





# THE WORLD ACCORDING TO MY DAD

How to get a chicken to start laying duck eggs

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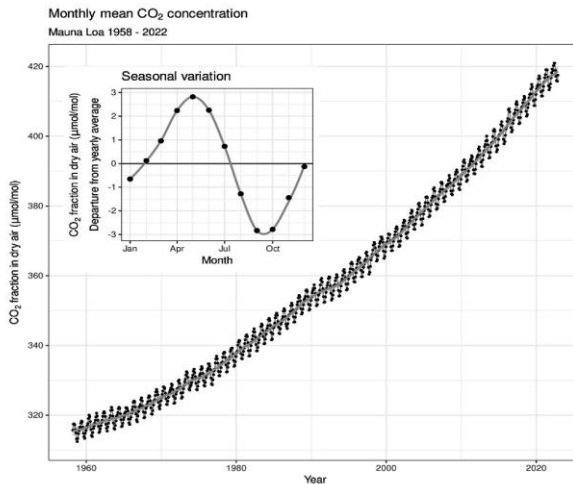
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*Reading for those despairing of  
the current approach to climate protection*



# Preface

I never liked reading prefaces and appreciated when they were short. I will therefore give only the essentials. Figure 1 shows the evolution of the concentration of carbon dioxide ( $\text{CO}_2$ ) in the atmosphere over the last 60 years. The points mark measured values showing annual variations, the curve was created by smoothing them. The growth of the curve was slightly affected by the 1973 oil crisis and the collapse of the socialist bloc in 1989, but the global financial crisis of 2008 or the recent crisis caused by the covid-19 pandemic have been virtually nonexistent. The graph demonstrates the failure of the mechanisms and efforts to date to reduce  $\text{CO}_2$  emissions agreed at the COP (Conference of Parties regularly hosted by the UN) climate summits over the last 25 years.



**Figure 1:** Growth of atmospheric  $\text{CO}_2$  as a function of time, measured at Mauna Loa Observatory (Hawaii), boxed seasonal variations.

Dear readers, please spend the time saved by this very short preface looking at the details of the chart and thinking about what we might be doing wrong and how to change it. Perhaps at the end of the book you will say to yourself: "I thought of that too! It's not that complicated. Why hasn't it been done this way for a long time?"



# 1. INTRODUCTION

In order to make the book easier to read and not to give the impression of an overwrought monologue, we decided to present it in the form of a friendly conversation or a kind discussion. Daughter Marta (**M**) plays the role of an inquisitive interviewer, father Jiří (**J**) tries to play the role of a more knowledgeable one.

**M:** *Dad, as a physicist, your work involves thermodynamic modeling of processes in solids. Is saving the global climate a physical or a social challenge for you?*

**J:** For physicists, thermodynamics is a valued discipline. Thermodynamics is a handy tool for describing very complex systems consisting of a huge number of interacting particles using a small number of parameters. While we cannot change the behavior of a particular particle to our liking by changing the temperature or pressure, we can affect the average (collective) behavior of the particles. Thus, we can induce quantitative and qualitative changes in the system that fundamentally affect its properties. Transferring this approach to society, I find that its evolution can be directed by a small number of appropriate, sufficiently effective motivational tools.

**M:** *People are not particles.*

**J:** Just as thermodynamics approaches a multiparticle system, economics approaches society (i.e., a "many-people" system). Economics derives its

laws for averaged human behavior under the assumption of free will in their rational decision-making. Macroeconomic laws are a successfully used tool in the management of the companies and society. They can also advantageously be used to address climate protection, where the main concern is to induce changes in the collective behavior of people, companies and institutions. For me, then, saving the climate is a social challenge inspired by physics and economics.

**M:** *How did you come up with the title of the book "How to get a chicken to start laying duck eggs"? It reminds me more of biological science fiction.*

**J:** The book has some science fiction features because it's set in the future. The title is a reaction to Graeme Maxton and Bernice Maxton-Lee's book "A Chicken Can't Lay a Duck Egg".<sup>1</sup> It is the words of Malcolm X, a human rights advocate from the 1960s. He meant to say that the economic system can only do what it is designed to do. Therefore, a system built on racism and inequality cannot work any other way and the only solution is to build a new one.

**M:** *Do you think Malcolm X was wrong?*

**J:** In my opinion, the evolution of society has not proved him right about racism and inequality. These have been more or less successfully corrected. Every excess provokes intense reactions in today's society. There is no need to build a new system. It would also not guarantee that it would be better anyway. But let us try to accept the proposition that the economic system can only do what it is designed to do. If we modify the

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<sup>1</sup> Maxton, G., Maxton-Lee, B. (2020), A Chicken Can't Lay a Duck Egg (Resetting Our Future).

current system appropriately for the sustainable development of global society, then the desired goal can be achieved. In a similar vein, the World Economic Forum issued a statement in 2019<sup>2</sup> that capitalism has got us into the problem of climate change, therefore only capitalism can again provide the solution. But the Maxtons contradicted this confident statement in the title of their book before the World Economic Forum took place. In the book, they analyze the failure of capitalist society's efforts to date to protect the planet from devastating global warming. From this they conclude irreparability of capitalist system and the need to eliminate it.

**M:** *So the chicken represents a metaphor for capitalist society and the duck egg represents sustainable development?*

**J:** Yes. The Maxtons consider it inevitable that we will "abandon" the current social order (the chicken) based on money, profit and the market and replace it with an as yet unknown global social order (the duck). This order will give the transition of society to sustainable development (laying duck eggs) an absolute priority. Listing the risks of such a plan could probably be the subject of another book.

**M:** *What do you see as the risks?*

**J:** First of all, the contours of the envisaged new global social order should be explicitly designed and thoroughly discussed. How will the system work politically and economically? How will all the actors be motivated

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<sup>2</sup> <https://www.weforum.org/agenda/2019/09/is-capitalism-incompatible-with-effective-climate-change-action/> (20.1.2022, report World Economic Forum).

for a pro-climatic transformation? What will replace the market – the proven driver of societal development? How to get strong and sustained enough support for change in a global society? Global society does not yet have a solid political anchorage and the influence of lobby groups is enormous. Perhaps the most difficult of all would be how to replace the world's social order gradually and yet quickly enough with a new one. Many countries have gone through the tortuous paths of capitalist-socialist transformations in both directions. Now, something similar would have to take place simultaneously on a global basis in countries with diametrically opposed conditions and cultures. How to fulfill the Maxtons vision, or rather wishful thinking, lies completely beyond my imagination. Moreover, in a situation where the rich and therefore powerful part of the world is more or less satisfied with the existing *status quo*.

**M:** *Are the Maxtons trying to find a concrete solution or are they just lamenting the status quo?*

**J:** The Maxtons are convinced that the current system has no choice but to provoke escalating consumption, endless growth, the accumulation of individual wealth and allow business to increasingly dominate politics. That is why capitalism is incapable of solving the problem of climate disruption. They call on readers to take the initiative themselves to devise and implement a transition to a social order that guarantees the sustainable development of civilization. Maxtons do not themselves present with a concrete idea for a solution.

**M:** *Starting a sustainable society is our common goal...*

**J:** Yes, but the paths to the goal are diametrically opposed. In order to meet Maxton's ideas, huge parts of the current socio-economic-political system would have to be dismantled and replaced by other, as yet unknown, parts. This is what I want to avoid. I do not want to remove the chicken and replace it with a duck, but to force it to lay duck eggs.

**M:** *Fulfilling the Maxtons ideas would be a hard job with an uncertain outcome. Moreover, it would be a very risky venture.*

**J:** TheMaxtons book is an excellent springboard for serious critical discussion. I recommend it for reading. Let everyone judge for themselves critically how the proposals described in the book are helpful. But effective action to address the causes of climate disruption must begin almost immediately.

About 20 years ago I realized that the main difficulty of climate protection is not its technical feasibility. It is primarily about how to make the existing global society move **spontaneously** towards pro-climate and sustainable development that does **not need to be kept alive by escalating incentives and restrictions**.

**M:** *Is that what your book offers?*

**J:** That's what I try to do in the book. The book presents my personal holistic view of the current global climate disruption and contains 8 chapters in addition to the Introduction. In Chapter 2, I try to present the most important and interesting scientific perspective on the causes of current global climate change. I refute ideas that I consider to be incorrect and describe the possible consequences of climate change. In Chapter 3, I discuss the technical options for addressing the climate crisis and propose some solutions of my own. Chapter 4 takes a critical look at

the current activist and political approach to addressing climate change. It slowly lulls the reader into thinking that all is not well here. Chapter 5 is devoted entirely to greenwashing and its forms. I try to point out the dangers of greenwashing mainly because of the false positive expectations it creates. In Chapter 6, I discuss the attempts to date to address climate disruption through carbon pricing and criticize their functionality and administrative complexity. Chapter 7 is devoted to introducing the central idea of the entire book, the concept of a growing over time uniform global fossil carbon fee and its 100% dividend. The advantages of the concept compared to existing approaches are highlighted. Chapter 8 discusses not only the potential pitfalls in adopting the concept, but also the reasons why the concept might appeal to many. The final Chapter 9 summarizes the book and adds more general considerations.

**M:** *The book should target a wide range of readers. It's hardly likely to interest everyone from beginning to end. How did you work it out?*

**J:** The goal of the book is not only to introduce and analyze the concept of a uniform global fossil carbon fee and its 100% dividend. I also try to justify from many points of view the **inevitability** of its introduction into the real world and the **need to** abandon current approaches to climate protection. Therefore, I had to be critical of current approaches, even though I may antagonize many people by doing so. If we want to take global climate protection seriously, an overall critical look at the issue is essential. Otherwise, we will not understand its gigantic scale and complexity. We must abandon the naive belief that all we have to do is announce bold targets, allocate sufficient funds from the national budgets and the global climate disruption will be extinguished. The socio-economic-political approach is the crucial link between scientific warnings and practical action in protecting the global climate. I consider

the lack of critical insight and reflection to be the main reasons for the failure of climate protection to date.

**M:** *We have been advised by several of our friends that it would be better if we presented the concept of the uniform global fossil carbon tax and its 100% dividend at the beginning of the book, and only afterwards dealt with the other aspects.*

**J:** But then there is a risk that the reader will not perceive the acceptance of the concept as inevitable. It will only be seen as a possible complement to current approaches to tackling the climate crisis. The necessity of accepting the concept and rejecting the existing approaches to the climate crisis is the culmination of the flow of arguments that I gradually present in the book. It is not important to agree with all my proposals. What is important is to acknowledge that climate protection is failing not because it is not in our power to deal with the problem technologically, but because we have grasped it inappropriately socio-economically and politically. The book is written in such a way that if the reader finds a certain chapter uninteresting, he/she can just skim or skip it and move on to the next chapter. An impatient reader can skip straight to chapter 7 and then return to the previous chapters. I would appreciate it if the readers would give the book time to think about it and eventually return to it. Then write to me about what premises or conclusions they disagree with.

## 2. GLOBAL CLIMATE DISRUPTION, ITS MAIN CAUSES, CONSEQUENCES AND PITFALLS

**J:** I don't want to exhaustively describe all aspects of the global climate change currently underway. There are many good publications on this. I will only mention the most important ones and highlight the sometimes neglected facts or arguments that I consider important.

### 2.1 *Greenhouse effect*

**J:** While the difference in the living conditions of people in antiquity and in the 17th century was slight, between the 19th and 21st centuries it is huge in every respect. The use of concentrated energy from fossil fuels such as coal, oil and natural gas is the main reason we are where we are.

**M:** *You mean in modern civilization or in a greenhouse?*

**J:** Both. Among many other harms, mankind's civilization is producing more and more gases that are amplifying the natural greenhouse effect in the atmosphere. This is having a significant impact on the biosphere. The growing greenhouse effect is increasingly preventing the escape of heat radiation from the planet which results in the increase of internal energy



of its envelope and thus its global temperature. That is the main reason of global warming.

**M:** *What gases are involved?*

**J:** The most important natural greenhouse gas is water vapor. However, its total amount in the atmosphere can only be significantly affected indirectly by changes in global temperature. Therefore, water vapor primarily has an amplifying effect on global warming caused by any other cause.

**M:** *So, we have to go after the primary causes of global warming. Mainly, I guess, other greenhouse gases.*

**J:** The second most important natural greenhouse gas is carbon dioxide  $\text{CO}_2$ . All plants need it to live, to make their bodies, or biomass, from it, water and light through photosynthesis. By decomposing the biomass,  $\text{CO}_2$  is returned to the atmosphere. This closed cycle has kept the concentration of  $\text{CO}_2$  in the atmosphere virtually constant and relatively low until recently. With the advent of fossil fuel combustion, the amount of  $\text{CO}_2$  in the atmosphere began to increase unprecedentedly rapidly by the so-called anthropogenic (i.e. man-released) carbon. Another important anthropogenic greenhouse gas is methane ( $\text{CH}_4$ ). Its most important source of release into the atmosphere is the extraction and transport of natural gas or the extraction of oil and coal. Another important greenhouse gas is nitrous oxide ( $\text{N}_2\text{O}$ ), mainly from agricultural activities and car exhausts. The effect of emissions of all greenhouse gases on climate can be converted to  $\text{CO}_2$  emissions of the same greenhouse effect and expressed as  $\text{CO}_2$  equivalent ( $\text{CO}_{2\text{eq}}$ ).

## 2.2 *Consequences of the greenhouse effect*

**J:** Scientific studies going back more than half a billion years show that there have been a number of major global climate changes in the history of planet Earth. These have produced global climates ranging from complete glaciation of the Earth's surface to a virtually ice-free surface with global temperatures 10-15 °C warmer than today. All global climate changes until the advent of the industrial age about 150 years ago had natural causes. They were linked to meteorite impacts, volcanic activity, changes in the intensity of solar radiation or in the chemical composition of the atmosphere, mainly due to plant photosynthesis. To this we owe most of the O<sub>2</sub> in the atmosphere (21 %), which was produced by the decomposition of atmospheric CO<sub>2</sub> and the storage of carbon in fossil fuel deposits. Their combustion has caused CO<sub>2</sub> to be returned to the atmosphere at an increasing rate over the last 150 years. This is considered by the scientific community to be the dominant cause of the unprecedentedly rapid global temperature rise of 0.8 °C over the last 40 years.

Models including significant feedbacks suggest that doubling the concentration of CO<sub>2</sub> in the atmosphere will cause a global temperature increase of about 3 °C. If in pre-industrial times there were 280 ppm CO<sub>2</sub> in the atmosphere, by 2023 there are already 420 ppm. At the current rate of increase of more than 2 ppm per year, we will reliably reach a doubling, i.e. 560 ppm, before 2090.

**M:** *In Italy, for example, the average temperature is more than 3 °C higher than in the Czech Republic and they are happy with that.*

**J:** At first glance, it may indeed seem that a 3° C increase in global temperature over 150 years might not cause serious problems. But a 3° C

change in global temperature means a 6° C change on land, because the oceans are warming much more slowly. We may get less heating in winter, we will start to populate more densely in areas closer to the poles, it will rain more on average because more water will evaporate from the warmer oceans. Wildlife used to a certain climate will help themselves by moving closer to the poles or to higher ground. In agriculture, there will be corresponding changes in the crops grown. But beware, the negative consequences of rising global temperatures will necessarily outweigh the positive ones. The higher internal energy of the atmosphere will increase its instability. Weather extremes will intensify significantly and increase in frequency. Changes in global temperature will cause changes in the prevailing streams in the atmosphere and in the oceans. This may radically change the local climate in many places on the planet.

**M:** *They say, the sea streams will weaken significantly. What if more energy is stored in the Earth's mantle?*

**J:** Ocean streams are driven by the temperature difference between places near the equator and near the poles. Places near the poles are warming faster than places near the equator due to global climate change. Therefore, the temperature difference and the driving force are paradoxically decreasing. This is already reflected in the weakening Gulf Stream, from whose existence Western Europe benefits handsomely.

**M:** *What is the threat?*

**J:** Prolonged droughts can occur in areas originally with plenty of water, and frequent intense flooding in formerly dry areas. Another serious threat is rising sea levels due to melting of land-based glaciers and thermal expansion of water. Fortunately, this phenomenon is happening

relatively slowly due to the enormous thermal capacity of the oceans and the high amount of heat needed to melt the ice. Ocean levels have only risen by 200 mm so far, and the current rate of sea level rise is about 4 mm per year. But the rate is still increasing. According to current knowledge, a 1 °C increase in global temperature has caused up to 10 m of ocean level rise in the past. But this corresponds to a steady state. To achieve this, a temperature increase of 1 °C is needed over several thousand years. In other words, if the global temperature is fixed at 2 °C higher than in pre-industrial times for 10 000 years, we can expect the sea level to be 1 m higher in 100 years, 3 m higher in 500 years, 10 m higher in 2 000 years and up to 20 m higher in 10 000 years. I think that just one meter of sustained sea level rise, combined with an increase in weather extremes, will lead to unprecedented damage.<sup>3</sup> That is the most likely forecast for the beginning of the next century. Much will have to be rebuilt or relocated, including many people who will lose their homes and livelihoods. It will not be a catastrophe, but it will be unpleasant and cost a lot of money and valuable land.

**M:** *Recently, permafrost melting in Siberia caused a chemical plant to crash with serious environmental damage.*

**J:** Due to the thawing of permafrost, permanently frozen ground, buildings are starting to collapse in northern areas. These needed no foundations because the permafrost is strong enough. But when the permafrost thaws, it becomes something between mud and peat. The thawing of permafrost will no doubt continue, as a global warming of 1° C will result in a 3-4° C warming in areas close to the poles. In addition, the melting of the permafrost will allow the decomposition of the huge

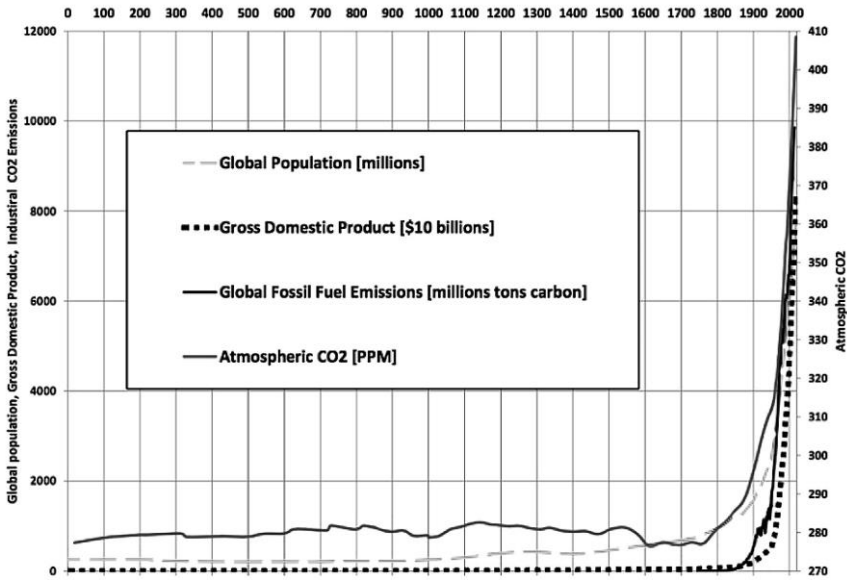
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<sup>3</sup> <https://osn.cz/fakta-a-cisla-o-svetovem-oceanu/> (2 Feb. 2022, official UN site)

amount of organic matter stored there. This will release significant additional greenhouse gases into the atmosphere, mainly CO<sub>2</sub> from aerobic and CH<sub>4</sub> from anaerobic processes. And to make matters worse, the white snow cover on the melted permafrost will disappear. The dark surface will absorb much more solar radiation. This will lead to further warming. Adding it all up, processes in melting permafrost could cause global temperature to stabilize at several degrees Celsius higher than today for many millennia. And that's even if we take back from the atmosphere all the CO<sub>2</sub> that we put in by combusting fossil fuels.

**M:** *So, almost everything is related to carbon oxidation, either by combusting it or by biological processes. When I was a kid, you sometimes said to me: "Don't oxidize here!". Were you thinking about climate protection back then?*

**J:** Just our local, family climate at that time. Much of what is actually going on here is evident in Figure 2. Humanity's exponential development to date is already exceeding sustainable limits in a number of parameters. Either humanity can deal with this problem, or the planet will deal with humanity accordingly.



**Figure 2.** Correlation between population growth, GDP growth and GHG growth.<sup>4</sup>

<sup>4</sup> <https://time.com/5680432/climate-change-history-carbon/>

(Chart from TIME article of Sept. 23, 2019), Data: Population-Angus Maddison and U.N.; GDP-Angus Maddison and World Bank; Emissions-Tom Boden and Bob Andres, Carbon Dioxide Information Analysis Center at Oak Ridge National Laboratory, and Gregg Marland, Research Institute for the Environment; Atmospheric CO2-NOAA, Chart: John Brooke.

## ***2.3 The pitfalls of tackling the global climate crisis***

**M:** *Can't the current considerable pro-climate efforts of the world's leading politicians stop or at least significantly slow down climate disruption?*

**J:** In recent years, there has indeed been a lot of publicly proclaimed effort to prevent worst-case scenarios of climate disruption. For example, the COP21 Paris climate summit in 2015 set a goal of limiting global warming to 1.5° C, or at most 2° C relative to pre-industrial times. This was to be achieved mainly by significantly reducing global greenhouse gas emissions starting as early as 2020, achieving carbon neutrality in 2050 and a negative carbon balance after 2050. Such a scenario is beautiful. However, the wishful thinking, frivolous commitments and political proclamations that were made at COP21 and then repeated countless times are one thing, but the reality is another. Projections suggest that in 2023, CO<sub>2</sub> emissions will once again set a record...

**M:** *So, it's not going well?*

**J:** It doesn't work. Just look at the Figure 1 in the Preface. Eight years after COP21 in Paris, global emissions continue to rise and there is no sign of the desired turnaround. Even the trillions of euro and dollars invested in promoting low-carbon technologies and the many other measures in some developed countries that are trying to take the COP21 commitments at least a little more seriously are not having the desired global effect. It is said that if something cannot be done by force, it should be done by greater force. And so world leaders are already planning how tens of trillions of euro and dollars will be invested in

climate protection from public budgets instead of trillions of euro and dollars. If even this does not succeed, the sums will increase further.

**M:** *I'm sure it will cost something. But the consequences of climate disruption will be much more expensive. Maybe it will turn back after all.*

**J:** You can't rely on something to turn back in the end. It's about the intensity of the climate disruption that will occur, how much the pro-climate (mitigation) and adaptation measures will cost us in sum and who will pay for them. These basic parameters determine the effectiveness of our solutions, and so far, we are doing a poor job of them.

