

Climate Change and Carbon Footprint Initiatives

Subjects: Environmental Sciences

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One of the most significant environmental aspects is the issue of climate change due to carbon dioxide emissions generated by human activities. Given the importance of this topic, this paper gathers initiatives and methodologies that have been undertaken to calculate and reduce CO₂ emissions and climate change effects. After studying these methodologies, their strengths and opportunities for further enhancement have been analyzed.

Climate change is an important global issue, which has become a major focus of attention because of its potential hazards and impacts on the environment^[1]. The on-going global climate change has been related to GHG emissions because of the atmospheric warming effect of these emissions^[2]. The main GHGs are carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O).

In order to measure the potential contribution of human activities to climate change, an environmental indicator can be used: carbon footprint. Carbon footprint is an environmental indicator that has been developed over the last decade^{[3][4]}.

Based on the Parliamentary Office of Science and Technology^[5], carbon footprint is the total amount of CO₂ and other GHG emissions which are emitted over the full life cycle of a process or product. The other GHGs are expressed as CO₂ equivalent (CO₂eq). The carbon dioxide equivalent of a quantity of gas is calculated by multiplying the mass of the gas (in tons), by the gas global warming potential (GWP). GWP value for CO₂ is equal to 1 for a 100-year time horizon, for CH₄ it is equal to 25 and for N₂O it is equal to 298^[2].

Many international initiatives have been taking place for many years in order to control climate change and carbon footprint. Some of the most significant ones are summarized in Table 1 and explained in more detail after the table.

Table 1. Summary of international initiatives to control climate change and carbon footprint in general.

Year	Organization	Significance of Initiatives
1979	World Meteorological Organization (WMO)	This was one of the first major international meetings on climate change.
1988	United Nations Environmental Program (UNEP) and World Meteorological Organization (WMO)	This set up the Intergovernmental Panel on Climate Change (IPCC) to provide policymakers with regular scientific assessments on the current state of knowledge about climate change.
1992	United Nations (UN)	The UN developed the United Nations Framework Convention on Climate Change (UNFCCC) to stabilize GHG concentrations in the atmosphere.
1995	Intergovernmental Panel on Climate Change (IPCC)	This published a set of guidelines for national GHG inventories. The revised versions of these guidelines were issued in 2006 and updated in 2019.
1997	United Nations (UN)	The UN developed the Kyoto Protocol, which established an action to limit GHG emissions by at least 5% below 1990 levels in the commitment period from 2008 to 2012.

1997	GRI (Global Reporting Initiative)	The GRI helps businesses, governments and other organizations to understand and communicate the impact of business on critical sustainability issues such as climate change.
1998	World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD)	This developed the GHG protocol in order to establish frameworks to measure and manage GHG emissions from private and public sector operations, value chains and mitigation actions.
1998	U.S. Environmental Protection Agency (EPA)	The EPA prepared a legal opinion concluding that CO ₂ emissions were within the scope of the EPA's authority to regulate.
2003	World Wide Fund for Nature (WWF)	The WWF established the Gold Standard emission allowance to ensure that the projects reduced carbon emissions under the UN's Clean Development Mechanism (CDM).
2006	International Organization for Standardization (ISO)	The ISO developed ISO 14064, which contains detailed principles and requirements for designing, developing, managing and reporting organization or company level GHG inventories. The revised version of this standard was developed in 2018.
2007	Ecological Transition Ministry (MITECO) of the Spanish government	This developed a tool and a guideline to calculate carbon footprint for scope 1 and scope 2.
2008	Catalan Office for Climate Change (OCCC)	This developed an excel-based tool to calculate CO ₂ emissions in three scopes. The latest version of this tool with its guidelines was published in 2019.
2009	United Nations (UN)	The UN launched the Partnership for Learning on Climate Change.
2015	United Nations (UN)	The Paris Agreement set the mitigation goal of limiting the global temperature increase to 2 °C and ideally to 1.5 °C.
2017	World Wide Fund for Nature (WWF)	The WWF established a next generation of the Gold Standard to quantify, certify, and maximize impacts on climate security and sustainable development.
2017	Carbon Trust (UK based company)	It introduces two types of carbon footprinting that affect businesses: one that measures an organization's overall activities, and one that looks at the life cycle of a product or service.
2019	United Nations (UN)	The main aim of COP 25 in Madrid is increasing countries' ambitions to meet the goals of the Paris Agreement.

As can be seen in Table 1, in 1979, the World Meteorological Organization (WMO) sponsored the first major international meeting on climate change in Geneva. In this event, concerns about this topic were expressed and first actions discussed^[6].

