10,507	5.9	323.0	-128.7	-50%
		Russian Federation	143,617.9	2,326.1	96,127.0	1,667.4	$14,038	16.2	669.3	-914.8	-28%
		Slovakia	5,433.4	43.8	3,161.0	37.0	$20,108	8.1	581.8	-53.4	-55%
		Slovenia	2,054.2	19.7	616.9	16.0	$24,984	9.6	300.3	2.5	15%
		Turkey	72,137.5	385.8	6,039.8	300.6	$12,671	5.3	83.7	151.7	65%
		Ukraine	46,050.2	390.3	25,738.0	285.8	$6,005	8.5	558.9	-520.2	-57%
	fSb+ Total		377,597.7	4,101.4	188,199.7	3,023.6	$13,389	10.9	498.4	-1,839.9	-31%
6	RDE	Bahamas	360.5	3.9	141.7	3.6	$26,760	10.8	393.2	1.8	83%
		Bahrain	1,251.5	34.9	501.9	30.6	$21,521	27.9	401.0	21.8	167%
		Brunei	400.6	21.3	185.3	8.4	$45,319	53.3	462.5	6.5	44%
		Equatorial Guinea	696.2	20.5	51.1	5.5	$30,679	29.4	73.4	20.3	9155%
		Israel	7,420.4	89.5	1,607.6	73.1	$26,706	12.1	216.7	45.1	101%

		Korea (South)	48,453.9	678.3	10,835.8	604.6	$27,302	14.0	223.6	379.6	127%
		Kuwait	2,991.6	196.5	1,745.8	87.5	$41,736	65.7	583.6	121.9	163%
		Malta	424.7	8.5	76.4	8.0	$22,230	20.1	179.8	6.0	242%
		Oman	2,802.8	90.4	488.0	52.7	$24,381	32.3	174.1	50.0	124%
		Qatar	1,749.7	74.7	731.1	70.1	$70,160	42.7	417.9	59.1	378%
		Saudi Arabia	27,258.4	542.1	7,287.2	491.8	$20,677	19.9	267.3	355.9	191%
		Seychelles	91.2	1.0	10.5	1.0	$20,448	11.5	114.6	0.9	497%
		Singapore	5,079.0	234.4	1,102.6	228.6	$52,147	46.1	217.1	203.8	666%
		Taiwan	23,145.8	0.0	5,757.3	295.0	$32,827	0.0	248.7	0.0	#DIV/0!
		Trinidad & Tobago	1,328.1	54.0	844.0	52.7	$23,406	40.7	635.5	34.1	172%
		United Arab Emirates	8,441.5	256.4	2,268.3	222.0	$37,688	30.4	268.7	182.8	248%
	RDE Total		131,895.9	2,306.5	33,634.6	2,235.4	$29,280	17.5	255.0	1,489.4	182%
7	China	China	1,359,821.5	10,385.5	113,144.4	8,895.7	$6,708	7.6	83.2	6,903.7	198%
	China Total		1,359,821.5	10,385.5	113,144.4	8,895.7	$6,708	7.6	83.2	6,903.7	198%
8	India	India	1,205,624.6	2,326.2	30,428.5	1,710.9	$3,122	1.9	25.2	1,235.3	113%
	India Total		1,205,624.6	2,326.2	30,428.5	1,710.9	$3,122	1.9	25.2	1,235.3	113%

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9	DE	Albania	3,150.1	6.6	232.6	3.8	$7,792	2.1	73.8	-5.1	-44%
		Algeria	37,062.8	169.4	2,378.4	121.7	$7,239	4.6	64.2	65.7	63%
		Antigua & Barbuda	87.2	1.2	17.1	0.7	$17,666	13.8	196.0	0.8	172%
		Argentina	40,374.2	359.0	6,082.4	179.7	$14,376	8.9	150.7	107.3	43%
		Azerbaijan	9,094.7	64.2	2,346.1	30.1	$8,873	7.1	258.0	-26.3	-29%
		Barbados	280.4	3.5	39.0	1.4	$18,042	12.3	139.2	0.6	21%
		Botswana	1,969.3	11.7	91.3	5.1	$12,701	6.0	46.4	-1.6	-12%
		Brazil	195,210.2	1,162.6	10,248.6	480.4	$10,079	6.0	52.5	432.9	59%
		Chile	17,150.8	103.5	1,888.2	81.1	$14,489	6.0	110.1	55.0	113%
		Colombia	46,444.8	174.0	2,280.4	71.1	$8,452	3.7	49.1	43.8	34%
		Cook Islands	20.3	0.1	1.2	0.1	$9,032	5.9	58.2	0.0	52%
		Costa Rica	4,669.7	15.1	152.9	7.0	$10,428	3.2	32.7	8.0	114%
		Cuba	11,281.8	53.6	1,291.5	28.3	$9,821	4.8	114.5	-10.0	-16%
		Cyprus	1,103.7	9.9	200.9	8.9	$18,907	8.9	182.0	4.5	84%
		Dominica	71.2	0.2	2.7	0.1	$11,190	3.1	37.6	0.1	40%
		Dominican Republic	10,016.8	30.4	451.0	18.7	$8,312	3.0	45.0	16.2	114%

