

Green House Gases Emission Reduction: Targets and Achievements by Annex I Parties (1990-2012)

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Abstract

Objectives: To analyse target achievements of Annex 1 parties' reduction of greenhouse gases emissions (GHG) by 2012 as per 1st phase of Kyoto Protocol. To analyse the methods used to achieve these targets.

Methods/Statistical analysis: Secondary data from World Development Indicators and UNFCCC websites have been used. Tabular method – totals and percentages have been computed to analyse differences in achievements of various countries. Pie graph is drawn to show the shares of compliant countries.

Findings: Overall GHG emission reduction from the 40 Annex 1 countries exceeded the target in 2012. However, 88% of this GHG decrease was due to the collapse of thirteen economies in transition (EIT). Of the remaining Annex 1 countries, only 13 had reduced, while the others had *increased* their emissions by 2012. Thus, the net decrease amounted to just 1.04% of 1990 levels in 2012, far below the Kyoto target of 5%. But for the historical chance of collapse of the socialist countries during this time period, the actual emissions reduction by these countries would have been negligible, thus defeating the purpose of the Kyoto Protocol.

The Flexible mechanisms available to Annex 1 parties were also examined for their efficacy or otherwise towards cutting GHG emissions. We find many inadequacies in their implementation and functioning and their effectiveness in tackling climate change to ensure sustainable development. We did not find any earlier study of such an analysis.

Application: This analysis throws light on the manner in which Annex 1 countries are undertaking reduction of their GHG emissions. It shows that the actual achievement by 2012 in reducing GHGs has been negligible compared to the target. It shows the negligent attitude taken by most of the Annex 1 Parties, and the need to speed up the process of capping GHG emissions to negate climate change effects and to attain sustainable development. We feel that this paper will help to highlight the actual GHG reductions by Annex 1 parties, and the loopholes through which parties are escaping their emissions reducing responsibilities to combat climate change.

Keywords: Greenhouse gases (GHG), Conference of Parties (COP), Kyoto Protocol (KP) targets and achievements, Annex I parties, LULUCF, Flexible mechanisms.

1. Introduction

Global warming and consequent climate change are caused by the growth of Greenhouse gases¹ (GHG), and have become the focus of international and national environmental negotiations and policies. Way back in 1896 itself, Svante Arrhenius, a Swedish scientist, emphasised the role of water vapour and carbon dioxide in maintaining global average temperature at around 15°C. He and Thomas Chamberlin warned that human activities, by adding carbon dioxide to the atmosphere, could warm the earth. A doubling of the CO₂ concentration by burning fossil fuels² would result in enhanced global warming, leading to an estimated 5°C rise in average global temperature, which would interfere with precipitation and climatic conditions on Earth. This in turn would affect agriculture, food security, growth of plants and trees, spread diseases, melt ice caps in the Poles and on mountains, increase sea levels, flood low lying coastal regions and small islands, leading to enormous economic and environmental catastrophes.

These warnings were long forgotten, until in 1976 Stephen Schneider again warned against global warming. By the 1980's, it was seen that the global annual mean temperature curve had started to rise; and in 1988, it was finally acknowledged that the world's climate was warmer since 1880. It was finally accepted by the scientific community that this was due to anthropocentric reasons, mainly the increase in Greenhouse gases (GHG). However, as global warming and climate change are in the nature of externalities, no country would voluntarily undertake to reduce its emissions. So, it was imperative for all polluting countries to resolve this problem together, and consciously and urgently decrease their GHG emissions. The UN spearheaded these international negotiations through various conferences, and established specialised bodies to address GHG emissions and Climate change.

In 1985, an International Conference was held in Austria on the role of GHG on world climate. In 1988, a World Conference held in Toronto called for a 20% reduction in CO₂ emissions by 2005. The Intergovernmental Panel on Climate Change (IPCC) was also set up in the same year.

2. The United Nations Framework Convention on Climate Change (UNFCCC):

In 1992 at the Earth Summit, Rio de Janeiro, world leaders discussed the need to reduce greenhouse gas emissions as a global response to climate change. More than 180 countries signed the United Nations Framework Convention on Climate Change (UNFCCC). At about this time CO₂ concentration had risen by almost 30% from preindustrial levels, i.e. from about 280 parts per million (ppm) to about 356 ppm. The objective of this Convention was stated to "stabilise greenhouse gas concentrations at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system." It stated that "such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner[1]."

In this Summit, it was decided that as industrialised countries³ are the chief source of past and current greenhouse gas emissions, *they* should take the lead in cutting their emissions. They were expected to reduce emissions to 1990 levels by the year 2000, although at that time no binding targets were set for them. Further, industrialised nations were asked to support climate change mitigating activities in developing countries by providing financial support for action on climate change. A system of grants and loans managed by the Global Environment Facility was also set up. Industrialised countries were also asked to share their renewable energy technology with less-advanced nations.

2.1. Conference of Parties (COP):

The UN also set up a Conference of Parties – COP, which is the supreme decision-making body of the UNFCCC and includes all the States that are Parties to the Convention[2]. It checks the implementation and legality of the Convention decisions, and assists in their successful execution through various institutional and administrative measures. Since 1995, the COP has met annually in different parts of the world, to discuss the modalities required to deal with climate change and to review the progress made by participating nations[3].

2.1.1 The Kyoto Protocol: 1997

The most important of the COP Conferences was the COP3 held in Kyoto, Japan in 1997, where the Kyoto Protocol (KP) was adopted. The Protocol *commits* and encourages industrialised countries to stabilise their GHG emissions on the lines of the UNFCCC objectives. Thus, the Kyoto Protocol places a heavier burden on developed nations under the principle of "common but differentiated responsibilities."

The Kyoto Protocol has travelled a long and difficult road of negotiations to finally emerge in its present form, with participation from the maximum number of countries of the world. The Treaty was not finalised until 1997 as there were acrimonious debates about various issues; for instance, the United States and Australia both stated they would not ratify it as no binding targets were fixed for developing nations. Although Australia has since signed and ratified the treaty, the United States is the only major country that did not do so in the first phase (1997-2012) of the Protocol[1].