**M:** *What do you see as the biggest challenge?*

**J:** Those who keepcombusting cheap fossil fuels will gain a huge advantage over those who take the expensive and difficult path to carbon neutrality. This is clearly the biggest pitfall of the problem. Its essence is described in Garrett Hardin's 1968 essay "The Tragedy of the Commons"<sup>5</sup>. The author analyzes a situation where a limited resource (pasture) is shared free of charge by many individuals who seek to maximize their personal benefit. This can lead to irreversible depletion of the resource, i.e., tragedy. Hardin disagrees with the view that human conscience is sufficient to save the pasture. Thus, only selfish individuals will profit at the expense of unselfish ones, and it will be confirmed that selfishness pays. The problem of global climate protection is much more anonymous, hidden and vast. Moreover, it is not about a dwindling resource, but about the accumulation of the gaseous product (CO<sub>2</sub>) of

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<sup>5</sup> Hardin, G. (1968), Science 162, 1243-1248. Hardin, G. (2009), The Tragedy of the Commons, Journal of Natural Resources Policy Research, 243-253.



fossil fuel combustion in the shared atmosphere. What may also be confusing is that CO<sub>2</sub> is in many respects a harmless or even life-giving gas and has been emitted into the atmosphere for centuries quite naturally and "with impunity". Global society has adapted to this over 150 years. The global biosphere can be thought of as a giant communal pasture with correspondingly bigger problems.

**M:** *So, it's about priorities. Whether we should prioritize planetary or individual interests.*

**J:** There is a theoretical consensus on the priority of planetary interest. This is documented by the commitments already mentioned at the UN climate summits. It is one thing to make promises to the distant future concerning governments that are still not installed, it is another to carry out difficult, expensive and inconvenient implementation of the promises if governments willing to implement them are elected at all. On such shaky foundations we are building the future of the planet and of future generations.

**M:** *Does the Tragedy of the Commons have a reasonable solution?*

**J:** A number of people have already addressed this. As far as I know, no one has thought of subsidizing cattle owners to graze on other pastures, thereby reducing interest in the municipal pasture. There was more or less a consensus that the pasture could reasonably be saved from tragedy by charging for grazing. Then we just need to work out how to collect the money and how to dispose of it. The general idea is to convert a free service, for which there is a huge demand, into one that is adequately charged for, and thus regulate the demand. This is how it already works in many cases, nothing new under the sun. I would almost say that the

only things that are free today are those for which charging a fee would be unprofitable because of the difficulty involved. The key issue for climate protection is therefore how to collect money for carbon emissions in the simplest, most consistent way technically and on a global scale.

## **2.4    *Climate change deniers***

**J:** A visible group that does not like the current pro-climate efforts are the so-called "climate skeptics". They consider the dominant cause of current global warming, i.e., CO<sub>2</sub> emissions from fossil fuel combustion, to be scientifically unproven. Spending trillions of euro and dollars on low-carbon measures is a thorn in their side.

**M:** *The theory of the current climate change dominated by CO<sub>2</sub> emissions is the only one that is well supported by science and has not yet been refuted. Science does not provide definitive evidence. Science is about disproving formulated hypotheses and accepted theories. Don't climate skeptics want something from science that it can't provide?*

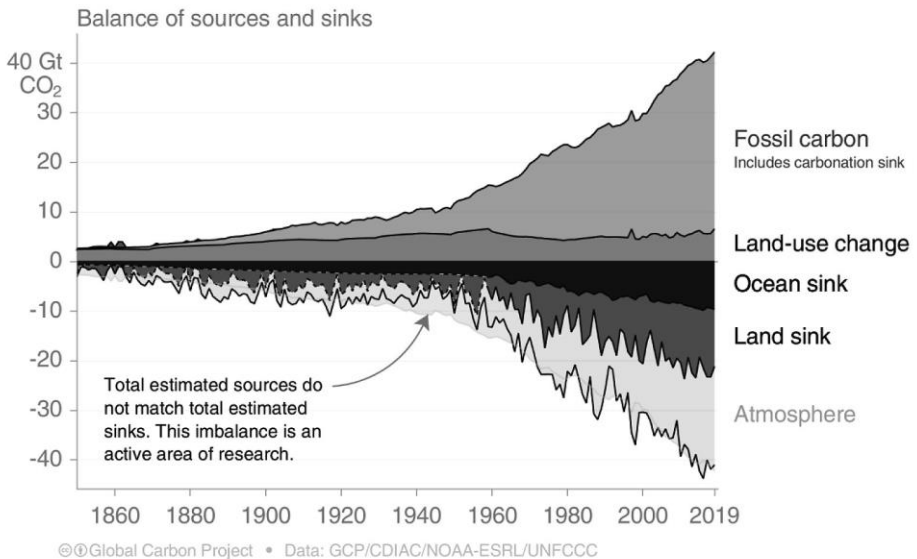
**J:** You are right, but the question has to be put to the climate skeptics. One can only take seriously arguments that either refute the accepted theory or provide an alternative, supported and complete explanation. I can only refute the frequent arguments of climate skeptics for denying the influence of human activity (anthropogenicity) on current global warming. I always give the climate skeptics argument (emphasis added) followed by my comment.

- **There is so little CO<sub>2</sub> in the atmosphere (0.04%) that it can cause virtually no greenhouse effect.** This is where science gives an

unequivocal answer. Theoretical quantum mechanical calculations are in agreement with experiments. They clearly tell us that even such small concentrations of  $\text{CO}_2$  in the atmosphere cause a significant greenhouse effect leading to global warming of several degrees Celsius. The amount of  $\text{CO}_2$  in the atmosphere corresponds to about a 3 m high layer of concentrated  $\text{CO}_2$  above the Earth's surface.

- **Carbon circulates very rapidly in the biosphere and the contribution from fossil fuel combustion is negligible compared to the rate of circulation.** The first part of the statement is true. Almost all of the carbon captured from the atmosphere during photosynthesis by plants and used to grow their bodies (biomass) is released back to the atmosphere relatively quickly, with some delay due to decomposition. The natural carbon cycle therefore has a virtually zero  $\text{CO}_2$  balance. Since this balance is currently distorted by the combusting of fossil fuels and we cannot prevent the spontaneous decomposition of a significant part of the newly emerging biomass, the positive contribution from fossil fuel combusting dominates the global  $\text{CO}_2$  balance.
- **The concentration of  $\text{CO}_2$  in the atmosphere is not rising through the combusting of fossil fuels, but through its release from oceans warmed by natural climate cycles.** Over the past few tens of thousands of years, the oceans have set an equilibrium concentration of  $\text{CO}_2$  equivalent to the pre-industrial concentration of 280 ppm. The solubility of gases in liquids is described by Henry's law. According to it, the solubility of a gas in a liquid is directly proportional to the concentration of the gas in the atmosphere above the liquid. By increasing the concentration of  $\text{CO}_2$  in the atmosphere by 50% over the last 150 years, we have also increased the solubility of  $\text{CO}_2$  in the oceans by 50%. The effect of ocean warming on the

solubility of  $\text{CO}_2$  in the oceans has so far been negligible. Therefore, oceans with forty times the capacity of the atmosphere can dissolve further huge amounts of  $\text{CO}_2$  in their waters. According to measurements, see Figure 3, about a quarter of  $\text{CO}_2$  emissions from fossil fuel combustion are currently dissolved in the oceans due to the imbalance described above. This also acidifies the ocean water. The figure also shows that another more than a quarter of the  $\text{CO}_2$  emissions from fossil fuel combustion are stored in the increasing amount of biomass in the biosphere. This is due to the increasing concentration of  $\text{CO}_2$  in the atmosphere, which causes an acceleration of photosynthesis in plants, while the rate of biomass decomposition remains approximately the same.



**Figure 3:** Carbon source and storage balance. Roughly a quarter of current emissions CO<sub>2</sub> from the combustion of fossil fuels is deposited in the ocean (ocean sink), a quarter is deposited in biomass accretion (land sink) and half remains in the atmosphere..<sup>6</sup>

**M:** *Why is photosynthesis accelerating?*

**J:** The direct cause is an increase in the concentration of the nutrient, which CO<sub>2</sub> certainly is for plants. Something like fertilization. However, biomass production is positively affected mainly by sufficient water. As the increased concentration of CO<sub>2</sub> allows plants to reduce their respiration and thus water loss, they become more drought resistant. This is also why they thrive better. The reasoning suggests that if we were to suddenly reduce global emissions CO<sub>2</sub> halved, the increase in the concentration of CO<sub>2</sub> in the atmosphere would be halted. All CO<sub>2</sub> emissions would be sequestered in the oceans and in the biomass.

**M:** *That sounds like a groundbreaking finding... So, why don't we say just halve emissions?*

**J:** If the concentration of CO<sub>2</sub> in the atmosphere stabilizes, a new equilibrium between carbon storage in biomass by photosynthesis and its decomposition will occur again. The result will only be more biomass accumulated in the biosphere. Then, for a relatively long time, CO<sub>2</sub> will only be stored in the oceans. To stabilize the concentration in the longer-term CO<sub>2</sub> in the atmosphere, we would therefore have to cut emissions to a quarter. All these phenomena are properly accounted for in complex climate models. They are just not given much attention. Cutting global CO<sub>2</sub> emissions in half is certainly not enough to solve the climate crisis.

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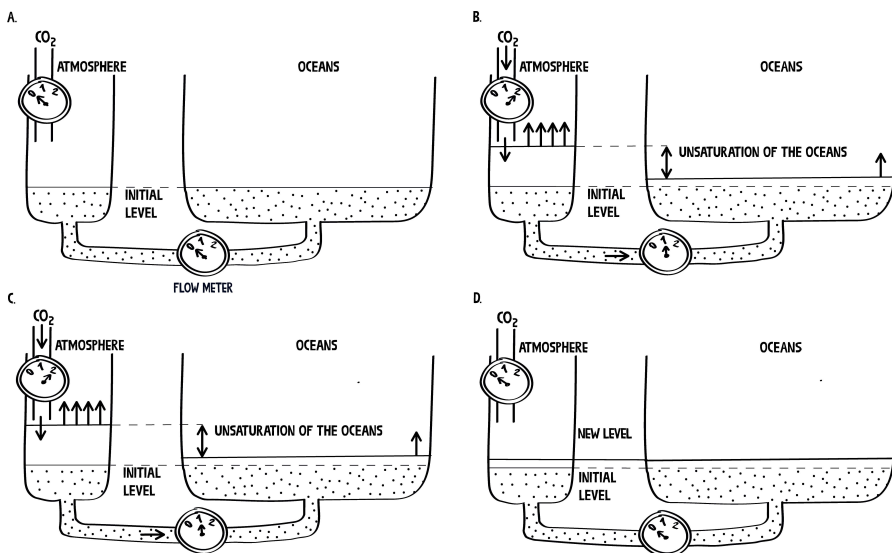
<sup>6</sup> <https://open.oregonstate.edu/climatechange/>  
(Schmittner, A. 2021, Introduction to Climate Science).

Even if we stabilized the concentration of  $\text{CO}_2$  in the atmosphere for a few decades, the inertia of the climate system would continue warming. Only the early achievement of carbon neutrality can stop the process of global warming. Then the natural decrease in the concentration of  $\text{CO}_2$  in the atmosphere by deposition in the oceans will roughly offset the inertia of global climate change.

**M:** *Can't you demonstrate the dissolution of  $\text{CO}_2$  in the oceans with an easy-to-imagine analogy?*

**J:** Imagine containers, a small and a large one, connected at the bottom by a tube, see Figure 4. The small container represents the atmosphere, the large one the ocean. The heights of the water levels in the containers correspond to the concentrations of  $\text{CO}_2$  in the atmosphere and in the ocean. The equilibrium between the atmosphere and the ocean, as established over the tens of thousands of years before the industrial age, corresponds to the levels in the two containers at the same height. Therefore, water does not flow through the tube, as can be seen in Figure A. When we began to emit  $\text{CO}_2$  into the atmosphere by combusting fossil fuels, the level in the small container began to rise. Some of the water began to flow through the tube into the large container. The ocean began to dissolve  $\text{CO}_2$  from the atmosphere, see Figure B. The flow of water through the tube between the containers depends on the actual difference in level. If we suddenly change the inflow of water into the small container to just the value of the outflow through the tube, the rise in level in the small container will stop. This is shown in Figure C and, in reality, would correspond to a situation where the oceans are able to absorb all the  $\text{CO}_2$  emissions. If the water stops flowing into the small container, the levels in the two containers will begin to equilibrate. Because the capacity of the large container (the ocean) is considerable, see Figure D, the final level will be only slightly higher than at the

beginning shown in Figure A. In other words, almost all of the  $\text{CO}_2$  emissions from fossil fuel combustion will be absorbed by the ocean.



**Figure 4:** Schematic for interpreting the dynamics of  $\text{CO}_2$  deposition in the oceans: A. the pre-industrial equilibrium state, B. the current state corresponding to the increase of  $\text{CO}_2$  in the atmosphere and its partial absorption by the oceans, C. the state after  $\text{CO}_2$  reduction, when all emitted  $\text{CO}_2$  is absorbed by the oceans, and D. the establishment of a new equilibrium state after global carbon neutrality is achieved.

It can be estimated that if global  $\text{CO}_2$  emissions were stopped in 2050, then the concentration of  $\text{CO}_2$  in the atmosphere by depositing  $\text{CO}_2$  in the oceans could fall to around 330-350 ppm by 2100. However, the release of  $\text{CO}_2$  and  $\text{CH}_4$  from thawed permafrost may significantly complicate this prediction.

**M:** *What are the consequences of that slight rise in the level in the big container, i.e. ocean acidification?*

**J:** I would say it won't do any good. Ocean acidification can cause further drastic reductions in biodiversity, such as the decay of corals (which is already evident) and shellfish. There are thousands of scientific articles on this subject.

- **Water vapor is the most important greenhouse gas that overwhelms the CO<sub>2</sub> greenhouse effect. Therefore, there is no need to address CO<sub>2</sub>.** This claim is oversimplified by climate skeptics. The total amount of water vapor in the atmosphere depends almost entirely on global temperature. It increases with temperature and increases the greenhouse effect. If an increase in the concentration of CO<sub>2</sub> by human activity causes a greenhouse effect responsible for a 1° C increase in global temperature, a secondary increase in the concentration of water vapor in the atmosphere will increase global temperature by further 2-3° C. Water vapor has a multiply amplifying effect on the greenhouse effect caused by increase of CO<sub>2</sub>. It is a positive feedback. The same water vapor effect would occur if global temperature were to rise for any other reason, such as a change in solar intensity or the reflectivity of the planet's surface.
- **With global warming in the past, CO<sub>2</sub> concentrations in the atmosphere increased with a lag, typically thousands of years. This means that global warming causes an increase in the concentration of CO<sub>2</sub>, and not the other way around.** If the oceans are warming gradually due to natural global climate change, then CO<sub>2</sub> is indeed released from the oceans into the atmosphere with some delay. This has been the case in the past. Today, CO<sub>2</sub> is being added to the atmosphere by the combusting of fossil fuels, and the global temperature is rising virtually in parallel with the rise in the



concentration of CO<sub>2</sub> in the atmosphere. This excludes the possibility that today's global warming has the same natural causes as climate change in the past. The main reason of current global warming is the increase in the concentration of CO<sub>2</sub> in the atmosphere by human activity. Moreover, such a high rate of global climate change as the current one has never been observed in the past, although very rapid changes can be expected to have occurred, for example, due to a meteorite impact.

- **Natural phenomena such as changes in the intensity of solar radiation, changes in the configuration of the planets in orbit, changes in the intensity of cosmic rays cause the current climate warming.** Theoretically, the changes listed above could be the causes of global warming. However, they have not been detected and measured at the necessary intensity in the last 40-60 years. Moreover, it would be necessary to explain why there is no warming at present due to the increasing concentration of CO<sub>2</sub> in the atmosphere and why the mentioned (currently unobserved) natural phenomena are mainly responsible.
- **Global warming caused by the combusting of fossil fuels is an expedient rumor so that politicians can subsidize low-carbon companies.** This argument does nothing to support the non-anthropogenic nature of the current global warming. Politicians would behave the same, if not more intensively, even if it were not a rumor.

**M:** *How do you explain that climate skeptics do not take into account the well-founded physical theory of anthropogenic global warming? On the contrary, they prefer views that are not consistent with the physical evidence and that can be easily refuted.*

**J:** This is again a question for the climate skeptics and perhaps also for psychologists. Many people trust fortune tellers, intuition or their own sense of specialness more than they trust scientific knowledge. I can't say that climate skeptics completely deny the human influence on the global climate. They will say that this influence is insignificant. That gets us to the need to quantify individual contributions, and that's where the discussion usually ends. At the same time, they cunningly avoid the problem that something needs to be done about CO<sub>2</sub> emissions.

I've heard the argument that climate skepticism is a defensive reaction to a loss of trust in society. I also consider myself a skeptic and need to react on this. I don't know in what segment of society climate skeptics have lost trust. I have full confidence in physics and society's cultivation of physical thinking. That is why I am confident of the dominant influence of CO<sub>2</sub> emissions on current global warming. But I have considerable distrust of current ways of dealing with the climate crisis. I don't like the excesses associated with it and I make that clear. I get the impression that these two aspects are mixed for most climate skeptics. I would also say that most climate skeptics have never used the scientific method, have not relied on physics and physical thinking, and have not found sufficient support in them. A modern skeptic (critical rationalist) is one who accepts a claim only after he has, if possible, competently verified it himself or can rely on a genuine authority. Therefore, those who consider themselves to be "climate skeptics" would be more appropriately referred to as climate deniers.

**M:** *Climate deniers are perhaps a normal product of human society, where "don't extinguish what doesn't burn you" is ingrained.*

**J:** Especially if it involves spending a lot of money and losing your own current comfort. If climate disruption continues to be dealt with expensively and ineffectively, such a mood may prevail in many

countries. The climate deniers will gain considerable influence there and elections will turn out accordingly. We cannot just uncritically accept the current often wasteful 'green' solutions and not see the danger.

## ***2.5 Other anthropogenic causes of global warming***

**J:** An often-discussed topic is the way in which the soil is cultivated, which affects the deposition or degradation of organic matter, i.e. humus. With intensive land use, we replace organic fertilizers with artificial ones, minimize the deposition of organic residues into the soil and often leave the soil bare (unseeded) for long periods of time, which supports erosion. Then the humus and the carbon fixed in the humus rapidly diminish. If we take care of the soil responsibly, the humus in the soil increases, albeit slowly. More humus means less CO<sub>2</sub> in the atmosphere and less greenhouse effect.

Until coal-fired power plants were desulphurized, they emitted large amounts of sulphur oxides that formed aerosols. They easily formed clouds that reflected sunlight. After the coal plants were desulphurized to reduce the formation of harmful acid rain, less cloud cover is formed and more water remains in the atmosphere as vapor. Both contribute to global warming. Ironically, it is not the operation of dirty coal-fired power stations, where the sulphur emitted climatically offsets the carbon emitted, but their later desulphurization.

**M:** *What percentage of human activities other than combusting fossil fuels contribute to climate change?*

**J:** Some human activities worsen climate disruption, others mitigate it. In sum, it could be 20-30 % towards increasing global warming. Something needs to be done about this contribution too.

**M:** *That's why it's important to address mainly CO<sub>2</sub> emissions from combusting fossil fuels, which contribute 70-80 %.*

**J:** Yes, that is the most important, but unfortunately also the most challenging.

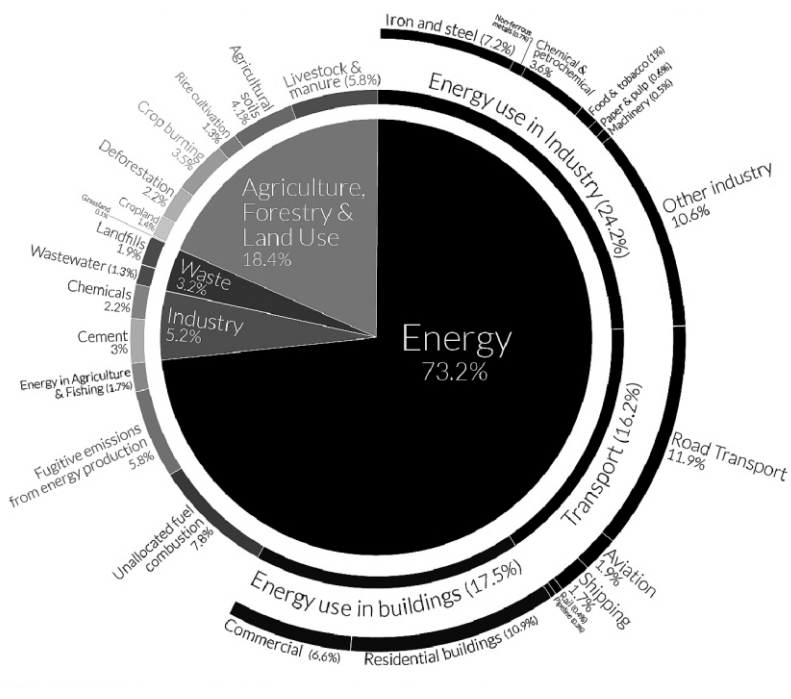
### **3. OPPORTUNITIES TO REDUCE CO<sub>2</sub> EMISSIONS IN DIFFERENT SECTORS**

**M:** *Virtually any human activity is now directly or indirectly linked to the combusting of fossil fuels, except perhaps sleeping naked in the open air and eating local berries. Man as an individual can live exemplary lives as stop flying, not driving, not eating beef, not buying superfluous things... He can also bring about many positive changes on a larger scale. But would that be enough to save the planet's climate?*

**J:** By being gentle at the level of individuals, you help, but you don't save. Much more CO<sub>2</sub> is produced in individual sectors of the national economy, where the influence of the behavior of ordinary people extends

only marginally. Here people are put in the role of consumers with little choice.

Most CO<sub>2</sub> emissions are produced in the energy, transport, industrial production, building construction and operation, agriculture and waste management sectors. For a basic orientation, a diagram can be used, see Figure5.



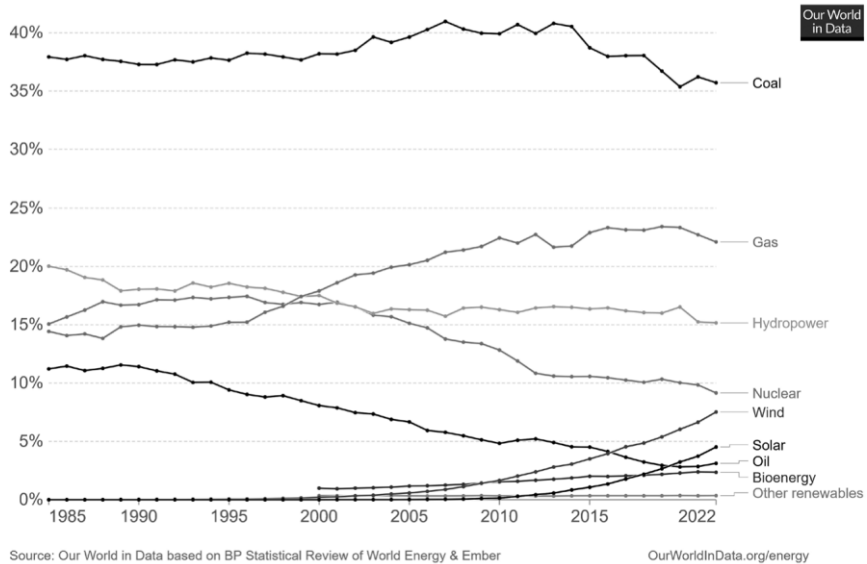
**Figure 5:** Global CO<sub>2</sub> emissions by sector..<sup>7</sup> Shown for 2016, when global CO<sub>2</sub> emissions were 49.4 trillion tones of CO<sub>2</sub> eq.

