

# Fair Plan 5: A Critical Appraisal of Five Congressional Bills to Reduce US CO<sub>2</sub> Emissions

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## Abstract

The most recent US Congressional climate bill, H.R.5271 in 2014, proposes to reduce US emissions of carbon dioxide relative to their 2005 value by 80% in 2050. This bill does not provide a rationale for this rapid phase down of CO<sub>2</sub> emissions. In 2012, we crafted a Fair Plan to Safeguard Earth's Climate such that: 1) The cumulative trade-adjusted CO<sub>2</sub> emissions by the developing countries equal the cumulative trade-adjusted CO<sub>2</sub> emissions by the developed countries; 2) The maximum global warming above preindustrial temperature does not exceed the 2°C (3.6°F) chosen by the United Nations Framework Convention on Climate Change "to prevent dangerous anthropogenic interference with the climate system"; and 3) The phase out of CO<sub>2</sub> emissions begins as late as possible in the 21<sup>st</sup> century and proceeds at the slowest possible pace, consistent with objectives 1 and 2. The Fair Plan begins in 2020 and reduces the world's emissions to zero in 2100. In the Fair Plan the emissions of the developed countries, including the United States, reach 80% below their 2005 values in 2094, that is, 44 years later than proposed by H.R.5271. While it is imperative that humanity begins to wean itself from fossil fuels no later than 2020, the transition from fossil to non-fossil energy need not be completed before 2100 if all countries follow their Fair Plan trajectories.

## Keywords

Climate Change, Global Warming, Greenhouse-Gas Emissions, Mitigation

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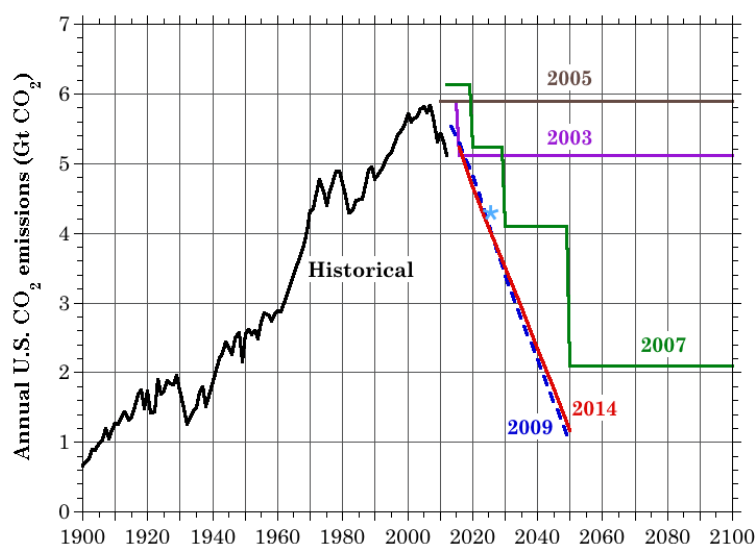
## 1. Introduction

As shown in [Table 1](#), the Congress of the United States has considered several bills to reduce the US annual emission of greenhouse gases, the most important of which is carbon dioxide (CO<sub>2</sub>). The annual US equivalent CO<sub>2</sub> emissions proposed in the 2003, 2005, 2007, 2009 and 2014 US Congressional bills [1]–[5] are shown in [Figure 1](#), together with the historical annual US CO<sub>2</sub> emissions from 1900 through 2012.

In these Congressional bills the emissions are given in “carbon dioxide equivalents” which was first defined in the 2005 bill as: “For each greenhouse gas, the amount of each such greenhouse gas that makes the same contribution to global warming as one metric ton of carbon dioxide, as determined by the administrator (of the Environmental Protection Agency)” [2].

Because the Congressional bills leave it to the future to define “carbon dioxide equivalents”, we will treat the emission of “carbon dioxide equivalents” as the emission of CO<sub>2</sub> alone. Since the emission of equivalent CO<sub>2</sub>, however defined, is not less than the emission of CO<sub>2</sub> alone, the treatment of equivalent CO<sub>2</sub> as CO<sub>2</sub> alone will not affect our conclusion about the US Congressional bills.

