Comments on the Climate Change Authority's Draft report " Australia's future emissions reduction target"

The science

The Authority states that "climate science confirms the problem" and that it's recommendations are founded on the comprehensive scientific evidence that human activities are the major contributor to global warming and that, as the climate warms, we are experiencing more frequent extreme weather events.

The Authority also states that the precise temperature response to future greenhouse gas concentrations is uncertain, that climate models project future temperature changes associated with different concentration scenarios but only within ranges of probability and that the uncertainties have been diminishing overtime and have resulted in greater confidence in the connection between increasing concentrations of carbon dioxide in the atmosphere and warming of the atmosphere and in projected climate impacts.

However, the Authority do not state the magnitude of "the problem" - the actual increase in global atmospheric temperatures from pre-industrial times to 2014 or provide any information to support the claim that there is greater confidence in the connection of global atmospheric temperatures with the concentration of carbon dioxide in the atmosphere in the IPCC's climate models .

The fundamental principle for determining the validity of a scientific theory and models based upon the theory is that that predictions in the models must reconcile with observed reality.

In 1990, the IPCC stated in AR 1 that under the "Business as Usual" scenario for increase in global emissions of greenhouse gases, the rate of increase in global mean temperatures over the next century would be 0.3 degrees per decade

In 2007, the IPCC stated in AR 4 that continued greenhouse gas emissions at or above current rates would cause further warming of about 0.2 degrees per decade for the next two decades

The observed reality is that

(i) the concentration of carbon dioxide in the atmosphere has risen steadily year on year from 1960 tracking the most "pessimistic" emissions growth scenario in the IPCC's climate models – and is now over 400 ppm.

(ii) global atmospheric temperature data compiled by HADCRU, NASA and NOMA indicate that global atmospheric temperatures have risen by about 0.6 degrees C over the period from 1960 to 2015 or about 0.1 degrees C per decade and have shown no statistically significant change over the period 1998 to 2014; a fact recently acknowledged by the IPCC.

(iii) the lower troposphere temperature - the more reliable and "uncontaminated" indicator of changes in atmospheric temperatures - has increased by about 0.4 degrees C over the same period and also shown no increase over the past 17 years,

In other words, there has been no "global warming" for the past 17 years

In 2013, the IPCC stated in AR 5 that, for the period from 1998 to 2012, 111 of the 114 available climate models show a surface warming trend larger than observations and that the difference between the models and observations may come from an overestimate of the global temperature response to increasing greenhouse gas concentrations and other anthropogenic forcing and natural climate sensitivity.

In other words, the IPCC have acknowledged the rather "inconvenient truth" that the predictions of global atmospheric temperatures of the climate models have not reconciled with reality for the past sixteen years . However, the IPCC did not state the magnitude of the difference between the temperatures predicted by the models and the observed reality.

As noted earlier, the actual evolution of global carbon dioxide emissions and the concentration of carbon dioxide in the atmosphere has tracked the most pessimistic of the IPCC emissions scenarios from 1960 to 2015. However, the actual rate of warming over the period from 1960 to 2014 was less than 0.1 degrees C per decade significantly lower than the IPCC climate model projections referred to in AR 1 and AR 4 of 0.2 to 0.3 degrees C per decade .

In addition, numerous independent comparisons of the IPCC climate models predictions with the observed reality have revealed that the actual increase in the global atmospheric temperature over the period from 1980 to 2014 has been about 1/3 of that predicted by the models

In any other field of science, a theory and the related models that had overestimated a cause and effect by a factor of three over a 34 year period would be regarded as having failed the basic test of scientific plausibility.

It is interesting to note that at a time when there has been no "global warming" for 17 years, the focus of many climate scientists has shifted from "global warming " to "severe weather events" and almost every severe weather event is now attributed to "climate change".

However, claiming that increasing severe weather events are due to "climate change " when there has been no "global warming" for 17 years seems to me to be a "scientific oxymoron".

I presume that in it's final report, the Authority will

- reconcile it's claims of increased confidence in the IPCC's climate models quantifying the connection between the concentration of carbon dioxide in the atmosphere and global atmospheric temperatures and the actual observed reality of the past 55 years.

- explain how the severe weather events over the past sixteen years are due to the climate warming when the climate has not warmed

Global carbon dioxide emissions

The Authority claims that "global attention and action is starting to have a **material** impact on emissions" and notes a recent comment by the IEA that, for the first time in 40 years of data collection, there was no increase in global energy emissions outside of global recession.

The available data on the actual evolution of the concentration of carbon dioxide in the atmosphere and the actual and forecast evolution of global carbon dioxide emissions and the comments and forecast in the IEA World Energy Outlook 2013 indicates otherwise.

(i) as noted above, the concentration of carbon dioxide in the atmosphere as measured at the Mauna Lao observatory has increased steadily year by year from 1960 through to April 2015

(ii) the recent reports by the Global Carbon Project and the US Energy Information Administration note that global carbon dioxide emissions have increased steadily year on year from 1990 and now amount to over 36 billion tonnes per annum , around 60 % above emissions in 1990 - the Kyoto Protocol reference year

(iii) the IEA's World Energy Outlook 2013 notes that "energy related emissions are off track in the run up to the 2015 climate summit" and that "the 2 degrees carbon budget is being spent much too quickly"

In addition, the Global Carbon Project forecasts that emissions will increase to 43.2 billion tonnes by 2019 and the US Energy Information Administration (and others) forecast that emissions will continue to increase through to 2035 / 2040 and "plateau" at around 45 billion tonnes per annum.

I presume that, in it's final report, the Authority will provide the data supporting it's claim that " global action is starting to have a **material** impact on emissions" .

Post 2020 pledges

The Authority claim that "experience indicates countries **overwhelmingly** take their emissions reductions targets seriously" and that "country pledges are credible" .

The actual evolution of global carbon dioxide emissions indicates otherwise.

As noted above, the global carbon dioxide emissions have increased by about 60 % over the period from 1990 to 2014 and the concentration of carbon dioxide in the atmosphere has increased steadily from 1960 to 2015.

In addition, the Global Carbon Budget 2104 report noted that consumption based emissions in the Annex B countries - allocating emissions in the Annex B countries to where goods and services were consumed rather than where they were produced - remained stable from 1990 to 2012 with growing outsourcing of emissions from Annex B countries to the developing countries .

The reductions in emissions claimed by the Annex B countries (the EU and others) under the Kyoto Protocol were largely achieved by outsourcing of part of the emissions associated with their territorial consumption to the developing countries with no net contribution to reducing global emissions ; the EU have shut down some of their steel mills , aluminium smelters and coal fired energy generators but have replaced the declining domestic production with imports of steel and aluminium from China and Russia and imports of electricity generated by coal fired station in Poland and other eastern European countries

I presume that in it's final report the Authority will include the data that supports it's claim that experience indicates that countries **overwhelmingly** take their emission reduction targets seriously and reconcile the claim with the actual evolution of global carbon dioxide emissions related to consumption. .

The Authority also claim that

- major emitting countries are stepping up their collaboration on climate change

- China's commitment to halt growth in carbon dioxide emissions around 2030 or earlier if possible and to increase its share of non-fossil fuel energy consumption to around 20 % by 2030 are **crucial undertakings** from the world's biggest emitter

- some projections suggest that the post 2020 pledges made in 2014 by the EU, the United States and China could, if fulfilled, reduce warming by around 0.3 degrees by 2100.

As noted in the Authority's report, the US has pledged to reduce emissions to 26 to 28 % below 2005 levels by 2025 and the EU has pledged to reduce emissions to 40 % below 1990 levels by 2030.

However, China has only stated that it "intends to achieve the peaking of CO2 emissions around 2030 and to make best efforts to peak early " but has not stated the level at which emissions will peak.

In addition, the scientific theory is that the key criteria for limiting the increase in global atmospheric temperatures - and hence climate change - is the cumulative emissions of carbon dioxide of over time; "peaking" of emissions in 2030 or earlier cannot be a "crucial undertaking" unless accompanied by a commitment to limiting cumulative emissions by rapidly reducing carbon dioxide emissions in the years following "peaking" .

The data in the Global Carbon Project, the pledges made by the US and the EU and the consensus forecasts of China's emissions indicate that the combined production based emissions from the US, the EU and China will increase through to 2030

	1990	2000	2005	2010	2013	2020	2030
	Billions of tonnes of carbon dioxide per annum						
USA	4.76	5.71	5.82	5.43	5.23	5.2	4.25
EU	4.24	3.91	4.05	3.71	3.49	3.3	2.54
China	2.46	3.40	5.79	8.29	9.98	12.7	15.00 (i)
Total	11.46	13.02	15.66	17.43	18.70	21.2	21.79

(i) consensus of forecasts by the US Energy Information Authority , Berkeley Laboratory and BP

Interestingly, the US have based their emissions reduction target on their emissions in 2005; the year in which their emissions peaked and the EU have based their target on emissions in 1990; the year in which their emissions peaked. In addition, neither the US or the EU have stated whether their targets are production based or consumption based.

I presume that the Authority will explain why China's pledge that it "intends to achieve the peaking of CO2 emissions around 2030" is a **"crucial undertaking"** and advise their estimates of China's emissions in 2025 and 2030 and China's cumulative emissions through to 2050.

I also presume that in it's final report, the Authority will advise the details of the projections that support it's claim that the pledges by the EU, the US and China would reduce warming by 0.3 degrees C by 2030 and the base from which the 0.3 degrees C reduction was determined .

Australia's emissions reduction target

The Authority recommends a 2025 target of a 30 % reduction in Australia's emission below 2000 levels and a 40 to 50 % reduction by 2030.

The Global Carbon Project data indicates that Australia's carbon dioxide emissions in 2000 were 490 million tonnes.

The proposed emissions reduction target of 30 % below 2000 levels translates to emissions of 343 million tonnes in 2025.

The Global Carbon Project data indicates that Australia's emissions in 2014 were 544 million tonnes.

The proposed emission reduction target of 343 million tonnes by 2025 translates to a reduction of 37 % below current levels over the next ten years.

The population is forecast to increase from 22.7 million in 2014 to 25.4 million in 2025. The proposed target translates to a near halving of emissions per capita over the next ten years

The Australian National Greenhouse accounts note that the sources of Australia's greenhouse gas emissions (predominantly carbon dioxide) are currently

	Million tonnes CO 2 per annum
Energy - Electricity generation	184
Energy - Stationary energy excluding electricity	95
Energy – fugitive emissions	43
Transport	94
Agriculture	82
Industrial processes and product use	32
Fugitive emissions	13
Waste	11
	554

Numerous behavioural research studies have found that individuals are rarely motivated by "targets" or "goals" unless they believe that the "target" or "goal" is achievable.

A target to reduce emissions by 37 % over the next ten years can only be credible if there are credible technologies, credible alternatives to fossil fuels and credible changes in individual's consumption patterns that can be adopted to achieve the target; unless of course, the Australian Government introduces a punitive price on fossil fuels or fossil fuel rationing.

As you would be aware, the Australian Academy of Science has recommended that Australia should adopt an emissions reduction target of 30 to 40 % below 2000 levels by 2030 and approaching zero carbon emission by 2050 .

I asked Professor England, one of the authors of the Academy's submission, to advise the zero carbon emissions processes that could be used for the manufacture of cement, steel, aluminium and other metals, silicon, sulphur, petrochemicals and plastics and the zero carbon alternatives to fossil fuels for the powering of heavy duty road transport, ships, boats, aeroplanes and mining, construction and agricultural equipment that would enable the targets to be achieved.