<sup>7</sup> Ritchie, H., Roser, M., (2020), "CO<sub>2</sub> and Greenhouse Gas Emissions", <https://urworld-indata.org/co2-and-other-greenhouse-gas-emissions> (20. 1. 2022).

### ***3.1 Vision in energy and power generation***

**J:** Energy is the sector that deals with the extraction, conversion and distribution of all forms of energy. The dominant part is the generation and distribution of electricity. In 2021, the electricity sector accounted for more than a third of global CO<sub>2</sub> emissions. Although, this is a significant share, simply converting the electricity sector from its current level of generation to carbon-free will not solve the climate problem. The diagram in Figure 6 shows where electricity (the noblest form of energy) has come from so far. If enough carbon-free electricity could be produced at an affordable price, it could replace much of the fossil fuels now used for other energy purposes. This is unavoidable in the near future.

**M:** *We've come to the key problem of how to generate enough emission-free electricity in the most cost-effective way. Isn't the era of cheap electricity irreversibly gone?*



**Figure 6:** Evolution of world electricity production from different sources.

**J:** The majority of electricity globally in 2023 was still generated by combusting fossil fuels, mostly coal. Low-carbon electricity generation has been driven not only by a significant increase in the use of renewable hydropower in the 20th century, but also by the development of nuclear power. France, for example, relied on nuclear power, where about  $\frac{3}{4}$  stable electricity is still produced in this way today. Now, it is relying on weather-dependent renewable energy sources to dominate electricity generation. There are studies showing that the price of electricity from renewable sources can be variable, very cheap and very expensive. The price of electricity is determined by the imbalance between demand and supply. Thus, the price depends on weather conditions and also on the time of day and the season.

**M:** *But many people are afraid of nuclear power.*

**J:** Like any human activity, the use of nuclear energy creates certain risks and potential hazards. These were most evident in the risky and irresponsible experiments at Chernobyl Unit 4 in 1986. These led to a widespread disaster. In 2011, there was a serious accident at the Fukushima II nuclear power plant. If there is a power failure on the connected grid, the fission reaction in the reactor automatically stops immediately. However, it is necessary to continue cooling the reactors. Approximately  $\frac{1}{6}$  power is further generated by the spontaneous decay of fission products. The diesel generators used to keep the cooling pumps running were not sufficiently protected from the giant tsunami at Fukushima. They were located in the basement along with backup batteries and failed to start after the room was flooded. This led to the reactors overheating and serious damage. I do not like the interpretation that the accident at Fukushima is the result of a natural event. The diesel generators, which are absolutely crucial to the safety of the plant, should have been 100% protected against a much larger tsunami or other event. It would not have been costly to place them, for example, at a height of 30 m above sea level. Or at least run a cable to that height to easily connect an external power supply for the pumps. In my opinion, the Fukushima accident was the result of trivial, inexcusable human failure, and should have been publicized as such from the outset.

It is necessary to establish a hierarchy of security measures according to the possible degree of threat and the amount of damage and to base the intensity and control of compliance with the measures on this hierarchy. In other words, the idea is to ensure that reliance on compliance with less important measures does not distract from compliance with the most important ones, with potentially fatal consequences. In this way, we can significantly reduce the human factor failures that have been the cause of the nuclear disasters and accidents to date.



**M:** *So you are saying that, for example, strict compliance with hygiene regulations in toilets should not detract from the inspection and maintenance of diesel generators placed in remote locations. Still on Fukushima. After all, the cooling pumps there ran on battery backup for quite a long time.*

**J:** Yes, they worked about eight hours. The pump system was operable. After the batteries had been discharged, there was still a few days of time to secure electricity for the cooling pumps from external sources. Then was the reactor destroyed by overheating. I think Fukushima is a clear testament to the design and improvisational skills and foresight of the Japanese.

**M:** *It's good that we know why all this happened. Instead of learning from the obvious mistakes, for example, in Germany after Fukushima the opposition to nuclear power intensified. Do you understand that?*

**J:** Mass anti-nuclear resistance has been successfully provoked in many developed countries by using often misleading arguments and an effective tool as creating an atmosphere of fear.

**M:** *I can be afraid of a nuclear power plant accident and I can be afraid of climate disruption. But these are completely incomparable matters.*

**J:** There are huge demands on the safety of nuclear power plants today. The likelihood of a serious accident, a relatively localized in time and space, is systematically decreasing. It is a thousandth of a per mille. In the case of climate disruption, we are **assured of a** global-scale "crash" with many orders of magnitude more serious long-term and often irreversible consequences. If I fly in a plane or drive a car, I am much

more likely to lose my life in a crash than I am in the case of a nuclear power plant accident in my neighborhood. Yet I am not afraid to fly or drive. It is absurd that the main instigators of anti-nuclear sentiment have been, and still are, organizations for which climate protection is central to their agenda. In the 1990s, for example, Greenpeace spoke out against the building of the nuclear power plant at Temelín in the Czech Republic. This was back when nuclear was the only sensible, emission-free alternative to coal. As an example of the unfair argumentation used to date, one can cite the statement: "Spent fuel from nuclear reactors is one of the most dangerous materials ever. Its radioactivity, once removed from the reactor, is so high that a person accidentally coming into contact with it would receive a lethal dose of radiation within seconds. Therefore, highly radioactive waste needs to be perfectly isolated for about 100,000 years."<sup>8</sup> In a similarly silly way, one could argue, "Falling out of a flying plane is almost always fatal, so we need to stop traveling by air."

In order to get rid of spent fuel, deep-underground storage facilities are to be built in the near future in all EU countries using nuclear energy. These will be expensive and most people do not want them in their vicinity. I do not understand why we should bury something that we can still use in the future.

**M:** *We have one of the selected locations for the building of a deep-underground repository behind the hills in our village. It faces stiff resistance from local residents. The situation is becoming impassable also in other locations. This is used by eco-activists as an argument for*

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<sup>8</sup> [https://chytra energie.info/images/stories/chytra\\_energie.pdf](https://chytra energie.info/images/stories/chytra_energie.pdf) (Specific Plan of Environmental Organizations April 2010 for Green Innovation, 12/12/2021).

*ending the use of nuclear energy in the Czech Republic as soon as possible.*

**J:** The possibility of keeping spent nuclear fuel in cheap and safe interim storage at nuclear power plants for much longer than planned is not yet being considered. Since there are fewer and fewer radioactive atoms in spent fuel as they decay, its activity decreases rapidly with time. Spent fuel is becoming less and less dangerous and reprocessing is becoming significantly easier. The problem of "what to do with it" could be left to future generations, along with a rich nuclear bank account. They are likely to have much more advanced technology than we have today.

**M:** *Those pushing for deep-underground storage argue that a "clean slate" needs to be passed on to future generations.*

**J:** Spent fuel in the interim storage would be many orders of magnitude less of a "gift" from us than a destroyed nature and a disrupted global climate. But that is what we are shamelessly preparing for the next generation.

**M:** *At the beginning of the 21st century, we are seeing a boom in the use of renewable energy for electricity generation. These could be the right solution to the climate crisis.*

**J:** Between 2005 and 2020, the global price of photovoltaic panels dropped to about a tenth. The price of electricity generated by them is lower than the price of fossil fuel electricity in places with favorable climatic conditions. A similar electricity price can be achieved by harnessing wind power. However, there are far fewer locations in the world with favorable wind conditions than those suitable for solar

energy. This calls for the solution of installing photovoltaic panels on every suitable roof or facade, building wind turbines on every hill or field where it blows a bit more, and connecting everything with power lines.

**M:** *And it's solved.*

**J:** Unfortunately, there are a few catches. We are used to having electricity in just the right amount at any time. But simply interconnecting these power plants, even if into a huge grid, will not ensure that. In the case of a major winter high atmospheric pressure over half of Europe, it can be cloudy and virtually windless for several weeks and we need proper heating. Then such a system will deliver barely a tenth of the electricity required. Not even the still expensive batteries (accumulators), which are suitable for making up the daily difference between electricity production and consumption, will help here. A few percent of the unstable electricity generated from the sun and wind will be absorbed by the electricity system. But as the percentage of electricity generation from renewable sources increases, the problems will grow exponentially. Not only in times of electricity shortage, but also in times of electricity surplus.

**M:** *It's getting complicated. What to do about it?*

**J:** The solution would be an industrial electrolyzer that would use surplus electricity from renewable sources to produce green hydrogen by decomposing water. Hydrogen could be stored on a large scale, similar to the way natural gas is stored today. The question is how this would be technically feasible, since the hydrogen molecule  $H_2$  is much smaller than the  $CH_4$  molecule in natural gas and much easier to escape from anywhere. In times of electricity shortages, hydrogen would be reused for electricity generation or, with greater efficiency, for simultaneous heat

and power cogeneration. But such a complicated system would not be cheap at all and has a chance of being used only 20 % of the time. This is the fate of back-up power sources, which only come on line when they are needed. Moreover, the efficiency of such electricity storage will be about 40 %. In theory, this is a solved problem. However, what is important in practice is how much it will all cost, what the requirements for land acquisition will be, how safe it will be, and how willing people will be to tolerate such facilities in their vicinity.

**M:** *Who is going to make such an investment?*

**J:** I don't know. The cost of the back-up resources must be covered by taking into account the spot price of electricity. It will be essentially free in times of surplus electricity from renewables and very expensive in times of shortage. Smart Grids should bring the solution closer. Using spot prices, they would motivate the use of appliances and backup sources to minimize the difference in electricity generation and consumption. This would translate into a significant reduction in the profitability of weather-dependent renewable energy plants if they were operated in a fair market environment.

In many countries, a transitional energy mix of renewables and natural gas-fired steam plants is being considered after the shut-down of coal and nuclear plants. But such carbon-free electricity generation is out of the question. Fortunately, there is the possibility of converting a natural gas power plant to green hydrogen at a later date.

**M:** *What other options do we have for backing up renewable electricity generation?*

**J:** You can use biomass, for example. But this has a number of negative impacts on agriculture and the landscape. It seems more viable to use the combustible component of municipal waste for backup. This would also elegantly solve the problem of its disposal. I have already mentioned green hydrogen and batteries, but also water pumped storage plants or compressed air in ground storage tanks offer some possibilities. All this is far from ideal. Unless there is a key breakthrough in backup, carbon neutrality for a global society based on the dominance of renewables will not be realistic. Scepticism is in order here.

**M:** *I've heard about the relatively short lifespan of solar and wind power plants.*

**J:** The estimated lifetime of solar and wind power plants is no more than 30 years and these sources will need to be continuously renewed. Recycling PV panels will probably be quite successful. A much bigger challenge will be how to recycle propeller blades of wind turbines made of composite materials. There are already several examples of their use in bridge construction. It occurred to me that the three spent propeller blades could be used to build the supporting structure of an observation tower. If the propeller blades could be cut lengthwise, for example with a water jet, they could be used as reinforcement in concrete after suitable shaping. Perhaps they could also be used for ceiling and roof structures. When will the first passive house made of spent propellers be built?

**M:** *"Renovation of the renewable energy sources" is a nice phrase. It's not talked about much. All power plants have to be renovated after a certain time...*

**J:** The lifetime of new nuclear reactors is about three times longer.

**M:** *But the cost of construction and disposal is many times higher compared to renewables.*

**J:** It may seem so. A nuclear power plant is a highly concentrated source where we use a lot of material and spend a lot of money in a small area to build it. But when you translate that into stable electricity produced over the lifetime of the plant, I think nuclear clearly wins out over renewables. As for the disposal of the nuclear power plant, it depends on how we approach the problem. A nuclear power plant normally covers an area of about 2 km<sup>2</sup> and 95 % of that area is unaffected by radioactivity. When a nuclear power plant is shut down, 95 % of its area is immediately usable and the remaining 5 % of the area may well remain inaccessible for thousands of years. The same is true of spent nuclear fuel intermediate storage facilities. In that time the radioactivity will have almost disappeared. Can't France afford to make 2-3 km<sup>2</sup> of its land area inaccessible for thousands of years? When you compare that to land grabs for renewable energy and the infrastructure needed for it, it's ridiculously small.

**M:** *What about the regulatability of nuclear power plants? They are always running at full power except for breakdowns or planned outages.*

**J:** Nuclear power plants are still running at full power because their operating costs are very low and it is not worth reducing their output. Modern nuclear power plants can be regulated. With the current technical possibilities, the French concept of 70 % nuclear and 30 % renewables seems the most feasible. Unfortunately, the construction of new nuclear power plants is currently subject to a number of obstacles. If they were built in much larger numbers in recurring projects, everything could be much quicker, easier and cheaper. A simile came to mind. If I want to eat

mushrooms (use emission-free electricity), I can either build a mushroom farm (nuclear power plant) with my friends or go mushroom picking in the woods (use renewable energy). Both have their advantages and disadvantages. But the situation could change quickly, either with major advances in large-scale energy storage or with new possibilities for nuclear power. Hopes are pinned on small modular or breeding nuclear fission reactors as well as fusion reactors. There may also come something completely new.

**M:** *How do you think it will ultimately play out with fossil fuels in the energy sector?*

**J:** The energy sector includes the extraction, distribution and use of coal, oil and natural gas. These activities are doomed to gradual extinction. However, energy exploitation of oil and gas can be expected to survive for at least another two decades after the end of coal. The use of these raw materials in the chemical industry will decline even more slowly. The use of high-temperature cracking of natural gas, which produces hydrogen and carbon black, is proposed. The carbon black can be injected underground in a mixture with water, or perhaps to improve the soil in a similar way to biochar. It would create a beautiful-looking black earth. It would be desirable to do the relevant studies as soon as possible.

**M:** *By cracking of natural gas, we use less than half of its energy content, but there are no CO<sub>2</sub> emissions. I quite believe that humanity will reach for this option. There is a lot of talk about "blue" hydrogen these days.*

**J:** Today, most hydrogen is produced by steam reforming from natural gas and water. With little energy loss, this produces hydrogen and CO<sub>2</sub>. If the resulting CO<sub>2</sub> is emitted into the air, it is grey hydrogen. If the



resulting CO<sub>2</sub> is captured and permanently stored using Carbon Capture and Storage (CCS) technology, it is blue hydrogen. Its success will depend on how expensive, reliable and safe CCS technologies are. Concentrated CO<sub>2</sub> can be permanently stored, for example, in depleted oil wells. But how to ensure that all the CO<sub>2</sub> to be stored is really stored? Opening a valve and releasing the CO<sub>2</sub> into the atmosphere is simple...

**M:** *What about heat production?*

**J:** The district heating industry is used for the heating of buildings and industrial enterprises, while at the same time also generates electricity. The advantage is that the heating plant produces the most heat and thus electricity in winter, when electricity is most in demand. But the heating industry has one serious problem. It needs to sell as much heat as possible, often through poorly insulated ground pipes. If the connected buildings are thoroughly insulated, less heat is used to heat them than escapes into the ground. The operation of the heating plant becomes unprofitable. It is therefore in the interest of owners of the district heating plants that the buildings connected to them are not insulated very well and that sufficient heat sales are maintained in the long term. Perhaps it would be best to wait for emission-free heating until small modular nuclear reactors are available. Then the connected buildings would not have to be well insulated and the heating plants would supply emission-free electricity mainly in winter. Everything would fit together well. But it's a pigeon on the roof for now.

The best pro-climatic solution today seems to be a gradual and consistent insulation of buildings, a switch to local heat sources and a reduction of heating networks. Heat pumps using heat from outside air or boreholes can be used to heat buildings locally. However, there will be a problem with e.g. historic buildings. These are difficult to insulate them well. In this case, existing heating plants converted for the energy

recovery of municipal waste can be used. Vienna and Brno are good examples of how this can be done. The transition to zero-emission district heating will be one of the toughest nuts to crack.

**M:** *The energy sector is responsible for most of global CO<sub>2</sub> emissions. What's next?*

## **3.2    *Transport***

**J:** Freight and passenger transport accounts for more than a fifth of global CO<sub>2</sub> emissions. It is a highly sophisticated system that has developed over centuries. All means of transport require energy to power them, almost all of which is now derived from fossil fuels. If electricity becomes emission-free, then train, tram, trolleybus and electric vehicle transport will also become emission-free, at least operationally. However, this is not yet the case.

**M:** *Well, let's hope so. But people will still want to fly at least occasionally.*

**J:** Air transport is likely to depend on liquid fuels for a long time to come. Since there will not be enough biofuels, the challenge in the near future will be to find a way to synthesize relatively cheap liquid fuel from water, CO<sub>2</sub> and electricity. The most suitable candidate appears to be methyl alcohol, the synthesis of which has already been mastered. It can also be a starting material for the production of other organic

compounds.<sup>9</sup> Municipal waste could also be a source for the production of aviation fuel.

**M:** *Ships often run on the worst quality oil. How would shipping be addressed?*

**J:** Giant ocean-going ships can be powered by small nuclear reactors. Smaller ships can run short distances on electricity, partly using solar and wind power, or hydrogen, ammonia or methyl alcohol.<sup>10</sup> A key turnaround could occur if efficient and safe storage of hydrogen in solids could be mastered.

**M:** *I often wonder why more use is not made of local resources and goods are shipped across half of Europe or even half the globe. It is obviously nonsense to bring carrots grown in the Netherlands to Poland and carrots grown in Poland to the Netherlands. Why is this happening?*

**J:** Carrot transport may be partly due to different levels of agricultural subsidies in different countries. It costs about 50 euro to transport one tone by truck over a distance of 1 000 km. In Poland, due to a temporary surplus, carrots can be 100 euro/tonne cheaper than in the Netherlands. It is then worth transporting the carrots. If the cost of transport were triple, this ecological perversion would not occur. We have two extremes:

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<sup>9</sup> Olah, G. A., Goepfert, A., Surya Prakash, G. K. (2009), Beyond Oil and Gas. The Methanol Economy, Weinheim, Germany, <http://doi.wiley.com/10.1002/9783527627806>.

<sup>10</sup> <https://www.osel.cz/8684-jak-from-carbonite-oxide-to-make-methanol.html> (February 22, 2022).

1. to do everything locally and use transport mainly for the supply of raw materials or
2. maximize the use of local resources, produce goods in huge amounts cheaply, qualitatively and environmentally at a high level and use a global optimized transport system to distribute them.

In many cases, the second approach is much more economically and environmentally advantageous. The quantity of raw materials transported is usually much greater than the quantity of final products. Tradition-based production and the use of local resources are particularly suitable for the local approach.

**M:** *The covid-19 pandemic has shown that most goods can be bought from an online store and sent to my home. This could be one way to reduce transport costs.*

**J:** I think so too. To some people, the usual four euro for transport may seem like a lot. However, one has to consider the significant time loss associated with in-store shopping, as well as the carbon footprint of the shopper's and goods journey to the store, including the store's own operation. A delivery service working with an online store will deliver goods much more efficiently and with a smaller carbon footprint. The delivery truck's journey is optimized. In addition, the purchase in the e-shop is usually cheaper than in the store, even including shipping. Moreover, during the pandemic, it has been shown that consumption can be significantly reduced without harming us too much.

**M:** *It's just that a lot of jobs will be lost.*

**J:** The development of society is always linked to the disappearance of unprofitable jobs and the creation of new ones. This is something we have to deal with in many other sectors as well. I would say that effective solutions to the climate crisis are more likely to create new jobs.

**M:** *There's also passenger transport. What are the prospects here?*

**J:** Passenger transport will increasingly be linked to the question of how often and where people really need to travel. The covid-19 pandemic has again suggested a number of ways in which travel can be avoided and communication can be done remotely. Even if the energy to produce and power transport vehicles is emission-free, it will certainly not be cheap. Nor will the capital and other operating costs of transport vehicles be low. In the future, everyone will have to think twice about making the journey at all. And if so, which means of transport to use for that purpose, in terms of cost, operability, speed, convenience, safety... The (e-)bicycle will probably remain one of the most environmentally friendly options for short-distance passenger transport for a long time to come.

**M:** *And electromobility?*

**J:** The development of electromobility will depend heavily on the development of batteries. Take, for example, how the price of photovoltaic panels has been reduced to a tenth in 15 years. Conversely, progress on fuel cells, which allow stored hydrogen and oxygen in the air to be converted directly into electricity, is stalling. For batteries, there are three main parameters that are being monitored. Energy stored per kg of mass, battery cost per kWh of capacity and number of charge cycles. In addition, it is wellcome to have a good recyclability. When I follow the

development of parameters for batteries, I remain rather sceptical. If the number of charging cycles were to approach 10 000, it would make sense to include electric cars in the electricity grid and to use their batteries for renewable backup. If autonomous driving were to be adopted for EVs, it would greatly help the sharing of EVs for personal transport and the automation of delivery to dispensaries on every street. Then the number of cars could be significantly reduced, parking lots would be reduced and the roads would be freer.

I don't need to own an autonomous electric car. If I want to travel somewhere in an autonomous electric car, I can call the nearest free one. I may be willing to pick someone up along the way, or even transfer several times myself, which will significantly reduce the cost of my trip at the expense of privacy, time and convenience. I think that, thanks to the development of artificial intelligence and information technology, we can expect significant breakthroughs in the coming decades. Whether in the field of autonomous driving of electric vehicles or in the field of transport system management.

The electric car is not beneficial for climate protection in the coming years. The more electric cars that increase total electricity consumption, the later we will shut down coal-fired power plants. Today's electric cars therefore run mainly on coal combusted in power plants that have not yet been decommissioned. It could also be said that trains, trams and trolleybuses run on coal today. However, these have the advantage of trolley power, which does not need batteries, and are much better utilized means of public transport. Electromobility will only start to make sense for the climate when electric cars are charged mainly at times of surplus carbon-free electricity. We are still a long way from that. But the issue needs to be seen in a holistic way. The transition to electromobility (unless something better comes along) will take several decades. Therefore, we cannot wait until there is enough emission-free electricity. In any case, the example of electromobility shows how carbon footprint

calculations can be fudged. It is common today to assume, falsely, that we use emission-free electricity to power electric cars.

**M:** *That doesn't sound so hopeless. We need to manage the production of emission-free electricity in sufficient quantities and its efficient storage and backup.*

**J:** But we are still at the beginning of a difficult journey. Excessive optimism is not appropriate.

### ***3.3 The expected green revolution in the industrial mass production***

**J:** Industrial mass production is more and more the basis for the rapid development of our civilization. The design of goods is not only increasingly suited to the needs of users, it is also more friendly to the automation of production and the reduction of raw material and energy consumption. This is why the prices of industrial products are falling. Specialized large-scale production in locations with cheap labor, close to raw material sources and ideally close to markets is also contributing to this.