		Gabon	1,556.2	6.6	150.8	4.5	$13,167	4.2	96.9	-0.6	-9%
		Grenada	104.7	1.9	5.3	0.3	$9,497	18.5	50.4	0.4	24%
		Iran	74,462.3	727.0	9,385.0	592.0	$10,094	9.8	126.0	474.1	187%
		Kazakhstan	15,921.1	245.4	10,765.0	181.6	$11,191	15.4	676.1	-108.3	-31%
		Lebanon	4,341.1	22.7	464.9	19.2	$12,289	5.2	107.1	14.5	178%
		Libya	6,040.6	142.7	1,310.7	61.7	$15,598	23.6	217.0	46.7	49%
		Macedonia, FYR	2,102.2	11.4	410.0	7.6	$9,104	5.4	195.0	-6.3	-36%
		Malaysia	28,275.8	287.3	2,899.2	200.0	$13,767	10.2	102.5	165.7	136%
		Mauritius	1,230.7	6.5	67.2	4.6	$12,785	5.3	54.6	4.1	168%
		Mexico	117,886.4	688.3	12,411.4	449.4	$12,008	5.8	105.3	257.0	60%
		Palau	20.5	0.3	2.6	0.2	$11,561	14.1	127.3	0.2	129%
		Panama	3,678.1	23.4	180.5	17.5	$12,084	6.4	49.1	16.1	223%
		Peru	29,262.8	79.7	1,177.4	45.9	$8,501	2.7	40.2	29.1	58%
		Saint Kitts & Nevis	52.4	0.4	3.4	0.3	$15,091	7.2	64.2	0.2	159%
		Saint Lucia	177.4	1.1	8.4	0.4	$10,032	6.3	47.1	0.3	44%
		Saint Vincent & Grenadines	109.3	0.3	4.1	0.2	$9,453	2.4	37.2	0.1	76%
		Serbia & Montenegro	9,647.1	108.2	2,323.5	57.4	$665	11.2	240.9	16.5	18%
		South Africa	51,452.4	559.7	13,476.8	478.4	$9,227	10.9	261.9	190.7	52%
		Thailand	66,402.3	381.9	4,174.7	290.0	$7,987	5.8	62.9	217.2	132%
		Tunisia	10,631.8	27.8	582.1	19.2	$8,428	2.6	54.7	7.9	40%
		Uruguay	3,372.0	34.7	291.0	8.5	$12,584	10.3	86.3	9.4	37%
		Venezuela	29,043.3	262.5	4,919.4	178.4	$10,894	9.0	169.4	77.7	42%
	DE Total		833,758.5	5,784.5	92,717.8	3,655.6	$10,260	6.9	111.2	2,104.5	57%

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10	LDE	Afghanistan	28,397.8	24.9	73.2	6.6	$1,183	0.9	2.6	9.9	66%
		Angola	19,549.1	219.8	329.5	26.6	$5,048	11.2	16.9	85.2	63%
		Armenia	2,963.5	13.4	511.1	10.6	$5,113	4.5	172.5	-10.7	-44%
		Bangladesh	151,125.5	130.2	711.8	59.5	$1,464	0.9	4.7	66.2	103%
		Belize	308.6	9.0	12.9	0.5	$6,679	29.1	41.7	3.6	66%
		Benin	9,509.8	17.2	43.3	5.1	$1,321	1.8	4.6	7.4	76%
		Bhutan	716.9	1.3	7.9	0.3	$5,035	1.8	11.1	-0.2	-15%
		Bolivia	10,156.6	59.8	287.1	13.3	$4,252	5.9	28.3	16.1	37%
		Bosnia & Herzegovina	3,845.9	28.6	701.2	21.9	$7,297	7.4	182.3	-2.0	-7%