In the COP7 held in Marrakesh in 2001, the Marrakesh Accord was adopted, which give detailed rules for KP's implementation. However, it could not come into effect until at least 55 countries, accounting for 55% of the world's emissions in 1990, ratified it. The Protocol was finally ratified in 2005, i.e. 8 years after Kyoto, only when Russia joined in, and 192 parties: (191 states and the European Union), had signed it. Under the Protocol, 37 industrialised countries and the (EC) European Community (called Annex I parties) committed themselves to reduce their emissions by an average of 5% below 1990 levels, over the five-year period 2008-2012. But the non-Annex Parties, i.e. developing countries like India, China, Brazil, South Africa, etc. that are Party to the Protocol did not have any fixed commitments to reduce GHG emissions in its first phase (2008-12) [1].

Reduction levels were not fixed uniformly over the Annex 1 Parties. For instance, the EC agreed to reduce its overall emissions by 8%, but with different allocations to countries within it. For example, UK had taken a commitment to reduce its GHG emission level by 12.5% in 2012, over 1990's emission level; Greece on the other hand was allowed to increase its emissions up to 25%. But the average reduction over all the Annex 1 parties was to be 5%. (Details are given in Table 1) [2].

Table 1. Total GHG emissions of Annex 1 parties (Kt CO₂ equivalent) without LULUCF

Party		1990 (KT)	2012 (KT)	Difference (2012 – 1990) emissions	Change over 1990	Kyoto Targets
1		2	3	4	5	6
1	Lithuania ^a	43935	12322	-31613	-72%	-8%
2	Liechtenstein	26184	10967	-15217	-58%	-8%
3	Luxembourg	47812	21242	-26570	-56%	-28%
4	Ukraine ^{0a}	912660	398310	-514350	-56%	0%
5	Estonia ^a	40030	19408	-20622	-52%	-8%
6	Bulgaria ^{a,b}	120742	61192	-59550	-49%	-8%
7	Slovakia ^a	66495	36390	-30105	-45%	-8%
8	Slovenia ^{a,b}	75533	43707	-31826	-42%	-8%
9	Latvia ^a	17285	10550	-6735	-39%	-8%
10	Hungary ^{a,b}	96255	60280	-35975	-37%	-6%
11	Poland ^{a,b}	566454	364307	-202147	-36%	-6%
12	Czech Rep ^a	193356	130598	-62758	-32%	-8%
13	Portugal	580896	398812	-182084	-31%	27%
14	UK	807223	589222	-218001	-27%	-12.5%
15	Romania ^{a,b}	394300	286227	-108073	-27%	-8%
16	Croatia ^a	35116	25505	-9611	-27%	-5%
17	Germany	1247868	928093	-319775	-26%	-21%
18	Denmark	70623	54077	-16546	-23%	-21%
19	Switzerland	71837	55325	-16512	-23%	-8%
20	Belgium	147118	119220	-27898	-19%	-7.5%
21	New Zealand	219477	196268	-23209	-11%	0%
22	Netherlands	225148	202444	-22704	-10%	-6%
23	Japan	521058	468913	-52145	-10%	-6%
24	France	552463	495734	-56729	-10%	0%
25	Spain	20300	18898	-1402	-7%	15%
26	Austria	78683	79793	1110	1%	-8%
27	US**	5936929	6235097	298168	5%	-7%
28	Italy	56672	59536	2864	5%	-6.5%
29	Finland	71066	75707	4641	7%	0%
30	Greece	105008	112579	7571	7%	25%
31	Iceland	15345	16654	1309	9%	10%
32	Malta	2428.964	2687.184	258.22	11%	0%
33	Russian Fed ^{0a}	60426	66956	6530	11%	0%
34	Canada***	612753	715220	102467	17%	-6%
35	Sweden	290740	348722	57982	20%	4%
36	Norway	66720	82078	15358	23%	1%
37	Ireland	3849	4787	938	24%	13%
38	Australia	428291	549756	121465	28%	8%
39	Cyprus	5023	9048	4025	80%	0%
40	Turkey ^c	199176.4	397495	198318	100%	-8%
	Total	15,033,279	13,764,126	-1,269,153	- 8.4%	-5%

Source: *World Development Indicators*, [6, 7]Dec 2015, and "National greenhouse gas inventory data for the period 1990–2013" *UNFCCC website*. [8]

* From 1989–2009. † From 1988 – 2008. Includes only CO₂, NO_x, and CH₄.

^a economy in transition.

^b Data for the base year defined by decisions 9/CP.2 and 11/CP.4 (Bulgaria (1988), Hungary (average of 1985–1987), Poland (1988), Romania (1989) and Slovenia (1986)) instead of 1990 data.

^c Decision 26/CP.7 Special circumstances of Turkey recognised.

⁰ These economies collapsed in 1990.

** USA did not ratify the Kyoto Protocol.

*** Dec 2011, Canada withdrew from the Kyoto Protocol, effective from 15 December 2012.

But USA, responsible for 25% of global GHG emissions in 1990, and a Party to UNFCCC, withdrew from this process stating that the Protocol would harm its national economy, and also because developing countries like China and India were exempted from it. Canada also withdrew from it in 2011. So, in the first phase, the major North American countries, which historically and currently are some of the greatest polluters, were not parties to the global GHG reduction process. Turkey and Belarus were not Party to the Convention during the negotiations of the Kyoto Protocol, although they were listed in Annex-I of the Convention. They became parties in 2009 and 2005 respectively.

2.1.2. COP Timeline:

The following time line of some important COPs gives an idea of the progress of the negotiations dealing with GHG reductions[1]:

1997COP3 — The Kyoto Protocol (KP) formally adopted in Kyoto, Japan.

2001 COP7— The Marrakesh Accords detailing the rules for implementation of the Kyoto Protocol, setting up new funding and planning instruments for adaptation, and establishing a technology transfer framework.

2005 COP11 —Kyoto Protocol entered into force, and the first Meeting of the Parties to the Kyoto Protocol (MOP 1) took place in Montreal. In accordance with Kyoto Protocol requirements, Parties launched negotiations on its next phase.

2007 COP13 — The IPCC's Fourth Assessment Report was released, and Parties agreed on the Bali Road Map, towards a post-2012 outcome.