Professor England responded " I don't pretend to have the answers on how this is to be achieved" and " I do ask the same questions; the challenge to decarbonise indeed seems considerable".

As noted earlier, the Authority claim that experience indicates that countries overwhelmingly take their emissions reduction targets seriously and that country pledges are credible.

I therefore presume that, in it's final report, the Authority will include comment on credible mitigation initiatives that the Australian Government, industry and consumers can take to achieve the proposed Australian target of a 37 % reduction in emissions by over the next ten years and, in particular, advise

- the low carbon technologies that are or are expected to be available for reducing emissions from industrial processes, particularly for the production of cement, steel, aluminium and other metals, chemicals and plastics by around 30 % over the next ten years

- the low carbon fuels that are or are expected to be available to reduce emissions from heavy duty transport, ships, boats, aeroplanes and mining, construction and agricultural equipment equipment by 30 % over the next ten years.

<u>The prospects of achieving the IPCC / UNFCCC global emission reduction targets</u>

The Authority claims that "the global community has agreed to limit greenhouse gas emissions so that the increase in warming is limited to less than two degrees above pre-industrial levels".

I presume that in it's final report the Authority will provide details of the agreement; particularly the signatories to the agreement, the agreed limit to global greenhouse gas emissions and the emission reductions that individual countries (both developed and developing countries) have committed to under the agreement.

As the Authority would be aware, the use of fossil fuels has become increasingly embedded in the developed countries economies since the industrial revolution.

A few salient facts

- fossil fuels remain the lowest cost and most versatile of source of energy; the recent significant declines in the price of coal and oil reinforce their cost advantage

- existing fossil fuel reserves are substantial ; equivalent to around 100 years of consumption

- the developing countries (including China) have over 70 % of the world's fossil fuel resources with China currently accounting for about half the global production and consumption of coal

- the developing countries (including China) now account for around 80 % of the global population. However, their per capita consumption of energy and emissions of carbon dioxide are currently around 1/3 of that in the developed countries reflecting their significantly lower standard of living.

- over 1 billion people in the developing countries (around 15 % of the global populations) currently have little or no access to modern energy services.

It is one thing to assume that the developing countries can improve their standard of living without increasing their use of fossil fuels but the reality is that the developed countries have not yet been able to show how it can be done.

As noted earlier

- the Annex B countries in the Kyoto Protocol have been pursuing renewable energy and energy efficiency for the past 25 years but their consumption based emissions have remained relatively unchanged ; "real world" issues such as the cost and intermittent nature of wind and solar power, the existing stock of fossil fuel dependent facilities, population growth, the preferences of consumers and the limits on availability of government financial assistance to make a significant transformation from fossil fuels to renewable energy have got " in the way" and will almost certainly remain "in the way" for the next ten years or more.

- there are currently no technically and financially viable substitutes for fossil fuels for the manufacture of cement, steel, aluminium, most plastics and many metals and chemicals and no low carbon fuels for the powering of planes, ships, boats, buses and heavy road transport and construction , mining and agricultural equipment.

Against this background,

- the IEA, the US Energy Information Administration, BP and Exxon Mobil have each forecast that the use of fossil fuels and global carbon dioxide emissions will continue to increase through to 2035

- seven million people responded to the recent UN survey My World 2015 and listed "action on climate change" last on a list of sixteen "priorities for world citizens"

- the Centre for International Climate and Environmental Research in Norway recently concluded that the prospects for achieving an effective international climate treaty are poor; the measures that are politically feasible are ineffective and the measures that would be effective are politically infeasible

I presume that in it's final report the Authority will include comment on

- the magnitude of the challenge to "decarbonise" the global economy to the extent necessary to mitigate climate change

- the alternatives to fossil fuels and the technologies that are currently available or are expected to be available to enable global emissions to be reduced from the current level of 36 billion tonnes per annum to below the IPCC targets which I understand translate to around 18 billion tonnes per annum by 2030 and to below 10 billion tonnes per annum by 2050.

- the prospects of the emission reduction commitments by individual countries (developed and developing) submitted to the UNFCCC prior to the conference in Paris in December putting the world on track to avoid 2 degrees of warming by 2100.

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17 May 2015

Attachments

1. Evolution of the global carbon dioxide emissions over the period 1980 to 2014 and of the concentration of carbon dioxide in the atmosphere over the period 1960 to 2015

   Global Carbon Project 2104 - CO 2 emissions 1990 to 2014

   Global Carbon Project 2014 - Emissions relating to consumption and production 1990 to 2013 Annex B and Non-Annex B, China, USA, EU 28 and India

   Global Carbon Project 2014 - Major flows from Production to Consumption

   Concentration of CO2 in the atmosphere at Mauna Loa Observatory

2. Comparison of IPCC climate models predictions of global atmospheric temperatures with observed reality

   Graphical comparison of IPCC climate model predictions and observed reality downloaded from the websites of a number of respected independent climate scientists including Dr R. Spenser, formerly with NASA and Dr J Christie from the University of Alabama

3. Forecasts of global carbon dioxide emissions for the period 2015 to 2035

   Global Carbon Project - Global Carbon Budget 2014

   International Energy Agency - World Energy Outlook 2013

      Emissions off track in the run up to the 2015 climate summit
      A mix that is slow to change
      Capacity to change ?

   US Energy Administration - International Energy Outlook 2013

   BP Energy Outlook 2013

      Carbon emissions are rising too fast for comfort

   Lawrence Berkeley National Laboratory - Key China Energy Statistics 2014

   Australian Government - Department of Environment – Australia, US and China emissions

Attachment 1

The attached

- graph showing the evolution of the concentration of carbon dioxide at the Mauna Loa Observatory over the period 1960 to April 2015

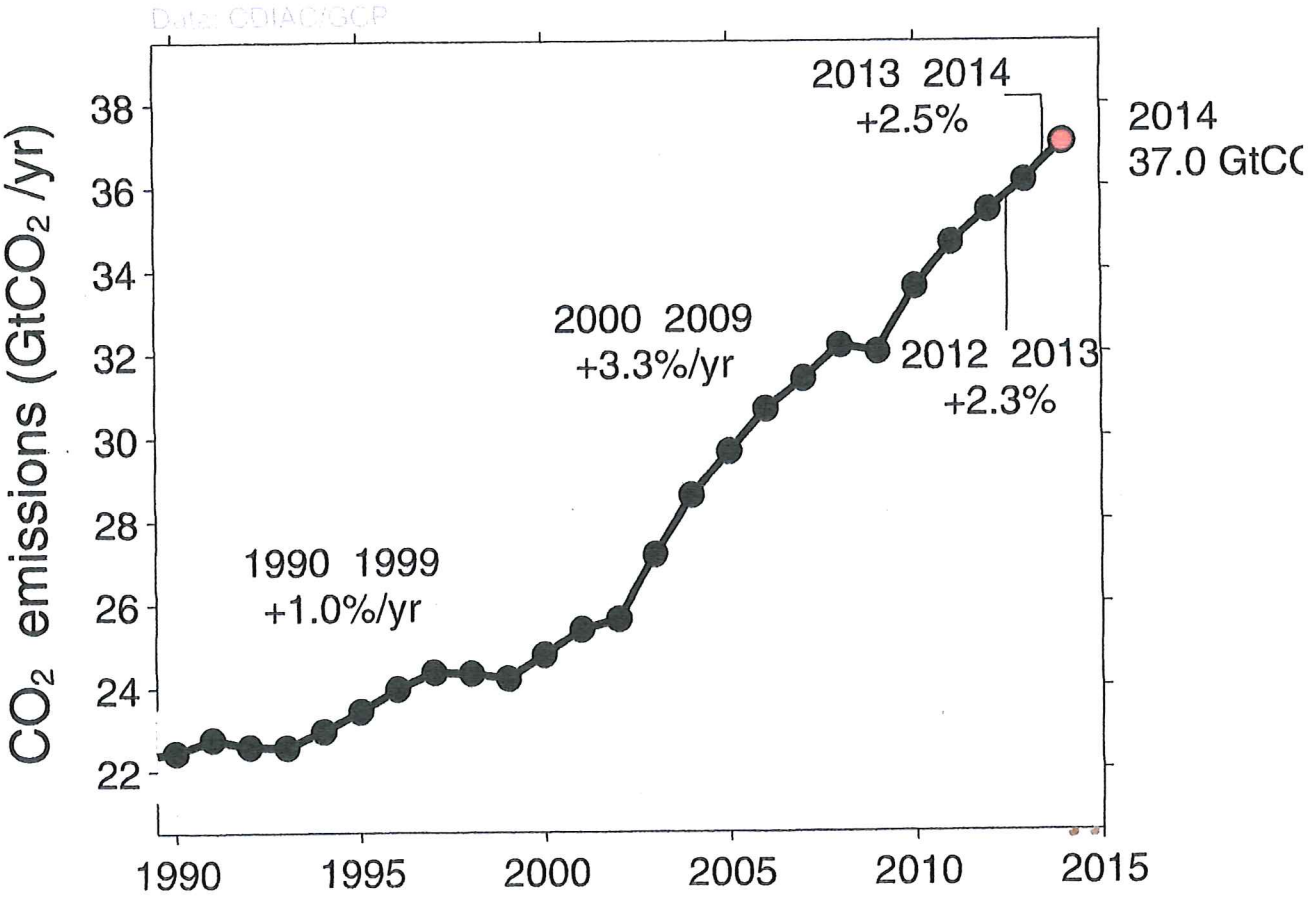
- extracts from the Global Carbon Project's Global Carbon Budget 2014