In the 2003 bill the annual US CO<sub>2</sub> emission was fixed at 5.8960 Gt (billion metric tonnes) in 2010. It was then reduced stepwise to 5.1230 Gt CO<sub>2</sub> in 2016. By comparison, the US Carbon Dioxide Information Analysis



**Figure 1.** Historical annual US CO<sub>2</sub> emissions (black line) and proposed future US annual (equivalent) CO<sub>2</sub> emissions proposed in the five Congressional climate bills (purple, brown, green, blue and red lines) of [Table 1](#). Historical emissions through 2010 are from [6] and the estimated 2011 & 2012 emissions are from [17]. The emissions reduction cited in the White House press release of 11 November 2014 about the US-China Joint Announcement on Climate Change and Clean Energy Cooperation [18] is shown by the cyan asterisk.

**Table 1.** Selected US Congressional bills that propose reduction in annual US emissions of greenhouse gases.

Year	Congress/Session	Bill Number	Title	Sponsor	Status
2003	108th/1st	S.139	Climate Stewardship Act of 2003 [1]	Sen. J. Lieberman (D, Connecticut)	Referred to Senate Committee on Environment and Public Works on 10/30/2003
2005	109th/1st	S.1151	Climate Stewardship and Innovation Act of 2005 [2]	Sen. J. McCain (R, Arizona)	Referred to the Committee on Environment and Public Works on 5/26/2005
2007	110th/1st	S.280	Climate Stewardship and Innovation Act of 2007 [3]	Sen. J. Lieberman (I, Connecticut)	Sent to Committee on Environment and Public Works on 7/24/2007
2009	111th/1st	H.R.2454	American Clean Energy and Security Act of 2009 [4]	Rep. H. Waxman (D, California)	Passed House on 6/26/2009; Placed on Senate Legislative Calendar on 7/7/2009
2014	113th/2nd	H.R.5271	Healthy Climate and Family Security Act of 2014 [5]	Rep. C. Van Hollen (D, Maryland)	Referred to Committee on Energy & Commerce & Committee on Ways & Means on 7/13/2014

Center reports 2005 US CO<sub>2</sub> emissions of 5.8259 Gt [6]. Thus the 2003 bill would have reduced US total emissions to 88% of this value.

In the 2005 bill the annual US CO<sub>2</sub> emission was fixed at 5.8960 Gt in 2010, that is, at 101% of the now-historical 2005 CO<sub>2</sub> emission. In the 2007 bill three stepwise decreases in the annual CO<sub>2</sub> emission were proposed to 2.0960 Gt in 2050, that is, to 36% of the 2005 emission.

In both the 2009 and 2014 bills essentially the same linear-in-time decreases in annual US CO<sub>2</sub> emission were proposed, the former beginning in 2012 at 97% of the 2005 emission and reaching 17% thereof in 2050, and the latter beginning in 2016 at 90% of the 2005 emission and reaching 20% thereof in 2050.

No explanation is provided in any of these US Congressional bills for their emission-reduction schedule, shown in [Figure 1](#).

In contrast, we have crafted a Fair Plan to Safeguard Earth's Climate [7] based on three objectives. These objectives are described in Section 3. In Section 4 we contrast the 2014 US Congressional bill with the Fair Plan. As we shall see, the 2014 US Congressional bill reduces US CO<sub>2</sub> emissions at a rate that exceeds the rate needed to solve the problem of human-caused global warming.

## 2. On the Origin of the 80% Reduction by 2050 Notion

We have endeavored to learn the origin of the “80/50” notion to reduce emissions by 80% relative to a reference year by 2050. It appears that a “causality chain” is from the Intergovernmental Panel on Climate Change (IPCC) Assessment Report 4 (AR4) to the European Council to the EUCO<sub>2</sub> 80/50 project. According to the latter:

“The European Commission’s ambitious objective manifests the intention to reduce the global CO<sub>2</sub> emissions by 50% compared to 1990, by the year 2050. Only this can ensure that the average global warming does not exceed 2 degrees centigrade. This requires the industrialised countries to reduce their emissions by 80%, in order to compensate for the lower mitigation capacities of the developing countries, due to the backlog demands of their national economies.” [8]

This notion appears on Page 7 of the Presidency Conclusions—Brussels, 29/30 October 2009 of the European Council:

“The European Council calls upon all Parties to embrace the 2°C objective and to agree to global emission reductions of at least 50%, and aggregate developed country emission reductions of at least 80% - 95%, as part of such global emission reductions, by 2050 compared to 1990 levels; such objectives should provide both the aspiration and the yardstick to establish mid-term goals, subject to regular scientific review. It supports an EU objective, in the context of necessary reductions according to the IPCC by developed countries as a group, to reduce emissions by 80% - 95% by 2050 compared to 1990 levels.” [9]

This notion apparently arose from Table SPM.5 “Characteristics of post-TAR stabilization scenarios” (Category A.1) of the Summary for Policymakers of the Fourth Assessment Report (AR4) of Working Group 3 (WG3) of the Intergovernmental Panel on Climate Change (IPCC) [10], and Table 3.10 (Class I) and Figure 3.38 of Chapter 3 of AR4 of IPCC WG3 [11]. These tables show that to limit global warming to 2.0°C - 2.4°C requires emissions reductions below 2000 values of 85% - 50% in 2050.

These 85% - 50% emissions reductions are what are required for scenarios that stabilize the CO<sub>2</sub> concentration at 350 to 400 parts per million by volume (ppmv), and the equivalent CO<sub>2</sub> concentration at 445 to 490 ppmv, respectively [10] [11]. Stabilizing the (equivalent) CO<sub>2</sub> concentration allows the (equivalent) CO<sub>2</sub> emissions to be nonzero in perpetuity, as long as they equal the natural (equivalent) CO<sub>2</sub> sinks plus any human-caused (equivalent) CO<sub>2</sub> sinks, such as carbon capture and sequestration.

In the following section we present our Fair Plan to Safeguard Earth's Climate. The Fair Plan achieves the same objective of preventing the global warming from exceeding 2°C (3.6°F), not by stabilizing the concentration of (equivalent) CO<sub>2</sub>, but by reducing the emissions of greenhouse gases to zero. Doing this allows for a much more gradual reduction in (equivalent) CO<sub>2</sub> emissions than does stabilizing the (equivalent) CO<sub>2</sub> concentration.

## 3. Fair Plan to Safeguard Earth's Climate

The Fair Plan to Safeguard Earth's Climate [7] was crafted based on three objectives:

**Objective 1:** The cumulative trade-adjusted CO<sub>2</sub> emissions by the developing countries equal the cumulative

trade-adjusted CO<sub>2</sub> emissions by the developed countries. Trade-adjusted emissions mean the emissions incurred by Country A to export goods and/or services to Country B are debited to Country B, not Country A.

**Objective 2:** The maximum global warming above preindustrial temperature does not exceed the 2°C (3.6°F) chosen by the United Nations Framework Convention on Climate Change (UNFCCC) “to prevent dangerous anthropogenic interference with the climate system” [12].

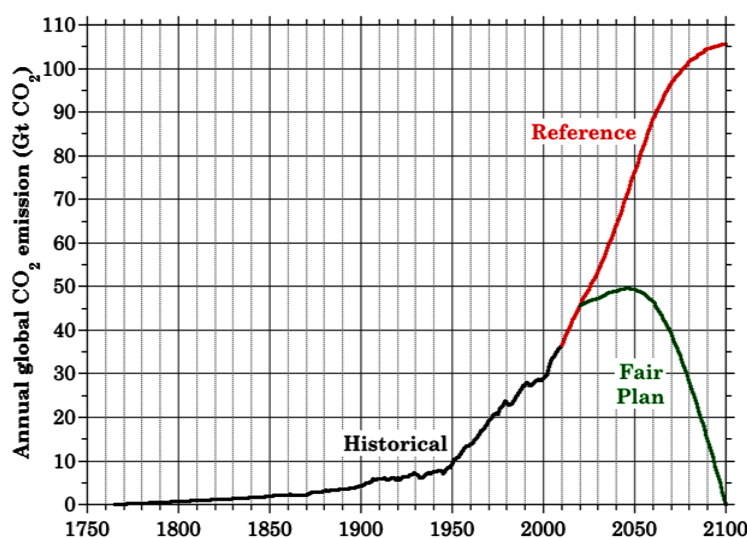
**Objective 3:** The phase out of CO<sub>2</sub> emissions are begun as late as possible in the 21<sup>st</sup> century and proceeds at the slowest possible pace, consistent with Objectives 1 and 2.