**M:** *You must be talking about China, where working conditions are not ideal. China is now sovereignly the largest emitter of CO<sub>2</sub> in the world.*

**J:** When you calculate China's CO<sub>2</sub> emissions per capita and consider that it also supplies half the world with products with a high carbon footprint, the Chinese cannot be blamed for their CO<sub>2</sub> emissions. Moreover, "Made

in China" is no longer a brand of low quality. I'd probably find a few products from varied Chinese assortment at your home as well.

**M:** *You'd find...*

**J:** I have to admit that the link between global industry, global trade and global information technology is working very well today. I think the cost and energy intensity of such a system is close to minimal. The global market has done this very well. And if autonomous electric vehicles are involved in logistics, it will be even more efficient. Then the key will be how to replace fossil energy sources in industrial production with emission-free sources.

**M:** *Could you give an example of a possible replacement in the large industry?*

**J:** Steel production was responsible for about 8% of global CO<sub>2</sub> emissions in 2020. Iron ore (iron oxide) is reduced to iron by carbon in coke by default. Today, smelters in the US are rapidly switching to reduction by natural (shale) gas. Iron ore can also be reduced emission-free with green hydrogen. I believe that if green hydrogen were cheaper than shale gas today, it would already be used in the US to make steel.

**M:** *Industrial production also needs a lot of process heat.*

**J:** Process heat needs in industry can be met with emission-free electricity in times of surplus and green hydrogen in times of shortage. This will help stabilize the electricity grid. Electricity consumption in a carbon-neutral society will increase several-fold.



**M:** *That's not what people are told. Most people think that electricity consumption will go down. After all, they bought energy-saving light bulbs or an A<sup>+++</sup> refrigerator.*

**J:** Consider that energy consumption per unit of product in industry and other sectors is already near a minimum. But emission-free electricity must replace all fossil fuels and all fossil heat sources that we commonly use today. Another indirect consumer of electricity through green hydrogen will be emission-free steel production. Substantial savings could only be achieved by significantly reducing our consumption. But this requirement is probably not going to work for most people.

The price of electricity will fluctuate considerably over time and will on average be significantly higher than today. The price will have to take into account not only all the costs of generation and distribution, but also of ensuring the reliability and operability of its supply. Industry and households will be able to react smartly to this and consume the most of electricity at times of surplus. However, this is often not possible. Frankly, I would not want to be responsible for managing an emissions-free electricity sector. But if one follows the successes of information technology and artificial intelligence, there is no doubt they can manage it.

### ***3.4 The future of construction and building operations***

**J:** Construction and building operations is a sector that is associated with about a fifth of global CO<sub>2</sub> emissions. This is where people can have the greatest impact on CO<sub>2</sub> emissions through their choices and behavior without having to limit themselves. That is why I want to look at this topic in more detail and try to impress as many readers as possible.

The production of cement alone, the basic ingredient in concrete, now accounts for about 8% of global CO<sub>2</sub> emissions. The problem is specific in that when cement is fired, CO<sub>2</sub> is released by the thermal decomposition of limestone, one of the components of cement. But when the concrete hardens, CO<sub>2</sub> is not recovered from the atmosphere. However, the CO<sub>2</sub> produced during cement production is concentrated. It can be captured and used as a raw material in the chemical industry, e.g. for the production of synthetic methyl alcohol, or captured by CCS.

**M:** *In any case, it will be desirable to limit the use of concrete in the future. Also because of the consumption of gravel, which is not unlimited. Is this realistic? Can concrete be replaced by wood in the construction of houses, for example?*

**J:** If a house is designed correctly, a kilogram of wood can replace a kilogram of steel or 30 kilograms of concrete or bricks. Passive house wood buildings can even have a negative CO<sub>2</sub> balance. Over the lifetime of the building, wood retains a significant amount of carbon that has been removed from the atmosphere as trees grow.

**M:** *But if we cut down forests that absorb CO<sub>2</sub> to build houses, it won't exactly be a win.*

**J:** Forests are being restored, so wood is a renewable building material. We need to treat wood as a very valuable construction material. We should not waste it, for example, on building log cabins, where wood is more likely to be poor and expensive thermal insulation. Only in this way can we make the most of the limited amount of wood to build as many cheap, well-insulated houses as possible. It is advisable to use as much as

possible lightweight mineral wool with very low thermal conductivity as thermal insulation.

**M:** *What about CO<sub>2</sub> emissions from building operations?*

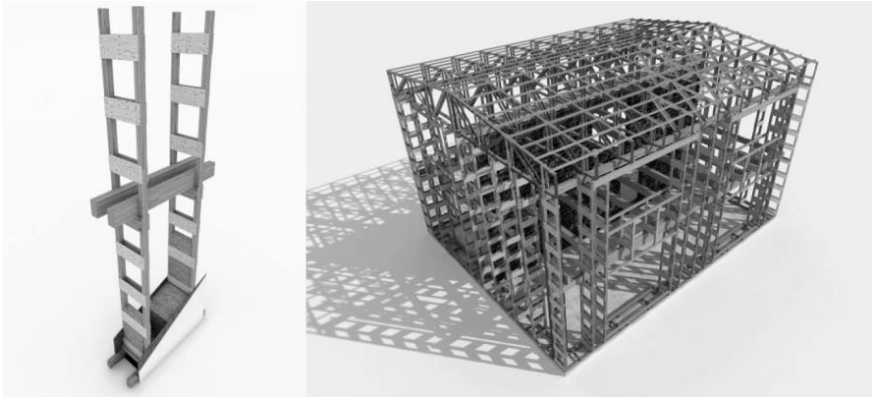
**J:** Heating in winter, cooling in summer and hot water heating are the largest contributors to CO<sub>2</sub> emissions. Domestic appliances also contribute a significant part. If only emission-free electricity were produced, the actual operation of buildings would also become emission-free. However, our concern is how to reduce the cost of running buildings as much as possible by minimizing energy consumption. Unconsumed energy tends to be the cheapest and most environmentally friendly. The starting point is superior thermal insulation and sufficient tightness of the building envelope (contact with the soil, external walls with windows and roof). Then the heat exchange between the interior and the exterior is significantly reduced. Such a house uses very little energy for heating in winter, when electricity is at its scarcest. In addition, such a house has a huge thermal inertia, so that the daily heating time can be adapted to the needs of stabilizing the electricity grid.

**M:** *You said that over the last 30 years, the ratio of energy and insulation prices has increased more than ten times. That must have had an impact on how we build.*

**J:** Impacted, but not enough. Taking into account the 100-year lifetime of the building and the current prices of thermal insulation and energy, I calculated that it is optimal to insulate the perimeter walls and roofs with at least 50 cm of lightweight mineral wool.

**M:** *This is a thicker layer than the normal thickness of perimeter walls. Where do you want to put the wool? Outside or inside?*

**J:** Neither outside nor inside, but into the construction of the perimeter wall. You know what the Eiffel Tower looks like when it is made up of a truss structure. We can easily make light and strong trusses 50 cm wide from wood and use them to construct the load-bearing perimeter walls and roof, see Figure 7. Wood is a wonderful construction material that you can easily join together with a combination of gluing, nails, screws, bolts and steel angles.



**Figure 7:** Example of a truss structure of a passive house made of wooden trusses. In the gaps between the trusses, space is created for thermal insulation (lightweight mineral wool), which fills almost the entire building envelope.

More information about building a cheap passive house with your own help and also free sample building projects can be found on Jiří Svoboda's website <http://www.optimalizmus.cz> (22. 2. 2022).

**M:** *So, the perimeter walls are not monstrously thick. Have you built such a house and does it work to your liking?*

**J:** There are several houses already standing according to my design and people are living in them happily. In winter, when there was no heating at all, the temperature inside never dropped below 13 °C. Everything was warmed by the sun through the mainly south-facing windows. Just for the record, the trusses for the house in the picture can be made in two people in two weeks. It's even quicker to build the wooden structure.

**M:** *That sounds unbelievable. But such a superhouse must be very expensive.*

**J:** On the contrary. Lightweight mineral wool is the cheapest building material per volume. Moreover, a house insulated in this way has such a low heat consumption that it can be heated with a simple floor heating system. Along with hot water, everything can be heated using a small heat pump unit. This takes only heat from the ground under the house throughout the winter using a heat exchanger made of polyethylene tubing. There is no need to do any extra digging to install it. In summer, the soil under the house is charged with the heat provided by the cost-free air conditioning of the house. This is done simply by circulating the liquid between the heat exchanger under the house and the floor heating. This simple system ensures a comfortable temperature in the house in summer and winter at an unbeatably low operating and investment cost. A prerequisite for this to work so nicely is excellent thermal protection of the house, allowing a number of synergies to be exploited and making much of the house simpler and cheaper. However, it is necessary for the residents to air-condition the house for free over the summer and charge the ground under the house for the winter. A single room thermostat controls heating in winter and air conditioning in summer.

**M:** *So, in summer and winter the house will be at the temperature I set on the thermostat. During the summer I can ventilate as much as I want and it will all work practically for free. Why don't they build like that?*

**J:** Building companies want to build the way they already know how. They have enough "experts" who can best justify everything to customers. People often have no choice but to trust them. It takes time. Excellent insulation in new buildings should be the norm today. We build houses for a hundred years and it is much easier and cheaper to store large amounts of insulation when building a well-designed house than to do it later, e.g. after 20 years. With quality insulation, we will in turn save money on a smaller and simpler heating and air conditioning system. That's why houses of my design come out much cheaper than conventional ones. There's nothing complicated or expensive about them, but you have to change your thinking and practices.

**M:** *Controlled air exchange with heat recovery is considered standard in passive houses. It is intended to ensure good indoor air quality. It is an expensive active system that requires maintenance. An active system in a passive house is quite a contradiction in terms, isn't it?*

**J:** People are used to adequate ventilation by opening windows as needed. It turns out that too much ventilation in the winter dries out the air indoors, which is harmful to mucous membranes. By breathing, we maintain a CO<sub>2</sub> concentration of about 50,000 ppm in the lung chambers. If it's more, we suffocate; if it's less, we get sick. I am convinced that we are unable to distinguish whether we are breathing air with 1000 or 3000 ppm CO<sub>2</sub>. Similarly, we are unable to distinguish whether we are breathing at 200 or 500 meters above sea level. In both cases we have to increase lung ventilation by about 4%. In my opinion, there may be no

heat recovery from ventilated air at all in a passive house. There is also the possibility to solve the recuperation much more simply and cheaply by using the heat from the ventilated air to preheat the hot water. Cost-free air conditioning can be much more appreciated by the residents of a passive house.

**M:** *Why are heat recovery units installed in passive houses?*

**J:** Because you can only get a subsidy for a passive house if the house has a certified ventilation system with heat recovery. The subsidy is often higher than the purchase price of the ventilation system. This is an example of real wasteful subsidy policy for climate protection.

Everyone should build the house he wants based on the information available. It is about his money. No "right solutions" should be mandated or undercut by subsidy programs. The authorities should only recommend good quality thermal protection of a passive standard. How economically the house will be run in practice is another question. This can be influenced by other motivation instruments that will emerge later.

**M:** *But if you give people and companies freedom, reinforced concrete buildings will still be built.*

**J:** At first they will. It is essential that people learn to think and take responsibility for their decisions. This will be an important skill in the transition of a global society to sustainable development. A carbon-neutral society cannot be built as a global police state based on bans and mandates. It will be necessary to engage people's free rational behavior within a properly motivating market environment.

**M:** *Doesn't the market mechanism of supply and demand work in construction?*

**J:** This works for building materials and building equipment. Everything is much more conservative in house construction. Management, investment, design and construction are usually done by different entities. Each wants to minimize their effort and maximize their earnings. This puts the end user at a disadvantage. Every year, at least one experimental house should be built according to some innovative building concept. Subsequently, the house should be objectively evaluated not only in terms of investment and operating costs, but also in terms of ease of construction, overall carbon footprint, recyclability and durability of construction. The results should be made public for all to understand and the customer should want what they themselves assess to be the best. That way, perhaps the construction industry could be moved a little. I am attempting one such study myself. We buy a pair of shoes every year, a mobile phone or computer every 5 years, a car every 10 years, but we buy a house once in a lifetime. I guess that's where the conservatism on the supply and demand side comes from. This is likely to be a significant obstacle in the transition to a carbon neutral society. Over the next 20 years, there will be still plenty of half-insulated houses built. These are not worth retrofitting with proper insulation and will be a significant burden in the carbon neutral future.

**M:** *Today there is a trend for green roofs. What do you think about them?*

**J:** From a climate protection point of view, white, well-insulated roofs are best. White reflects the sun's rays the most, and the roof and the surrounding area of the house heat up the least. It is also desirable that all rainwater from the roof is captured and used or soaked up. The soaked



water benefits trees providing shade or other benefits. This is an effective way in which urban heat islands can be turned into islands of coolness. A green roof with declining vegetation will not remove any CO<sub>2</sub> from the atmosphere. It is relatively dark and absorbs about twice as much solar radiation as a white roof. A green roof requires a robust, technically demanding structure and evaporates about half the rainwater unnecessarily. The evaporation cools places where people are not normally present. In architecture, green roofs can have aesthetic value. But their contribution to the global climate is negative compared to a white, well-insulated roof.

**M:** *You get a subsidy for a green roof.*

**J:** But you won't get any subsidy for a white roof. In many cases, even the building authority won't give you permission. Getting designers, builders and the authorities to work consistently and responsibly for climate protection will probably take decades. I know these issues and I know what I am saying.

### **3.5    *Agriculture and its outlook***

**J:** Agriculture is a sector that directly produces about a tenth of global CO<sub>2</sub> emissions. Indirect emissions, which are associated with land degradation and deforestation, account for a similar amount. Direct emissions are associated with the combusting of fossil fuels to produce fertilizers and to power agricultural machinery. The use of emission-free energy sources will significantly increase the price of fertilizers and the operation of agricultural machinery.

The inevitable halt in population growth and the end of biofuel production could reduce the demands on agricultural intensity. Then much more biomass and organic fertilizer would be incorporated into the soil and the amount of humus in the soil would at least stabilize. This would lead to a significant reduction in both direct and indirect CO<sub>2</sub> emissions.

**M:** *I wish! What about the forests? They say that planting trees can offset our emissions.*

**J:** Experience to date shows that tree planting and properly managed forests can offset at most CO<sub>2</sub> emissions from deforestation elsewhere. Emissions from combusting fossil fuels cannot be offset in this way. How forestry is conceived in the future is important for climate protection. It has a number of irreplaceable functions such as maintaining biodiversity, retaining water in the landscape and cooling the landscape in summer. Forests are said to significantly support the small water cycle or attract rain. I don't think so. In any case, we must not lose sight of the important function of forests in removing CO<sub>2</sub> from the atmosphere. Forests, especially rainforests, are considered by many to be the "lungs" of the planet, breathing in CO<sub>2</sub> and breathing out oxygen. But the carbon balance of the forest is equilibrated. Virtually all of the biomass produced is decomposed in the forest. So, the forest does not function as the lungs of the planet. I believe that for the forest to function as the lungs of the planet, it is necessary to harvest the wood of mature trees and use it effectively, for example in house construction. This will delay the release of carbon from the wood into the atmosphere by about 100 years. The carbon sequestration effect of the forest is roughly doubled.

**M:** *In 2017-2019, we experienced droughts and bark beetle calamities that destroyed a huge amount of our forests. What to do about it?*

**J:** We need to make forests much more resilient so that they retain all their functions. This precludes the monoculture clearing method of forest management that is still common today. A sustainable forest concept, the so-called Dauerwald, which is diverse in species and age, seems optimal. Every 10 years, mature trees are harvested or new species are planted, taking into account the expected course of climate change. It is desirable that a similar approach be applied to much of the rainforest. Local people need to benefit from the vast areas of forest cover. A forest without the possibility of extracting its wealth through logging encourages its gradual, often illegal, destruction to establish plantations. Managed logging would make the rainforest lucrative for local people. There would be no reason to destroy them. They would become the true sustainable lungs of the planet. The rainforest needs to be transformed into a commercial rainforest, thereby protecting large areas of woodland from gradual deforestation in the long term.

**M:** *But this will greatly disrupt the biodiversity of the rainforest.*

**J:** If once every 10 years heavy machinery goes into the rainforest and harvests mature tree trunks, I don't think it will threaten biodiversity too much. What has legs will escape from the site, and the damaged vegetation will quickly recover in the rainforest. The branches of the felled trees will remain in the rainforest, and the site vacated by logging can become an ecological niche for other plant or animal species. Appropriate rules must be followed during logging to sufficiently preserve the ecosystem. The carbon in the harvested wood and the

economic benefits of the rainforest are definitely worth it. In my opinion, the current rainforest biodiversity will not suffer significantly.

**M:** *What if it turns out that we have to not only stop CO<sub>2</sub> emissions, but remove CO<sub>2</sub> from the atmosphere? How can forests be used for this?*

**J:** We've already said that about a quarter of current CO<sub>2</sub> emissions dissolve in the oceans. Even if we reduce CO<sub>2</sub> emissions fast enough to zero, CO<sub>2</sub> will continue to move from the atmosphere to the oceans. If ocean acidification proves to be a serious problem, it will indeed be necessary to start removing CO<sub>2</sub> from the atmosphere. Then, for example, wood from demolished wood buildings or branches from logging in farm forests can be converted into biochar by pyrolysis, i.e. heating without air. Biochar can be shredded and incorporated into the soil. A number of studies show that biochar in soil does not oxidize to CO<sub>2</sub> and improves its fertility and water retention capacity in the long term. Biochar in the soil would then become an agriculturally beneficial permanent carbon deposit. In principle, this would gradually compensate for the fossil fuels previously extracted and combusted. It would be a long haul, because the volumes of biochar would have to be enormous.

**M:** *Building militias could be a welcome break from computer work.*

**J:** Themilitias would be reusable from steel. Branches need to be applied to them, which is certainly a healthier activity than sitting at a computer.

**M:** *What about livestock production? Would it help if we stopped eating meat?*

**J:** A little bit, yes, but the climate won't save it. If you eat a lot of meat and give it up, it's said to have the same effect as giving up a car with a combustion engine. But if we agree on the need to cut down on artificial fertilizers, we need manure for good crops and for humus formation in the soil.

### ***3.6 Waste management, a seemingly simple but complex problem***

**J:** Waste management is associated with about 5% of CO<sub>2</sub> emissions. I would say it's the worst performing sector. Evidence of this is, for example, the infestation of the oceans and seas with plastic packaging.

**M:** *How can we fix and decarbonize waste management?*

**J:** Waste is largely a consequence of consumerism and market mechanisms imposing maximum consumption are inappropriate. It would be best not to produce as much waste at all, or at least to recycle a substantial part of it. Industry often produces pure single-source waste, the recycling of which can be environmentally and economically beneficial. Municipal waste, which consists of many types of often layered and contaminated packaging, is different. Clean paper, metals, glass or PET bottles can be sorted and recycled. In all cases, however, it should be assessed whether sorting and recycling are beneficial at all. It is not just possible to boast about the positives and empty phrases about recycling, as is often the case.<sup>11</sup> The negative effects of sorting and recycling, such as the operation and transport of the contents of specialized containers, the need to separate and clean the waste, and the

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<sup>11</sup> <https://incien.org> (NGO website about circular economy, 20 Jan. 2022).

recycled material usually being of lower quality than the original, cannot be ignored.

**M:** *I know which container to put PET bottles in and which one to put paper in. But what happens to it next is more of a mystery...*

**J:** Not much is said about the "success" of plastic recycling. The following seems to be a promising option. To buy back clean collection materials such as paper, glass, metals and PET bottles from people. This will ensure that they are of sufficient quality for recycling. The remaining mixed municipal waste could be used to produce liquid aviation fuel or, after drying by waste or solar heat, could be compressed and stored seasonally. Municipal waste bales can be used for energy in modern power or heating plants to back up long term renewable energy outages.

**M:** *So, save your dried municipal waste for the winter.*

**J:** I believe that the necessary efficient technologies will soon be available. If municipal waste comes mainly from packaging produced from biomass, the combustion of municipal waste or its use for aviation will be almost carbon neutral. The idea here is not to use biomass directly as fuel, but to turn it into packaging and then use the used packaging, after possible reprocessing, as fuel.

Landfilling of municipal waste, which releases CH<sub>4</sub> or CO<sub>2</sub> through gradual decomposition, is clearly the worst "official" way to deal with waste. It is astonishing that many environmentalists and climate campaigners are less bothered by landfilling than by energy recovery.<sup>12</sup>

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<sup>12</sup> <https://hnutiduha.cz/nase-prace/odpady>  
(DUHA / Rainbow Movement website on waste management, 20 January 2022).

Conservationists apparently fear that if energy recovery of municipal waste becomes the norm, it will hinder the progress in sorting and recycling. This is a priority for them. There should be a clear rule here. Sort what is worth recycling and use the rest for energy.

**M:** *Another form of recycling is reuse.*

**J:** Everyone knows about returnable glass bottles, but this has been repeatedly found to be less environmentally friendly than using PET bottles. I'm a fan of secondhand. Many useful things can be found in salvage yards, flea markets or bazaars. A shelter could be set up in every salvage yard for usable items that would be disposed of after a monthly offer of free takeaway. Salvage yards would become more socially attractive.

**M:** *We are increasingly shopping in online stores. I get the product wrapped in its original attractive packaging, plus lots of padding in a sturdy paper package that is covered with yards of tape for shipping. It breaks my heart.*

**J:** First of all, goods from an e-shop don't need to have attractive packaging that attracts customers to buy them on the shelves. In addition, the packaging for shipping can be multi-purpose. I imagine there will be 20 types of standardized rigid shipping containers of various shapes and sizes made from recycled thermoplastic (polyethylene). The purchased goods will be delivered to my point of delivery in the most suitable container without any packaging, just fixed against movement with a padding. I will remove the goods at the point of delivery and carry them in my bag. The containers and the reusable padding will be delivered back to the e-shop warehouse on the next trip by the carrier. In case of

damage, the containers will be used as raw material for the production of new containers.

**M:** *So, the manufacturer wouldn't pack the goods in attractive packaging at all, the e-shop would have much simpler packaging, the customer wouldn't have to deal with the problem of "where to take it" and the carrier would still have a full car. A packaging-free system with 100% recycling. Maybe it's that raw materials are too cheap.*

**J:** You're right. As long as it's cheaper to get the raw material by mining than by recycling, it won't naturally be recycled. But I'm sure that in the case of polyethylene shipping containers, recycling them twice, as reusable packaging and as raw material, would work even at current raw material prices.

**M:** *I think it's time to close this chapter. What should the reader take away from it?*

**J:** I hope the reader has realized how complex, challenging and unprecedented the task of global decarbonization will be. He/she won't believe the hopefully deliberately naive manuals and articles giving a few simple instructions on how the global climate can be saved.