do not support the Climate Change Authority's claims that

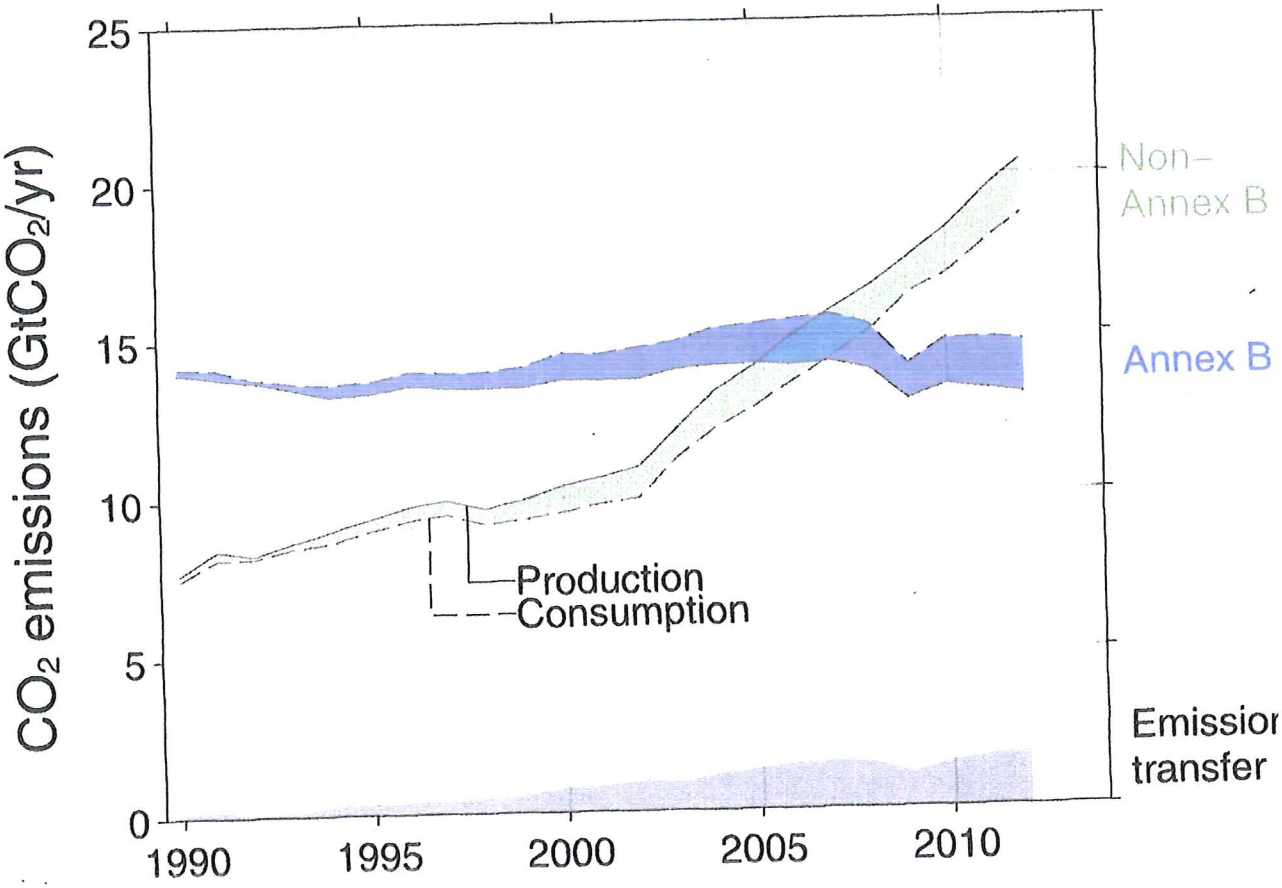
- global attention and action is starting to have a material impact on emissions

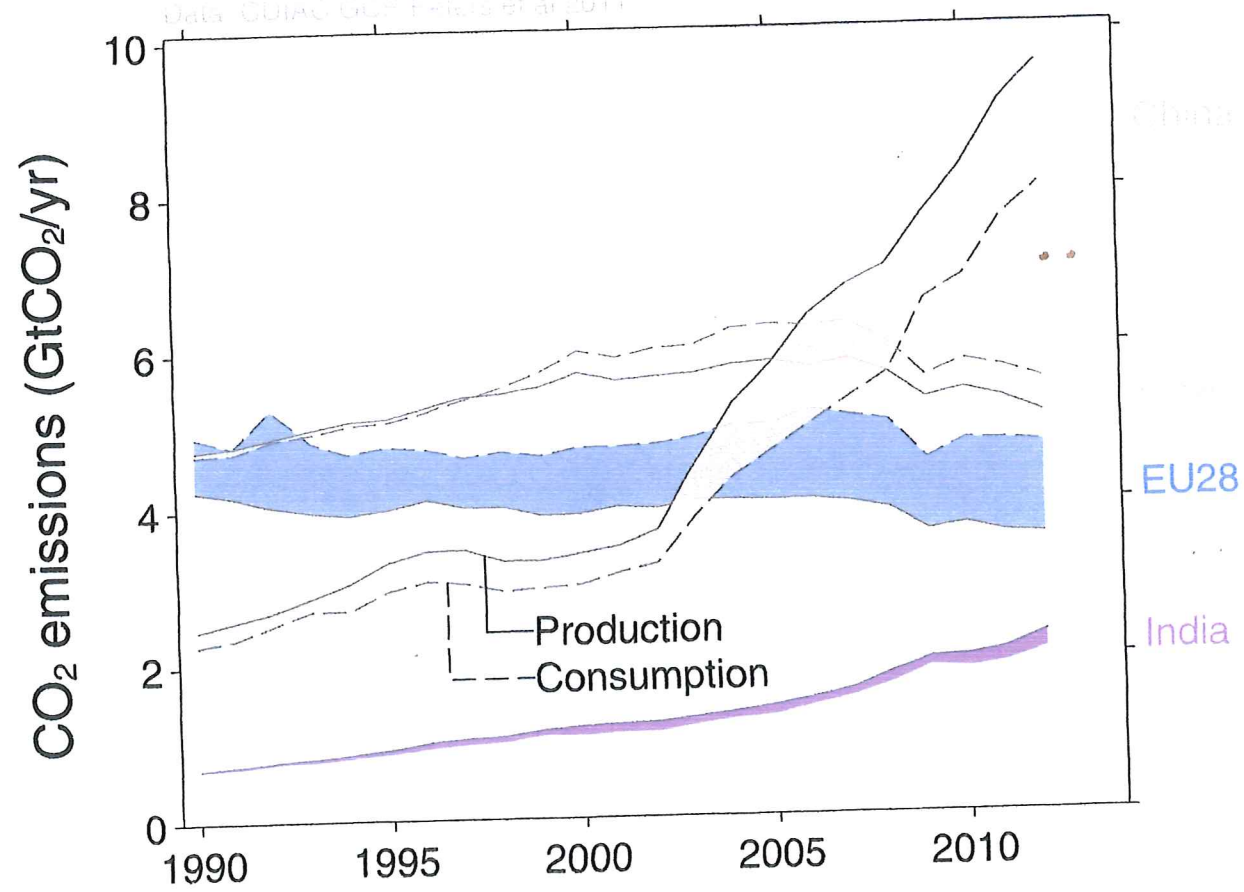
- experience indicates that counties overwhelmingly take their emission reduction targets seriously

Global Carbon Project - Global Carbon Budget 2014



Global Carbon Project - Global Carbon Budget 2014

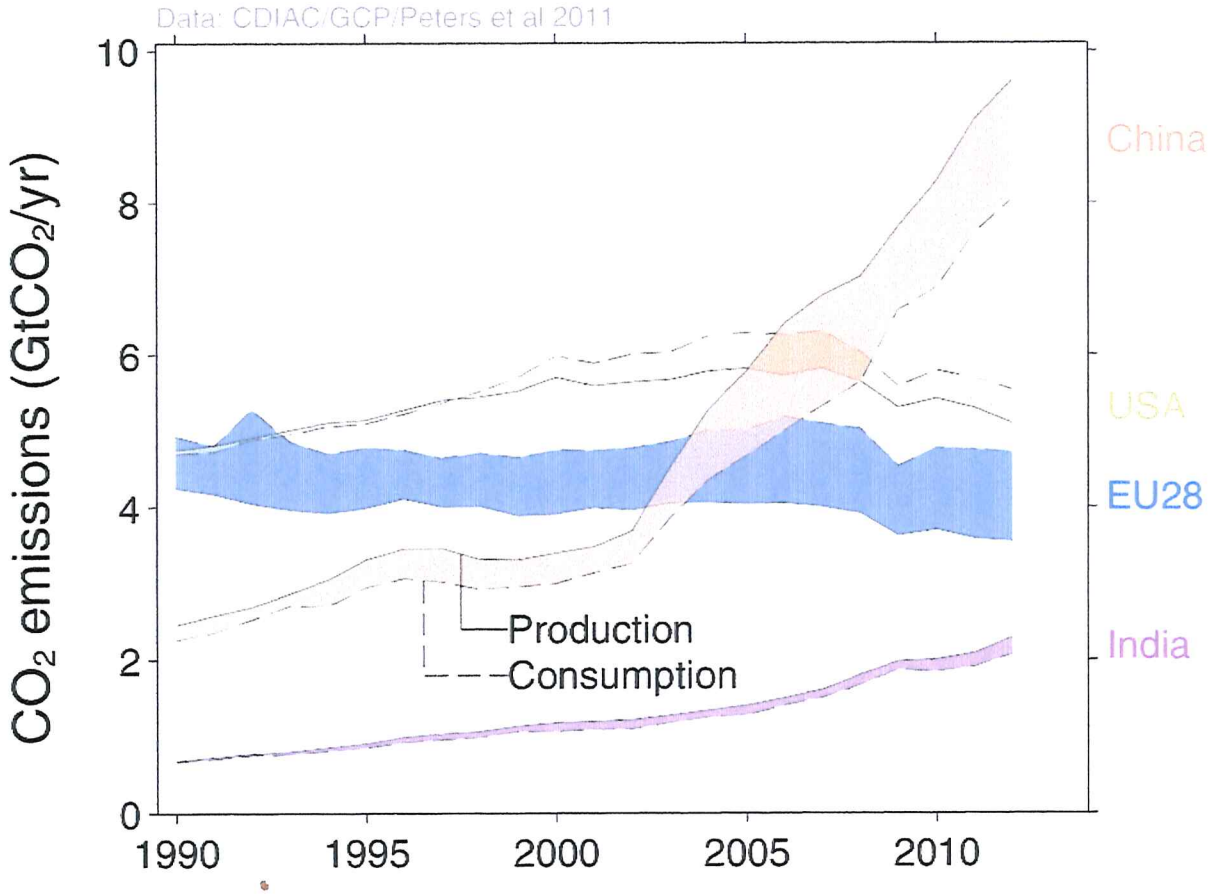




GLOBAL CARBON PROJECT

Consumption-based emissions (carbon footprint)

Allocating emissions to the consumption of goods and services provides an alternative perspective on emission drivers



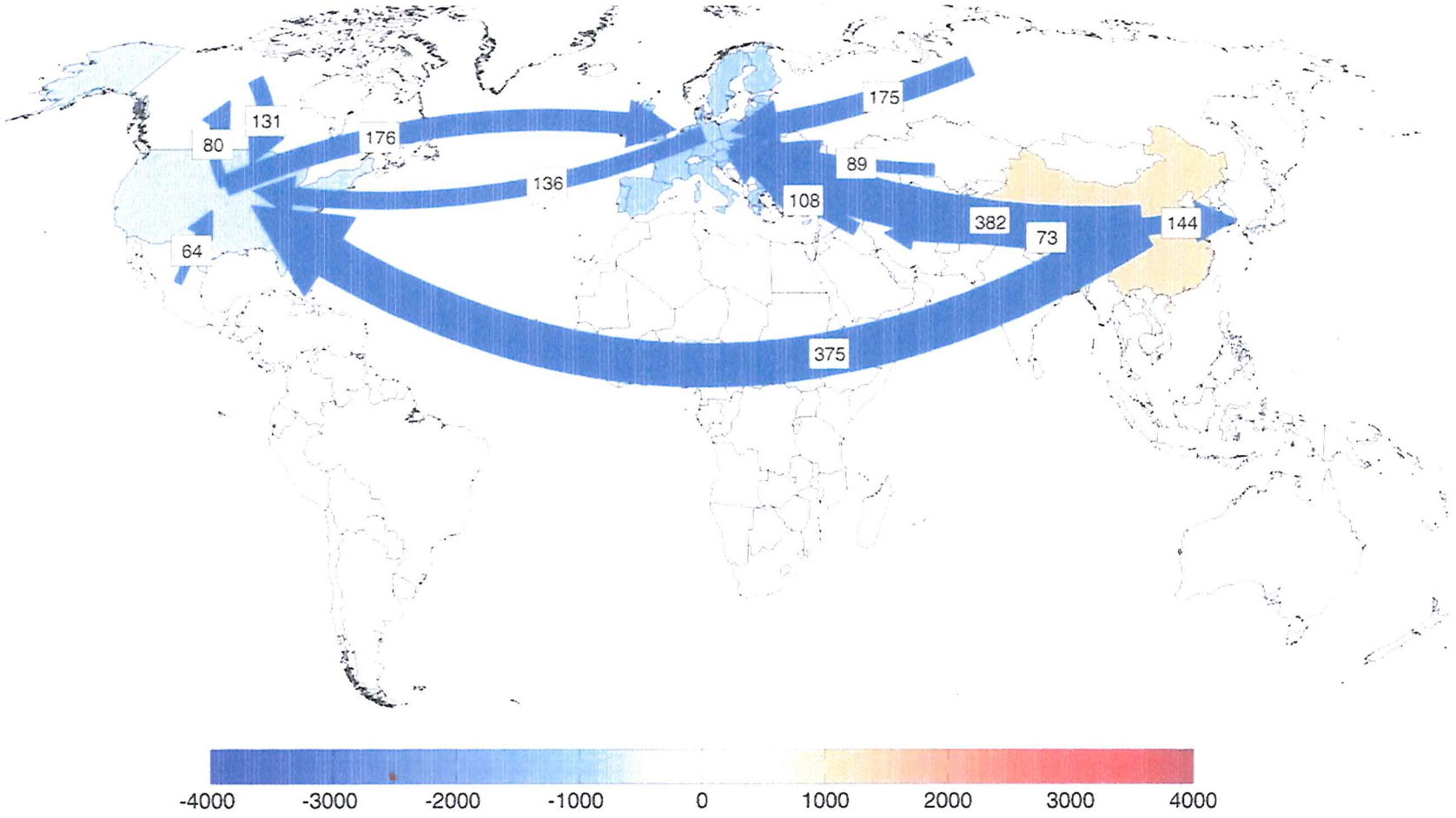
Consumption-based emissions are calculated by adjusting the standard production-based emissions to account for international trade

