

Article



Uniform Global Carbon Tax and 100% Dividend as a Solution to Climate Disruption

Jiří Svoboda*1, Alexander Ač2*, Marta Kovářová3

¹ Institute of Physics of Materials, Academy of Sciences of the Czech Republic, 61662 Brno, Czech Republic; svobj@ipm.cz

² CzechGlobe, Global Change Research Institute CAS, 603 00 Brno, Czech Republic; ac.a@czechglobe.cz

³ Masaryk University, Faculty of Education, Department of Art, 603 00 Brno, Czech Republic; marta.svoboda@gmail.com

*Correspondence: ac.a@czechglobe.cz

Abstract: The current threat of climate disruption is historically the first challenge where humankind must agree on a common approach to quickly reduce fossil CO₂ emissions. Despite considerable international efforts, climate protection remains highly insufficient. To fill this gap, this paper introduces and evaluates the concept of the Uniform Global Carbon Tax (UGCT) and 100% dividend, having the ambition to form a legal basis for an effective solution of climate disruption. The basic difference between the current approaches and the UGCT consists in the fact that the same tax must be levied on extraction of all global fossil fuels in proportion to their carbon content. Not on products! This minimizes administration and maximizes effectiveness. The concept assumes that after the extraction of fossil carbon, mining companies pay UGCT into a global fund and add the tax to the price. As a result, the cost of carbon footprint would be automatically accounted in every activity. It is easier to keep an eye on hundreds mining companies in the world than to argue about never ending calculating the carbon footprint of each product. No need for CBAM Carbon Border Adjustment Mechanism! The collected tax would then be evenly distributed back to all adults. This would cause a natural monetary net flow from people and countries with a high carbon footprint towards those with a low carbon footprint, thus helping to reduce the socio-economic imbalances. An adequate progressive carbon pricing would direct the spontaneous development of global society into a low carbon pathway. This approach is simple, fair, accurate, with clear rules, without any complicated administration and with a real ambition to cover 100% of the extracted global fossil carbon.

Keywords: global carbon tax; progressive carbon pricing; global climate fund; climate change inequality; climate legislation; climate justice

Citation: Svoboda, J.; Ač, A.; Kovářová, M. Uniform Global Carbon Tax and 100% Dividend as a Solution to Climate Disruption. *Climate* **2021**, *9*, x. https://doi.org/10.3390/xxxxx

Received: date Accepted: date Published: date

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2021 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/license s/by/4.0/).

1. Introduction

The use of fossil fuels in the market economy during the last 200 years has been and still is the dominant driving force behind the exponential growth and development of human civilization. However, the continuation of such scenario is currently hampered by the limits of the planet's repair mechanisms [1-3]. The shared biosphere can no longer tolerate additional large quantities of CO₂ while also maintaining acceptable climatic conditions for future generations [4-6]. Climate disruption is a typical example of a phenomenon known as a "Tragedy of Commons" [7]. It is, therefore, necessary to perform "an economic irrationality" and give up the use of lucrative and readily available fossil fuels much sooner than they would become scarce.

The past 25 years of climate summit negotiations at Conferences of Parties (COPs 1-25) have not delivered expectations and intended outcomes, and global CO₂ emissions are still rising [8,9]. This can be considered a climate crisis, not only because progressing global climate change is already causing serious problems, but also because sufficiently effective tools to address the root cause of this problem have not been applied yet. Carbon Pricing [10-11] seems to be the right basis, and there is also an idea of a suitable carbon price increase scenario [12]. However, the key issues remain unresolved: how to collect fossil carbon fees as simply and consistently as possible, and how to properly utilize the fees collected?

If no radical decline in global CO₂ emission in the next few years is realized as a result of existing climate policies, it is inevitable to critically review current approaches and launch significantly more effective climate protection legislative tools. This paper aims to present and start a broad inter-disciplinary discussion about the concept of the progressive Uniform Global Carbon Tax (UGCT) and a 100% dividend that could meet the ambitious criteria for an effective solution to the climate crisis.