2009 COP15 — Copenhagen Accord drafted. Countries later submitted emissions reductions pledges or mitigation action pledges, which were all non-binding.

2010 COP16 — Cancun Agreements: emission reduction pledges were made official in a mutually accountable way.

2011COP17 — Durban Platform for Enhanced Action was drafted, and the blueprint for a universal, legal agreement to deal with climate change beyond 2020 was drawn up.

2012 COP18 —The Doha Amendment to the Kyoto Protocol was adopted: new commitments for Annex I Parties to the Kyoto Protocol, and a second commitment period from 1 January 2013 to 31 December 2020 were made. A revised list of greenhouse gases to be reported by Parties in the second commitment period, and amendments to several articles of the Kyoto Protocol in the first commitment period, which had to be updated for the second commitment period, were also made.

2015 COP21 – Paris Accord: More than 180 countries (developed and developing) agreed to cut, or curb their CO₂ emissions, so as to keep the rise in temperature below 2C⁰ or even below 1.5C⁰. But there were no binding targets, or legal sanctions against those violating their objective. Many countries agreed to have zero emissions between 2050 – 2100, and take stock of their achievements every 5 years, as well as to pledging an amount of \$100 billion by 2020, to finance less developed countries to introduce clean energy. However, aviation and maritime transport were not included in the negotiations. Also, the price of carbon credits was not set, but left to the free market[4].

We next look at the targets and achievements of the Kyoto Protocol Phase I, to observe the level and extent of achievement by the different participants.

2.1.3. Kyoto Protocol-Phase I-Commitments and Methods:

The Kyoto Protocol divides countries into three main groups based on their differing emission reducing commitments[5]:

- 1) *Annex I*: Originally consisted of 42 countries and EC. Parties include the OECD countries in 1992, Economies in Transition (the EIT Parties), including Russian Federation, Baltic States, and several Central and Eastern European States⁴.
- 2) *Annex II*: consist of the OECD members (23 countries and EC) of Annex I, but not the EIT Parties. They should provide financial resources to enable developing countries and EIT parties to reduce emissions, adapt to ill-effects of climate change, and help in development and transfer of eco-friendly technologies.
- 3) *Non-Annex I*: are the 153 developing countries, many of which are highly vulnerable to the adverse impacts of climate change. They include small island states, low-lying coastal areas, and counties prone to desertification and drought. Other countries at risk are those that rely on income from fossil fuel production and commerce. As such, the Convention suggests investment, insurance and technology transfer to these countries.

The 49 Parties classified as *least developed countries* (LDCs) by the United Nations were given special consideration under the Convention, due to their inability to respond and adapt to climate change[4, 1, 2].

3. GHG Reduction Targets and Achievements by Annex I Parties in The First Phase:

Now we analyse the achievements, failures, and contributions of different Annex 1 parties to GHG emissions in the first phase of the Kyoto Protocol, i.e. 1990 – 2012. Under the Protocol, the Annex 1 parties (except USA) had committed to reduce their emissions by an average of 5% against 1990 levels by 2012.

Table 1 gives the achievements and targets of GHG emissions by 40 Annex 1 countries⁵ at the end of the first round of the Kyoto Protocol i.e. 2012. The data is published online on the websites of the World Bank, World Development Indicators 2015[6, 7], and UNFCCC[8]. It includes six GHGs without adjusting for land use, land use change, and forestry (LULUCF).

Of these 40 countries, only 37 officially ratified the Protocol [1], of which 13 countries in Europe are in transition to capitalism (EIT), and Turkey was awarded a special status. USA has not ratified the Kyoto Protocol, but as it is a large emitter of GHG gases, and an Annex 1 party, it is included here. Australia similarly had not ratified the Protocol, but joined in later, while Canada exited in 2011.

In Table 1, column 2 shows the base year 1990 emission data for these 40 countries, column 3 shows the target year 2012's. Column 4 shows the difference between 2012 and 1990 emissions. Col. 5 shows the percentage change in each party's emissions between 2012 and 1990. Column 6 shows the Kyoto targets set by each Party for this time period.

From Table 1 it can be seen that 25 out of 40 countries were committed to reduce their emissions by 2012, over their 1990 emissions⁶. Seven countries were allowed to maintain the same emissions as 1990, and eight could exceed their 1990 emissions.

3.1. Analysis of Kyoto Protocol target achievements by Annex 1 parties

The above data shows the following:

Total GHG emission target reductions were not only achieved by Annex 1 Parties, but were *exceeded* over and above the 2012 target. While the target should have been 5% reduction below 1990 levels (i.e. 751,663.93 KT CO₂ equivalent), the actual emission reduction was 1,269,153 KT, i.e. 8.4% reduction. Thus, an excess of 3.4% reduction was achieved between 1990 and 2012.

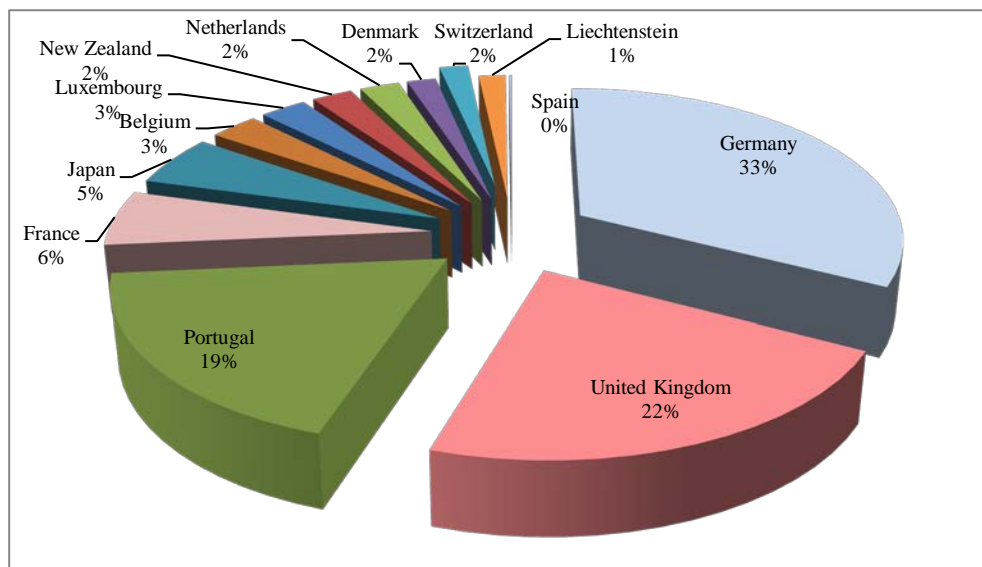
However, a breakup of these emissions shows that:

- Out of this reduction, 1,113,365 KT emission reductions or *about 88%* (87% with Russia) were from the 13 EIT countries. Therefore, it was due to the *collapse* of these EIT parties, rather than proactive mechanisms implemented by all Annex I countries, that led them to exceed the target. Actual reduction of total GHG emissions was therefore only 155,788 KT in 2012 compared to 1990.
- Of the remaining 27 countries (Annex II), 13 economies like Germany, UK, etc. had not only reduced but also exceeded their targets. The total GHG reduced by these countries was 978,792 KT of CO₂ equivalent.
- But the remaining 14 parties, excluding EIT economies, had increased their emissions by 816,474.2 KT.
- Thus, the net reduction of GHG by all the non-EIT economies was only 155,788 KT, which works out to be just **1.04% reduction** of 1990 levels in 2012, far below the 5% target emission reduction required by the Kyoto Protocol.
- Most of the European countries (22 countries) were able to reduce their emissions far beyond their required targets. Of these, Portugal and Spain though permitted to increase their emissions, actually decreased them, and France which was permitted to maintain its 1990 levels, also reduced its emissions.
- Similarly, New Zealand also reduced its emissions, though it was also allowed to keep the same level as 1990. Japan was also able to reduce emissions beyond its target requirements.
- Ukraine, a transitory economy also reduced its emissions, but this was more due to the economic crisis that it was facing. The same applies to Russia and the 12 other Economies in Transition, whose economies were in turmoil due to transition to market economy.
- However, eight European countries failed to meet their emission standards and some countries such as Norway and Sweden had large increases in their emissions.
- Half of the total increase in GHG emissions came from just two countries of North America - nearly 300 thousand KT by USA, and another 100 thousand by Canada.
- Australia had been accused of manipulating its emissions, and hence received permission to *increase* them during this time interval [9]. It also exceeded its emission target by 20%, and is one of the three largest contributors to GHG emissions among Annex 1 countries, after USA and Canada.

3.2. Country wise breakup of emission reductions:

Figure 1 shows the share of the 13 Annex 1 parties that reduced their emissions by 2012 in total GHG emissions.

Figure 1. Shares in GHG reductions of the 13 Annex 1 countries (2012) Source: estimated from Table 1



Germany had the highest reduction of 33%, followed by UK 22%, and Portugal 19%; nearly $\frac{1}{4}$ of net reductions came from just these three parties.

In short:

- Overall GHG emissions had fallen by 8.4% of 1990 levels in 2012, taken across all 40 Annex 1 economies.
- Out of the total reductions of emissions, 88% was due to the collapse of 13 EIT economies,
- Of the remaining 27 economies, 13 had reduced their emissions (mostly European countries, Japan, and New Zealand), while 14 had increased their emissions in this time period. Overall for these 27 economies, GHG gases had fallen by a mere 1.04% over 1990 levels in 2012.
- Emissions by USA, Canada, Australia, Cyprus, and Turkey were 10% of total increases in the time period.
- Economic recession in 11 European countries, (half of which experienced negative growth, while others had falling growth rates), also led to a 1.1% decrease in CO₂ emissions from energy in 2012.

Hence only 13 countries (11 European, plus Japan and New Zealand), could successfully reduce their GHG emissions (excluding LULUCF). Of these more than half (55%) was achieved by just two parties: 33% reduction by Germany and 22% by UK. In Germany, this was possible due to increasing efficiency in power and heating plants, as well as economic restructuring after German reunification. In the UK, both energy market liberalisation, and fuel switch from oil and coal, to gas and renewable energy contributed to decreases in emissions. In [10] however, a large amount of these emission declines could be due to various other mechanisms promoted by the Kyoto Protocol that facilitated the Annex 1 countries to achieve their goals. We discuss these mechanisms next.

4. Flexible Mechanisms – The Escape Routes:

The Kyoto Protocol gave some escape routes by which participating countries could achieve their GHG emissions targets without actually reducing their own emissions. Flexible Mechanisms are available to Annex 1 Parties, making it possible for them to earn “carbon credits” for activities other than domestic decline in GHG emissions. These Flexible Mechanisms include: a) Carbon trading with the EIT countries and Russia, b) Land use and forestry changes LULUCF, c) Joint implementation, and d) Clean Development Mechanism [1].

4.1 Emissions Trading: GHG reduction can be traded between compliant and non-compliant parties in the international market; this is known as “emissions, or carbon trading”. Parties that exceed their targets can buy “carbon credits” from parties with lower emissions⁷. There are a number of emissions trading systems around the world – such as the European Union emissions trading system (EU ETS), as well as different systems in Canada, China, Japan, New Zealand, South Korea, Switzerland and the United States, where carbon trading takes place. For instance, UK claims that around 38-40% of its emissions reductions from 2005 – 2012, were from EU ETS (emission trading system) [11].

Carbon credits are also available for the other flexible mechanisms discussed below:

4.2 Land use, Land Use Change and Forestry (LULUCF): Since net emissions⁸ from land are complexly affected by biological processes, they tend to be more difficult to estimate than from other sources of emissions. Atmospheric CO₂ is absorbed by ecosystems, such as vegetation and soils, increase in forest and tree cover, as well as land management activities such as plantations, management of wet lands, and agriculture. According to the IPCC, the land sector has contributed an estimated 19% of global carbon dioxide emissions since 1960 [12].