Source: Le Quéré et al 2014; Peters et al 2011;Global Carbon Project 2014

GLOBAL CARBON PROJECT

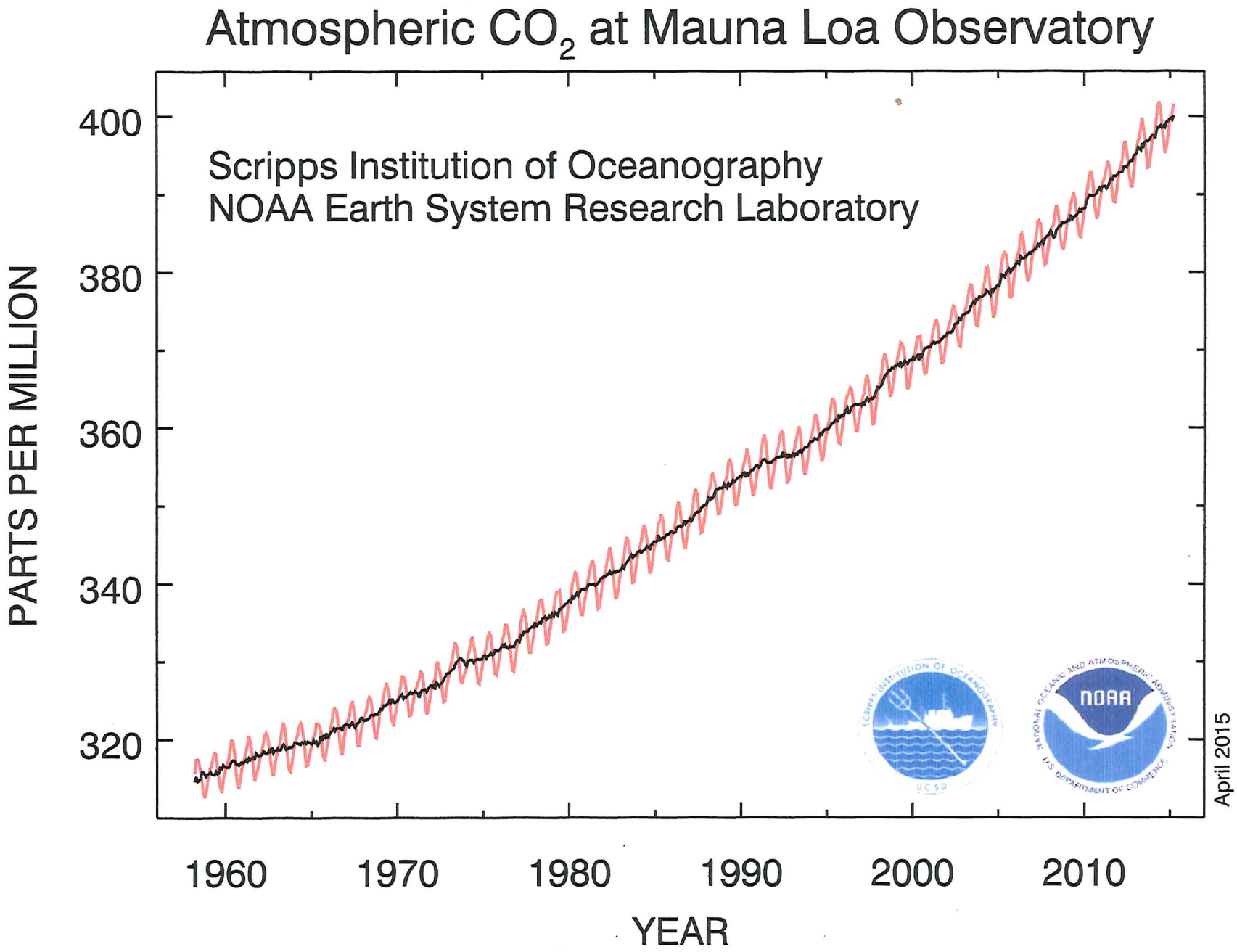
Major Flows from Production to Consumption

Start of Arrow: fossil-fuel combustion
End of arrow: goods and services consumption



Values for 2007. EU is treated as one region. Units: $MtCO_2$

Source: Peters et al 2012


Atmospheric CO_2 at Mauna Loa Observatory
Scripps Institution of Oceanography
NOAA Earth System Research Laboratory
PARTS PER MILLION
400
380
360
340
320
1960
1970
1980
1990
2000
2010
YEAR
April 2015

Attachment 2

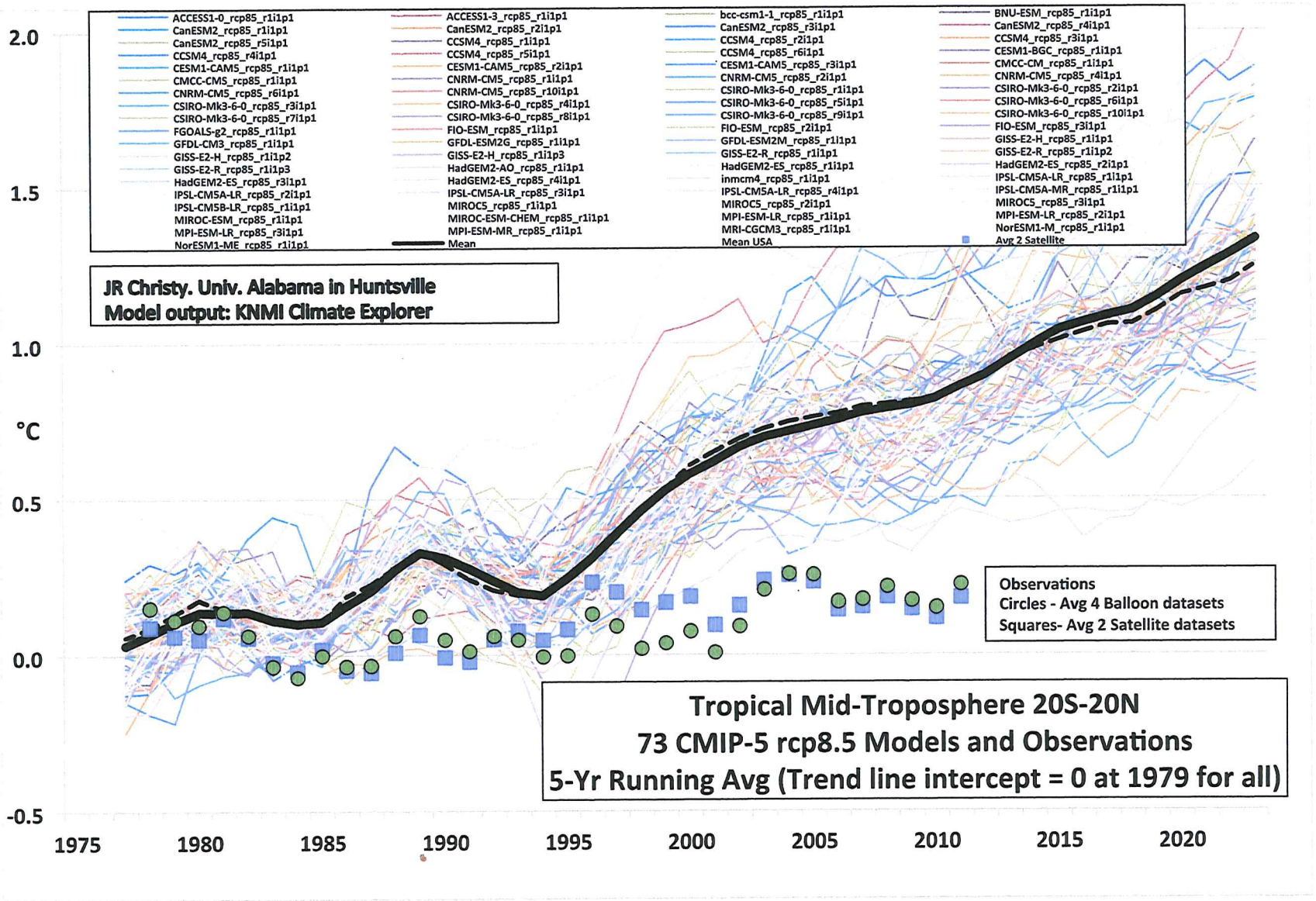
Comparison of IPCC climate models predictions of warming with observed reality

In Assessment Report 5, the IPCC note that for the period 1998 to 2012, 111 of the 114 available climate models show a surface warming trend larger than observations.

However, the IPCC did not include any quantitative comparisons of the predictions of the climate models with the actual evolution of global atmospheric temperatures .

The attached graphs extracted from eminent climate science researcher's reports do not support the Climate Change Authority's claim that there is greater confidence in the IPCC's climate models predictions of the connection between global atmospheric temperatures and the concentration of carbon dioxide in the atmosphere.

The comparisons indicate that over the period from 1980 to 2014, the actual increase in global atmospheric temperatures has been about one third of that predicted by the IPCC's climate models for "business as usual" increases in the global carbon dioxide emissions and do not support the Authority's claim that there is greater confidence in the IPCC's models connection between increasing concentration of carbon dioxide in the atmosphere and warming of the atmosphere.