2. Current approaches to solving climate disruption

The existing approaches are summarized in the following paragraphs.

• At UN climate summits, individual countries commit themselves to specific targets and choose their own emission reduction tools commonly known as Intended Nationally Determined Contributions (INDCs). Leading countries in the EU make increasingly ambitious commitments into the more or less distant future often with unclear pathways and rules, while some other countries such as those intensively extracting fossil fuels boycott such efforts. However, the failure to meet targets or boycotts cannot be directly penalized. Many developed countries "reduce" their emissions by importing carbon-intensive products from countries in Asia and criticize them for increasing CO₂ emissions. Politicians want to keep the voters' favor by keeping energy prices low, but that fulfills the interests of fossil fuel mining and distributing companies and ensures their profits.

• The Emission Trading System (ETS) was the only measure that countries could agree on at the COP3 in Kyoto in 1997. The main idea of the ETS is to distribute fewer and fewer emission allowances and permit their trade to reduce emissions as effectively as possible. The market price of emission allowances is expected to rise as a result of the decreasing ceiling for total CO₂ emissions. In practice, however, this does not work, therefore, the United Kingdom and Canada have recently adopted Carbon Price Floors [13] which limit the price of the allowances both from the top and the bottom. During the 23 years since its adoption, the ETS has not demonstrated the necessary effectiveness and has been criticized many times [14]. In 2018, the countries using ETS covered only 52.61% of their emissions with an average allowance price of \$ 22.75 per ton of CO₂[12].

• Many countries have introduced national carbon tax schemes, and others are considering it [15]. States with national carbon taxes covered on average 49.25% of their CO₂ emissions in 2018 with an average price of \$ 12.78 per ton of CO₂ [12].

• Subsidies are often used to support the implementation of low-carbon measures (e.g., the use of renewable energy or thermal insulation of buildings). However, subsidies often apply only to the "right" measures as arbitrarily determined by politicians and not by independent analysis, which leads to an unequal competitive environment for the development and implementation of

alternative low-carbon solutions [16]. Such legislative situation is seized by lobbyists, which subsequently decreases public trust in the fairness and cost-effectiveness of the subsidies.

• Climate disruption has various consequences, often fatal, especially in poor countries that have had a negligible contribution to it. These countries demand quick solutions and compensation from others. Developed countries have pledged to contribute \$ 100 billion annually to poor countries starting in 2020 [17] and the respective Green Climate Fund [18] has been founded only by a small fraction of this amount.

• The main item on the agenda of the Madrid COP25 was Article 6 [19], which concerns international cooperation on climate change mitigation. Effective instruments to meet country commitments were also sought. But two weeks of negotiations did not lead to an outcome due to fundamental differences in responsibility and approaches to tackling climate disruption. There is consensus on the need to reduce global emissions rapidly, but some countries have called for zero-emission commitments. This blocked the debate because of political impassibility and postponed it without any clear schedule.

Reducing emissions by using low-emission energy sources, increasing efficiency, energy saving, planting trees, or changing the behavior of people and companies is welcome anywhere in the world. All these measures, therefore, deserve uniform and extensive support in the form of Carbon Pricing. Economic models predicting global warming scenarios [20-22] can account for the impact of Carbon Pricing when all fossil carbon is included and appraised. However, in 2019, Carbon Pricing (ETS and national carbon taxes) covered only 20% of fossil carbon emissions [23], and 80% remained out of control! This is, apparently, why the efforts to reduce CO₂ emissions so far have been toothless and failing.