## 4. THE CLIMATE PROTEST MOVEMENT AND CURRENT POLITICAL PRO-CLIMATE SOLUTIONS

**M:** *Protecting the planet and significantly reducing climate disruption is a priority for young people in particular, and they feel a legitimate need to make their concerns known. A number of successful movements have emerged around the world, the most famous of which is Greenpeace, founded in 1971. Today, there are visible pro-climate movements, especially in Western Europe, such as Fridays for Future and Extinction Rebellion. How would you assess these activities?*

**J:** I would classify the activities of these movements as follows:

- Occupation actions or lawsuits against specific entities directly or indirectly responsible for environmental or climate damage.
- Strikes, demonstrations, blockades and happenings where members and supporters of the movement rally and call attention to the lack of protection of the planet and the climate.
- Meetings of movement representatives with politicians and work on expert committees to address current planetary and climate protection issues.

The activities of the movement are perceived positively by the public, for example because they draw attention to the fundamental problems of sustainable development of humanity and demand their solution. However, they are often perceived also negatively. For example, because they scare and behave hysterically or block the implementation of publicly beneficial actions such as the construction of motorways and bypasses or the use of nuclear energy. The movements often rely on legislation in their actions and have already won many court cases.

**M:** *Unfortunately, I often get the impression that by fighting hard against specific negative phenomena or planet-damaging entities, movements gain an exaggerated interest from the media and the public.*

**J:** For example, Extinction Rebellion supports civil disobedience and rebellion because they believe it is necessary. They are asking people to muster the courage to come together and do whatever is necessary to bring about change.<sup>13</sup> From my discussions with them, I have come to understand that what is important to them is not so much what they have achieved through their actions, but what media and public response they have generated. There are millions of concrete injustices happening in the world. The movement's visibility comes from "fighting" one or a few of them. If the Extinction Rebellion movement had primarily advocated for effective systemic change, perhaps its visibility would have been even greater. It would also bring more benefits to society.

However, it is certainly not possible to lump all movements together. There are thoughtful people in many movements and environmental organizations with good intentions to do the best they can for the planet and the climate. What is sadly often lacking there is a substantive

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<sup>13</sup> <https://www.extinctionrebellion.cz/fakta/nase-pozadavky/>  
(protest movement ER website, 21 December 2021)

discussion that is free of ideology. It is appropriate to ask questions like, "What and how could we do better?", "Is it enough if we continue to just kick the climate change giant's ankles?" or "Isn't it inevitable to use a tool of adequate caliber to save the global climate?"

**M:** *I have also repeatedly tried to establish communication with several environmental organizations. I have tried to initiate a substantive discussion on the topic of whether to fight against individual injustices or rather to advocate for radical systemic changes that would eliminate injustices in many entities at the same time. My efforts have so far, unfortunately, always come to naught. What could it be? Perhaps it is too big a bite for them.*

**J:** I have the same experience and I'm very sorry. I guess they have an agenda and it's hard to deviate. Everything has its inertia. I am convinced that only targeted radical systemic change can turn around a world that is increasingly beyond the limits of sustainability. But the best idea will not take hold unless at least part of the population embraces it. Movements and their supporters could help significantly here. I really don't know how to do it.

**M:** *So, let's at least give people hope for a radical systemic change in their approach to climate protection and maybe they will join us. Hopefully our book will help. At demonstrations of the climate movement, we hear from speakers appeals to politicians to listen to scientists. That's good, isn't it?*

**J:** That's not enough. Scientists have properly analyzed the causes of the ongoing climate disruption and are even able to predict its intensity for different emission scenarios. When they have been tasked by

policymakers with what emissions scenarios are needed to keep global temperatures below 1.5 or 2°C of warming, they have calculated such scenarios with reasonable accuracy. These scenarios then began to be used by pro-climate politicians and eco-activists to argue that climate catastrophe would occur if they were not followed. This is not what scientists claim. On the contrary, how the necessary emission scenarios can be effectively achieved does not get much space from scientists. The IPCC climate panel reportedly does not allow scientists to propose any specific measures in the "Summary for Policymakers". However, what the IPCC can afford to do is at least partly decided by the scientists themselves. On the other hand, many scientists are narrowly focused experts and do not feel competent to speak to policy. Maybe some scientists are a bit alibi.

**M:** *What can politicians do to protect the climate?*

**J:** Politicians handle public money intended for the needs of society. If they have clear signals that climate protection will bring votes, they decide to invest significant public funds in this area as well. This activates "green" businessmen who start convincing politicians that their business is the most important thing to save the climate. They will negotiate with them for the adoption of the "right" laws and for subsidy programs that are favorable to them. I doubt that this subsidy-induced 'business' is an effective way of protecting the climate. The trend in global emissions to date and the huge resources spent in this way so far show that it is a failure.

In 2008, the cost of each measure to save one tone of CO<sub>2</sub> emissions was analyzed by a major independent auditing company<sup>14</sup>. It showed that

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<sup>14</sup> Costs and potential for reducing green house gas emissions in the Czech Republic. Mc Kinsey study from 2008.

the potential of a measure with a positive cost balance, where the investment pays for itself relatively quickly and a net profit is made, is about 20%. The potential for cost-neutral investments is about 40% and the rest of the measures have to be paid extra. Surprisingly, it is mainly the most expensive measures that have received massive subsidy support. The support was so generous and so tempting that only these measures were practically implemented. The subsidies distorted the market for low-carbon measures and influential lobby groups established mutually beneficial alliances with politicians.

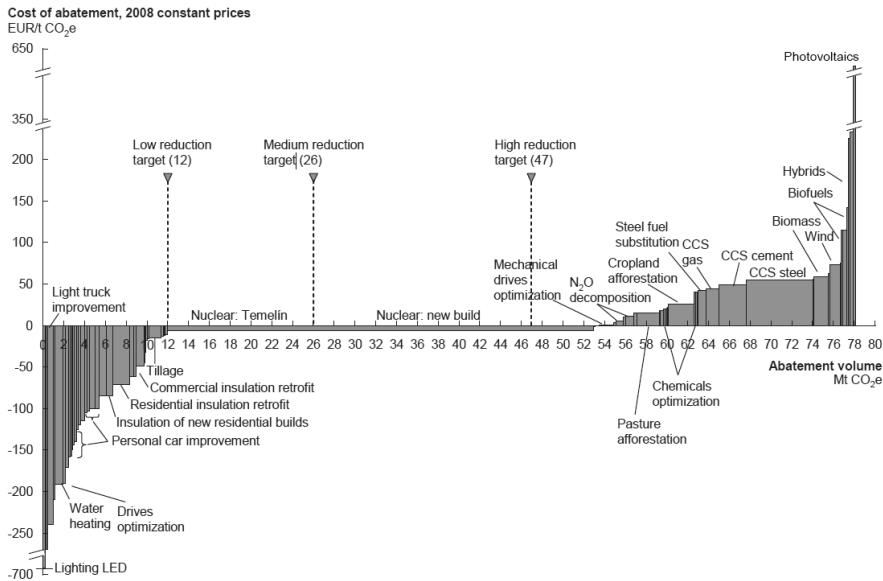
**M:** *I don't believe that.*

**J:** That's right, unfortunately. For example, in 2008, photovoltaics in the Czech Republic were rated by an auditing company as the absolute most senseless way of reducing CO<sub>2</sub> emissions at a price of 640 euro/t, see Figure 8 (description of photovoltaics added by the authors). Nevertheless, so many PV plants were built in the Czech Republic in the following two years that their support cost more than half a trillion CZK (20 billion euro). If CO<sub>2</sub> emissions were reduced by market mechanisms, just the measures described in the graph on the left would be mainly used.

**M:** *How many zeros does a trillion have?*

**J:** Twelve, it's a thousand billion and can be written as 10<sup>12</sup>. The current subsidy programs don't look much more reasonable. Speakers at climate protection demonstrations are sending messages to politicians: "Do much more for the climate!" So far, however, this has mainly led to more public money ending up in the pockets of lobbying "green" companies, leaving the problem of climate disruption unresolved. Subsidies often

support the ineffective measures and the effective ones remain unused. I do not want to paint the devil on the wall, but if current practices escalate, the global climate crisis may be joined by an economic and social crisis.



**Figure 8.** Cost curve of individual CO<sub>2</sub> reduction measures.<sup>15</sup> It is clear from the graph that about one sixth of the measures (left) can be profited from CO<sub>2</sub> savings, another half or so are cost neutral and the remaining third (right) have to be paid for in very different amounts.

<sup>15</sup> [http://www.geology.cz/co2net-east/download/McKinsey%20Report\\_czech\\_version.pdf](http://www.geology.cz/co2net-east/download/McKinsey%20Report_czech_version.pdf) (information portal on publications related to CCS technology, 20 February 2022)

**M:** *So, you want to condemn the environmental movements and the Green parties for their approach so far and give up trying to cooperate with them?*

**J:** Absolutely not. They are increasingly important forces in global society that can persuade people to accept climate protection as a necessity. But the movement and the Greens should realize that politicians cannot effectively address the problem of climate change with the tools they have used so far. Politics is about finding compromises, and these usually do not provide the best solutions for the climate. We need to demand that the political decisions that have been chosen are replaced by free decisions made by companies and people within the framework of a properly modified and subsidy-free market. It is essential to use the market, the main instrument for the development of our civilization, also as the main instrument for protecting our civilization from climate disruption.

I propose to exclude politicians from deciding what technical and organizational measures should be taken to address the global climate crisis and leave this decision to the market. Just as, to our satisfaction, politicians do not decide where goods come from and how much they cost in the supermarket. I want to start a substantive and critical discussion about this with the movements and the Greens as soon as possible. Time is running out.

# 5. GREENWASHING - APPEALING BUT DANGEROUS

## 5.1 *Greenwashing in business*

**M:** *More and more businesses are using terms like "sustainable", "reduce CO<sub>2</sub> by X% through Y measure", "for people and planet"... It can also be products like bio-wool clothing or a "zero-emission" car. Increasingly, we are seeing "green" products with appropriate labels. This is probably good news that corporations are trying to reduce their carbon footprint.*

**J:** But how do we distinguish real positive actions by corporations on behalf of the planet and the climate from greenwashing? This term was coined by environmentalist Jay Westervelt in the 1980s. He described his experience in a hotel where visitors were encouraged to reuse their towels to protect the environment. The hotel advertised this cost-cutting ruse as green behavior. The environmentalist, on the other hand, saw rampant waste everywhere else in the hotel and saw no apparent effort at sustainability. Today, greenwashing is much more sophisticated. When a customer buys a product with a cleverly devised "eco" label, he/ she can get a sense of making a significant contribution to protecting the planet even if he/she doesn't need the product at all.

**M:** *I have the impression that the contemporary world is so saturated with greenwashing that it has become almost a necessary condition for success. Or am I wrong?*



**J:** You're not wrong, but you didn't capture its insidiousness at all. Greenwashing is the practice of spreading false information to create the impression of environmentally responsible behavior. But what is "false"? It is certainly false when a company states, for example, that it combusts half as much coal in its operations as it actually does. But is it also untrue if a company gives the correct figure for how much natural gas it has combusted, but says nothing about its considerable coal consumption? That's still greenwashing in my opinion.

**M:** *Another variant of greenwashing is the introduction of a banal measure that inflates advertising and PR methods.*

**J:** And I'm afraid it is not the last variant. Let's try to agree on a more general definition of greenwashing as the presentation of a body of information, including false, incomplete or misleading information that overstates the ecological benefits and does not allow an objective comprehensive picture of reality to be formed.

**M:** *Let's show it best with an example.*

**J:** Let's take a hypothetical example of an electric company that predominantly combusts fossil fuels. The company doesn't hesitate to advertise itself with data on how much photovoltaic power it has put into operation in the past year. The investment was lucrative thanks to subsidies and the firm's capabilities; there was nothing sacrificial about it. Moreover, this investment only covers 1‰ of electricity production. Had the company transformed itself at this rate, its desired green transformation would not occur until the next millennium.

**M:** *What do you like least about it?*

**J:** Mainly the fact that the company makes a profit thanks to the subsidies and uses it for its green advertising. I used to go to conferences organized by a company that suddenly added "green" to its name. Since then, instead of plastic bag and a plastic pen, we've been provided with a cloth bag and a pen with paper holder. The program remained on coated paper. Here at least no subsidies were used and the 2 dollars for the green measure was paid for out of the conference fee.

**M:** *So, you're mainly bothered about doing greenwashing with money that primarily comes from subsidies and makes a profit.*

**J:** Yes, it seems unfair to me. For example, a school does a not-so-good and overpriced insulation of a building that is paid for by generous grant programs. Then it will save its budget for many decades with cheaper heating. What is there to brag about? That someone is well-connected and got a subsidy? If only it worked so that only a certain amount of money is allocated to the program each year. This is then distributed to the projects with the lowest required support based on saving 1 tone of CO<sub>2</sub> emissions. But then it would be a matter of counting the CO<sub>2</sub> savings as "cleverly" as possible, and the spiral of red tape and its associated protectionism would continue to spin.

**M:** *That's the reality. Isn't it easier to accept it and be grateful that it works like this?*

**J:** You can't ask me to do that. A lot of money is lost in the system itself for administration. The binding conditions of the subsidy program will not allow the most efficient ways of achieving CO<sub>2</sub> savings to be

implemented. We need to create motivating conditions in society so that money from owners' pockets goes into e.g. insulating buildings in the first place. Only private investment will guarantee high efficiency of the funds spent. Let us be aware of how many buildings need to be insulated and how much it should cost in subsidies. We are reaching completely unacceptable lead times and astronomical costs from public funds. This is not the path to carbon neutrality in sight.

**M:** *If subsidy systems grow through the state administration, it will be difficult to get rid of them. But you have strayed from the main topic, i.e. greenwashing.*

## **5.2 Political greenwashing**

**J:** I came to another variant of it by a circle. I would call it political greenwashing. Parties and politicians do green politics in the way that they promise people and, if they succeed in elections, announce generous subsidy programs for green measures. Their effectiveness is usually not monitored. In other words, politicians are only being green by putting taxpayers' money into the pockets of companies whose "green" lobbyists promise the "most correct" solutions. Politicians bear no responsibility whatsoever. Not only for the inefficient use of public money, but also for the damage caused by subsidies to the market environment or to the political culture by the proliferation of corruption.

**M:** *Politicians do not have criminal liability. But what about their moral responsibility?*

**J:** It is certainly something that can be appealed to, especially by politicians who are at the forefront of current climate protection efforts.

If efforts to mitigate climate disruption are unsuccessful, one day their work will also be evaluated. And if it turns out that they have refused to listen to critical voices suggesting more appropriate approaches to climate protection, history may condemn them. That is all that is likely to happen. The problem is that it will probably be too damn late. The other difficulty lies that the politicians are convinced they are doing the best they can. Why should they listen to critical voices?

**M:** *Green policies like this have so far been a great success in many developed countries, and climate campaigners there are calling for further and further intensification. Don't the environmentalists see the wrong approach?*

**J:** I don't know if the success can be attributed to green politics. Rather, it is the success of effective political greenwashing that is hard to see. People putting climate protection first often do not evaluate the solution method. They want to save the planet and the climate with maximum intensity at any cost. In doing so, the price factor for limiting climate disruption is important, because monetary resources are always limited. The higher the price per tone of CO<sub>2</sub> reduction, the less climate disruption we will limit. And we will also be more likely to give up on climate protection after a certain time. The requirements "at maximum intensity" and "at any price" are mutually exclusive.

**M:** *We can't be angry with green policies in developed countries. They are doing policies that attract voters, which is considered the main criterion for success in politics.*

**J:** Then political greenwashing can also be called green populism. The main criterion you mentioned clearly shows the degeneration of our

society. It has probably given up the need to put statesmen in leading political positions in the sense of personalities, not just functions. A *statesman* should be able to think and act in a time horizon that extends far beyond the electoral term and not consider the criterion of electoral success as the most important. A *statesman* is one who prevents fires, not one who merely puts them out successfully or unsuccessfully by virtue of his office. *Statesmen* have shown themselves in times of crisis, now we have a climate crisis, so we need *statesmen*.

**M:** *A statesman does not have to come up with new concepts that are good for people and the planet. These can be invented by others.*

**J:** He doesn't have to. But he should be able to distinguish between good and bad concepts and try to push the good ones.

**M:** *So, if someone came to a statesman with a redeeming concept on how to effectively prevent global climate disruption, the statesman would recognize the quality of the concept and enforce it?*

**J:** I think *a statesman* would recognize the salvation of the concept. The problem is that there is no position in the world (not created) for him to be able to enforce the concept by virtue of his position. This would require many *statesmen* in many countries to agree together to accept and implement the concept. This makes the situation very difficult. It is questionable whether the usual political environment will allow potential *statesmen* the necessary rise and thus give the electorate the opportunity to elect them. And, if elected, whether or not the *statesman* will be chipped out of his office or adapt his behavior to "political standards".

**M:** *That doesn't sound encouraging at all. Then there is nothing to do but to present everything clearly and understandably and hope that the ice will be broken also without statesmen. What do you think should be the basis of such a redemptive concept?*

**J:** Replace ineffective subsidy programs with market-economic instruments that work across the board and in a simple way. Then even greenwashing would lose its justification and would itself, at least to a significant extent, disappear.

**M:** *You talked about greenwashing being insidious. What is its danger?*

**J:** Almost all efforts to date related to global climate protection can be considered greenwashing by our definition. The primary goal of these efforts is to create the perception that climate protection is being vigorously pursued<sup>16</sup> and that it is only a matter of time before it has a positive impact. The transition to a carbon-neutral global society is often presented as an easy process with nothing to go wrong. All that is needed is to invest enough money in green measures. But this is certainly not the case. It is an unprecedentedly complex global undertaking. If today's global climate campaigners push politicians to do much more for the climate, they will only get more political greenwashing. No one is responsible for the outcome, and "quality" greenwashing allows governments to spend more and more public money "for climate protection". This is akin to the "wolf eats and the goat stays whole" way of doing things, or rather "so that the wolf can eat more and more and what happens to the goat is irrelevant". The goat is just a backdrop.

The danger of greenwashing is that it gives many people a satisfying feeling of intense struggle against climate change, without leading to the

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<sup>16</sup> <https://www.enviweb.cz/121036> (environmental news, Jan. 21, 2022).

goal. We are wasting precious time and wasting huge resources. People should be presented with the updated chart from the Preamble every year. They could think for themselves about who and what to believe. The voice of people who are not doing greenwashing may be sorely missed at a time of serious decisions about changing the approach to climate protection. This, in my view, must come soon. If the approach to climate protection does not change, in a few years' time it should be clear whether or not I was wrong in my assessment of current climate protection.

**M:** *Can you provide some evidence for your critical assessment today?*

**J:** The reality of the failure to address the global climate problem and the amount of public money that has already been spent on it clearly illustrates this. These facts, in line with our definition of greenwashing, are not mentioned because they do not fit.

### ***5.3 International Energy Report Agency's report "Net Zero by 2050"***

**J:** I recently read the International Energy Agency's report "Net Zero by 2050, a roadmap for the global energy sector".<sup>17</sup> In its report, the International Energy Agency "lays out a path" to carbon neutrality for the planet. It envisages electricity generation from 90% renewable sources supplemented by no more than 10% generation from aging and new-build nuclear sources.

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<sup>17</sup> <https://iea.blob.core.windows.net/assets/ad0d4830-bd7e-47b6-838c-40d115733c13/NetZeroBy2050-ARoadmapfortheGlobalEnergySector.pdf>  
(IEA - InternationalEnergyAgency Report, 2022).

**M:** *Great, the path is set and we just need to implement it.*

**J:** It is in the realization of the ideas that the great difficulty lies. The Agency assumes that all the governments of the world will immediately adopt the plan presented in the report. They will somehow arrange for fossil energy sources to be replaced by renewable sources in their countries over the next 30 years. However, fossil resources will remain readily available and will become increasingly cheaper as demand for them falls. In addition, renewables will have to be integrated into ever more complex, larger, smarter managed and more expensive infrastructure networks. They will have to include an increasing number of storage elements or back-up sources. In other words, we want all the countries of the world to move intensively, on their own initiative, towards carbon neutrality, thereby significantly reducing their standard of living and competitiveness. In the report, we find many graphs and diagrams detailing what the state of global society in a carbon-free future should technically look like in many areas. However, the important political, economic and technical aspects that could make the implementation of the plan unrealistic are not mentioned or discussed.

**M:** *It's quite common to "forget" to mention what's not appropriate.*

**J:** There is also a lack of a basic idea of what motivational instruments will be used to trigger the transformation of society in all countries. How will the transition from a carbon to a carbon-free society be realized? The report mainly describes the end state. But the path to it won't be something like changing a light bulb or a pesky highway repair. It will be an unprecedentedly large project in time and space. It will place extreme demands on the quality of design, coordination and execution. The conflicting interests of many influential stakeholders will come into play.



We see complications accompanying projects that are many orders of magnitude simpler. For example, the construction of a nuclear power plant or the bringing of electricity from wind farms on the north coast of Germany to Bavaria. I have no choice but to regard the feasibility of the plan as envisaged by the International Energy Agency over the next 30 years as a chimera. I therefore consider this report to be another form of agency greenwashing, this time even blasphemed by the top leaders of the G7. I recommend that readers familiarize themselves with this report. All it takes is for the people of a few countries not to elect a government professing this "climate bible", a domino effect will occur and the climate plan dreamt up in the report will collapse.

**M:** *Who can be served by such a report?*

**J:** Look for financial interests behind everything. The energy lobbies are extremely wealthy and influential, but politicians can only benefit if they dominantly support the "right" ones. Then they will be able to justify to voters the huge flows of money from the state budget to private entities - the climate "saviors". If the plan described in the report becomes part of a country's policy, there will be a huge injection of public money into renewable energy. When the proportion of these fluctuating sources reaches an unacceptable level, there will be problems with security of energy supply. This is because the necessary and much more demanding control infrastructure with long-distance lines and backup sources will not be built in time. Then fossil sources will be at the mercy, at least in part. The plan assumes that coal and, in many countries, nuclear will be thrown overboard within the next 10 years. The energy world will be increasingly dominated by renewables, with a slightly declining share of natural gas and oil. But the political underpinnings of the plan's feasibility are unrealistic. Therefore, the share of renewables can be expected to reach barely 50 % globally in 2050 and total CO2 emissions

to fall by no more than half. Such a scenario is friendly to renewable electricity producers and oil and gas producers, but unacceptable to the climate crisis. The plan offers false hope.

**M:** *Could you give us a few quotes from the report so that we can get a better picture of it?*

**J:** Here are selected quotes (highlighted) with my comments.

- **"Even so, this remains a narrowly defined and extremely challenging process, requiring all stakeholders - governments, businesses, investors and citizens - to take action this year and every year thereafter to ensure that the target is truly met."** How can this be achieved? With a wave of a magic wand? It is a completely unrealistic demand, which condemns the whole plan (perhaps deliberately) to failure in advance and makes it easy to get out of accountability.
- **"The path set out in our plan is global in scope, but each country will have to design its own strategy, taking into account its specific circumstances. Plans need to reflect the different stages of countries' economic development: advanced economies will reach net zero earlier on our pathway than emerging economies."**or **"Without international cooperation, emissions will not fall to zero by 2050."** While achieving the goals depends on a harmonized approach and mutual cooperation, each country will have to design and apply its own approach. Much confusion can be expected as to what international cooperation should actually be based on. It was therefore appropriate for the report to suggest at least the basic principles of international cooperation on which countries could build.