ACCESS1-0_rcp85_r1i1p1
CanESM2_rcp85_r1i1p1
CanESM2_rcp85_r5i1p1
CCSM4_rcp85_r4i1p1
CESM1-CAM5_rcp85_r1i1p1
CMCC-CMS_rcp85_r1i1p1
CNRM-CM5_rcp85_r6i1p1
CSIRO-Mk3-6-0_rcp85_r3i1p1
CSIRO-Mk3-6-0_rcp85_r7i1p1
FGOALS-g2_rcp85_r1i1p1
GFDL-CM3_rcp85_r1i1p1
GISS-E2-H_rcp85_r1i1p2
GISS-E2-R_rcp85_r1i1p3
HadGEM2-ES_rcp85_r3i1p1
IPSL-CM5A-LR_rcp85_r2i1p1
IPSL-CM5B-LR_rcp85_r1i1p1
MIROC-ESM_rcp85_r1i1p1
MPI-ESM-LR_rcp85_r3i1p1
NorESM1-ME_rcp85_r1i1p1
ACCESS1-3_rcp85_r1i1p1
CanESM2_rcp85_r2i1p1
CCSM4_rcp85_r1i1p1
CCSM4_rcp85_r5i1p1
CESM1-CAM5_rcp85_r2i1p1
CNRM-CM5_rcp85_r1i1p1
CNRM-CM5_rcp85_r10i1p1
CSIRO-Mk3-6-0_rcp85_r4i1p1
CSIRO-Mk3-6-0_rcp85_r8i1p1
FIO-ESM_rcp85_r1i1p1
GFDL-ESM2G_rcp85_r1i1p1
GISS-E2-H_rcp85_r1i1p3
HadGEM2-AO_rcp85_r1i1p1
HadGEM2-ES_rcp85_r4i1p1
IPSL-CM5A-LR_rcp85_r3i1p1
MIROC5_rcp85_r1i1p1
MIROC-ESM-CHEM_rcp85_r1i1p1
MPI-ESM-MR_rcp85_r1i1p1
Mean
bcc-csm1-1_rcp85_r1i1p1
CanESM2_rcp85_r3i1p1
CCSM4_rcp85_r2i1p1
CCSM4_rcp85_r6i1p1
CESM1-CAM5_rcp85_r3i1p1
CNRM-CM5_rcp85_r2i1p1
CSIRO-Mk3-6-0_rcp85_r1i1p1
CSIRO-Mk3-6-0_rcp85_r5i1p1
CSIRO-Mk3-6-0_rcp85_r9i1p1
FIO-ESM_rcp85_r2i1p1
GFDL-ESM2M_rcp85_r1i1p1
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HadGEM2-ES_rcp85_r1i1p1
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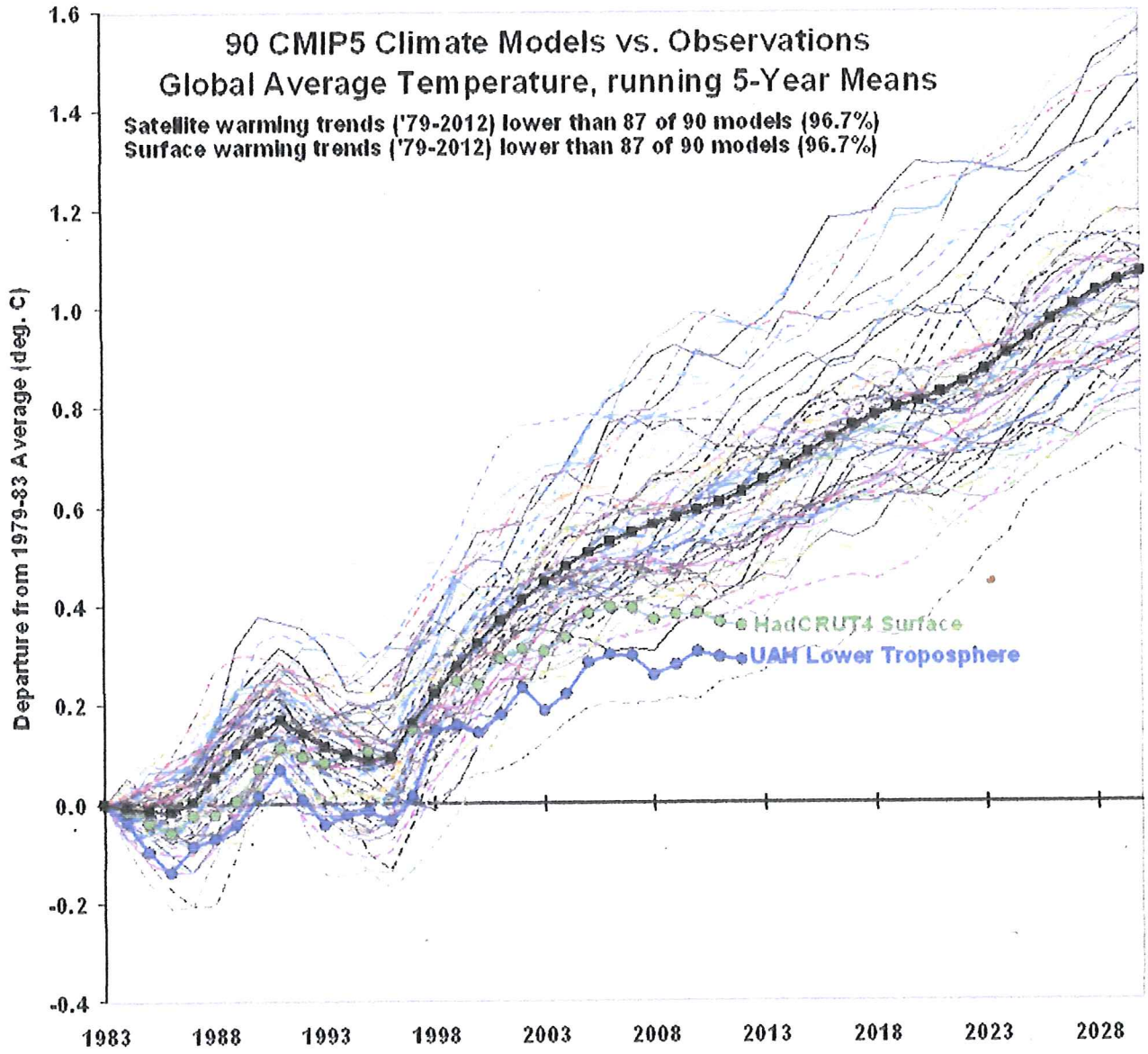
MIROC5_rcp85_r2i1p1
MPI-ESM-LR_rcp85_r1i1p1
MRI-CGCM3_rcp85_r1i1p1
Mean USA
BNU-ESM_rcp85_r1i1p1
CanESM2_rcp85_r4i1p1
CCSM4_rcp85_r3i1p1
CESM1-BGC_rcp85_r1i1p1
CMCC-CM_rcp85_r1i1p1
CNRM-CM5_rcp85_r4i1p1
CSIRO-Mk3-6-0_rcp85_r2i1p1
CSIRO-Mk3-6-0_rcp85_r6i1p1
CSIRO-Mk3-6-0_rcp85_r10i1p1
FIO-ESM_rcp85_r3i1p1
GISS-E2-H_rcp85_r1i1p1
GISS-E2-R_rcp85_r1i1p2
HadGEM2-ES_rcp85_r2i1p1
IPSL-CM5A-LR_rcp85_r1i1p1
IPSL-CM5A-MR_rcp85_r1i1p1
MIROC5_rcp85_r3i1p1
MPI-ESM-LR_rcp85_r2i1p1
NorESM1-M_rcp85_r1i1p1
Avg 2 Satellite
JR Christy. Univ. Alabama in Huntsville
Model output: KNMI Climate Explorer
2.0
1.5
1.0
°C
0.5
0.0
-0.5
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
Observations
Circles - Avg 4 Balloon datasets
Squares- Avg 2 Satellite datasets
Tropical Mid-Troposphere 20S-20N
73 CMIP-5 rcp8.5 Models and Observations
5-Yr Running Avg (Trend line intercept = 0 at 1979 for all)

90 climate model projectons versus reality

Anthony Watts · October 14, 2013

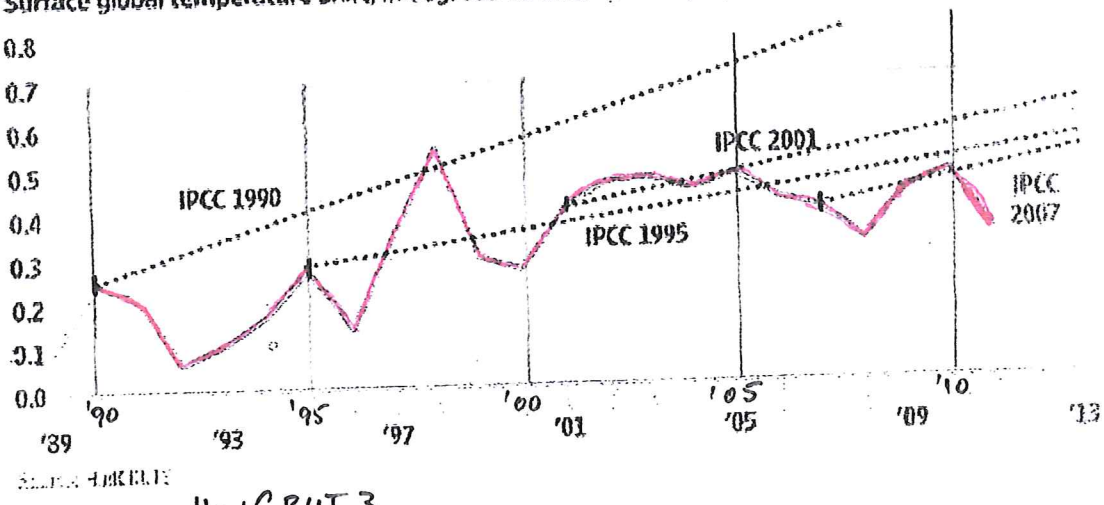
Reality wins, it seems. Dr Roy Spencer writes:

> *As seen in the following graphic, over the period of the satellite record (1979-2012), both the surface and satellite observations produce linear temperature trends which are below 87 of the 90 climate models used in the comparison.*



Reality Versus Alarm

Surface global temperature shift, in degrees Celsius, vs IPCC projections, 1989-2011