3. National carbon tax on fossil fuel extraction and 100% dividend

James E. Hansen introduced a promising concept of a national carbon tax on fossil fuel extraction and a 100% dividend for the USA more than 10 years ago [24], which further advanced the basic idea of global carbon tax first conceptualized by Cooper [25] and Stoft [26]. Hansen suggests that all carbon contained in fossil fuels extracted or imported is taxed by the country. The tax would be automatically reflected in the prices of all products and services without any further administration. The funds collected from the tax would then be distributed across the board to all people in the country (100% dividend) to compensate for price increases by taxing fossil carbon. If the carbon prize progressively increased over time, it would make low-carbon products and services effectively cheaper and cheaper (or relatively less expensive) and high-carbon ones more and more expensive. Therefore, demand and subsequently also production of low-carbon products would significantly increase at the expense of high-carbon products. A sustained pressure to reduce fossil carbon consumption spread over the whole society and in all segments of economic activity would be created. The consumer baskets of people and the behavior of companies would spontaneously change towards reducing their carbon footprint. The free market would be left to decide which low-carbon measures are the most appropriate. Subsidies for low-carbon measures would become redundant and unnecessary, they would cease to distort the market, and fossil fuel extraction would spontaneously become uneconomical. Low-income households, expected to have a low carbon footprint, would profit, people with a high carbon footprint would pay extra money. Social imbalances would be significantly reduced.

However, complications would arise in international trade between countries with different carbon tax rates, which would require Border Carbon Adjustment [27]. This requires an individual determination of the carbon footprint of each traded product. But what should be included in the calculation? Mining the necessary raw materials, building the plant and its operation, the production itself, transport, the carbon footprint of the employees in the factory, and what about the carbon footprint of the experts calculating the carbon footprint? To determine the complete life-cycle emissions of any product would be simply too complex. Moreover, it would be necessary to perform Adjustments in different heights in the case of trade between countries with different

rates of carbon taxes. Therefore, intense disputes about what should be included in the Border Carbon Adjustment Mechanism and which products can be left excluded would become likely [27].

And there is another aspect of Hansen's concept of national carbon tax and 100% dividend. Budgets of countries mining and exporting massive amounts of fossil fuels would greatly benefit from a high national carbon tax. For the budgets of carbon-intensive countries without fossil fuel resources, it would be most profitable to import fossil fuels from countries without an established carbon tax. On the contrary, fossil fuel trade companies would prioritize the cheapest suppliers regardless of the carbon tax. This could cause many disputes and instabilities. Countries with low emissions, where fossil fuels are not extracted, would have no chance of benefiting from the system in any way. Therefore, national carbon taxes do not, from a global perspective, produce any social and economic solidarity.

The International Monetary Fund (IMF) states that "... carbon taxes - levied on the supply of fossil fuels (for example, from oil refineries, coal mines, processing plants) in proportion to their carbon content - are the most powerful and efficient, because they can afford firms and households to find the lowest-cost ways of reducing energy use and shifting towards cleaner alternatives.", and "Limiting global warming to 2 °C or less requires policy measures on an ambitious scale, such as a global carbon tax that will rise rapidly to \$ 75 a ton of CO₂ in 2030." and also "... carbon pricing combined with an equal dividend to the whole population rather than an income tax cut redistributes income to favor lower-income groups but forgoes gains in economic efficiency." [12]. This is a clear rationale to replace national carbon taxes with UGCT to get rid of the problems mentioned above and to gain crucial benefits. The problem is that these three sentences are listed in three different places in the two-page document as three individual, tepid recommendations, and are not presented as a coherent concept that is highlighted in the text. Few people put that together! Surprisingly, carbon pricing is also endorsed by major oil producers such as BG Group, BP, Eni, Royal Dutch Shell, Statoil and Total [28].

4. The Uniform Global Carbon Tax on fossil fuel extraction and its 100% dividend

The concept is based on the authors' suggestion that to effectively protect the climate, it is not necessary to change the existing socio-economic system or the natural behavior of people in a market environment (to work as efficiently as possible in order to maximize profits and to satisfy the needs as much as possible with the money earned), but to utilize them appropriately. The overwhelming majority of the global population and companies would be involved in climate protection by means of an acceptable modification of global political and economic rules causing economical behavior to automatically become ecologically advantageous as well (see Figure 1).



Figure 1. The motto of the central idea of uniform global carbon tax and 100% dividend

We build the concept on the following premises:

- People want to keep a free choice regarding how to meet their needs best.
- Carbon in fossil fuels, irrespective of country of origin, is the primary source of global CO₂ emissions that people need to reduce.
- The global atmosphere is an equal common property of all people. All people should pay in proportion to their respective CO₂ emissions.
- All people should participate, through their elected representatives, in determining the level of carbon fees.
- The carbon fees should be distributed equally to all adult people.