- **"Policies need to be designed to send market signals that unlock new business models and mobilize private spending, especially in emerging economies."** That said, such policies are not yet known, let alone tested. Is every country supposed to start experimenting on its own? It would be far better to devise a uniform, simple and transparent global strategy that would help achieve the desired aims much more effectively and reliably.

**M:** *Interesting. The report describes the technical design in detail, the "right" end state, but doesn't care at all about its attainability.*

**J:** The fact that some influential politicians, even G7 leaders, take it seriously can be dangerous.

**M:** *Why?*

**J:** Because there is a complete lack of motivation for **all** countries to participate in the process. The leaders of the rich countries will only seek to achieve carbon neutrality in their own country. The global climate goal will not be even remotely achieved. I think that the developed countries have an obligation to take care of the **global** transition to carbon neutrality in the first place. Who else should do it?

**M:** *What vision does the report present for energy, fossil carbon and other raw materials?*

**J:** The report assumes that fossil carbon extraction will be reduced to only about 25% by 2050. Any remaining CO<sub>2</sub> emissions will be used or safely stored by Carbon Capture, Utilization and Storage (CCUS) technology to keep it out of the atmosphere. However, the technology for safe storage

of CO<sub>2</sub> has not been tested in the long term. In the future, it may cause problems unknown today. The report predicts that in 2050 we will need to generate about three times the amount of electricity compared to today, which is in line with my estimates. The current relatively small global share of electricity from nuclear will remain roughly the same in the mix. This means that by 2050, the capacity of nuclear power plants will need to triple. The proposed material-intensive restructuring of the global economy will require that the mineral extraction will be increased by factor of five! This is shocking to me.

**M:** *What will the minerals be needed for?*

**J:** It will be mainly ores of elements needed to provide electromobility and production of renewable and backup sources. The giant wind power towers will consume a lot of gravel, cement and steel to make reinforced concrete. A lot of metal will be needed to build large capacity electricity and pipelines. A number of new mines will need to be opened and adequate infrastructure and processing capacity built. This in itself is a daunting task for three decades. In addition, it will involve significant land take. The same requirements will arise for the installation of renewable and backup sources and the corresponding infrastructure. New line structures will be needed to distribute green hydrogen and transport CO<sub>2</sub> to its permanent storage sites. How will all this be accepted by the citizens around the mines and buildings? The NIMBY (Not In My Back Yard) effect is widely known. I didn't find in the report that it was considered in any particular way.

The report also fails to address the modest 20-30 year lifespan of renewables, which places additional ongoing financial demands on renewals and recycling. Therefore, I also have considerable doubts about the cost figures quoted in the report, which amount to around 5 trillion dollars per year globally. This is clearly not enough to implement the

transformation, and it is also an awful lot for the payers. An average of 600 dollars per head per year.

**M:** *What does the report say about nuclear sources?*

**J:** The report considers nuclear as part of the plan, so it sees it as an acceptable and safe technology. It is a great pity that the report does not consider an option with a much higher proportion of nuclear power. Nuclear plants with a lifetime of 60-100 years will provide reliable controllable power. In the case of multiple repeated construction and further technological development, they can be much cheaper than today. Moreover, the "nuclear" option would certainly be less demanding in terms of mineral extraction and land take. It would be built on already proven technologies that are still being improved. For four decades, the nuclear program has already provided France with a carbon footprint about half that of other advanced economies. Why is this not emphasized?

**M:** *The International Energy Agency report invites questions and comments. Did you participate?*

**J:** I sent my critical comments and did not get a response. Over 50 authors contributed to the report and over 80 reviewers across the world opposed it. Could there be anything wrong to criticize?

**M:** *You have to praise first and then criticize. With a representative, you had the opportunity to discuss the International Energy Agency in person at one of the COP summits we attended.*

**J:** Yes, I tried it. I appreciated the benefit of their report in that it revealed, at least in part, how technically and resource intensive the transition of global society to carbon neutrality will be. However, I also pointed out the unrealistic nature of the policy instruments described in the report that would lead to the implementation of their global decarbonization plan. This is where I stumbled and the discussion quickly ended.

## **5.4 Summit greenwashing**

**M:** *How do the COP climate summits actually work?*

**J:** Summits, or United Nations Climate Change Conferences, are annual meetings held under the United Nations Framework Convention on Climate Change (UNFCCC). They serve as formal meetings of the Parties to the UNFCCC to reach international agreements on how to address global climate change. The first meeting was held in 1995, and this is the twenty-eighth meeting in 2023.

We decided to go to two summits. But the decision is not nearly enough. An ordinary person has no chance to get to the summit, let alone present something at it. You either have to be part of a government delegation, an established organization or an active journalist. After a painstaking process of checking all the possibilities, thanks to your filmmaker friends and Czech Television, we got accreditation.

**M:** *The atmosphere of our mission is nicely described in Veronika Všíanská's (VV) report for A2larm "In a few days it is possible to knock on the whole world".<sup>18</sup> I am taking a piece of it with Picture 9:*



**Figure 9.** COP 25. Marta and Jiří before entering the climate conference in Madrid.

At the time of the UN summit in Madrid on 4-8 December 2019, both Minister Richard Brabec and Prime Minister Andrej Babiš were back home from Spain. Nevertheless, the Czech Republic was still unofficially represented at the UN global climate change conference (COP 25). At the Madrid exhibition center, a tall, bearded grey man with a shabby satchel was among the selected delegation. A few other people with trunks were milling around him.

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<sup>18</sup> Full report from COP25 for A2larm (20 Jan 2020)  
<https://a2larm.cz/2020/01/za-par-dni-je-mozne-zaklepat-na-cely-svet>

**VV:** *Did you know there are cloakrooms in the back?*

**J:** We don't want a cloakroom. We have to be ready all the time. We carry our filming equipment in our crossbodies and I have brochures that I hand out to people. There are 29,000 accredited conference attendees.

**VV:** *You hand out flyers, but on your nametag I see Jiri Svoboda, PRESS. How am I supposed to understand that?*

**J:** I'm a scientist, a materials physicist, and I've also been interested in planetary protection for a long time. My daughter is making a documentary about climate change and insisted that I be part of it. She said, "Dad, stop writing for those environmental magazines. It's always the same people reading it, it has no effect. Let's go to where these problems are being solved."

**VV:** *Was she right?*

**J:** Yes and no. It says "Time For Action" everywhere... But as I observe, there is a call for action, but no systemic idea of what to do about it. I mean, how to actually effectively reduce greenhouse gas emissions.

**VV:** *And you have the idea for the event?*

**J:** Here it is written (pulls out a flyer). Do you want the English or Spanish version? I've been working on the concept of a Uniform Global Carbon Tax and a 100% Dividend in my spare time for over a decade. I'd like to have a substantive and constructive discussion with someone here. There is hardly anyone to talk to in the Czech Republic and no one responds to emails abroad.



**VV:** *If your idea has no support in the Czech Republic, why do you think it would have support elsewhere in the world?*

**J:** I'm not giving up in the Czech Republic. But most people in our country make excuses that they can't change anything in this respect. The European Union has been running on emission allowances for over twenty years, and although the system is demonstrably leaky and dysfunctional, no one is willing to do anything about it. Not even the Director of the Climate Change Unit of the Ministry of the Environment, to whom I offered my concept for presentation at the summit. "You could come up with something new," I persuaded him, but he didn't join us to his delegation (laughs).

**VV:** *So you came here on your own...?*

**J:** Yes, I took time off work, my daughter printed flyers and got a cameraman. My wife made a website and bought us muesli bars for the trip. Cheese and salami are cheaper here than in the Czech Republic.

**VV:** *Did Greta Thunberg make an appearance?*

**J:** Unexpectedly, she showed up right here at the conference, not far from us, at the Fridays For Future silent strike we were filming. Then she also spoke at a huge demonstration on the streets of Madrid. She was still surrounded by journalists, but we managed to give her our letter.

**VV:** *What did you write to her?*

**J:** On the cover it was For Greta's Inspiration and inside was a suggestion that Fridays For Future could strike with a specific agenda, i.e. a tool to

address the situation, rather than just demonstrating for the climate in general. And I described my tool in detail there.

**VV:** *And will you describe it for us?*

Voluntary modesty is a unique characteristic on which we cannot base saving the planet. I've accepted that we can't change in this way most people's behavior, and I'm using their traditional behavior to save the climate. Planet Earth, like its atmosphere, is all of us. We should therefore have one benchmark for greenhouse gas emissions - to put a uniform global fee on emissions. No matter, whether they are emitted in China, in America or here.

**VV:** *That sounds logical, doesn't it work that way now?*

**J:** No. Until now, each country has determined its own way of reducing emissions. At the summits, they then sign up to more or less ambitious targets for how much they will reduce their emissions and by when. But there are no sanctions for failing to meet these commitments. Then anything can be promised with impunity.

**VV:** *And who and how should punish these sinful states? There would have to be a global authority with incentives.*

**J:** We have the UN. If UN likes the plan I've presented, UN will get those incentives too. That is the collected carbon tax that would be paid by miners around the world.

**VV:** *That's pretty ambitious. Does the UN know about your plans?*

**J:** Yes. When I wrote to them in the summer, they recommended that I contact individual representatives of countries with the idea and get their support. And that's what I'm doing, especially here at COP 25. Because every country represented here has its own door, so in a few days it's possible to knock on the whole world's door. Yesterday, I was in Africa and the Americas, now I am coming from Asia and tomorrow I am planning Europe, NGOs and universities.

**VV:** *What did you tell them?*

**J:** Hello, I have developed the concept of a uniform global carbon tax. Please give this document to the responsible people in your country. Read it and consider whether it is a reasonable proposal. I am interested in your opinion and would like to ask for your support. It was nice to meet you.

**VV:** *It was nice to meet you too.*

~

**M:** *When we came back from the summit, I felt that we had really achieved something. We weren't in the news, but we handed out thousands of flyers, gave out hundreds of brochures and talked to almost all the national representatives.*

**J:** And then we didn't hear from anybody. Our success rate can be compared to the effect of the first ten drops of water to break up solid rock.

**M:** But you once commented more jokingly: "The response was huge, but immeasurable." And because of that, I gathered the strength to try to make it more professional at the next COP26 summit in Glasgow (2021), see Figure 10.



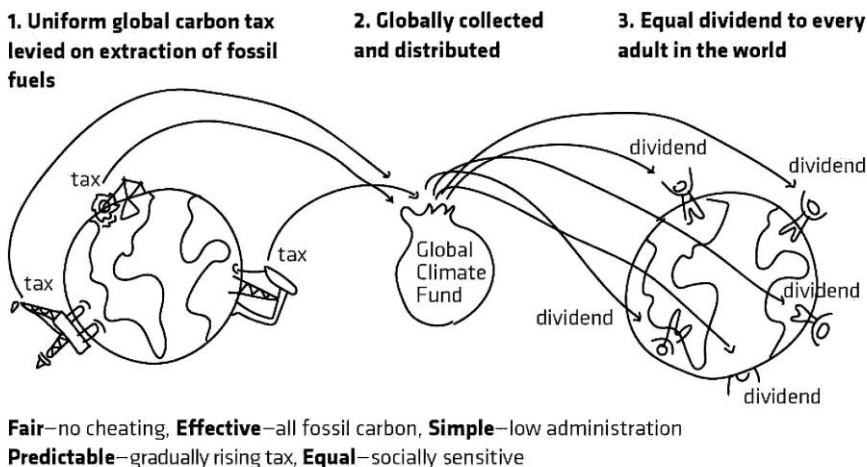
**Figure 10.** COP 26. The Glasgow summit could have been a turning point. From left: Ian Parry (International Monetary Fund), Alexander Ač (Czech Globe), Jiří and Marta.

**J:** The Glasgow summit (at the time of the covid) was attended by over 20,000 participants, including hundreds of important heads of state and government. The slogan was: TOGETHER FOR OUR PLANET. The queue on the first day at the entrance went to a 2 hour standstill. It was a herd event. I used it right away to distribute flyers; let the participants read and not just stand around. The atmosphere was not as exuberant as at COP25 in Madrid. Glasgow was talked about as the last chance for the

world to agree on a common approach. So here we were with our plan in the right place.

**M:** *We had vaccination checks, daily test results, passports, invitation letters. All this was even more stringent because of the covid. I couldn't even get away with a metal spoon. They confiscated it so I wouldn't poke someone's eye out with it. And I had to unpack the tube with our poster "Uniform Global Carbon Tax and 100% Dividend" in front of the security guards, see Figure 11.*

**J:** I had to take my 10 kg of flyers out of my backpack. The security guys approved it for a quarter of an hour before they let me go. Only Alex Ač got through without any trouble because he was walking lightly.



**Figure 11:** The carbon fee collection and redistribution scheme from our poster for COP26.

**M:** *The conference aimed, among other things, to find common rules for carbon trading. In four days, we intended to communicate that carbon should be taxed directly at the point of extraction, and globally, not locally. However, most of the negotiations took place behind closed doors, which we did not get to.*

*I had arranged an interview with Ian Parry of the International Monetary Fund (IMF) in advance. After all, according to the latest report they had issued, we could become allies, I cheered. But the IMF recommends not a uniform global carbon fee, but a minimum.<sup>19</sup> carbon fee (called a Price Floor) for the whole world, with different rates depending on the wealth of each country. Parry argued that if, for example, Europe started now with a fee increasing from zero, it would not have the desired effect for several years.*

**J:** I countered that it would be possible to continue with the current system of emission allowances, gradually phasing out and replacing it with a global carbon fee. But Parry saw another problem in the global distribution of the accumulated fee. Although he liked the idea that our concept would benefit poor, low-emitting countries, he did not believe that high-emitting countries would give up the money they had collected for carbon. He pointed out that each country must find some benefits in the concept or they would not sign up to it. Parry said he would be satisfied if a carbon fee could be pushed through in at least a few of the world's most powerful economies. But that's not enough.

**M:** *Not even to begin with?*

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<sup>19</sup> The fee per tonne of CO<sub>2</sub> is scaled to \$25, \$50 and \$70 for individual countries according to the level of development of their economies, according to the IMF proposal. More in Parry, I., Black, S., Roaf, J. (2021). Proposal for an International Carbon Price Floor among Large Emitters. IMF Staff Climate Notes 2021/001, International Monetary Fund, Washington, DC.

**J:** Unless the fee is uniform, there will always be complex carbon offsets to do at the borders. And if at least some of the money collected from the carbon fee does not automatically flow to poor developing countries, it will be difficult to find resources elsewhere.

**M:** *We had a similar debate with the officer of Czech Ministry of the Environment Pavel Zámyslický, who stubbornly defended the current system of emission allowances in the EU, arguing that they should be extended to transport and housing. He saw the Carbon Border Adjustment Method (CBAM) as a necessary tool to prevent the shifting of production of carbon-intensive products to, for example, Asia and their cheap import. He acknowledged that negotiations on the level of the CBAM would be extremely complex and that far from all commodities and products could be included.*

**J:** So, the carbon pricing system will remain leaky. The system will continue in failing.

**M:** *Efforts to meet with representatives of the European Commission, the Saudi prince and a platform representing developing African countries have failed.*

**J:** And how did the proven poster turn out?

**M:** *We finally pulled it out in the corridor in the hall. This is where the conference participants were flowing towards the exit. Some were just passing by, others were stopping, having lively debates with us. But by far the security guards were the most interested. The latter only half-listened to our explanation and was primarily interested in the UN's permission for an impromptu presentation in an unusual location. We*

*didn't have that. So we rolled up the poster and went... Do you think we could have done more at the summit as three individuals?*

**J:** Probably not. We can be glad we weren't kicked out at the entrance.

**M:** *And isn't it unfair that it's an event only for the chosen few?*

**J:** I am convinced that there was a sincere effort to do something about the global climate at the first COP summits. Although the technical capacity to mitigate climate disruption has improved many times over in that time, it has not significantly helped climate protection. It is becoming increasingly clear that what is causing the failure in climate protection is the current approach based on political decision-making, where non-binding promises are no longer seen as reality. But the organizers and prominent participants in climate summits can hardly be expected to admit a mistake. You expect them to say: "We haven't done it well enough so far, let's find a way to fix it?" If the climate summits refuse to see the elementary reality of the chart in the Preface, they become mere show for 8 billion viewers. This summit greenwashing was seen through by Greta Thunberg when she rated COP26 as "blah, blah, blah".

**M:** *Apparently she didn't register our ten drops that hit the rock.*

**J:** Every despair plants a new seed of hope, and this makes it possible not to give up. The main objectives of the summit, i.e. the promises to phase out coal-fired power generation, to fill the Green Climate Fund with the necessary money and to use it primarily for adaptation measures in the developing countries most affected by climate change, were not achieved. COP26 will not bring about the necessary reversal of the



current trend in global emissions of greenhouse gases, especially CO<sub>2</sub>. Nor have the unenforceable promises made by representatives of the participating countries lived up to expectations. Between COP25 and COP26 we have wasted another two years of increasingly precious time. And another year of wasted time has passed until the COP27 summit in Sharm El-Sheikh, Egypt. And I quite doubt that anything will change fundamentally at COP28 in Dubai.

**M:** *Where is the seed of hope!?*

**J:** The format of the COP25-COP27 summits and their outcomes have amply demonstrated the powerlessness, ineffectiveness and apparently wrong approach to tackling global climate change to date, see the chart in the Preface. This allows me to formulate the most important outcome of the COP25-COP27 summits for me:

**"The long-term approach is not leading to the necessary mitigation of global climate change and it is therefore inevitable to rethink this approach at the most basic level. If this unintended outcome were widely accepted and properly reflected, COP25-COP27 would be groundbreaking summits."**

**M:** *So, do you want to stand climate protection efforts to date on their head? And do you want world leaders to recognize that?*

**J:** Just look at the track record of the conventions. It is foolish to base solutions to global climate change on inconsistent and ever-changing policies of sovereign governments and their unenforceable promises. Governments in individual countries are elected on the basis of voter sentiment. It is naive to assume that the financially and organizationally unprecedentedly challenging task of protecting the global climate has a

chance of **permanently placing itself at** the top of the government agendas **of the vast majority of** countries. Unless voters in a few major countries elect governments that support climate protection, the global effort will collapse like a house of cards. Citizens of other countries will see indispensable "stowaways" and will be unwilling to pay "fares" even for themselves, let alone for these stowaways. There is no time for such political experiments. Perhaps, one glimmer of hope did at COP26. The voices of leaders such as Canadian Prime Minister Justin Trudeau or Kristalina Georgieva, Executive Director of International Monetary Fund, which called for a global carbon price. "We believe that a carbon tax is the best way forward. It is the most effective," Georgieva said, adding that imposing carbon tariffs would be a "nightmare" for the World Trade Organization.<sup>20</sup> This little spark cannot be relied upon to do anything significant. We need to do everything we can to help it and to ensure that the resulting flame spreads in the right direction. There is undoubtedly a danger of improper development.

Parliamentary democracy is a more or less well-functioning instrument of governance within countries. Even COP25-COP27 made it clear that every government tries to protect the interests of **its** citizens first and foremost, even if it is at the expense of other countries. Therefore, we cannot be surprised at the poor results of the summits. To build a colossal global project on such shaky foundations is, in my opinion, irresponsible and doomed to failure. These considerations warrant a fundamental question that is not of my own mind: **"Is there any principled compatibility between parliamentary democracy and effective global climate protection?"**

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<sup>20</sup> <https://www.cbc.ca/news/politics/trudeau-carbon-tax-global-1.6233936>  
(article in CBC News, Canada's public news and information service, Jan. 20, 2020).

**M:** *You've brought up some very serious issues that people will probably have to deal with. The sooner, the better.*

## **6. LET'S GIVE CARBON AN ADEQUATE PRICE!**

**M:** *Let's go back to the current real politics. It would be unfair to say that politicians are only addressing climate protection with extortionate subsidy programs and not using the market-based economic instruments you call for.*

**J:** There is a long experience with the functioning of the market and there is a general consensus among economists about its principles and laws. If **all** fossil carbon emissions were assigned **a uniform** adequately high and increasing price over time, this would naturally provide a motivation to reduce the combusting of fossil carbon in the most efficient ways. Both the motivation and the effect on climate protection would grow in proportion to the level of the carbon price. It would also allow the rate of global society's transition to carbon neutrality to be easily regulated.

**M:** *What has already been done to price carbon?*

**J:** Real politics is not about failing to push for the right thing, but about being able to find and push for at least a compromise. The Kyoto Protocol, negotiated in 1997 at the COP3 climate summit, is an example of such a "at least" compromise. Here, most countries committed to adopt an Emissions Trading System (ETS). The main idea behind an

ETS is that, for example, a government authority sets a declining cap on the total amount of CO<sub>2</sub> emissions in its country each year. Individual companies are then allocated or sold emission allowances up to the cap. These can be traded between companies. In this way, the cheapest anti-emission measures at a given time should be implemented in the companies best placed to do so. In other words, the most affordable raisins should always be taken. The price of an emission allowance is set by the market in dependence on the chosen rate of reduction of the cap on total emissions.

**M:** *That's exactly what you want!*

**J:** Unfortunately, this seemingly good idea causes many difficulties in practice. I would like to mention at least the most serious ones.

- Assessing the CO<sub>2</sub> emissions of enterprises is administratively demanding and therefore only large enterprises, mostly in heavy industry, are included in the system. Therefore, the ETS covers only about 50% of emissions in the countries where it is implemented.
- There are no clear and uniform rules on how to set country-by-country caps on how many allowances will be allocated free of charge to individual companies and how many will be sold.
- Giving politicians and officials the power to make decisions under unclear rules is a breeding ground for corruption. Even the emissions trading itself has given rise to a number of prosecutions for fraud.
- The price of an allowance is difficult to predict, can fluctuate widely and can severely destabilize the economy.

If we want to increase the pressure by moving the piston in the cylinder, the system must be tight. The ETS can be compared to an engine with a hole in the piston. It is astonishing that such a vaguely worded and poorly functioning system has taken hold. I understand that at the time of COP3

the ETS was better than nothing. But the ETS, despite its serious shortcomings, is still in operation in many countries today, and is even regarded in the EU as a pillar for implementing pro-climate action.

**M:** *Putting a price on carbon can also be done by introducing a national carbon tax. That could work better.*

**J:** In some ways yes, in some ways no. High carbon commodities or products are taxed in countries with a carbon tax in a similar way to excise duties on alcohol, tobacco or fuel. The advantage is that the level of the national carbon tax can be changed operationally or the planned development of the tax level can be notified. Whereas in the ETS only big companies are the payers of carbon emissions, in the case of a national carbon tax all those who purchase the taxed commodities or products pay for the carbon. In countries with a national carbon tax, again only about 50% of CO<sub>2</sub> emissions are covered in this way.