Source HadCRUT3

Attachment 3

The attached extracts from recent reports by

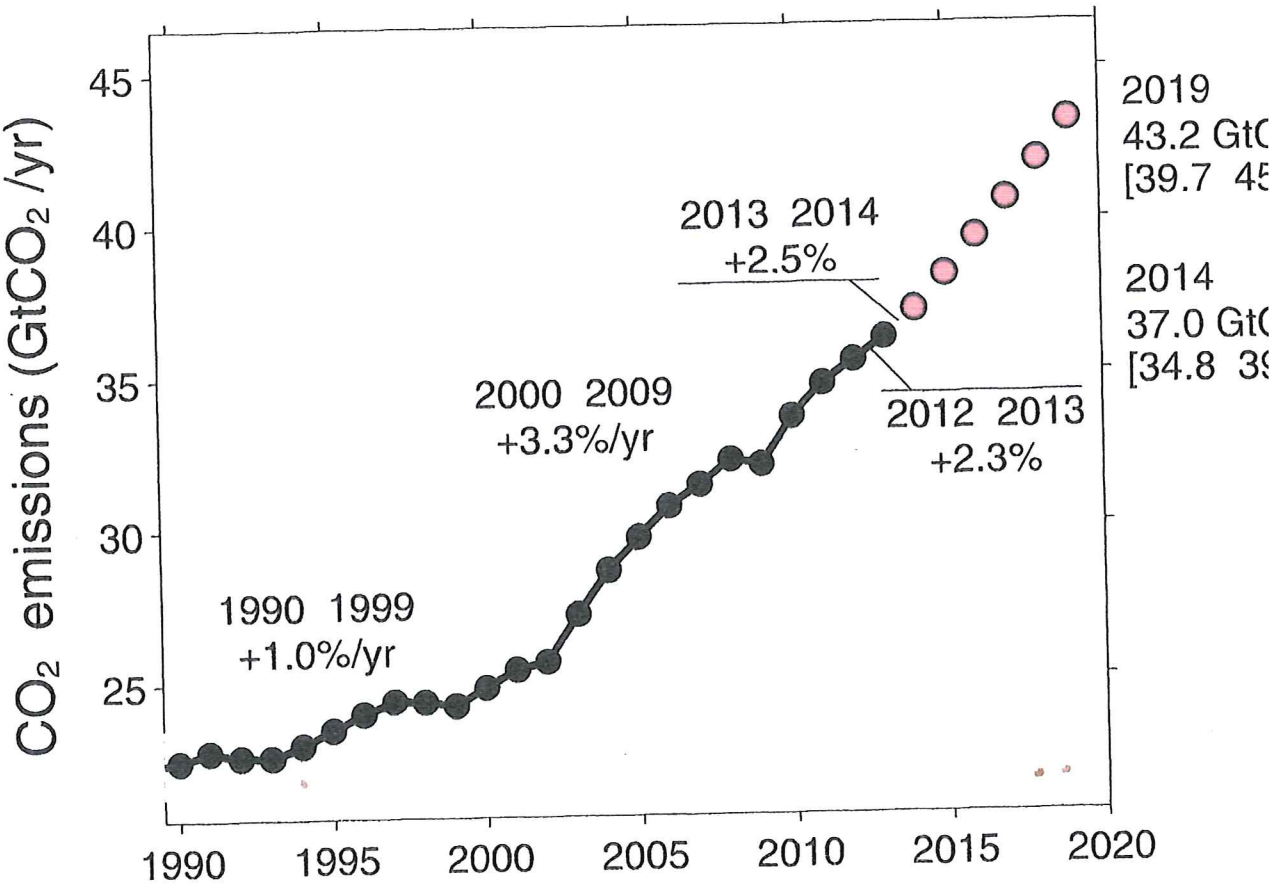
- the Global Carbon Project
- the International Energy Agency
- the US Energy Information Administration
- BP
- the Australian Government Department of the Environment
- the Berkeley Laboratory

do not support the Climate Change Authority's claims that

- global attention and action is starting to have a material impact on emissions
- experience indicates that countries overwhelmingly take their emissions reduction targets seriously
- projections suggest that the post 2020 pledges by the EU, the USA and China could reduce warming by around 3 degrees C
- China's pledge (that it intends to achieve the peaking of CO2 emissions around 2030) is a "crucial undertaking"

and cast serious doubt on the UNFCCC in Paris in December 2015 reaching an agreement that would avoid further increases in global carbon dioxide emissions over the next 10 years, let alone reach an agreement to reduce emissions to 30 % below 2005 levels by 2025.

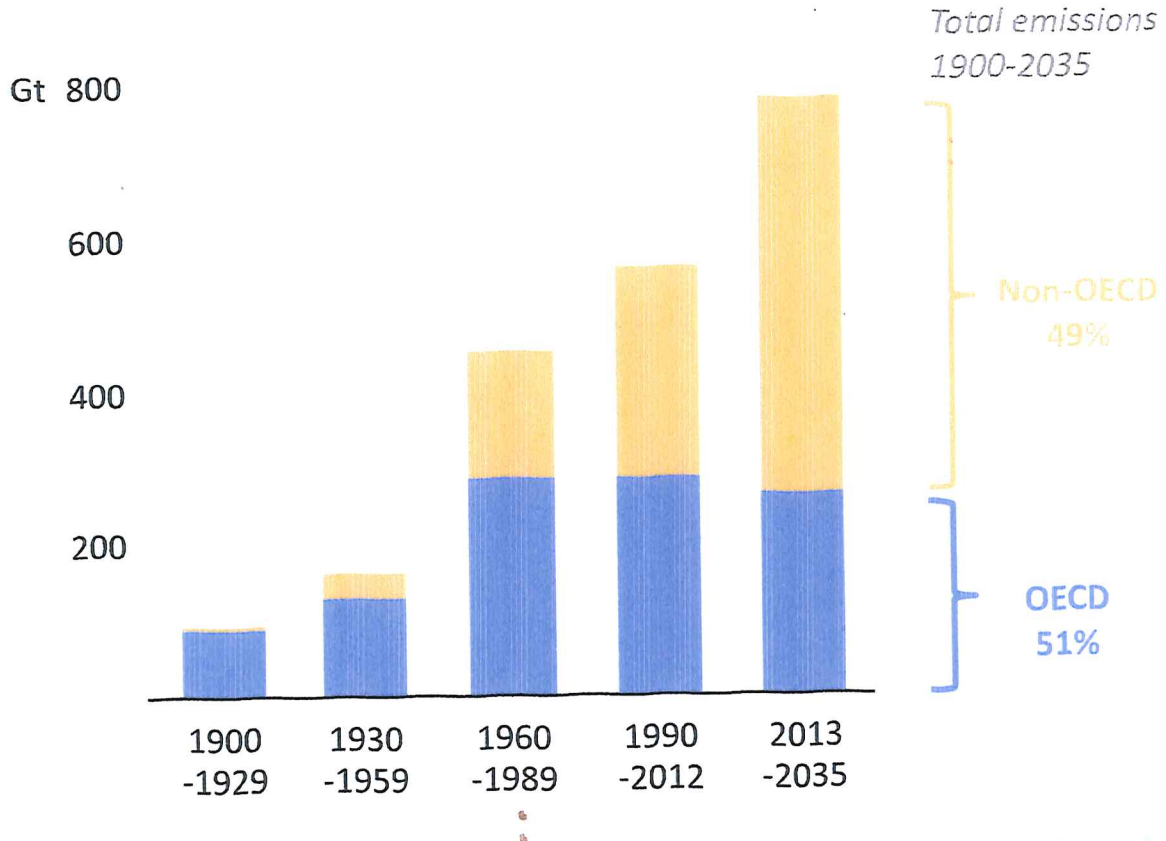
GLOBAL CARBON PROJECT - Global Carbon Budget 2014



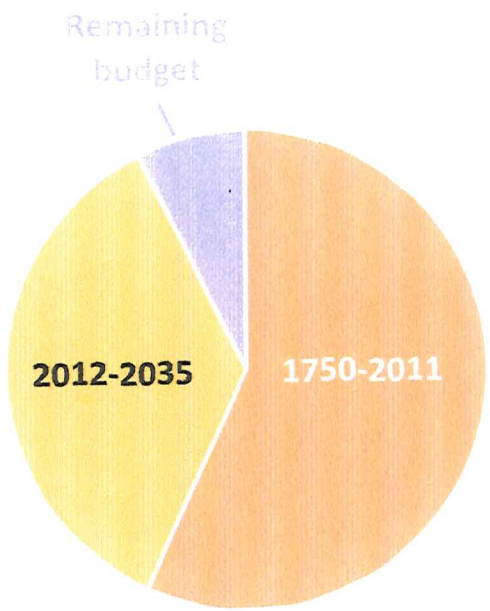
Emissions off track in the run-up to the 2015 climate summit in France

WORLD ENERGY OUTLOOK 2013

Cumulative energy-related CO_2 emissions



'Carbon budget' for 2 °C



Non-OECD countries account for a rising share of emissions, although 2035 per capita levels are only half of OECD; the 2 °C 'carbon budget' is being spent much too quickly

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A mix that is slow to change

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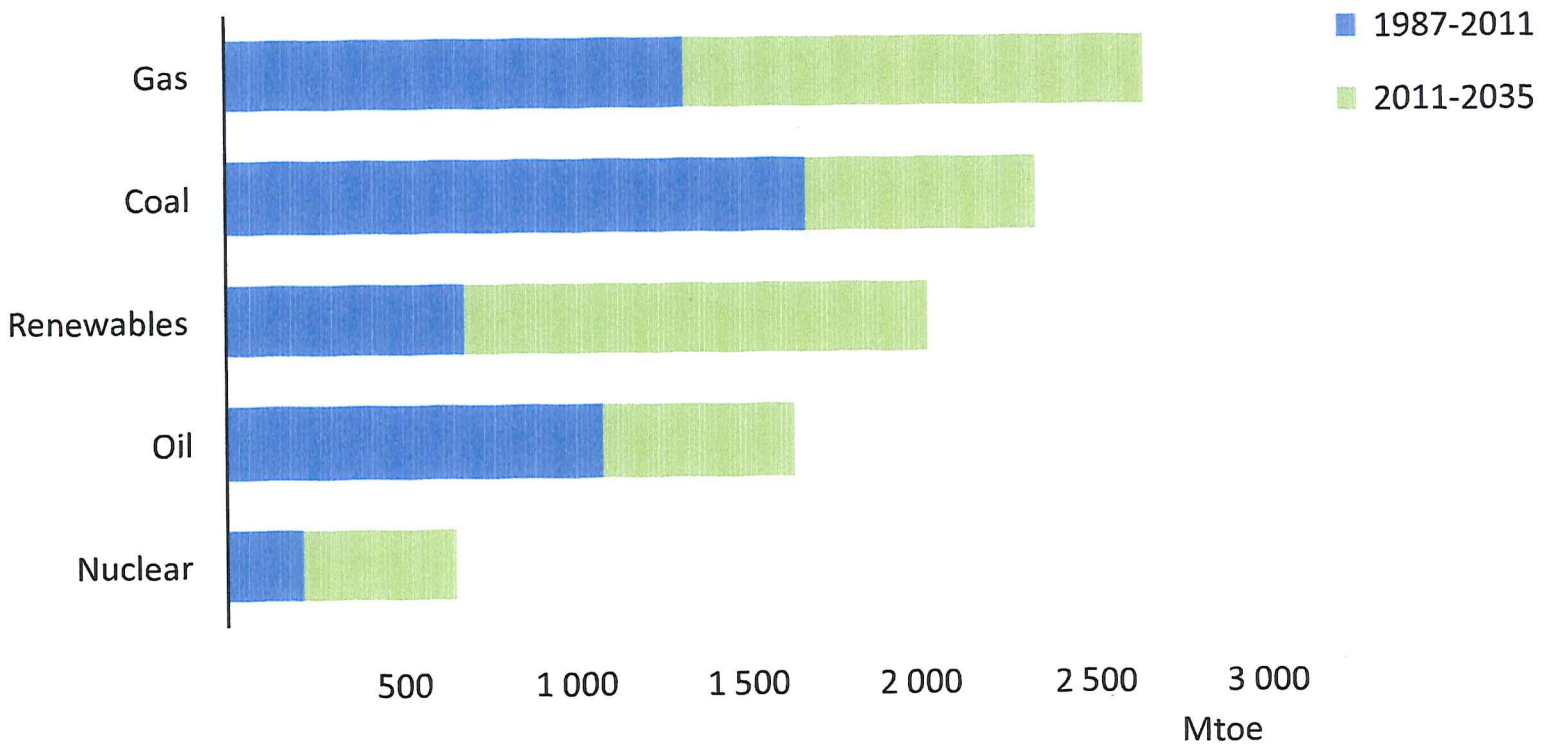
Growth in total primary energy demand



Today's share of fossil fuels in the global mix, at 82%, is the same as it was 25 years ago; the strong rise of renewables only reduces this to around 75% in 2035

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Capacity to change?