To craft the Fair Plan to Safeguard Earth’s Climate that satisfies these three Objectives, we used our Simple (engineering-type) Climate Model [13] to calculate the change in global-average near-surface air temperature from 1765 through year 3000 for historical emissions and two scenarios of future emissions of CO<sub>2</sub>: 1) a “Business-as-Usual” Reference scenario—the Representative Concentration Pathway 8.5 scenario (RCP-8.5); and 2) a Mitigation scenario—the Fair Plan scenario. For the emissions of the other greenhouse gases we took their curves from RCP-8.5 and applied the same intensities thereto for the developed and developing countries as we did for CO<sub>2</sub>. Further details of these calculations are described in our four antecedent papers [7] [14]–[17].

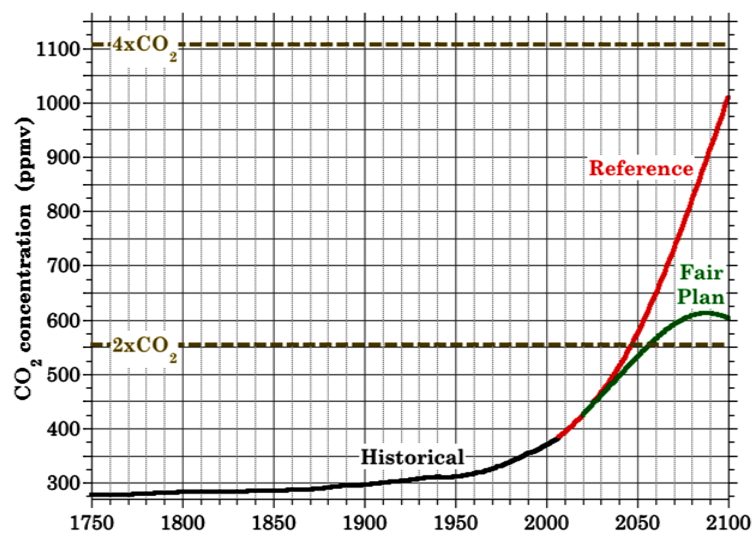
The global annual CO<sub>2</sub> emissions for the Reference scenario and the Fair Plan are shown in **Figure 2**, together with the historical global annual CO<sub>2</sub> emissions. The annual emissions for the Reference scenario increase throughout the 21<sup>st</sup> century, reaching a value of almost 106 Gt CO<sub>2</sub> by 2100. (Note that, in our earlier Fair Plan papers we reported these annual emissions in Gt C.) The global annual CO<sub>2</sub> emissions for the Fair Plan begin to deviate from those of the Reference scenario beginning in 2020. Note however that these Fair Plan global annual CO<sub>2</sub> emissions continue to increase slowly from 2020 to 2046 when they peak at 50 Gt CO<sub>2</sub>. Thereafter the Fair Plan global annual CO<sub>2</sub> emissions decrease to zero in 2100. The annual CO<sub>2</sub> emissions of the developed and developing countries are presented in **Section 3**.

The CO<sub>2</sub> concentrations for the Reference scenario and the Fair Plan are shown in **Figure 3**, together with the historical CO<sub>2</sub> concentrations. The concentrations for the Reference scenario increase throughout the 21<sup>st</sup> century, reaching a value of almost 936 parts per million by volume (ppmv) by 2100 which is 3.4 times the pre-industrial concentration of 277 ppmv. In contrast, the CO<sub>2</sub> concentrations for the Fair Plan increase to only 612 ppmv by 2088 and thereafter decrease to 604 ppmv in 2100, a difference then of 332 ppmv from the concentration for the Reference scenario.