Upon the adoption of UGCT, all mining companies in the world would begin to pay to the Global Climate Fund created and administered, for example, by the IMF or the World Bank, (Fig. 2.) a prescribed tax on all extracted fossil carbon. Mining companies would sell fossil fuels at prices increased by the uniform global tax. Thus, every product or service worldwide would automatically reflect the real fossil carbon footprint in its price. This method requires no additional calculations. It is simple, fair, accurate, with clear rules, without any complicated administration and with a real ambition to cover 100% of the extracted global fossil carbon. The same tax rate should also be levied on the extraction of carbon in limestone used for the production of cement causing about 4% of current global CO₂ emissions [8].



Figure 2. Schematic diagram of a Uniform Global Carbon Tax collection to the Global Climate Fund.

In order for the world economy to gradually adapt and at the same time for the UGCT to remain motivating, carbon taxation needs to start at a low level and increase according to the agreed medium-term scenario (10-30 years) announced in advance. As the price of fossil fuels gradually would increase, the global consumption and demand of fossil fuels will gradually decline, and their exploitation will be stopped at the least profitable sources. The UGCT increase scenario known in advance together with the expected evolution of demand would provide mining companies with sufficient information to make their own decisions about which resources to shut down and shift to other activities. Moreover, the foreknown medium-term scenario of increasing the UGCT would have huge impacts on all medium- and long-term investments in companies and families. Products with a high carbon footprint would become expensive at the fastest rate, gradually disappear from the market basket and stop being produced.

The initial rate of the global carbon tax and its progression in time should be subject to political negotiations by elected representatives of all countries. For example, the initial tax rate could be set to \$ 35 per ton of carbon extracted (Figure 3a) (about \$ 10 per ton of CO₂) and its increase could be set to \$ 35 per year. Such tax scenario (Figure 3b) could realistically reduce global CO₂ emissions from fossil fuel combustion to about 1/10 in 2050, which correlates well with IMF proposals [12]. Once emissions have been sufficiently reduced, the tax should be conserved as a safeguard to prevent fossil fuel extraction in the future. With today's relatively high oil price of \$ 360 per ton compared to other fossil fuels, see Figure 3b, it can be seen that in 10 years the relative change of oil price would be the smallest, only 1.8 times higher, while the price of natural gas and coal would rise 3 and 5 times, respectively.



The increasing fuel prices would favor local producers and local markets in general, more expensive electricity from fossil fuels would motivate the use of more environmentally friendly appliances, efficient thermal insulation of buildings, and the use of low-emission sources. If the tax progression scenario is known in advance, prices are predictable as well and provide a fair trade environment for businesses in a wide range of activities around the world. The effects of UGCT would result in the abandonment of all national ETS, carbon taxes, and market-distorting subsidies for low-carbon measures. Low-emission sources would, sooner or later, become competitive with more and more expensive fossil fuels and would be naturally invested in. Research and development of all truly effective low-carbon technologies would start. A fair global carbon market involving all human activities would be created.

As a result of the introduction of UGCT, there would be a noticeable increase in energy, commodities and service prices, so it would be necessary to mitigate this impact. Inspired by Hansen [24] and the most recent IMF report, see Executive Summary in [12], we consider it most social and, therefore, most appropriate to distribute the tax levied to all countries according to their population (see Figure 4). Individual states would undertake to distribute the tax levied equally to all their adult citizens or by similar socially beneficial means. For a country where the recommended distribution of tax did not take place, the dividend would be suspended and retained in the fund until the government of the country guarantees its appropriate use. This may have a positive effect on the development of the countries with an unstable or undemocratic regime. As the carbon tax would increase gradually from low rates, any initial shortcomings in the redistribution system would not have serious consequences, and there would be sufficient time to fine-tune the functioning of the system.