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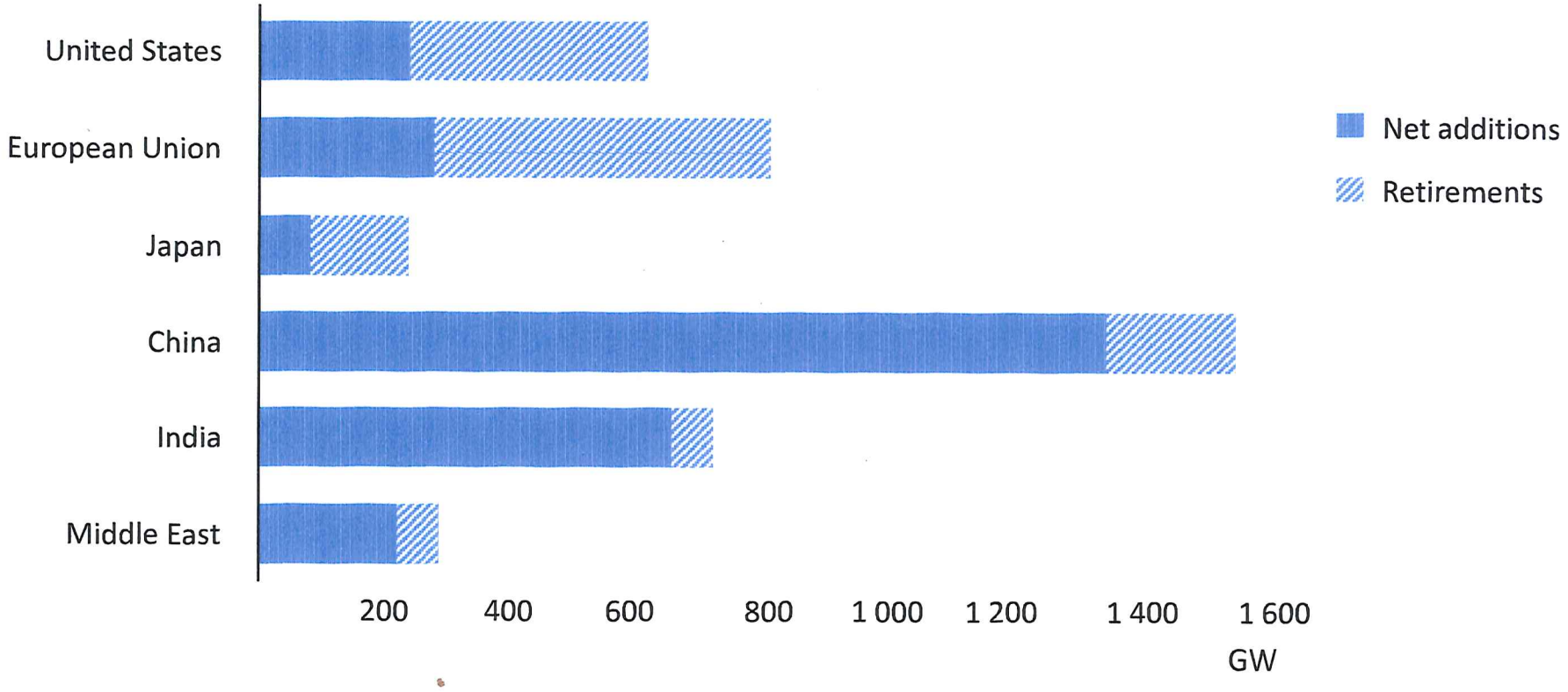
Power generation capacity additions and retirements, 2013-2035



China & India together build almost 40% of the world's new capacity; 60% of capacity additions in the OECD replace retired plants

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Chapter 9

Energy-related carbon dioxide emissions

Overview

Energy-related carbon dioxide emissions—those emissions produced through the combustion of liquid fuels, natural gas, and coal—account for much of the world's anthropogenic greenhouse gas emissions. As a result, energy consumption is an important component of the global climate change debate. In the *IEO2013* Reference case, which does not assume new policies to limit greenhouse gas emissions, world energy-related carbon dioxide emissions[47] increase from 31.2 billion metric tons in 2010 to 36.4 billion metric tons in 2020 and 45.5 billion metric tons in 2040. Much of the growth in emissions is attributed to the developing non-OECD nations that continue to rely heavily on fossil fuels to meet fast-paced growth in energy demand. Non-OECD carbon dioxide emissions total 31.6 billion metric tons in 2040, or 69 percent of the world total. In comparison, OECD emissions total 13.9 billion metric tons in 2040—31 percent of the world total (Table 20 and Figure 140).

Near-term events can have a substantial impact on year-to-year changes in energy use and the corresponding carbon dioxide emissions. For instance, recent years have seen fluctuations in economic growth and, as a result, energy demand and emissions. During the 2008-2009 global economic recession, world energy consumption contracted, and as a result total world carbon dioxide emissions in 2009 were about 1 percent lower than in 2008. In 2010, as the world economy rebounded—especially among the emerging economies—total emissions increased by about 5.1 percent. In the longer term, conservation, improved technology and increased use of energy sources with low or no emissions moderate the growth of energy-related carbon dioxide emissions in the Reference case.

The *IEO2013* Reference case projections are, to the extent possible, based on existing laws and policies. Projections for carbon dioxide emissions could change significantly if new laws and policies aimed at reducing greenhouse gas emissions were implemented in the future. For example, emissions cap-and-trade programs, fees, and credits for meeting energy efficiency standards could facilitate global efforts to curb emissions that contribute to global warming. In addition, beyond energy-related carbon dioxide, other greenhouse gases (such as methane) and other activities that influence carbon dioxide levels (such as deforestation) contribute to anthropogenic influences on the climate but are not included in the *IEO2013* Reference case projections.

Figure 140. World energy-related carbon dioxide emissions, 1990-2040 (billion metric tons)

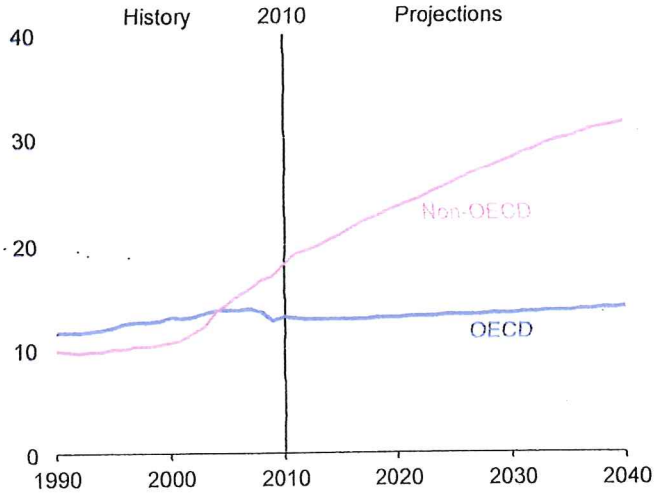


Table 20. OECD and non-OECD energy-related carbon dioxide emissions by fuel type, 1990-2040 (billion metric tons)

Region/country	1990	2010	2020	2030	2040	Average annual percent change, 2010-2040
OECD	**11.6**	**13.1**	**13.0**	**13.4**	**13.9**	**0.2**
Liquid fuels	5.5	5.8	5.7	5.6	5.7	-0.1
Natural gas	2.0	3.0	3.4	3.7	4.1	1.1
Coal	4.1	4.2	4.0	4.0	4.0	-0.2
Non-OECD	**9.8**	**18.1**	**23.4**	**28.1**	**31.6**	**1.9**
Liquid fuels	3.6	5.4	6.6	7.7	9.0	1.7
Natural gas	2.0	3.2	3.8	4.9	6.0	2.2
Coal	4.2	9.6	13.0	15.5	16.6	1.8
World total	**21.5**	**31.2**	**36.4**	**41.5**	**45.5**	**1.3**

Note: Historical estimates are as of November 15, 2012, and do not include revisions made to the series after that date.

[47] In *IEO2013*, energy-related carbon dioxide emissions are defined as emissions related to the combustion of fossil fuels (liquid fuels, natural gas, and coal). Emissions from the flaring of natural gas are not included.

Figure 145. Average annual increases in non-OECD energy-related carbon dioxide emissions by region, 2010-2040 (percent per year)

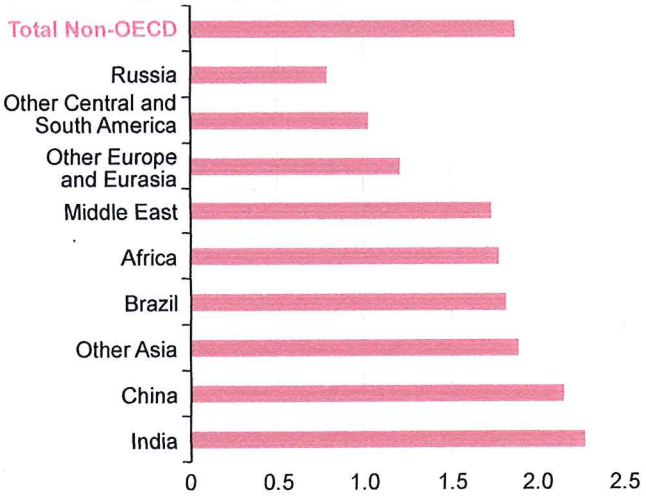


Figure 146. Increases in energy-related carbon dioxide emissions by fuel type for non-OECD regions with the largest increases, 2010-2040 (billion metric tons)