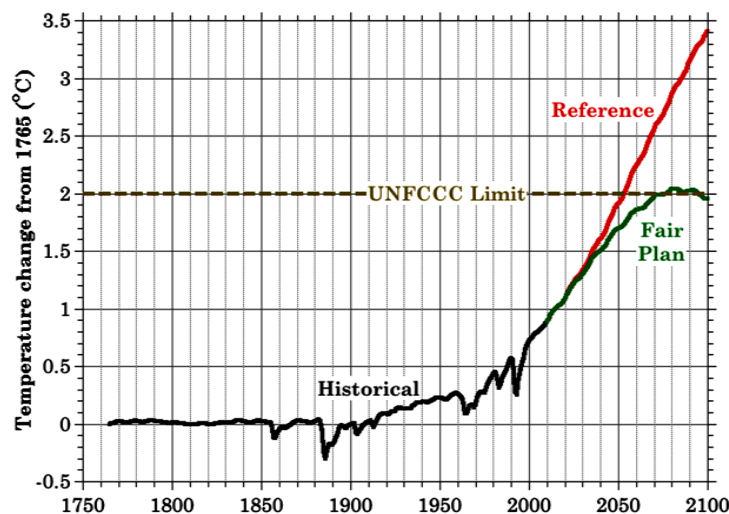
The change in global-mean near-surface air temperature from its preindustrial (1765) value is shown in **Figure 4** for the Reference scenario and Fair Plan, together with the historical values. For the Reference scenario the temperature change increases throughout the 21<sup>st</sup> century, reaching 3.4°C (6.1°F) in 2100, a global warming which exceeds the UNFCCC limit by 1.4°C (2.5°F). In contrast, the temperature change for the Fair Plan in-



**Figure 2.** Historical (black line) and future annual global CO<sub>2</sub> emissions, the latter for the Reference (RCP-8.5; red line) and Fair Plan [7] (green line) scenarios.



**Figure 3.** Historical (black line) and future annual global CO<sub>2</sub> concentrations, the latter for the Reference (RCP-8.5; red line) and Fair Plan [7] scenarios. Twice and quadruple the pre-industrial CO<sub>2</sub> concentration are shown by the brown dashed lines.

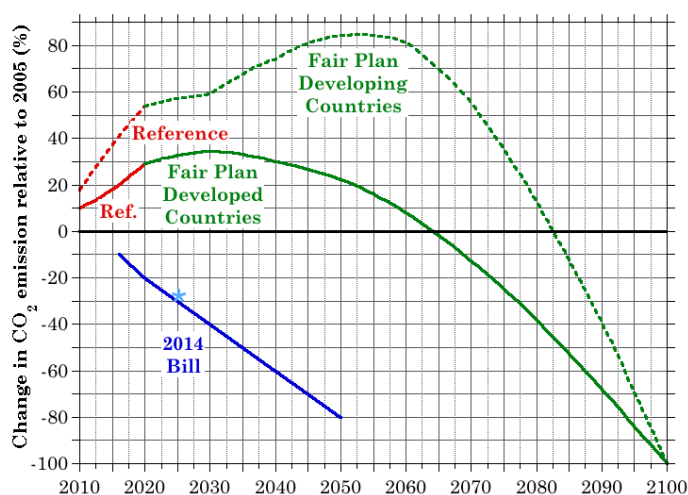


**Figure 4.** Historical (black line) and future annual global-average near-surface temperature changes from 1756, the latter for the Reference (RCP-8.5; red line) and Fair Plan [7] (green line) scenarios. The 2°C (3.6°F) UNFCCC limit “to prevent dangerous anthropogenic interference with the climate system” [12] is shown by the brown dashed line.

creases to the 2°C (3.6°F) UNFCCC limit by 2077, stays just above (by no more than 0.04°C) until 2096, and then begins to decrease. As shown by our second Fair Plan paper [7], this temperature decrease continues throughout the third millennium to 0.9°C (1.6°F) in year 3000, when the global warming of the reference scenario is 5.3°C (9.5°F).

#### 4. Comparison of the 2014 Bill and the Fair Plan

The annual CO<sub>2</sub> emissions for the developed and developing countries are shown in **Figure 5**, together with those proposed for the United States by the 2014 US Congressional bill (**Table 1**), in terms of the percentage change from the 2005 CO<sub>2</sub> emissions for the developed countries, developing countries and the United States.