Parties can earn carbon credits, called removal units (RMU), on the basis of their land use, land-use change and forestry activities(LULUCF), such as reforestation. Under the LULUCF system, mandates are required for just three activities, while others are left to the Parties for voluntary disclosure. They are:

- **Afforestation:** planting trees on an area not previously forested, usually plantations and monoculture,
- **Reforestation:** replanting trees (plantations) on areas previously deforested and converted to wasteland. These two methods are supposed to lead to removal of carbon from the atmosphere via sequestration.
- **Deforestation:** cutting down forests and using that land for other non-forest purposes. This activity adds a minus point.

Table 2. Emissions achievement with and without LULUCF – Annex 1 parties 1990-2012

Party	Difference with and without LULUCF 1990	Difference with and without LULUCF 2012	Category after adjustment	Party	Difference with and without LULUCF 1990	Difference with and without LULUCF 2012	Category after adjustment
Iceland	1175	706	1	Ireland	-2,313	-3,145	3a
Australia	130522	15161	1	Greece	-2,114	-2,866	3a
Canada	-71020	40860	1	Belgium	-834	-1,381	3a
Netherlands	3013	3536	2	Denmark	5,283	-837	3a
United States	-817,400	-941,543	3a	Luxembourg	332	-438	3a
Russian Fed	164,571	-542,017	3a	Malta	-5	-7	3a
Japan	-66,818	-75,065	3a	Sweden	-38,703	-35,418	3b
Turkey	-44,070	-59,815	3a	Ukraine	-69,737	-27,241	3b
France	-28,620	-44,254	3a	New Zealand	-37,250	-26,598	3b
Spain	-23,305	-33,529	3a	Romania	-24,257	-20,516	3b
Poland	-25,506	-31,855	3a	Latvia	-19,867	-12,301	3b
Norway	-10,147	-26,678	3a	Bulgaria	-13,508	-8,207	3b
Finland	-13,675	-25,853	3a	Slovakia	-9,008	-8,103	3b
Italy	-3,609	-18,556	3a	Croatia	-7,181	-6,544	3b
Portugal	58	-10,648	3a	Austria	-9,877	-3,839	3b
Lithuania	-4,294	-8,077	3a	Germany	-24,518	-3,488	3b
Czech Republic	-3,437	-7,252	3a	Estonia	-8,820	-1,951	3b
UK	1,879	-6,978	3a	Switzerland	-1,921	-1,129	3b
Hungary	-1,967	-4,407	3a	Cyprus	-139	-19	3b
Slovenia	-1,484	-4,356	3a	Liechtenstein	-9	-7	3b
Total	-1,078,582	-1,944,654	3a				

Sources: [6, 7, 8]

Under the Kyoto Protocol Rules, a tradable allowance called an assigned amount unit (AAU) is issued for every tonne of emissions from Forest conversion in the 1990 base year. Thus, countries which have large forests, as well as those that undertake reforestation and afforestation activities can claim carbon reduction credits and deduct them from their own emission accounts. But one allowance is cancelled for every tonne of emissions reported from *deforestation* activity. For instance, Sweden's data shows that LULUCF was 62% of her total emissions in 2012, while it was 51% for Norway [7].

In Table 2, we show the GHG emissions data of the Annex 1 Parties adjusted for LULUCF activities. Data for 1990 and 2012 (with and without LULUCF) are taken from UNFCC and World Bank websites [6, 7, 8], and the difference between the two years with and without LULUCF is estimated for each participating economy. The Parties are classified on the basis of whether their total emissions had increased or decreased after accounting for LULUCF activities.

The difference in emissions for each Annex 1 party after adjusting for LULUCF in 1990 and 2012 is shown in Table 2. Countries are classified on the basis of whether they have achieved greater emission reductions in 2012 through LULUCF as compared to 1990, lower, or else if emissions are still positive even with LULUCF.

These categories (1, 2, 3a and 3b), after adjusting each country's emissions to its LULUCF activities, are given below, and are shown against each Annex 1 party.

Category 1: In 2012 some countries had a plus sign in their emissions over the time period even with LULUCF. This denotes a worsening of their land and forest management, and increase in emissions. Three countries come under this group: Iceland, Canada, and Australia. Their emissions had increased in 2012 even with LULUCF, as compared to without it.

Category 2: Some countries had higher emissions in 2012 as compared to 1990 without LULUCF, but after adjusting for it, their emission was lower in 2012, but still not negative. This shows that they have somewhat improved their land management, or else undertaken reforestation either in their own economies, or elsewhere in less developed countries. Netherlands falls in this category, its emissions in 2012 was higher even with LULUCF, as compared to without it.

Category 3: Lastly, a few countries had negative change in their emission without LULUCF in 2012 as compared with 1990, showing that they are compliant with the Protocol regulations. But after adjusting for LULUCF, their emissions have changed in two ways: -

- 3a) Net emissions had further decreased with LULUCF, showing improvement in land and reforestation measures, either within their own economies, or through investment in less developed countries. Twenty-two countries have shown improvement in their emissions after adjusting for LULUCF between 1990 and 2013, Table 2. This includes USA, Russia, etc. Many of these countries are getting carbon credits either due to the size of their own forests, or because of reforestation programmes in both EIT and developing countries.
- 3b) For 14 other parties with negative net emissions had levels in 2012 that were less than in 1990, showing lower efficiency of land and forestry management in 2012 as compared to 1990.
 - Thus, overall for all the 40 Annex 1 parties, there has been greater decrease in emissions due to LULUCF in 2012 as compared to 1990, (last row).
 - 26 countries, which had negative change in emissions, had claimed lowering of their emissions due to land and forestry management in 2012. Of these 22 had further lessened their emissions in 2012 due to higher LULUCF (3a). For the other 14, the difference between with and without LULUCF, was greater in 1990 than in 2012 (3b), showing reduced efforts at land management and reforestation.

Thus, the majority of the parties claimed some type of reappraisal due to their land management and forestry activities. But there is no data on where these forestry activities took place. Most of these could have been through forestry programmes in less developed countries, as these would be cheaper than both reforestation or actual reductions of emissions in their home countries. However, data for the credits earned through reforestation in developing countries by the Annex 1 countries is not available.