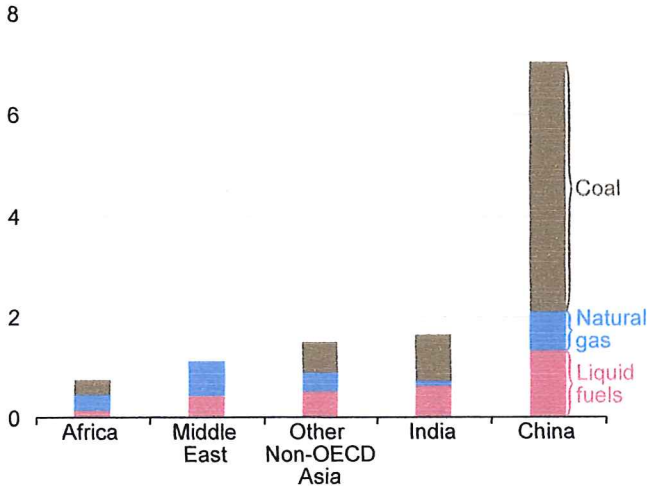
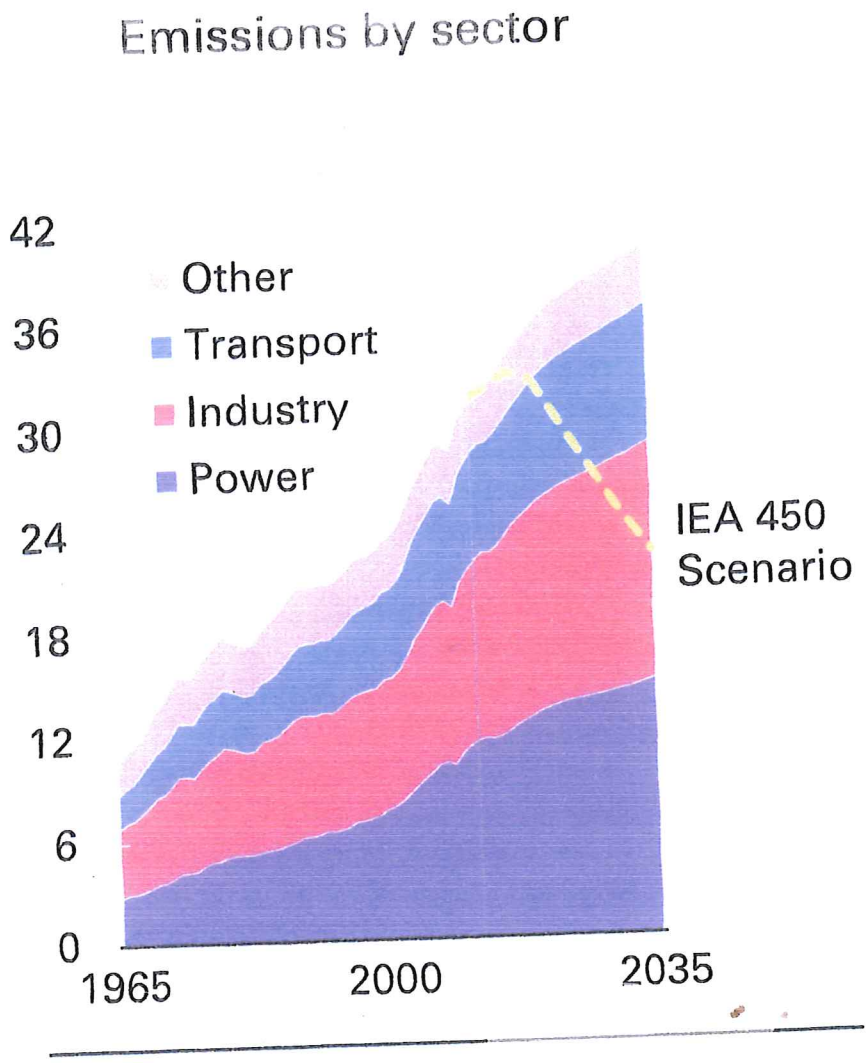


Table 21. World carbon dioxide emissions by region and country in the Reference case, 1990-2040 (million metric tons)

						Average annual percent change	
Region/Country	1990	2010	2020	2030	2040	1990-2010	2010-2040
OECD							
OECD Americas	**5,832**	**6,657**	**6,627**	**6,880**	**7,283**	**0.7**	**0.3**
United States	5,032	5,608	5,454	5,523	5,691	0.5	0.0
Canada	466	546	574	609	654	0.8	0.6
Mexico/Chile	334	503	599	748	937	2.1	2.1
OECD Europe	**4,195**	**4,223**	**4,097**	**4,151**	**4,257**	**0.0**	**0.0**
OECD Asia	**1,585**	**2,200**	**2,296**	**2,340**	**2,358**	**1.7**	**0.2**
Japan	1,047	1,176	1,220	1,215	1,150	0.6	-0.1
South Korea	242	581	627	666	730	4.5	0.8
Australia/New Zealand	296	443	449	460	478	2.0	0.3
Total OECD	**11,612**	**13,079**	**13,020**	**13,373**	**13,897**	**0.6**	**0.2**
Non-OECD							
Non-OECD Europe and Eurasia	**4,199**	**2,645**	**2,898**	**3,249**	**3,526**	**-2.3**	**1.0**
Russia	2,368	1,595	1,749	1,945	2,018	-2.0	0.8
Other	1,831	1,050	1,149	1,304	1,508	-2.7	1.2
Non-OECD Asia	**3,652**	**11,538**	**15,812**	**19,392**	**21,668**	**5.9**	**2.1**
China	2,270	7,885	11,532	14,028	14,911	6.4	2.1
India	569	1,695	2,109	2,693	3,326	5.6	2.3
Other	814	1,958	2,171	2,671	3,431	4.5	1.9
Middle East	**669**	**1,649**	**2,126**	**2,419**	**2,756**	**4.6**	**1.7**
Africa	**657**	**1,070**	**1,224**	**1,474**	**1,815**	**2.5**	**1.8**
Central and South America	**663**	**1,202**	**1,366**	**1,556**	**1,793**	**3.0**	**1.3**
Brazil	235	450	547	632	771	3.3	1.8
Other	428	752	819	924	1,022	2.9	1.0
Total non-OECD	**9,840**	**18,104**	**23,426**	**28,092**	**31,558**	**3.1**	**1.9**
World total	**21,452**	**31,183**	**36,446**	**41,464**	**45,453**	**1.9**	**1.3**

BP Energy Outlook 2103

Carbon emissions are rising too fast for comfort.



Energy Outlook 2035

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Lawrence Berkeley National Laboratory - Key China Energy Statistics 2014

Key China Energy Statistics 2014

Title	Key China Energy Statistics 2014
Publication Type	Book
Year of Publication	2014
Authors	Fridley, David (/publications?f[author]=1), Mark D. Levine (/publications?f[author]=61), Hongyou Lu (/publications?f[author]=64), and Cecilia Fino-Chen (/publications?f[author]=83)
Publisher	Lawrence Berkeley National Laboratory
City	Berkeley, CA
Keywords	china (/publications?f[keyword]=1), co2 (/publications?f[keyword]=45), energy (/publications?f[keyword]=23)
Abstract	

2014 Highlights:

- China accounted for 20% of global energy consumption.
- Energy grew 51% percent as fast as GDP.
- China accounted for more than 20% of global energy-related CO2 emissions.
- China's per capita CO2 emissions were 6 tonnes/person,
- 32% percent above the world average but 65% below that of the United States.
- China accounted for a staggering 47 percent of total world coal consumption.
- In contrast, oil consumption was 11 percent of world demand and natural gas, 4 percent.
- Since 2000, natural gas consumption grew at a rate of 15 percent per year.
- China's Western region continues to be the dominant source of increased production of oil and natural gas.
- China built 88 GW of power plants, of which about 60 percent were coal-based. To date, about 35% of all global coal-fired power generation capacity has been built in China.
- China built 14.6 GW of wind power, accounting for about 32% percent of world capacity additions.
- China installed 1.1 GW of solar power, 4% percent of world capacity additions.
- Imports of natural gas jumped 40% to 63 billion cubic meters (including a 50% increase in pipeline gas from Central Asia), crude oil imports rose 7% to 5.4 million barrels/day, and coal imports rose 29% to 234 million tonnes.

File Attachments:

PDF (https://china.lbl.gov/sites/all/files/key_china_energy_stattistics_2014_online.final_.pdf)

AUSTRALIA, US AND CHINA TARGETS HISTORICAL AND BUSINESS AS USUAL PROJECTED EMISSIONS

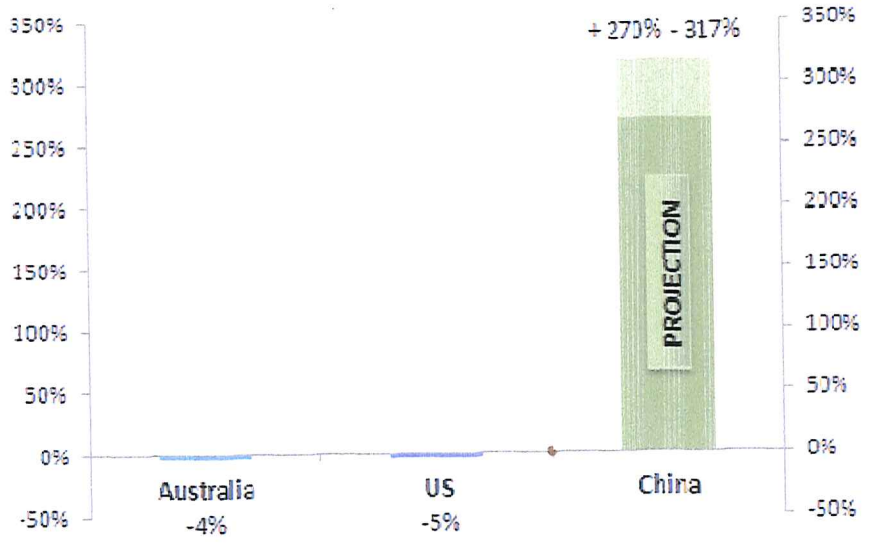
Australia, United States and China 2020 emission reduction targets

Country	2020 Target	2020 Target emissions absolute (Mt CO_2-e)	2020 target from a		
			1990 base	2000 base	2005 base
Australia	5 per cent below 2000	555[i]	-4 per cent	-5 per cent	-12 per cent
United States	17 per cent below 2005	5144	-5 per cent	-20 per cent	-17 per cent
China	Carbon dioxide intensity target of 40-45 per cent below 2005				

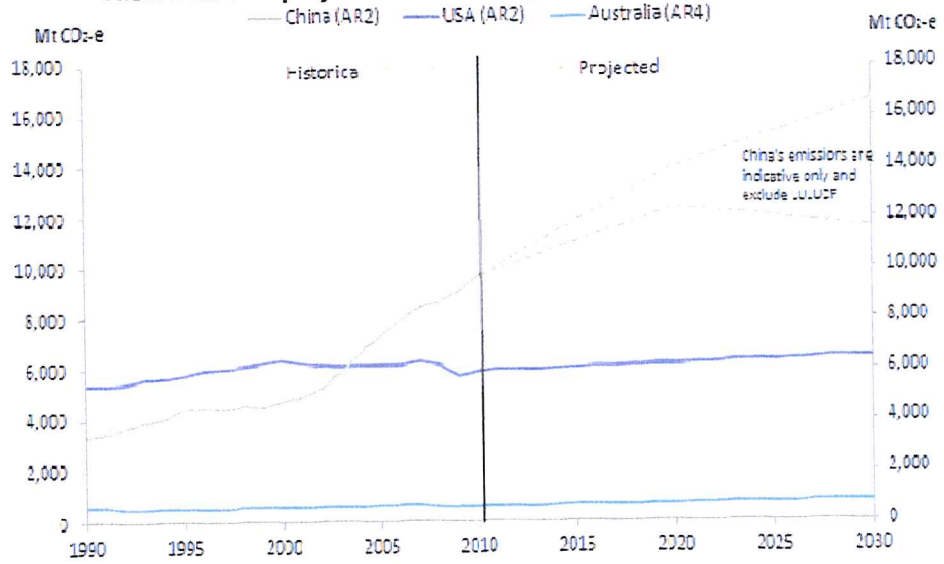
Historical emissions, 2020 target for Australia and United States and Business as Usual (BAU) Projections for China (Mt CO_2-e)[ii]

Country	1990	2000	2005	2010	2020	2030
Australia[iii]	580	586	635	590	555 (target)	
United States[iv]	5,389	6,395	6,197	5,923	5,144 (target)	
China[v]	3,356	4,754	7,337	9,769	12,400-14,000 (indicative projection)	11,600 – 16,600 (indicative projection)

Australia and United States 2020 target on 1990 levels and China emission projections



Historical and projected emissions, Australia, US and China



Australian Government - Department of Environment website.