Please note that the collected tax is to be distributed to adults only. One of the reasons for the current population explosion in developing countries is that many people want to secure their old age by having many children. If the collected tax were also distributed to children, it would further motivate population growth. Conversely, if adults had a secure income, they would not have to rely on their children. Thus, the tax distribution set up in this way could significantly reduce undesirable population growth in developing countries. We expect this topic to be the focus of many discussions.



Figure 4. Scheme of redistribution of global carbon tax in the form of 100% dividend.

People and countries with below-average carbon footprint (a large majority of the world [29] would benefit from such a concept, those with a high carbon footprint would lose. There would be a net flow of money from high-emission to low-emission people and countries. This would help solve the currently unresolved problem of funding poor countries affected by climate disruption. In the first year alone, about \$ 350 billion would be collected, nearly half of which would go to developing countries. The recently established Green Climate Fund [18] would no longer be needed. If UGCT increases by \$ 35 a year and CO₂ emissions do not increase further, the annual dividend would reach about \$ 500 after 10 years (see Fig. 4). At this rate of global carbon tax growth, coal use can be expected to cease within 10 years, and oil and gas production would be significantly reduced in 20-30 years. Such a scenario is in line with the recommendations of the COP21 Paris Agreement [30].

The chances of adopting a carbon tax in five representative countries, whether uniform global or national harmonized (i.e. at the same level in many countries), based on public opinion are examined in detail by Carattini et al. [31]. The study also investigates preferences how to use this tax. Based on the results of the study, it can be stated that people's views on the carbon tax and its redistribution are far from negative, even if it had not been pointed out that the introduction of a carbon tax would alleviate the climate crisis and stop worsening the living conditions. Moreover, an additional advantage that a carbon tax can replace very inefficient subsidy programs that people have to pay from their taxes, is not mentioned in the study at all. In any case, it also follows from the study that the solution of the climate problem could be influenced not only by public opinion, but also by interests of influential groups and the politicians linked to them.

5. Why would people and countries want the uniform global carbon tax and its 100% dividend?

• People in **developing countries** could appreciate a dividend that would help improve their living situation and allow them to invest in decentralized low carbon technologies. The adoption of a global carbon tax and a 100% dividend could significantly reduce the incentive to migrate. Developing countries would then most likely skip the fossil carbon-based period.

• People **in developed countries** and wealthy people could welcome the ethical dimension of a carbon tax to "buy" their lives so far associated with high CO₂ emissions. At the same time, thanks to the development of low-carbon technologies, a wide range of low-carbon products and services would be ensured, so that the people would not lose their standard of living even with a low carbon footprint.

• **Countries with** introduced **national carbon tax or ETS** already in place would eliminate enormous difficulties in offsetting the carbon footprint of imported/exported goods, which could also bring many other benefits, see Table 1.

• **Right-wing** people could appreciate the simplicity, systematic rules, and efficiency of the market-based instrument used.

• **Left-wing** people could be interested in the social aspects - closing the global social scissors and reducing pressure on migration, see Figure 5.

• **Environmentalists** could appreciate the direct impact of the carbon tax on any carbon activity as well as on the overall decarbonization of the global economy.

• Activists could fight for an as-quick-as-possible implementation of a specific, effective tool for tackling climate disruption as UGCT.

• **Climate-skeptics** could appreciate that politicians would not determine the ways of climate protection through inefficient subsidies but a fair undistorted market would do it.

Mining companies could appreciate the good long-term predictability of the unavoidable downturn of fossil fuel extraction.

• By referring to this article, the **IPCC** could point to the concept of the Global Carbon Tax and 100% Dividend in its Summary for Political Leaders and help with its introduction in real life.

• The **UN** could support the Global Carbon Tax and 100% Dividend concept as an effective climate protection tool at the COP 26 in Glasgow in 2021 or at next COP and create a forum for expert discussion.