		Burkina Faso	15,540.3	20.4	27.2	1.7	$1,205	1.3	1.8	10.4	103%
		Burundi	9,232.8	37.1	8.7	0.2	$475	4.0	0.9	35.4	2092%
		Cambodia	14,364.9	26.0	55.4	4.1	$1,937	1.8	3.9	12.8	97%
		Cameroon	20,624.3	90.1	188.7	8.5	$1,941	4.4	9.2	2.8	3%
		Cape Verde	487.6	0.7	5.8	0.4	$3,534	1.5	12.0	0.6	345%
		Central African Republic	4,349.9	89.6	9.3	0.3	$714	20.6	2.1	-23.7	-21%
		Chad	11,720.8	37.9	9.0	0.3	$1,281	3.2	0.8	15.7	71%
		Comoros	683.1	0.3	2.7	0.1	$1,058	0.4	3.9	0.1	29%
		Congo	4,111.7	15.1	80.8	6.8	$3,748	3.7	19.6	5.1	52%
		Congo, Dem. Republic	62,191.2	171.3	162.5	3.1	$336	2.8	2.6	-70.3	-29%
		Cote d'Ivoire	18,976.6	57.0	177.3	6.6	$1,761	3.0	9.3	5.8	11%
		Djibouti	834.0	1.8	15.1	1.2	$2,078	2.1	18.1	0.9	110%
		Ecuador	15,001.1	53.3	682.5	35.2	$6,944	3.6	45.5	23.4	78%
		Egypt	78,075.7	287.4	3,742.4	214.2	$5,760	3.7	47.9	155.7	118%
		El Salvador	6,218.2	12.3	155.7	5.9	$5,953	2.0	25.0	4.9	67%
		Eritrea	5,741.2	5.7	11.2	0.5	$448	1.0	2.0	0.6	11%
		Ethiopia	87,095.3	122.7	116.5	6.4	$888	1.4	1.3	46.6	61%
		Fiji	860.6	2.2	38.2	1.3	$4,155	2.6	44.4	0.7	41%
		Gambia	1,680.6	7.4	8.2	0.5	$1,764	4.4	4.9	3.2	74%
		Georgia	4,388.7	14.0	779.5	6.4	$4,612	3.2	177.6	-30.2	-68%
		Ghana	24,262.9	26.1	187.0	9.1	$1,486	1.1	7.7	8.9	51%
		Guatemala	14,341.6	35.0	257.3	11.4	$4,311	2.4	17.9	20.8	145%
		Guinea	10,876.0	19.8	51.7	1.4	$898	1.8	4.8	4.2	27%
		Guinea-Bissau	1,586.6	2.3	8.1	0.4	$1,035	1.4	5.1	0.7	43%
		Guyana	786.1	3.9	72.4	1.6	$2,979	4.9	92.1	0.2	5%
		Haiti	9,896.4	7.7	46.9	2.1	$1,002	0.8	4.7	2.9	60%
		Honduras	7,621.2	19.0	147.0	7.6	$3,509	2.5	19.3	8.1	75%
		Indonesia	240,676.5	823.4	7,354.4	439.7	$3,872	3.4	30.6	388.1	89%
		Iraq	30,962.4	221.7	2,553.7	113.5	$3,305	7.2	82.5	62.5	39%
		Jamaica	2,741.5	12.9	350.3	9.2	$6,983	4.7	127.8	2.6	25%
		Jordan	6,454.6	25.7	414.6	20.7	$4,918	4.0	64.2	8.2	46%
		Kenya	40,909.2	46.4	276.6	12.3	$1,471	1.1	6.8	11.8	34%
		Kiribati	97.7	0.1	1.2	0.1	$2,096	0.8	12.0	0.0	133%
		Korea (North)	24,500.5	92.2	4,124.5	64.7	$1,633	3.8	168.3	-67.6	-42%
		Kyrgyzstan	5,334.2	11.0	630.1	7.5	$2,070	2.1	118.1	-18.9	-63%
		Laos	6,395.7	21.4	24.8	1.4	$2,242	3.3	3.9	7.1	50%