**M:** *If we cleverly combine subsidy programs, the ETS and national carbon taxes, it could work in the end.*

**J:** I quite doubt I can make a tasty meatloaf from a mixture of skin, hooves and horns. The subsidy system is unfair because it only supports selected anti-emission measures. The ETS is unfair because it burdens and perhaps even favors certain businesses. A national carbon tax is unfair because it only burdens selected commodities and products. How should it work, for example, in a country with both an ETS and a carbon tax in place? Is a company supposed to pay for the carbon taxed also by buying emission allowances? The pro-climate system in the EU and other countries is crowned by the fact that all revenues from emission allowances will have to be used to support low-carbon measures.

**M:** *Why do you think it's bad?*

**J:** On the one hand, a functioning market is needed to ensure the effectiveness of the ETS and carbon taxes; on the other hand, the market function is paralyzed by subsidy programs. This must be seen by economists as putting sand between the wheels of the market machine, but they are curiously silent. And since all this is decided "entirely disinterestedly" by bureaucrats and politicians, the system appears indestructible. It is mainly for the benefit of its main players, not for the benefit of climate protection. It is precisely such climate policy instruments that are praised in the International Energy Agency's report.

**M:** *How much of global emissions are covered by the ETS and national carbon taxes today?*

**J:** In 2020, ETS and national carbon taxes together covered only about 20% of global emissions.<sup>21</sup> CO<sub>2</sub> eq. They paid on average around 30 dollars per tone of CO<sub>2</sub>. The remaining 80% of CO<sub>2</sub> emissions were out of control. In many countries carbon is not priced in any way, high-carbon products are cheaper to produce there and the goods are more competitive on world markets. In order to compensate for this mismatch in international trade between countries with different carbon prices, the introduction of the Carbon Border Adjustment (CBA), already mentioned, is being considered. The International Energy Agency's report also describes this as a positive measure.

**M:** *Introducing carbon tariffs would require determining the carbon footprint of every traded product. But how to properly account for*

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<sup>21</sup> The World Bank Group, Carbon Pricing Dashboard, Map & Data, [https://carbonpricingdashboard.worldbank.org/map\\_data](https://carbonpricingdashboard.worldbank.org/map_data) (Jan. 20, 2022).

*everything: the extraction of the necessary raw materials, the construction of the factory and its operation, the actual production, the transport, the carbon footprint of the factory workers... What about the carbon footprint of the officials calculating the carbon footprint of the product?*

**J:** Yes, it will lead to a further expansion of the administration. In addition, there will be a need to set different carbon tariffs on the same products when trading between countries with different carbon prices. This may end up with carbon duties being levied only on the most carbon-intensive commodities and products. The pressure in deciding what to include and what not to include in a carbon tariff system will be enormous. If we want to combat corruption in society, we cannot create more fertile ground for it. The pricing of fossil carbon should incentivize a reduction in the amount of carbon combusted. Instead, the leaky and complex system will look for the cleverest ways to avoid paying for carbon or to enrich themselves undeservedly.

**M:** *History shows that many civilizations (e.g. the Roman Empire) have also perished because bureaucracy ate its creators.*<sup>22</sup>

**J:** If the climate crisis is to be addressed with existing and planned instruments, which will be increasingly applied, history may repeat itself.

**M:** *We currently have the European Green Deal.*<sup>23</sup> *In your opinion, doesn't it bring hope?*

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<sup>22</sup> <https://www.national-geographic.cz/clanky/proc-padl-anticky-rim-kvuli-problemum-ktery-mi-trpi-i-nase-civilizace.html> (January 20, 2022).

**J:** The main objective of the Green Deal is to achieve EU climate neutrality by 2050. The deal includes a plan to reduce EU greenhouse gas emissions by 55% by 2030 compared to 1990 levels. Until recently, this was only 45%. The agreement does not tell individual countries what technical measures and policy instruments to use to achieve the targets. Nevertheless, the European ETS remains the decisive economic instrument. Implementing the agreement is expected to cost 260 billion euro a year in additional investment and a significant increase in administration. Current EU emissions represent less than a tenth of global emissions. The Green Deal may be the "hope" for EU decarbonization, but it does not offer any hope of tackling global climate disruption. Would it not be better for the EU to make a cheaper contribution to, say, 30-20% of global decarbonization, rather than just playing on its own turf? The incentive instruments for mitigating climate disruption mentioned in the agreement are not innovative, but rather outdated and their inappropriateness has been proven in practice. This is mainly why the agreement does not fill me with optimism.

A politician can plan anything. But if he does not have good political tools to execute the plan, planning is meaningless. The plan can then become a hammer. I would do the opposite. I would create the most appropriate and motivating conditions for solving the problem and let events run their course. Naively, I thought the five-year plan was a socialist relict. It is right to put a price on fossil carbon. But let us implement a way of doing so that covers all its global emissions simply, fairly and with minimum administration. A way that does not paralyze the most important economic instruments for the further development of global civilization. Progress is not determined by the spontaneous

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<sup>23</sup> Green Deal for Europe, [https://czechia.representation.ec.europa.eu/strategie-priority/klicove-politiky-eu-pro-ceskou-republiku\\_cs](https://czechia.representation.ec.europa.eu/strategie-priority/klicove-politiky-eu-pro-ceskou-republiku_cs) (Dec. 12, 2022).



evolution of society towards complexity and the growth of bureaucracy. Progress requires making the occasional radical cut that brings simplicity, efficiency and a new quality to the social system. The current approach to climate protection has been ripe for such a cut for many years. But its actors do not want to admit it.

**M:** *So how can all fossil carbon be priced simply, uniformly and fairly?*

**J:** I need a whole chapter for that.

# 7. THE CONCEPT OF A UNIFORM GLOBAL CARBON FEE AND ITS 100% DIVIDEND

**J:** The promising concept of a national carbon tax on fossil fuel extraction and a 100% dividend for the US was formulated and presented in 2009 by James E. Hansen.<sup>24</sup> He was formerly director of NASA's Goddard Institute for Space Studies and is now head of the Earth Institute at Columbia University. Hansen proposed that the country impose an increasing tax over time on all carbon contained in extracted or imported fossil fuels. The tax, when added to the price of fossil fuels, would automatically be reflected in the prices of all products and services according to their exact carbon footprint, without any counting or additional administration, see Figure 12. In order to compensate people for the increase in prices by taxing fossil carbon, the tax collected is then distributed across the board to all people in the country. This is called a 100% dividend. Low carbon products and services effectively become cheaper, high carbon ones more expensive. The demand for low carbon products will be increasing permanently and their production will grow at the expense of high carbon products. There will be systematic economic pressure to reduce fossil carbon consumption in all areas of

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<sup>24</sup> Carbon Tax & 100% Dividend vs. Tax & Trade, Testimony of James E. Hansen to Committee on Ways and Means U.S. House of Representatives, February 25, 2009, [http://www.columbia.edu/~jeh1/2009/WaysAndMeans\\_20090225.pdf](http://www.columbia.edu/~jeh1/2009/WaysAndMeans_20090225.pdf) (Jan. 20, 2022).

society. People's consumption basket and corporate behavior will spontaneously change in favor of reducing their carbon footprint. Free market decision-making will be strengthened, and this will determine which low-carbon measures are most appropriate and feasible at a given time and place.



**Figure 12.** Projection of fossil carbon pricing into product prices.

**M:** *Low carbon subsidies will no longer be needed?*

**J:** Subsidies will need to be removed as quickly as possible so that they stop distorting the market. As demand for fossil carbon falls, fossil fuel extraction will become unviable, and banks and mining companies will stop investing in it. The most viable strategies for phasing out fossil fuel extraction and switching first to low-carbon and then to zero-carbon

activities will be sought. Low-income households, which can be expected to have a low carbon footprint, will benefit from the system, people with a high carbon footprint will pay the price. There will be a net flow of money from high carbon footprint people to low carbon footprint people. Social scissors will be tightened, it will cost the state budget nothing.

If we want to change something in society for the better, it is much more effective to systematically suppress the bad by charging than to subsidize the good. The system of excise duties on alcohol, tobacco and fuel is a recognized and commonly used instrument in developed market economies. This is how societies manage to suppress unhealthy smoking and drinking and ensure acceptable road and highway traffic. Today, it would probably not occur to anyone to suppress smoking and drinking by subsidizing chewing gum and soft drinks. It is a matter of principle to proceed to subsidies only when it cannot be technically solved by consistently charging for the wrong thing. Hansen's concept is actually a modification of a fossil carbon tax for climate protection, and the dividend is added to reduce social inequalities.

**M:** *That sounds beautiful. That's how the US could have functioned for ten years.*

**J:** Hansen's concept is beautifully administratively simple. It will cover 100% of the carbon from imported and U.S.-produced fossil fuels and automatically value (i.e., support) anything low-carbon produced in the U.S. Hansen even discussed his concept with prominent US politicians, but failed. But even this concept has its flaws if we want to address the climate crisis globally, not just reduce CO<sub>2</sub> emissions in one country.

**M:** *What defects?*

**J:** Let's imagine an ideal case where every country in the world accepted this concept and the carbon tax was the same everywhere. There would then be no point in paying carbon tariffs, so there would be no duty or tax on imported fossil fuels. But then the carbon fee would remain in the countries where the fossil fuel was extracted. This would be unfair, because countries that extract fossil fuels massively would become even richer at the expense of countries without fossil fuel resources. If Hansen's concept were applied consistently and a tax were also paid on imported fuels, the tax would be paid twice on those fuels. But that makes no sense. Therefore, exported fossil fuels would have to be exempt from the extraction tax. Then each country would collect a carbon tax equivalent to its fossil fuel consumption. This would be unfair to low carbon countries that have contributed nothing to climate disruption and are being harmed by it just as much, if not more.

A system needs to be devised so that the people and countries with the lowest carbon footprint and those most vulnerable to climate change are rewarded the most. The key issue is not only how to collect the carbon levy on fossil fuels consistently, but also how to dispose of it in the **most appropriate way**.

**M:** *Politics should be all about how to use the money properly. What do you suggest?*

**J:** In 2019, the International Monetary Fund<sup>25</sup> published the following thoughts in its Fiscal Monitoring Report (emphasis added):

**"Carbon taxes levied on the supply of fossil fuels (e.g. from oil refineries, coal mines, processing plants) in proportion to their carbon content are the strongest and most effective tool because they allow**

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<sup>25</sup> <https://www.imf.org/en/Publications/FM/Issues/2019/10/16/Fiscal-Monitor-October-2019-How-to-Mitigate-Climate-Change-47027> (February 20, 2022).

**companies and households to find the lowest cost ways to reduce energy consumption and switch to cleaner alternatives...", "Limiting global warming to 2°C or less requires ambitious policy measures, such as the immediate implementation of a global carbon tax, which will quickly rise to \$75 per tonne of CO<sub>2</sub> in 2030." Or "... if we use the carbon tax collected as a 100% dividend to the entire population, it will benefit lower income groups; if we use the income tax reduction, it will increase economic efficiency."**

This is the IMF's obvious guide to extending Hansen's concept to the whole world. Unfortunately, these three sentences appear in three different places in the two-page document as three separate, tersely stated recommendations. They are not presented as a coherent concept that is emphasized in the text, so few people will put the pieces together. It is as if the IMF does not have the courage to push for something radical in the matter of global climate protection. Even though it itself writes that it is the most correct and therefore necessary thing to do.

**M:** *What characteristics do you think the "right" concept for global climate protection should have?*

**J:** The concept should be based on exactly what the International Monetary Fund has published. The concept should be simple, fair and without the possibility of cheating. It should cover with minimal administration all global fossil carbon emissions and take into account social and climate (environmental) justice. All these are, in my opinion, necessary conditions for success in tackling the unprecedentedly complex problem of the climate crisis. Let us call the concept "A uniform global time-progressive carbon fee on fossil fuel extraction and its 100% dividend". For short, we will call it the Global Carbon Fee and 100% Dividend (GCFD).

**M:** *Why are you suddenly using the word fee instead of tax?*

**J:** By definition, a tax must always go to the state budget of a country and there is no way to determine how it is disposed of. The fee has no such restrictions. Moreover, the word tax is perceived negatively by many people.

**M:** *As you indicated in the introduction, your concept is based on the belief that to effectively protect the climate, we need to preserve the natural market behavior of people and companies. It is therefore not necessary to abolish capitalism, but rather to utilize it appropriately.*

**J:** For capitalism to provide a solution, we must remove one of the most serious negative externalities, fossil CO<sub>2</sub> emissions, by consistently charging for them. It is necessary to make a thorough but acceptable modification of the rules for the functioning of the global market, so that all green behavior becomes economically profitable and economically profitable behavior is automatically green, see Figure 13. In global economy modified in this way, only the most necessary but most important changes in favor of carbon neutrality will be pushed through spontaneously, without us having to manage or enforce anything.



**Figure 13:** Converting carbon footprint to money. By changing the rules, people's natural economic behavior becomes green. And vice versa.

**M:** *On what assumptions is the concept based?*

**J:** The concept is based on the following premises:

- People want to retain the freedom to choose how to meet their needs with the money they earn.
- The increase in the concentration of CO<sub>2</sub> in the atmosphere is the most significant cause of the current global climate disruption.
- Carbon in fossil fuels, regardless of which country it is extracted or combusted in, is the main cause of the increase in the concentration of CO<sub>2</sub> in the atmosphere. We need to start reducing its extraction and combusting as quickly as possible.
- The atmosphere is the common property of all people and they want to protect it. All people should pay equally and proportionately for the damage to the atmosphere caused by CO<sub>2</sub> emissions.
- The people, through their elected representatives, agree on a common scenario of charging for fossil carbon extraction.
- All collected carbon fees will be distributed to all countries or directly to the people according to agreed rules (100% dividend).

**M:** *If the atmosphere is to belong to everyone, wouldn't it be better to look at the problem from the point of view that all adults on Earth are equal shareholders in the atmosphere?*

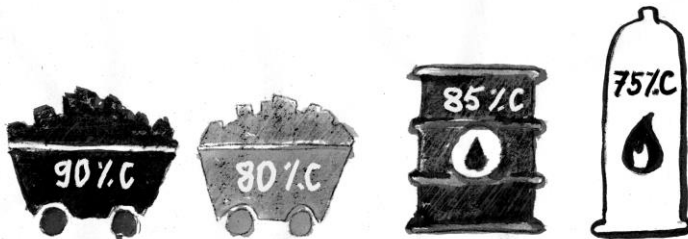
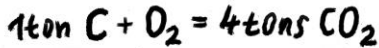
**J:** Maybe so. Let a global climate corporation be established and given ownership of the atmosphere, or even the biosphere. All adult humans on Earth could become free shareholders. It would not be possible to trade shares or force anyone to become a shareholder with the acceptance that they would forfeit dividends. Shareholders would elect their climate



representatives, who would have to agree on the level of carbon fees and their increase over time. They would also have to ensure that the fees are collected from the miners and that dividends are paid according to rules set by them. This would take the whole climate agenda out of the politics and governance of individual countries, and everything would be done at the level of a global joint stock company. There would certainly be a lot of work for lawyers to do to get everything implemented and legalized correctly. The Climate Joint Stock Company would be a one-stop global non-political climate protection organization. If all goes well, its remit could be extended to other areas of planetary protection. But these would only be problems that can be solved by an easy charging for undesirable phenomena and distributing a dividend as e.g. mining of minerals.

**M:** *So let's try to get the idea of a global climate stock company out into the world with this book and see. But let's go back to your basic thesis. How would the GCFD concept work in practice?*

**J:** After the adoption of the GCFD, all mining companies in the world would start paying an agreed carbon fee to the Global Climate Fund for all the carbon they extract (see Figure 14). This could be administered by, for example, the International Monetary Fund or the World Bank. All mining companies would sell fossil fuels at their prices plus the uniform carbon fee. This would in no way distort competition between, for example, oil producers. However, it would relatively favor lower carbon and higher hydrogen fuels such as natural gas over coal, see Figure 14. No calculations would be needed. World trade would not be hampered by carbon tariffs. It would be simple, fair, accurate, almost administration-free and with a realistic ambition to cover 100% of global fossil carbon.



**Figure 14:** There is no need for complex carbon pricing , but it is sufficient to charge consistently for all fossil carbon extraction. The containers show the approximate carbon content of each fossil fuel. The figure shows that 1 tonne of coal will be charged the most.

**M:** *Correctly, fossil carbon pricing should also apply to limestone mining for cement production.*

**J:** Yes, the extraction of this fossil carbon also needs to be included in the system.

**M:** *But we can't suddenly introduce a global carbon fee and fundamentally change the global economic landscape.*

**J:** It is important that carbon prices start low and rise over time according to a pre-known binding medium-term scenario for 10-30 years. This will

avoid economic shocks and allow all market participants to plan their strategic decisions. This certainty is desperately lacking today. The most advantageous decarbonization measures will be implemented at any moment. The less favorable ones will come later, when the carbon price has risen sufficiently. All fossil carbon will be covered with minimal bureaucracy, there will be no room for fraud. This is a technically simple adjustment to the global market rules: a set fee is paid for a tone of carbon extracted in a given year. It would be relatively easy for climate representatives of all countries to agree on the rate of increase of the fee. The known scenario of carbon fee increases and the resulting projected demand trends will give miners the data to decide which mines and wells to close and to switch to other activities.

***M:** I wonder how the miners will "appreciate" being able to close their mines and wells by their own decision. So products with a high carbon footprint will become more expensive and less in demand.*

**J:** Yes, they will gradually disappear from the consumer basket and stop being produced. They will therefore not even be available to the rich who would like to senselessly sabotage climate protection. The price of raw materials for the production of plastics, for example, will also rise. This will naturally increase the pressure to save and recycle them.

***M:** The concept therefore does not anticipate any technical solution for reducing CO<sub>2</sub> emissions.*

**J:** Exactly. The concept seeks to create the best possible **global social environment** that will cause the **spontaneous** transition of the development of global society into a carbon-free corridor. Everything should work on the basis of free decision-making within the least

distorted market. Any reduction in CO<sub>2</sub> emissions, for example by introducing a new technology, an energy-saving measure or a change in the behavior of anyone anywhere in the world, will always be **fairly** rewarded. It will be reflected in reduced costs. In this way, there will be a steadily increasing pressure for the complete decarbonization of the entire global society. It will all work with little administration and no expenditure of public funds. The familiar scenario of increasing the carbon fee will give clear signals to businesses and consumers as to where and how far in advance to invest. I consider a market where charging removes as many negative externalities as possible to be freer, fairer and less distorted than a "classically" understood free market with negative externalities tolerated.

**M:** *Can you be sure that a relative reduction in the price of low-carbon products will increase demand from shoppers? Knowing people, they usually buy what they just need and don't pay much attention to price.*

**J:** I do behave in a market-like way when shopping, but I recognize that many people do behave as you say. For those people, the interplay between price and ecology might be appealing. Plus, at least for a transitional period, there will be cheaper low-carbon and more expensive high-carbon products side by side. Why should shoppers reach for the more expensive high-carbon product? In any case, market behavior can be relied upon by companies. I doubt that the shopper would not choose the cheaper low carbon option and risk being fired.

**M:** *At what rate would it be appropriate to increase the carbon fee?*

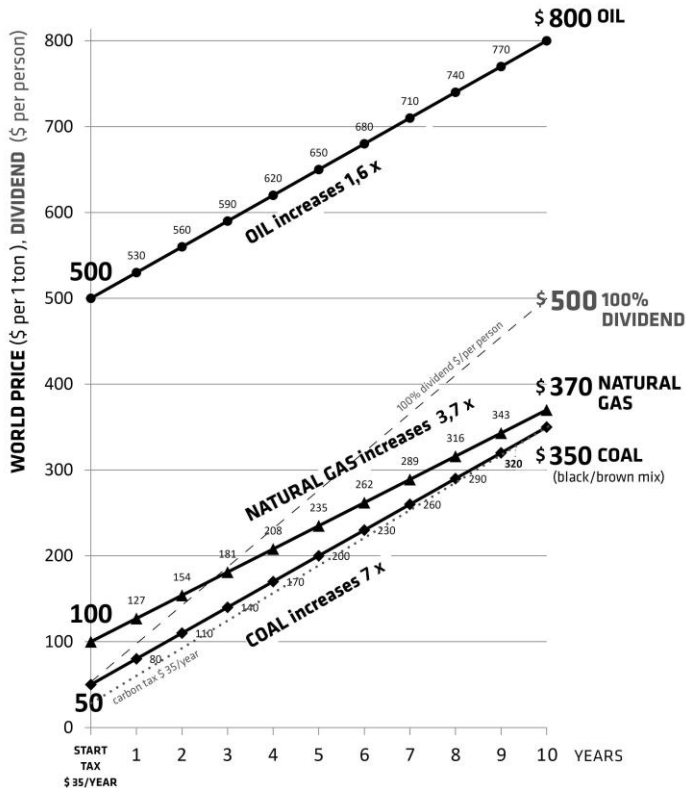
**J:** The initial level of the global carbon fee and its development should be the subject of negotiations among climate representatives of all countries.

I expect that the fee could be set at 35 dollars per tone of carbon extracted in the first year. This is about 10 dollars per tone of CO<sub>2</sub>, which is acceptable even for poorer countries. A year-on-year increase in the fee can also be expected at 35 dollars per tone of carbon extracted, see Figure 15. Such a scenario is almost identical to the IMF's proposals published again in its 2019 fiscal monitoring report.<sup>26</sup> According to IMF experts, this scenario could lead to a reduction in global CO<sub>2</sub> emissions from fossil fuel combustion to about one tenth in 2050. Of course, these are model-based estimates and we cannot expect miraculous predictions from them. But it is certain that the adoption of the GCFD concept will sooner or later trigger the decarbonization of global society, and at the lowest possible cost. Crucially, a GCFD-based system will cover all fossil carbon. In a leaky system, the required reduction in global CO<sub>2</sub> emissions cannot be achieved. All efforts will unravel and be ineffective. We must finally realize and accept this fact.

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<sup>26</sup> International Monetary Fund (2019), Fiscal Monitor: How To Mitigate Climate Change <https://www.elibrary.imf.org> (accessed February 20, 2022).

## WORLD PRICE GROWTH SCENARIO OF OIL, NATURAL GAS, COAL, & 100% DIVIDEND



**Figure 15:** Possible scenario for world fossil fuel prices if fossil carbon is charged progressively over time. For simplicity, let us assume an annually increasing fee of 35 dollars per tone of carbon extracted ( $\approx$  about 10 dollars per tone of  $\text{CO}_2$ ): With the known carbon content of each fuel, we can arrive at the following fees for fossil fuels, according to their carbon content (Carbon Content):

- charge of 30 dollars per tone of coal (mix of black and brown coal contains 85% carbon)
  - charge of 30 dollars per tone of oil (85% carbon content)
  - charge of 27 dollars per tone of natural gas (75% carbon content)
- calculated for 2020 world prices.

**M:** *When global decarbonization happens, it will be possible to abolish the carbon fee, because none will be collected anyway.*

**J:** That would be a huge mistake. Once global CO<sub>2</sub> emissions have been sufficiently reduced, the level of the carbon fee needs to be fixed. The fee will remain as an insurance policy to prevent readily available fossil fuels from being extracted again. It may be appropriate to abolish the dividend. The money collected for much reduced fossil fuel extraction can be used in areas of planetary protection where we cannot do without subsidies.