Effect/Concept	Global carbon tax	National carbon tax
Coverage of fossil carbon taxation	Almost 100%	Medium, approx. 50%
Administrative demands	Very low	High (Border Carbon Adjustment)
Barriers to international trade	None	High
Global economic solidarity	High	Undefined
(flow of money from rich to poor countries)		
Corruption potential	Low	High
Enforceability/feasibility	Unknown, no attempt was	Politically feasible, practically not
	made, public support,	feasible (Border Carbon Adjustment)
	however, exists, see [31]	
The adjustability of Tax Progression	Simple	Simple
Perspective (stable prospects)	Very high	Very low
Environmental justice-(the emitter pays)	High and equal	Inconsistent (does not cover everything)
		and unequal (different tax in different
		countries)

Table 1. Comparison of the effects of global and national carbon taxes.



Figure 5. Demonstration of the basic social effect after the introduction of the concept of the Global Carbon Tax and 100% Dividend

6. Concluding remarks

When there was a shortage of resources, past human societies always found ways to adapt. Once a given raw or energy material became increasingly scarce, its price rose or fluctuated [32] and its replacement was intensively sought. However, this is not yet the case with fossil fuels since they are still plentiful. It is the waste from their combustion released into the atmosphere, which is the planetary limit by causing global climate disruption. Therefore, we propose to simulate a shortage of fossil fuels by their Uniform Progressive Global Taxation. If fossil fuels were running out, huge profits would flow predominantly into the pockets of the owners of the companies extracting the remaining resources. On the contrary, a global carbon tax would serve to address poverty in a substantial part of the world.

The concept of the Uniform Global Carbon Tax and 100% Dividend could become a unifying idea of today's highly heterogeneous world.

References

1. Hellevang, H., Aagaard, P., Constraints on natural global atmospheric CO₂ fluxes from 1860 to 2010 using a simplified explicit forward model. *Sci Rep* **2015**, *5*, 17352, doi: 10.1038/srep17352.

2. Popkin, G., How much can forests fight climate change? Nature 2019, 565, 280-282, doi: 10.1038/d41586-019-00122-z.

- 3. Wang, S., Zhang, Y., Weimin, J. et al., Recent global decline of CO₂ fertilization effects on vegetation photosynthesis. *Science* **2020**, 370, 1295–1300, doi: 10.1126/science.abb7772.
- 4. Lenton, T. M., Rockström, J., Gaffney, O., Rahmstorf, S., Richardson, K., Steffen W., Schellnhuber, H. J., Climate Tipping Points to risky to bet against. *Nature* **2019**, 575, 592-595.
- 5. Ripple, W. J., Wolf, Ch., Newsome, T. M., Barnard, P., Moomaw, R. W., World Scientists' Warning of a Climate Emergency. *BioScience* **2020**, 70, 8–12, doi: 10.1093/biosci/biz088.
- 6. Steffen, W., Rockström, J., Richardson, K. et al., Trajectories of the Earth System in the Anthropocene. *The Proceedings of the National Academy of Sciences (PNAS)* **2018**, 115, 8252–8259, doi: 10.1073/pnas.1810141115.

7. Hardin, G. The Tragedy of the Commons. Science 1968, 162, 1243–1248.

8. Friedlingstein, P., O'Sullivan, M., Jones, M. W. et al., Global Carbon Budget 2020. *Earth Syst. Sci. Data* 2020 12, 3269–3340, doi: 10.5194/essd-12-3269-2020.

9. Friedlingstein, P., Andrew, R. M., Rogelj, J. et al., Persistent growth of CO₂ emissions and implications for reaching climate targets. *Nat. Geo.* **2014**, *7*, 709–715, doi: 10.1038/ngeo2248

10. Harrison, K., The politics of carbon pricing. Nature Clim. Change 2018, 8 852, doi: 10.1038/s41558-018-0289-4.

11. Klenert, D., Mattauch, L., Combet, E. et al., Making carbon pricing work for citizens. *Nature Clim Change* **2018**, *8*, 669–677, doi: 10.1038/s41558-018-0201-2.

12. International Monetary Fund (IMF). Fiscal Monitor: How to Mitigate Climate Change. Washington, 2019, at:

https://www.imf.org/en/Publications/FM/Issues/2019/09/12/fiscal-monitor-october-2019.