4.3 JOINT IMPLEMENTATION II: is a programme under the Kyoto Protocol that allows industrialized countries to meet part of their required cuts in greenhouse-gas emissions by paying for projects that reduce emissions in other *industrialised* countries such as the countries of Eastern Europe and the former Soviet Union -- the

"transition economies". The justification for such measures is that the world will benefit by all GHG reductions, regardless of where they occur. The sponsoring governments of Western European and North American countries will receive credits that can be deducted from their emissions targets. It is also supposed to benefit the recipient nations who get foreign investment and advanced technology, though no credits are allotted to them for meeting their own emissions targets. This system allows industrialised countries to achieve their targets at a cheaper rate than reducing their own emissions. As of March 2015, almost 872 million ERUs were issued under JI, about one-third of all Kyoto offset credits[17].

4.4 *THE CLEAN DEVELOPMENT MECHANISM: CDM*: Annex 1 economies can also achieve reduction credits by investing in clean projects in Non-Annex or developing countries. For this they get "certified emission reduction" (CER) credits, which they add as 'reduction' to their own GHG accounts. Such projects must lead to sustainable development in the recipient country, and must be "additional" to what would have been possible without CDM funding [21]. Private companies of Annex 1 countries can fund 'clean energy' projects in developing countries that reduce greenhouse gas emissions, and then sell these credits in the 'carbon market'[18].

The CDM therefore allows Annex 1 countries to continue emitting greenhouse gases at home, so long as they pay for reductions made elsewhere. The reason being, that it would be more expensive to implement emission reductions in industrialised countries than in developing countries. Secondly the developing countries could achieve sustainable development by the entry of "clean" and more energy efficient technologies from the industrialised countries. CDMs have operated since 2006, and registered more than 1,650 projects, to produce CERs equal to more than 2.9 billion tonnes of CO₂ equivalent between 2008 and 2012[18].

5. Evaluation of Kyoto Target Achievements

From the above analysis, it can be seen that it was mainly due to the historical accident of collapse of the EIT countries, and recession in European countries that the 40 Annex 1 countries could show that the Kyoto target reductions were exceeded by the in 2012. However, 88% of these GHG emission reductions came from the 13 collapsed EIT economies. Of the rest, while 13 economies reduced their emissions, 14 economies actually increased their emissions by 2012. After adjusting for these, the net actual reduction by the 27 economies (ignoring the EIT countries) was only 1.04% of 1990 emissions, as against the required 5% target reduction.

Further, the various escape routes given by the Flexibility mechanisms, provided a convenient means for the industrial countries to show emission reductions through various carbon credits, without actually reducing their own emissions.

In fact, many studies have shown that total emissions have increased in spite of these flexibility mechanisms. These are discussed below:

1. A study by [17] found that the use of JI may have enabled global GHG emissions to be about 600 million tCO₂e *higher* than otherwise, if countries had met their emissions targets domestically. According to Carbon Market Watch Director Eva Filzmoser, 95% of all JI offset credits issued so far come from JI track1, which has weak environmental integrity, and lacks international regulatory oversight. It is feared that such use of JI credits would "weaken the ability of the EU-ETS to protect the climate because substandard offset credits increase global emissions." [19].
2. CDM projects have also been severely criticised. The CDM was originally intended to be a zero-sum instrument, allowing increased emissions in developed countries to be exchanged for corresponding decreased emissions in developing countries, with no net impact on global GHG emissions. But this philosophy of CDM is questionable – also called CDM projects in many cases are just "green wash", while domestic GHG emissions increases in investing countries are ignored. Studies [22] have shown that CDM projects implementation has led to unequal distribution of benefits, difficult and lengthy registration processes, high transaction costs, and inaccessibility to certain sectors. Though carbon trading companies and countries claim to reducing emissions, they continue to burn fossil fuels, destroy forests and pollute at home. Also, carbon trading is being seen as a form of colonialism, with rich countries increasing their levels of energy consumption, and getting credit for carbon savings in inefficient industrial projects in less developed countries. But poorer countries, with low

industrial development cannot earn any credits that will help them to access more sustainable development projects and clean energy [13].

- Greenhouse gases have been converted into a commodity, giving “owners” undue rights to pollute. Many companies are violating the “additionality” rule, and getting millions of dollars in CERs for projects they would have done anyway, even without the CDM incentive. So, these projects, rather than reducing overall emissions are actually increasing them. Also, there are high chances that some CDM projects may not be additional, or are being awarded more credits than the actual emission reductions achieved (e.g. due to overly high baselines, leakage or perverse incentives). As such, it is feared that the CDM could result in a net *increase* in global GHG emissions[13].
- The hypothetical baseline derived from future emission projections, is the basis for award of CERs. But it is feared that such baselines could be manipulated so as to allow projects to get CERs even if they actually increase emissions.
- Surveys [18] have found that many CDM projects are investing in highly polluting and environmental harmful technologies in less developed countries, leading to increase, and not decrease in GHG emissions. For instance, incinerators and landfill gas systems are given credits; for e.g. out of 90 projects funded by the CDM till May 2008, 83 were highly polluting landfills, and another five were incinerators. Incinerators emit huge amounts of carbon dioxide, and landfills are a major source of methane, a dangerous GHG [22].
- It has also been found that large-scale power projects account for more than 65% of all CDM credits to be issued until 2020. CDM projects are mostly in large-hydro and coal-based thermal plants, and monoculture plantations set up in China and India. Such projects are low in environmental integrity, and many of them have been found to violate both national and international environmental impact assessment rules and laws. For example, France is constructing a new Thermal plant in Mundra, Gujarat, which will spew GHGs for the next 25 years, while earning carbon credits for France[23].
- There is rising concern regarding the efficacy of CDM projects in bringing about sustainable development. There is growing apprehension that CDM projects are benefitting only big industries, while excluding and injuring local people and local environment [13].
- The CDM rewards emission reductions, but does not penalise emission increases, and therefore acts more like an ‘emissions reduction subsidy’ rather than a tax on emissions[14]. Therefore, it can create a perverse incentive for firms to raise their emissions in the short-term, with the aim of getting credits for reducing emissions in the long-term. In the same way, it can act as an incentive for non-Annex 1 countries to cap their emissions, which is more beneficial to them compared to a world emissions trading scheme (ETS), where their emissions are capped. In China and India, companies started artificial production of greenhouse gases to gain carbon credits for their recycling. These earned credits are being sold to US and European companies[10].
- Another criticism levied against the CDM practice is the credits earned from non-existent emission reductions, which are recorded under the Kyoto Protocol as surplus allowances. For example, Russia, after the collapse of the Soviet Union, had a surplus of allowances, which other countries bought. However, this does not reduce physical emissions, but simply redistributes the emissions allowances[10].
- The market price for CERs has been falling over this time period. In the biggest carbon market, the European Union Emissions Trading Scheme, the market price for CERs fell to €2.67 a tonne in July 2012 (from €20/tonne when the scheme first started), and by October to €1.36, with a further fall to a record low of just 31 cents by December 2012, a fall of about 92% by the end of that year[24]. This falling trend in CER is attributed to lower prices for European Union emissions allowances due to oversupply, and recession in Europe[15]. With such low CER prices, potential projects are becoming commercially unviable, and the CDM mechanism is now in danger of collapse, as well as being a “complete disaster in the making” and “in need of a radical overhaul”[13, 14].
- CDM has reduced the compliance costs for Annex I countries, to meet their commitments under the Kyoto Protocol. CDM has reduced compliance costs for firms in the EU ETS and Japan by at least \$3.6 billion for the period from 2008 to 2011. The savings could be much larger, depending on the impact of CER use on the price of EUAs. For the 2008–2012 commitment periods the compliance cost savings for these firms were estimated to be at least \$2.3 billion. Annex I government use of CERs to meet their national emission limitation commitments will yield an additional \$1.3 billion in savings[18].
- LULUCF has also been criticised on various grounds. For instance, the accounting rules of the Kyoto Protocol do not fully cover remissions from land use, land use change and forestry, for unlike land-based accounting, they are based on activities that do not cover the entire land sector.