		Lesotho	2,008.9	2.7	5.2	0.6	$1,565	1.4	2.6	0.8	44%
		Liberia	3,958.0	1.6	40.3	0.5	$493	0.4	10.2	0.4	29%
		Madagascar	21,079.5	48.3	60.5	1.9	$854	2.3	2.9	25.9	116%
		Malawi	15,013.7	17.3	34.7	1.0	$774	1.2	2.3	6.6	62%
		Maldives	325.7	1.1	10.0	1.1	$7,164	3.5	30.8	0.9	476%
		Mali	13,986.0	25.8	19.2	0.7	$1,063	1.8	1.4	9.7	60%
		Mauritania	3,609.4	9.1	61.0	1.9	$2,110	2.5	16.9	1.5	19%
		Moldova	3,573.0	11.0	895.9	6.6	$2,785	3.1	250.7	-27.7	-72%
		Mongolia	2,712.7	23.5	362.1	8.0	$3,678	8.7	133.5	-1.4	-6%
		Morocco	31,642.4	44.3	1,015.2	43.3	$4,339	1.4	32.1	19.8	81%
		Mozambique	23,967.3	26.2	109.4	2.6	$803	1.1	4.6	4.9	23%
		Myanmar	51,931.2	163.6	344.8	11.9	$1,102	3.1	6.6	0.7	0%
		Namibia	2,179.0	15.7	40.2	3.3	$6,109	7.2	18.4	9.7	160%
		Nauru	10.0	0.2	5.1	0.2	$5,985	19.1	508.4	0.1	37%
		Nepal	26,846.0	36.7	58.5	3.5	$1,209	1.4	2.2	12.3	50%
		Nicaragua	5,822.2	17.4	116.2	4.5	$3,230	3.0	20.0	9.7	125%
		Niger	15,893.7	19.4	30.2	1.3	$635	1.2	1.9	13.6	233%
		Nigeria	159,707.8	309.9	2,399.6	73.7	$2,120	1.9	15.0	77.5	33%
		Niue	1.5	0.0	0.1	0.0	$6,819	34.0	94.8	0.0	47%
		Pakistan	173,149.3	313.5	2,811.1	159.0	$2,403	1.8	16.2	160.7	105%
		Papua New Guinea	6,858.9	10.9	93.5	3.3	$2,217	1.6	13.6	3.2	42%
		Paraguay	6,459.7	40.1	98.6	4.4	$4,622	6.2	15.3	6.2	18%
		Philippines	93,444.3	148.9	2,137.9	86.2	$3,554	1.6	22.9	64.4	76%
		Rwanda	10,836.7	4.8	21.3	0.8	$1,056	0.4	2.0	1.7	54%
		Samoa	186.0	0.4	4.7	0.2	$3,830	2.2	25.1	0.1	22%
		Sao Tome & Principe	178.2	0.2	2.7	0.1	$1,653	1.2	15.1	0.1	81%
		Senegal	12,950.6	21.3	130.1	6.0	$1,669	1.6	10.0	1.5	8%
		Sierra Leone	5,752.0	5.7	33.9	1.4	$982	1.0	5.9	0.9	19%
		Solomon Islands	526.4	0.6	5.6	0.2	$2,484	1.1	10.6	0.2	55%
		Sri Lanka	20,758.8	39.1	300.8	11.8	$4,577	1.9	14.5	10.3	36%
		Sudan	35,652.0	168.7	242.7	18.6	$2,455	4.7	6.8	82.0	95%
		Suriname	525.0	4.0	91.1	2.0	$7,108	7.6	173.6	-0.2	-5%
		Swaziland	1,193.1	2.8	24.8	1.0	$4,722	2.3	20.8	0.8	39%
		Syria	21,532.6	99.9	1,289.2	65.5	$4,502	4.6	59.9	43.6	77%
		Tajikistan	7,627.3	10.5	313.0	2.7	$1,748	1.4	41.0	-7.5	-42%
		Tanzania	44,973.3	72.7	119.8	6.4	$1,251	1.6	2.7	9.7	15%

		Togo	6,306.0	8.1	31.5	1.4	$862	1.3	5.0	-0.5	-5%
		Tonga	104.1	0.4	3.5	0.2	$4,128	3.9	33.4	0.1	58%
		Turkmenistan	5,042.0	96.4	1,894.5	52.5	$7,344	19.1	375.7	25.6	36%
		Uganda	33,987.2	27.5	56.7	3.4	$1,130	0.8	1.7	9.6	54%
		Uzbekistan	27,769.3	220.0	6,115.4	109.5	$2,832	7.9	220.2	29.6	16%
		Vanuatu	236.3	0.6	3.1	0.1	$3,962	2.6	13.0	0.2	40%
		Vietnam	89,047.4	256.8	1,762.6	148.6	$2,807	2.9	19.8	181.6	242%
		Yemen	22,763.0	29.0	393.8	21.0	$2,507	1.3	17.3	16.6	135%
		Zambia	13,217.0	67.7	184.5	2.2	$1,370	5.1	14.0	-14.6	-18%
		Zimbabwe	13,077.0	20.4	641.7	9.1	$327	1.6	49.1	-8.2	-29%
	LDE Total		2,054,617.2	5,370.0	49,871.5	2,034.9	$2,476	2.6	24.3	1,598.4	42%

country group#	**country group**	**country**	**population 2010 ('000)**	**cumulative CO2 1950-2008 (Mt)**	**total CO2 2010 (Mt CO2-e)**	**total GHG 2010 (Mt CO2-e)**	**GDP-PPP 2010 per capita**	**cumulative CO2 per capita**	**annual GHGe per capita**	**change GHG 2010 vs 1990**	**% change 2010 vs 1990**
subtotal (data available)			6,874,794.3	43,967.3	1,204,089.4	32,899.6	$9,781	6.4	175.1	12,722.7	41%
residual	(world total minus subtotal data available)		41,389.2	575.4	4,913.0	255.9		0.0	-0.3	-222.8	
% residual/World total			0.60%	1.29%	0.41%	0.77%		0.70%	-0.19%	-1.78%	
Word total		**World**	6,916,183.5	44,542.7	1,209,002.4	33,155.4	$9,512	6.4	174.8	12,499.9	39%