**Figure 5.** Percentage change in annual CO<sub>2</sub> emissions for the Reference (RCP-8.5; red lines) and Fair Plan (green lines) scenarios for the developed and developing countries [7], and for the US as proposed by the 2014 Congressional bill [5] (blue line), relative to their respective 2005 CO<sub>2</sub> emissions. The emissions reduction cited in the White House press release of 11 November 2014 about the US-China Joint Announcement on Climate Change and Clean Energy Cooperation [18] is shown by the cyan asterisk.

The CO<sub>2</sub> emissions for the developed and developing countries were calculated as the product of the Reference CO<sub>2</sub> emission scenario and an annual CO<sub>2</sub> intensity, which is unity in the starting year YS of the phaseout and decreases to zero in ending year YE of the phaseout, linearly in time for the developed countries and cubically in time for the developing countries. In our first Fair Plan paper [14], YE and the duration of the phaseout,  $D = YE - YS$ , were prescribed to be 2015 and 50 years, respectively. In our second Fair Plan paper [7], we examined YE from 2015 to 2025 in 5-year increments, and  $D$  from 50 to 100 years in 10-year increments. We found that **Objective 2** could not be attained if YS and  $D$  exceeded 2020 and 80 years, respectively. Thus in our third and fourth Fair Plan papers [15] [16] and here,  $YS = 2020$  and  $YE = 2100$ . These starting and ending years of the phaseout uniquely define the coefficients of the linear-in-time intensity curve for the developed countries. The starting and ending years, and the requirement that the cumulative CO<sub>2</sub> emissions of the developing countries equal the cumulative CO<sub>2</sub> emissions of the developed countries, uniquely determine the coefficients of the cubic-in-time intensity curve for the developing countries [7]. The resulting annual CO<sub>2</sub> emissions trajectories are shown in **Figure 5** in terms of the percentage change from the 2005 CO<sub>2</sub> emissions for the developed and developing countries, respectively, this for comparison with the percentage changes specified in the 2014 US Congressional bill for the United States.

**Figure 5** shows that in the Fair Plan the annual CO<sub>2</sub> emissions of the developed countries, including the US, and developing countries increase slightly until 2030 and 2053, respectively. In the Fair Plan the annual CO<sub>2</sub> emissions of the US and all other developed countries in 2050 are 22% above their 2005 value. The developed countries CO<sub>2</sub> emissions reach 80% below their 2005 values in 2094, 44 years later than proposed in the 2014 US Congressional bill for the United States.

## 5. Conclusions

The most recent US Congressional climate bill, H.R.5271 in 2014, proposes to reduce US annual equivalent CO<sub>2</sub> emissions relative to 2005 by 80% in 2050. This is a more rapid decrease in US CO<sub>2</sub> emission than proposed in the three antecedent congressional bills: S.139, S.1151 and S.280, and is 3% less than that proposed by H.R.2454 (**Table 1** and **Figure 1**). No justification is given by any of these bills for their proposed time schedule for the reduction in US annual equivalent CO<sub>2</sub> emissions.

The Fair Plan to Safeguard Earth's Climate that we crafted in 2012 eliminates the worldwide emission of CO<sub>2</sub> from 2020 to 2100, allows the cumulative CO<sub>2</sub> emissions by the developing countries to equal the cumulative



CO<sub>2</sub> emissions by the developed countries, and keeps the rise in the global-mean near-surface temperature within 0.04°C (0.07°F) above the 2°C (3.6°F) limit adopted by the UN Framework Convention on Climate Change “to prevent dangerous human intervention in the climate system”. In the Fair Plan the CO<sub>2</sub> emissions of the developed countries, including the US, increase slightly until 2030, while the CO<sub>2</sub> emissions of the developing countries increase until 2053. In the Fair Plan the CO<sub>2</sub> emissions of the US and all other developed countries in 2050 are 22% above their 2005 value. These developed countries CO<sub>2</sub> emissions reach 80% below their 2005 values only in 2094, 44 years later than proposed in the 2009 and 2014 congressional bills.

While it is imperative that humanity begins to wean itself from fossil fuels no later than 2020, the transition from fossil-fuel energy to non-fossil-fuel energy need not be completed before 2100 if all countries follow their Fair Plan trajectories. However, if not all countries do so, then the 2°C goal will be exceeded. So, while the trajectory under H.R.5271 is more rapid than necessary for the United States, it is imperative that the United States exerts leadership to ensure that other countries participate in the Fair Plan.

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