- a) In the case of forests, the LULUCF accounting system only indicates whether land is getting converted into forests or not, but it does not reveal the negative impacts of logging. Annex 1 Parties are interested in increasing their logging activities, and not in conserving stores and sinks for CO₂. So, they select a few activities such as removals (sequestration) to add to their accounts, but not those that involve emissive activities, like logging. In fact, many Parties are trying for a new accounting framework to remove logging emissions from their GHG accounts, so that they can increase logging without taking responsibility for the consequences. Canada, USA, Russia, and Australia have the most carbon dense natural forests in the world, and there is a fear that increased logging of these forests may release emissions by an estimated half a billion tonnes of CO₂. [16]
- b) More often than not, the following activities are generally *not* included in a Party's voluntary activities for LULUCF accounting: 1) Forest (logging, and conversion of natural forests to plantations), 2) Cropland, and 3) Grazing land. These activities are emissive in nature, and so many parties do not present them in their LULUCF accounting. However, due to this loophole, huge amounts of emissions are not shown, and so the extent of GHG released is masked. For example, drained organic soils in developed countries emit about half a billion tonnes of CO₂ emissions every year, which are kept hidden in the emission accounts. Similarly, the drainage of peat soils and use of drained peat lands, both highly emissive, are not part of the emission framework[16].
- c) In the first commitment period (up to 2012), management activities of existing forests were not eligible for LULUCF projects. This denotes that it is possible for Annex 1 Parties to gain credits through afforestation and reforestation in one area, but no penalties for degradation/deforestation in other areas.
- d) The CDM LULUCF policy has also not escaped criticism. It has been criticized by environmentalists, as it allows for monoculture plantations and GM plants, causing problems of biodiversity loss, and environmentally unfriendly practices.
- e) There is little opportunity for stakeholder involvement, since the benefits of LULUCF CDM are not transferred to local communities. Hence there is serious doubt whether these activities are really ushering in sustainable development in less developed countries.
- f) Some critics [20], have pointed out the gender implications of LULUCF projects. In most developing countries, women collect fuel wood, which is freely available in surrounding woodlands for cooking and heating. But with industry controlled CDM forests, women may be deprived of easy availability of fuel wood, thus increasing their drudgery.
- g) The problem of correct pricing of carbon credits due to LULUCF projects, is yet another concern. While buyers try to get maximum carbon credits at a minimum possible price, it is doubtful if developing countries can stand up to their pressure and get higher values of carbon credits[20].

6. Summary and Conclusions

The Kyoto Protocol Phase 1 (2008-12) laid down certain caps to GHG emissions from Annex 1 countries, to be achieved by 2012. Data analysis shows that the overall target reduction of GHG emissions was not only reached, but exceeded by Annex 1 Parties. But there are some unseen features in the data that do not show such a rosy picture. The collapse of the EIT economies was the chief cause of this reduction, being about 88% of total reductions in 2012. While the Kyoto Protocol's target was an overall 5% reduction of 1990 levels by 2012, the actual decline, after adjusting for the EIT economies and recession in Europe, was a mere 1.04% of 1990 levels. While some Parties succeeded in over shooting their targets, others actually increased their GHG emissions. USA abstained from participation, whilst Canada withdrew from the Protocol in 2012.

The various Flexible Mechanisms that allow Annex 1 Parties to achieve their goals also have a large number of flaws in both interpretation and implementation. Emissions trading, LULUCF, CDM projects, and JI have all been criticised for the conniving methods used by Annex 1 Parties to conceal both their emissions, and their exploitation of the recipient countries.

Overall therefore, there is still a long way to go if the spectre of climate change impacts has to be laid. With economic considerations being more preferred, and money cost cutting and monetary profits being of sole importance, it seems to be getting more difficult to stabilise and bring down GHG emissions. In the next phase till 2020, even the less developed countries will have to participate in GHG reductions. This will in all probability lead to greater stress on their economies and on climate change, and without a transparent reduction policy by the rich countries, the chances of achieving economic equality, environmental benefits, and sustainable development appear to be bleak.