13. The Mercator Research Institute on Global Commons and Climate Change (MCC). Carbon price floor to reform emissions

trading, 2016, at: https://www.mcc-berlin.net/en/research/policy-briefs/emissions-trading.html.

14. Corporate Europe Observatory. EU emissions trading: 5 reasons to scrap the ETS, 2015, at:

https://corporateeurope.org/en/environment/2015/10/eu-emissions-trading-5-reasons-scrap-ets.

15. World Bank, Washington, DC., State and Trends of Carbon Pricing. 2019, doi: 10.1596/978-1-4648-1435-8.

16. Höckner, J., Voswinkel, S. & Weber, C. Market distortions in flexibility markets caused by renewable subsidies – The case for side payments. *Energy Policy*, **2020**, 137, 111135, doi: 10.1016/j.enpol.2019.111135.

17. COP21 Final Draft Text, 2015, at: https://www.scribd.com/doc/293086602/COP21-Final-Draft-Text.

18. The Green Climate Fund, 2020, at: https://www.greenclimate.fund/who-we-are/about-the-fund.

19. Carbon Brief, In-depth Q&A: How 'Article 6' carbon markets could 'make or break' the Paris Agreement, 2019. At:

https://www.carbonbrief.org/in-depth-q-and-a-how-article-6-carbon-markets-could-make-or-break-the-paris-agreement.

20. Nordhaus, W., Economic aspects of global warming in a post-Copenhagen environment. *The Proceedings of the National Academy of Sciences (PNAS)* **2010**, 107, 11721–11726, doi: 10.1073/pnas.1005985107.

21. Nordhaus, W., Projections and Uncertainties about Climate Change in an Era of Minimal Climate Policies. *American Economic Journal: Economic Policy*, **2018**, 10, 333–360, doi: 10.1257/pol.20170046.

22. Revesz, R. L., Howard, P. H., Kenneth, A. et al., Global warming: Improve economic models of climate change. *Nature* **2014**, 508, 173–175, doi: 10.1038/508173as.

23. The World Bank Group, Carbon Pricing Dashboard, Map & Data. 2019, at:

https://carbonpricingdashboard.worldbank.org/map_data.

24. Hansen, J. E., Carbon Tax & 100% Dividend vs. Tax & Trade, Testimony to Committee on Ways and Means United States House of Representatives, 2009, at: <u>http://www.columbia.edu/~jeh1/2009/WaysAndMeans_20090225.pdf</u>.

25. Cooper, R. N., The Case for Charges on Greenhouse Gas Emissions. Discussion Paper 08–10, Harvard Project on International Climate Agreements, Belfer Center for Science and International Affairs, Harvard Kennedy School, 2008.

26. Stoft, S., Carbonomics: How to Fix the Climate and Charge It to OPEC. Nantucket. MA: Diamond Press, 2008.

27. Lowe, S., Border carbon adjustment: how to get it right. The Centre for European Reform's, 2019, at: https://www.cer.eu/in-the-press/border-carbon-adjustment-how-get-it-right

28. Lund, H., BG Group plc; Dudley, B., BP plc; Descalzi, C., Eni S.p.A.; van Beurden, B., Royal Dutch Shell plc; Sætre, E., Statoil ASA;

29. Oswald, Y., Owen, A., Steinberger J. K., Large inequality in international and intranational energy footprints between income groups and across consumption categories. *Nature Energy*, **2019**, *5*, 231–239, doi: 10.1038/s41560-020-0579-8.

30. COP 21 - Documents, The UNFCCC secretariat (UN Climate Change), 2019, at: https://unfccc.int/es/node/180842.

31. Carattini, S., Kallbekken, S., Orlov, A., How to win public support for a global carbon tax. Nature 2019, 565, 289–291.

32. Bardi, U. Energy Prices and Resource Depletion: Lessons from the Case of Whaling in the Nineteenth Century. *Energy Sources, Part B: Economics, Planning, and Policy* **2007**, 2, 297–304.