In 1988, the United Nations Environmental Program (UNEP) and World Meteorological Organization set up the Intergovernmental Panel on Climate Change (IPCC), to provide regular scientific assessments of the current climate change situation and assist policymakers to control it^[7]. In addition, IPCC published a set of guidelines for National Greenhouse Gas Inventories in 1995. The revised versions of these guidelines were issued in 2006 and updated in 2019^{[8][9]}.

This was followed in 1992 by the development of the United Nations Framework Convention on Climate Change (UNFCCC) in Rio de Janeiro to stabilize GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system^[10].

After this, in 1997, the Kyoto Protocol was adopted in Kyoto (Japan) and entered into force in 2005. This aimed to limit GHG emissions by at least 5% below 1990 levels in the commitment period from 2008 to 2012^[11].

Another interesting attempt is the Global Reporting Initiative (GRI), an international independent organization that has pioneered corporate sustainability reporting since 1997. GRI helps businesses, governments and other organizations understand and communicate the impact of business on critical sustainability issues, such as climate change, human rights, corruption and many others^[12].

The development of the Greenhouse Gas Protocol was a very important milestone in the fight against climate change. In 1998, the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) developed this protocol. It included standards, tools and online training that helped countries and cities to track progress towards their climate goals^[13].

In 1998, the EPA (U.S. Environmental Protection Agency) developed regulations for GHG emissions, such as regulations related to GHG emissions from new motor vehicles and new motor vehicle engines under section 202 of the Clean Air Act^[14].

Later on, in 2003, the World Wide Fund for Nature (WWF) and other international NGOs developed the Gold Standard emission allowance. The aim of this project was to ensure that the projects reduced carbon emissions under the UN's Clean Development Mechanism (CDM) and also contributed to sustainable development. The next generation of this standard launched in 2017, and allowed climate and development initiatives to quantify, certify, and maximize their impacts on climate security and sustainable development^[15].

Another important landmark is the development of ISO 14064 by the International Organization for Standard (ISO) in 2006. This international standard includes principles and requirements for designing, developing, managing and reporting organization or company-level GHG inventories^[16] [26]. The complete and revised version of this standard was published in 2018^[17].

Bearing in mind the importance of the carbon footprint, in 2007 the Ecological Transition Ministry (MITECO) of the Spanish government developed a tool and guidelines to calculate it. The last version of these guidelines was published in 2019 and they aim to calculate emissions of scope 1 and scope 2^[18].

In the same direction, in 2008, the Catalan Office for Climate Change (Catalonia, Spain) developed an excel-based tool to calculate CO₂ emissions. The latest version of this tool with its guidelines was published in 2019. The purpose of these guidelines is to facilitate the estimation of GHG emissions^[19].

In order to foster training in sustainability issues such as climate change, in 2009, the Partnership for Learning on Climate Change (UN CC: Learn) was launched by the United Nations (UN). The main function of this collaborative initiative was to provide support to countries that wanted to develop and implement training plans in sustainability, addressing in particular climate change^[20].

Following the aforementioned Kyoto protocol, in 2015, the Paris Agreement was established. Within the framework of the United Nations Framework Convention on Climate Change, the Paris Agreement recognized climate change as an urgent threat and set the mitigation goal of limiting the global temperature increase up to 2 °C and ideally up to 1.5 °C^[21]. However, GHG emissions have continued to rise^[22].

In 2017, in the UK, the Carbon Trust aimed at developing a common understanding of what the carbon footprint of a product is and circulated a draft methodology for consultation^[23]. The Carbon Trust is a private company set up by the UK

government to accelerate the transition to a low-carbon economy. The Carbon Trust methodology estimates the total emission of greenhouse gases (GHG) in carbon equivalents from a product across its life cycle, from the production of raw material used in its manufacture to disposal of the finished product (excluding in-use emissions).

The next step after the Paris Agreement was the Conference of Parties (COP 25) of the UNFCCC gathered in Madrid in December 2019. One of the main achievements of this COP was increasing countries' ambitions to meet the goals of Paris Agreement^[24].

Discussions on climate change have thus been evolving at an international scale for around forty years, and the issue remains dynamic in terms of science and politics right up to the current period, with future pathways still to be determined. In the post-covid-19 period, it will surely gain further status in terms of multinational collaboration regarding trans-boundary impacts and the goals of sustainability and overall environmental quality.

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Keywords

climate change; carbon footprint; greenhouse gases

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