7. References

1. Kyoto Protocol. http://unfccc.int/kyoto_protocol/items/2830.php. Date accessed: 9/06/2016.
2. Parties & Observers. http://unfccc.int/parties_and_observers/parties/annex_i/items/2774. Date accessed: 3/06/2016.
3. Towards-a-climate-agreement. <http://www.un.org/climatechange/>. Date accessed: 2/07/2016.
4. The COP21 decisions at a glance: Infographic: <http://www.euractiv.com/sections/development-policy/infographic-cop21-decisions-glance-320520i>. Date accessed: 2/06/2016.
5. Glossary: Key terms. <http://www.c2es.org/international/negotiations/kyoto-protocol/glossary>. Date accessed: 12/06/2016.
6. GHG data: <http://data.worldbank.org/data-catalog/world-development-indicators>. Date accessed: 3/06/2016.
7. GHG emissions World: <http://wdi.worldbank.org/table>. Date accessed: 12/05/2016.
8. Greenhouse Gas Inventory Data: http://unfccc.int/ghg_data/items/3800.php. Date accessed: 3/05/2016.
9. Readfearn Graham and Lenore Taylor (12 Dec 2014) Australia could increase emissions 26% and still meet Kyoto pledge, says climate group. <http://www.theguardian.com/environment/2012/Jan/16/greenhouse-gases-remain>. Date accessed: 7/07/2016.
10. D.M. Liverman. Conventions of climate change: constructions of danger and the dispossession of the atmosphere, *Journal of Historical Geography*. 2009; 35(2) 279-296
11. EU ETS under heavy pressure, (16 Oct, 2012): <http://www.carbontradewatch.org/>. Date accessed: 5/07/2016.
12. Climate Change 2014: Impacts, Adaptation, and Vulnerability, IPCC Report: Published by IPCC, Geneva, 2014.
13. Carbon markets: Complete Disaster in the Making. Finance and Economics article, *The Economist*. <http://www.economist.com/node/21562961>. Date accessed: 15/09/2012.
14. Burniaux, Jean-Marc, Jean Chateau, Rob Dellink, Romain Duval and Stéphanie Jamet: The Economics of climate change mitigation: how to build the necessary global action in a cost-effective manner, *Economics Department Working Papers, No. 701*, ECO/WKP42 Organisation for Economic Co-operation and Development. 2009
15. Allan, Andrew. U.N. offsets crash to 15 cents ahead of EU ban vote. www.pointcarbon.com. Date accessed: 12/06/2016.
16. Graham, Alistair: The Hypocrisy of Land-Use Accounting, Humane Society International, <http://www.ecosystemmarketplace.com/articles/the-hypocrisy-of-land-use-accounting/> Date accessed: 14/08/2016.
17. Kollmuss Anja, Lambert Schneider and Vladyslav Zhezherin: Has Joint Implementation reduced GHG emissions? Lessons learned for the design of carbon market mechanisms, Stockholm Environment Institute Working Paper No. 2015-07. 2015
18. Randall Spalding-Fecher, Amrita Narayan Achanta, Peter Erickson, Erik Haites, Michael Lazarus, Neha Pahuja, Nimisha Pandey, Stephen Seres and Ritika Tewari (July 15, 2012): Assessing the Impact of the Clean Development Mechanism. http://www.cdmpolicydialogue.org/research/1030_impact.pdf. Date accessed: 7/06/2016.
19. Eva Filzmoser–Write up, www.carbonmarketwatch.org. Date accessed: 12/08/2016.
20. Chatterjee, Anish: CDM in the Forestry Sector. <http://www.devalt.org/newsletter/oct04/of4.htm> Date accessed: 5/07/2016.
21. GAIA_CDM Factsheet <http://no-burn.org/downloads/> Date accessed: 1/06/2016.
22. Marie Marciano, Global Alliance for Incinerator Alternative, www.no-burn.org/climate. Date accessed: 28/07/2016.
23. Harmful CDM projects: <http://carbonmarketwatch.org/category/project-campaigns/>. Date accessed: 20/06/2016.
24. Data and Maps: <http://www.eea.europa.eu/data>. Date accessed: 8/06/2016.

DECLARATION: This paper is an original work done by me; it has neither been done earlier nor have I published it in any journal or newsletter. It is based on data collected from World Development Indicators website, and UNFCCC website. As my area of specialisation is Environmental Economics, I was interested in analysing whether the commitment made by the Annex 1 countries to reduce their GHG emissions was fulfilled or not, and hence took up this analysis.

The findings and conclusions are based on my own personal enquiry, and may be useful for both further research and policy decisions. They do not reflect the views of the University.

¹ GHG includes carbon dioxide, methane, water vapour and nitrous oxide. Man-made gases (F-gases) include chloro-fluorocarbons (CFCs), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), as well as sulphur hexafluoride (SF₆).

² There are large variations in the lifetime of these gases in the atmosphere, ranging from months to centuries. It is difficult to predict the lifetime of CO₂ accurately, because of its various sequestering processes. These include dissolving in the ocean over a period of 20–200 years, and other slower processes such as chemical weathering and rock formation, which could take up to several hundreds of thousands of years. Methane, though it can be removed from the atmosphere by chemical reaction, can still persist for about 12 years. In case of Nitrous oxide, it remains in the atmosphere for around 114 years, while CFCs, HCFCs, HFCs, PFCs can persist from less than a year, to many thousands of years. (5)

³ Annex I countries include the OECD and 12 countries from Central and Eastern Europe.

⁴ Of these, a further subdivision (Annex B) in the Kyoto Protocol, consists of 38 Annex 1 countries (except Belarus and Turkey), plus the European Community, who have all agreed to QELRCs (Quantified Emission Limitation and Reduction Commitment) (24)

⁵ Data for two countries: Monaco and Belarus are not available.

⁶ For e.g. if a country was emitting 100 KT GHG in 1990, and had pledged to reduce them by 5% by 2012, then its emission in 2012 should be only 95 KT.

⁷ For instance, if a country X's cap is 8% but it has achieved 20% reduction (like Latvia an EIT country), but another country Y has increased emission by 5%, while it should have reduced by 5%, then Y can "buy" carbon credits from X and put it into its own account. Y can pay X for 10% of its emission reduction, transfer, and add it to its own emission total, bringing it down to the required target. Thus, Y can achieve its target without reducing its actual emissions, while X can earn dollars for exceeding its targets.

⁸ Terrestrial activities are sources of both greenhouse gas emissions, and sinks that remove or sequester carbon dioxide from the atmosphere. Net emissions are defined as emissions less removals by sinks.

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