**M:** *And what if the GCFD concept fails to take off and the climate problem continues to be tackled with existing approaches?*

**J:** If climate disruption continues to be addressed mainly by subsidy programs that make carbon-free alternatives so cheap that fossil fuels are not worth extracting, subsidy programs would have to be sustained indefinitely. We would never get away from either the huge payments from government budgets or the huge administration inevitably associated with corruption. To ensure that climate protection is not undermined, we would have to demand this **on a permanent basis from every** country in the world. Even the poorest. Such a system cannot realistically work in the long term. It would pose enormous risks to the development of global society. It therefore makes no sense to develop subsidy systems further, but to get out of them as quickly as possible. Subsidies would make emission-free energy even cheaper than cheap fossil energy. This would not motivate energy savings. It would be even more wasteful than it already is. I honestly can't imagine how to create a subsidy program that would effectively reduce waste. I have recently realized that subsidies can be regarded as the modern opium of mankind.

Perhaps we will soon recognize that it is inevitable to start tackling the climate problem by pricing all fossil carbon in a uniform way. Then we can pull our GCFD concept out of the drawer and start working on its implementation.

**M:** *How will society feel the increase in fossil fuel prices?*

**J:** The world price of oil has been significantly higher than other fossil fuels for a long time. Therefore, in 10 years oil will be relatively less expensive, at just under twice the price of oil, while natural gas will be almost four times as expensive and coal seven times as expensive.<sup>27</sup> Higher fuel prices will favor local producers, see Figure 16. More expensive electricity or heat from fossil fuels will encourage the use of cleaner appliances, quality insulation of buildings and the use of emission-free sources for electricity and heat. If the scenario of how the carbon charge will increase over time is known, prices will be well predictable. There will be a uniform fair stable competitive environment for a wide range of low-carbon products and activities worldwide. The GCFD effect will make it not only possible, but desirable, for all national ETs, carbon taxes and market-distorting subsidies for low-carbon measures to be scaled back and abolished as quickly as possible. They will cease to burden the future. Non-carbon sources will soon become competitive with more expensive fossil sources and investment in them will start to flow spontaneously. Research and development of all efficient low-carbon technologies will be really green. Here, subsidy support could be maintained on condition that the results of R&D are

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<sup>27</sup> Calculated on the basis of prices in 2020. The following year saw fossil fuel prices fluctuate by hundreds to thousands of percent with very serious economic consequences.



made available to all free of charge. It should be: either research subsidies or research profits.



**Figure 16:** Spontaneous change in the consumption basket after the introduction of fossil carbon pricing. E.g. regional products, mass travel will become more profitable, production of junk and its importation will stop paying off as well as overproduction of plastics.

**M:** *How can the known medium-term scenario of increasing the global carbon fee affect the behavior of companies and individuals?*

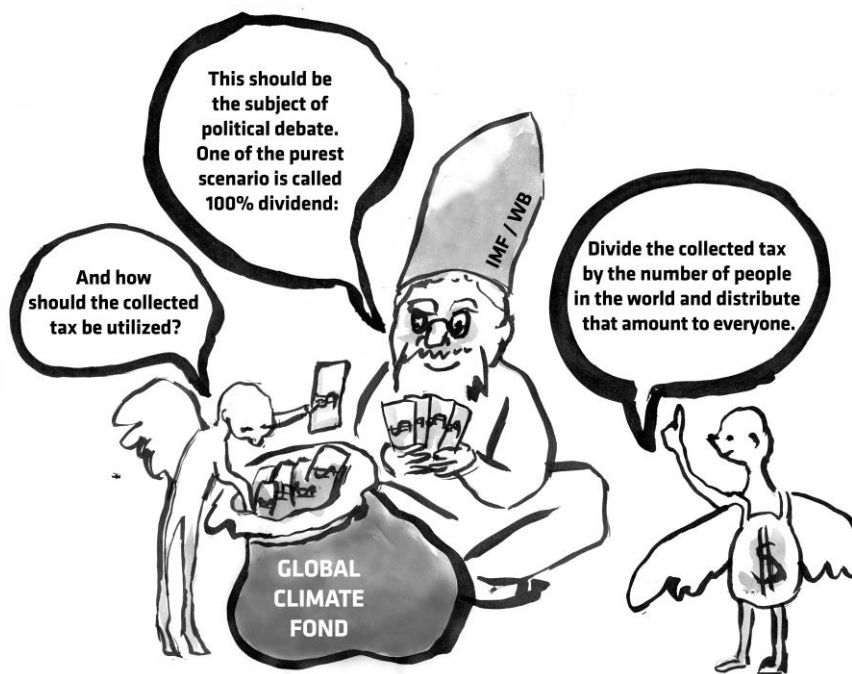
**J:** Absolutely! All medium- and long-term investments will already be severely affected once the concept is introduced. The price of carbon will be known for a period of time corresponding to medium- to long-term planning in companies and families. This should have an impact especially in the construction sector. Demand for non-passive houses will quickly cease. Additional insulation of houses will be carried out to a much higher standard. Everyone will be able to calculate that the sooner they insulate their house to a high standard, the cheaper it will be. The prices of materials and labor will rise because of the increasing global carbon fee. There will also be a natural pressure for low carbon footprint cars. Car companies will spontaneously invest in EV production and energy companies in EV infrastructure. They will expect secure sales.

The spontaneous development of zero-emission electricity sources will take off. Subsidy motivation will no longer be needed. Many other examples could certainly be given. I place great emphasis on the medium-term scenario of increasing the global carbon fee being made **binding**. This will create a **well-predictable**, consistent driver for short- and long-term carbon-free business and behavior for all actors in the least distorted market. People will stop being directed by often not very meaningful subsidy programs, bans and regulations. They will start to think about and act for a carbon-free future themselves, because it will be economically beneficial for them.

**M:** *The introduction of a global carbon fee will result in a significant increase in the price of energy, products and services. Therefore, any revenue from the carbon fee will need to be used to mitigate this impact.*

**J:** We can take inspiration from Hansen and the IMF's proposals, see Figure 17. The simplest would be to distribute the collected fee to all countries according to population. Individual countries would then commit to distribute the collected fee to their citizens. Countries where this does not happen would have the dividend suspended and kept in the Global Climate Fund until the agreed distribution is secured. The correctness of the distribution of the dividend in each country should also be judged by climate representatives. Withheld dividends can motivate positive developments towards democracy and the rule of law in countries with unstable or undemocratic regimes. The carbon fee will gradually increase from small values. Any shortcomings in the redistribution system will not initially have serious consequences. Adequate time will be available to fine-tune the system.

**M:** *Won't the dividend cause a population explosion in developing countries?*



**Figure 17:** A newly established global climate fund would distribute the money collected from carbon fees. In the figure, beings discuss the most socially sensitive scenario for the distribution of the carbon fee. This is a 100% dividend to all people on Earth.

**J:** There is a view that one of the reasons for the population explosion in developing countries is the desire of many adults there to provide for their old age by having large numbers of children. If the dividend also went to children, it would encourage even more children. One extreme

option is for each country with a significantly growing population to distribute the fee calculated from the number of all its inhabitants to adults only. Thanks to the carbon dividend, every adult would then have a guaranteed income in old age. They would not have to rely on their children. A dividend not given to children would motivate a significant reduction in population growth. There is also the possibility of giving several times less to children than to adults, which could be specified by the parliaments of the individual countries and confirmed by the climate representatives. I expect serious discussions on this sensitive topic. The planet has its obvious limits, and if they are not properly taken into account in time, this could have disastrous consequences for humanity. Although everyone will probably think differently about it, a dividend denied to children might be an acceptable measure in this context.

**M:** *GCFD would then make a solidarity and fair contribution to solving other problems of humanity. People and countries with below-average carbon footprints (the majority in the world) would gain from this system, people and countries with high carbon footprints would lose.*

**J:** There would be a net global flow of money from high-carbon to low-carbon people and countries, see Figure 18. This could cause an early tipping point in global emissions.

**M:** *Won't rich countries boycott the GCFD concept?*

**J:** It's hard to say. Rich countries have already learned to spend huge public funds on climate protection through subsidy programs. It shouldn't matter if the amount of smaller funds is used more efficiently and carbon fees were collected and distributed much more fairly. The pressing

problem of finding finance for poor, climate-disrupted countries would also be solved by this concept.



**Figure 18:** People and countries with below-average carbon footprints (the majority in the world) would benefit from the GCFD concept. People with above-average carbon footprints would find their high-carbon activities no longer profitable.

**M:** *What about countries rich in fossil fuel resources? They will certainly be against it. How to force them?*

**J:** First of all, there would be no loss of competitiveness of individual miners because all have to pay the same carbon fees. But they would probably be bothered by the fact that GCFD will lead to a rapid reduction in fossil fuel consumption and much more of their carbon wealth will

stay in the ground. There's just no other way. Under any pro-climate scenario, a substantial portion of the carbon must stay in the ground. Proven coercive methods that could force the adoption of GCFD include the use of tariff barriers or the imposition of trade sanctions.

**M:** *What if the method of equal per capita dividend distribution is the only obstacle to the adoption of the GCFD concept?*

**J:** How carbon fees paid into the Global Climate Fund are distributed back to individual countries will probably be critical to the general acceptability of the GCFD. Herein lies a fundamental change in the current carbon pricing approach to addressing global climate disruption. The carbon tax and dividend concepts considered so far are intended to work on a country-by-country basis. What is collected in taxes in a country stays in the country. But the use of GCFD and the Global Climate Fund offers a number of suitable fairer options. The point is that **each** country should find something attractive in the GCFD. There is the possibility of splitting the fees collected into four parts and allocating them to each country according to

- (a) the population ("per capita" criterion),
- (b) the magnitude of the consequences of continued climate change (the "at risk" criterion),
- (c) the amount of emissions produced (the "emissions" criterion) and
- (d) the amount of fossil carbon extracted (the "extraction" criterion).

The "per capita" criterion, combined with the price increase due to the carbon fee, will cause a net flow of money from people and countries with a high carbon footprint to those with a low carbon footprint. The decarbonization of global society will then be paid for primarily by

countries and people with high carbon footprints. I think that is fair. Current thinking on global carbon pricing assumes that poor countries will pay less per tone of carbon than rich countries that can afford it.<sup>28</sup> But many poor countries can be expected not to agree to any carbon pricing. If, however, the GCFD is adopted, poor countries with a low per capita carbon footprint will earn substantial revenues from carbon fees. **They will instead want global carbon fees to be as high as possible.** Dividends should contribute significantly to the development of predominantly carbon-free economies in poor countries. This will significantly accelerate global decarbonization. The danger of a significant increase in CO<sub>2</sub> emissions in developing countries will be averted.

The "at risk" criterion will ensure a significant contribution to all countries affected by climate change. **The Green Climate Fund will no longer be needed.** The "emissions" criterion will make the GCFD more attractive to high emitting countries by partially offsetting the costs of reducing emissions. However, it is questionable whether these countries deserve any compensation as they have largely caused the climate change problem. The "extraction" criterion will partially offset the loss of profits and costs associated with the decline in fossil fuel extraction. Again, the question is whether countries that have profited heavily from fossil fuel extraction in the long term deserve such compensation.

The setting of parameters for increasing the global carbon charge, as well as the parameters (weights) of criteria (a) to (d) (and possibly others), should also be the subject of negotiations between climate representatives. If a country rejects the GCFD, other countries can impose tariffs on it equal to several times the carbon fee. This may force it to accept the GCFD. Countries that leave or stop complying with the

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<sup>28</sup> <https://www.imf.org/external/pubs/ft/fandd/2019/12/pdf/the-case-for-carbon-taxation-and-putting-a-price-on-pollution-parry.pdf> (accessed February 20, 2022).

GCFD would be treated the same way. Perhaps the approach described above would be fairer than just the same 100% dividend "per capita". I'd be happy if we got to that point anytime soon.

**M:** *How high should I imagine the dividend to be?*

**J:** If the fee increases by 35 dollars per tone of carbon extracted per year, an adult could receive an annual dividend of around 600 dollars after ten years.

**M:** *In the context of GCFD, you talk about global justice. But what about the local one? What about the poor grandmother heating with coal in an uninsulated house? That's what people often ask when we talk to them about GCFD.*

**J:** It would be illusory to think that a general global concept of GCFD will ensure detailed fairness. GCFD can ensure a highly effective transition of global society to carbon neutrality, including climate and social justice at the macro level. Accompanying social programs will need to be attached to our concept. But these would have to emerge, perhaps even to a greater extent, in any way to address the climate crisis. It is important that social programs do not undermine the basic principle of GCFD. They can only mitigate its effects at more detailed levels. Certainly poor people with high carbon footprints will be affected. They will not have the means to take measures to reduce it. This is where targeted assistance will be needed. But the cost will be many orders of magnitude less than current public spending on climate protection. This area will be left open to the search for policy solutions.

Poor countries with high per capita carbon footprints, which will not have enough money to decarbonize, will be a bigger problem. Therefore,



the "emissions" criterion will probably need to be correlated to the level of gross domestic product per capita.

**M:** *It can be expected that despite the increase in the global carbon fee over time, the dividend will start to decline after 20-30 years as less and less fossil fuels are extracted. Aren't you worried about a negative reaction from developing countries?*

**J:** The time you mention could be enough to address poverty and the population explosion in developing countries and kick-start their carbon-neutral development. Developing countries would benefit from GCFD for quite a long time and, like the increase in the dividend, the decrease would be gradual. Nothing can last forever.

**M:** *You also claim that global decarbonization would take place at a much lower overall cost than under the current approach. How can you be so sure?*

**J:** For many reasons. You'll have to pay a minimum number of officials. You'll be investing private money in the most effective decarbonization measures at a given time and place. You'll be able to make informed strategic decisions because you'll know the carbon price well in advance. Just take the huge difference in how people feel about spending public and private money. I can't imagine better conditions for implementing effective global decarbonization. If we estimate the cost of global decarbonization at 200-400 trillion dollars, we are talking about hundreds of trillions of dollars that can be saved by using GCFD. That is tens of thousands of dollars per capita.

**M:** *Could you summarize the effects of GCFD and compare them to a national carbon tax and a 100% dividend?*

**J:** I have prepared a table for this.

Effect / Concept	GCFD	National carbon tax and 100% dividend
Amount of fossil carbon coverage	close to 100 %	medium, about 50%
Administrative complexity	very low	high
Barriers to international trade	none	high (need for carbon tariffs)
Global economic solidarity (the flow of money from the rich to poor countries)	high	indefinable depends on the willingness of countries to give some of the taxes collected to poor countries
Corruption potential	zero to low	high
Enforceability / feasibility	enforceability unknown / feasibility simple	politically enforceable (in many countries are already considering it) / consistently practically unfeasible
Tax progression adjustability	simple	simple
Prospectivity (stable future prospects)	high	low (a newly elected government can change everything)
Environmental justice (those who emit pay, those who don't get)	high and straight	inconsistent and uneven (does not cover all emitted carbon, the carbon is paid for in different amount) has only a local reach

I expect that there will be a big discussion on this topic soon. There is a growing movement around the world for a national carbon tax and 100%

dividend.<sup>29</sup> We have already started discussion with the movement. I am afraid it will be very difficult to find common ground. I have a very strong opinion on the problem. To protect the global climate, we must create the best **possible** conditions in a global society; any compromise is wrong.

## 8. WHY MIGHT PEOPLE (NOT) WANT GCFD?

**M:** *I think the key to success in adopting any new concept, like your GCFD idea, is the need to get as many people as possible excited about the cause. Motivate them enough to vigorously demand its adoption by their governments. We are experiencing a lot of disinterest from powerful people committed to climate protection. But when you talk to ordinary people about your idea, they often ask, "Why isn't it already?" or "I thought it had been around for so long."*

**J:** Let us therefore devote this chapter to a critical evaluation of the concept of GCFD. When people who are more closely involved in climate protection become familiar with GCFD, they often start to make arguments against the concept, or rather the difficulty of enforcing it. This is usually followed by the sigh: "It is better to do something small

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<sup>29</sup> <https://citizensclimatelobby.org/blog/grassroots/ccl-in-54-countries-updates-from-our-international-chapters> (20 Jan. 2022).

and enforceable than to try to do something much better but not enforceable." Unfortunately, the small and enforceable can also be counterproductive because it gives actors and the public the false satisfaction that they are making a tangible contribution to global climate protection. It's like manually pouring buckets of water from a nearby river over the burning roof of a ten-story house while we leave efficient modern robotic firefighting equipment locked in the firehouse. We are too busy manually extinguishing the fire and are unable to agree on who should go unlock the firehouse. Everyone has an excuse: "I'm putting it out!" As the fire spreads to other rooftops, the firefighters are running out of strength.

**M:** *I understand, it's complicated. A lot of people don't want to do things where there is only a slight chance of success. They need to succeed and be seen to succeed. That's why they tend to focus their efforts on local projects.*

**J:** I don't want to do almost hopeless things to people. But if they're really good, all they have to do is express support for them, no matter how hard they are to accomplish. The degree of feasibility should not be the criterion for support. It is enough to demand vehemently, "Unlock the firehouse!" and if someone enjoys carrying buckets of water, no one can stop him. But certainly no one should be praised for carrying water and made an example of. Paradoxically, carrying water in buckets may contribute to the spread of fire, because it will so exhaust the firefighters that no one will have the strength to go to the firehouse. Although carrying buckets does not give hope of fighting a fire, it is still done. Maybe because the TV cameras sometimes pick it up. Unfortunately, showing effort and dedication is often more important than the actual result of the effort.

After the introduction of GCFD, the only thing that will be asked of the people is to continue in behavior as they have been used to. Modified rules for the operation of the global world will ensure that society will spontaneously transit to a carbon-free corridor without people having to make the effort. But that is not attractive to the TV cameras.

**M:** *This can be a great motivation for ordinary people to adopt GCFD sought. But the powerful are probably more attracted by the benefits of the current approach to global climate protection. And that does not give much hope for the adoption of GCFD.*

**J:** How many "hopeless" and unexpected things have already been realized in the world?! Democracy, inalienable human rights, affordable health care and the welfare state were once utopian ideas too. And they were pushed through despite the opposition of the powerful. None of us knows in advance what can or cannot be pushed through without trying. And what seems hopeless today may have a chance in 5 or 10 years if people get to know it, everything is discussed in a substantive way, and people demand it of politicians. It may also confirm my belief that simply escalating the current climate protection methods does not really get the job done. Global society has been led to a dead end or to the brink of collapse and the introduction of the concept of GCFD will become a necessity. Adoption of the concept will not fall from the sky. We have to work patiently to enforce it and accept the likelihood of failure.

**M:** *What do you consider to be the main obstacles against the adoption of the concept?*

**J:** I have learned many of them in discussions and I am aware of many of them myself. However, I do not consider any of them insurmountable or

disqualifying. I do not always share the views of my opponents. Here is a list of them.

- It is difficult to admit the mistake of doing something incorrectly or inappropriately up to now. On the contrary, it is to be expected that the existing ways will be continued all the more stubbornly and intensively.
- The introduction of GCFD would significantly help developing countries. However, the developed world benefits greatly from the poverty and underdevelopment of developing countries and is rather uninterested in changing anything.
- It is hard to imagine that any political party in rich countries would put on its agenda the adoption of a concept that would systematically divert substantial funds out of the country to other countries without compensation.
- Many countries and mining companies will boycott the GCFD concept.
- In some countries, a large number of people can be expected to drink the dividend or hand it over to the mafia.
- Organizations that have taken it upon themselves to solve a problem have no interest in being shut out of the solution. They do not want a problem to be solved by some "self-functioning" mechanism without their participation. By supporting GCFD, they would be cutting the branch on which they are sitting.
- The subsidy programs funded by state budgets are already packed with "green" companies that have formed close ties with officials and politicians. Both sides are profiting from this and plan to further multiply the "cooperation". The introduction of the GCFD concept would cause these benefits to disappear, and the beleaguered green

firms would find it difficult to establish themselves in the market environment.

- The concept of GCFD is so simple that there is not much left to invent on it. This makes collaboration based on refinement of the concept impossible. Simply pushing someone else's idea is not attractive.
- The policies of many countries, whether democratic or dictatorial, are closely intertwined with powerful mining companies. They would see GCFD as a direct attack on their business and will go to great lengths to prevent the introduction of GCFD. The current policy of false promises and ineffective solutions is much more profitable for the mining companies. It gives them a chance for a longer term and bigger job.
- There is no will to establish a world political force of action with sufficient authority to enforce the GCFD. The only way to establish and operate GCFD is through a global dictatorship.
- Adoption of the GCFD would mean severely curtailing the current ineffective, bureaucratically burdensome methods of climate protection. This would eliminate a number of institutions with many lucrative jobs.

**M:** *The obstacles are not few and not trivial at all.*

**J:** We could now discuss at length the validity of the objections, but let us leave it to the readers to judge. I think there is at least a grain of truth in all of them, often uncomfortable. There may be many other barriers to the enforceability of the concept that we have no idea of yet. But many of the objections stem from serious problems in global society that we will not be able to avoid solving in the future. The introduction of the GCFD concept could speed up or simplify the resolution of some of these

problems. Here I would like to highlight the fact that international law already exists and that, for example, the rules for the functioning of the global market are already in place and well respected. For this, no world government or global dictatorship had to be created; an agreement by individual countries was sufficient. A GCFD could be established on a similar platform. If the powerful were interested, a way to adopt GCFD would certainly be found. For a start, it would certainly be good if the concept of GCFD became the central theme of a future COP climate summit. If we really want to tackle the problem of global climate protection effectively, we need to start thinking about how to overcome the obstacles. Not use them as arguments against the concept. I would very much welcome a substantive discussion in this way.

**M:** *Let us now turn to the arguments why the GCFD concept might appeal to groups of people, organizations or governments.*

**J:** I'm happy to do it.

- **People in developed countries** are likely to be a decisive force in promoting/hindering the GCFD concept. That is why I want to pay most attention to them. They are mostly aware that the current way of living, producing and consuming is not sustainable in their countries. In order to change this at least a little, they can insulate their houses with good insulation, install photovoltaic panels on their roofs, and buy electric cars and electric bicycles. In this way, they will reduce their individual carbon footprint. However, they can hardly influence what happens in industry and other sectors of the economy. Not only in their own country, but especially worldwide. They will have to continue to buy products and services with a significant carbon footprint, because there will be no others on offer. Perhaps their country will be able to achieve carbon neutrality in the



coming decades by spending considerable resources. Maybe it will only be on paper, because a lot of their carbon emissions will be emitted in other countries because of them. There will still be many countries unable or unwilling to devote significant resources to at least partial decarbonization. The efforts of the exemplary developed countries will thus be largely frustrated. People in developed countries should want the GCFD concept for these and a number of other reasons.

People in developed countries should accept that it is not a competition to see which country achieves carbon neutrality first. What is important is when the whole planet becomes carbon neutral and remains so permanently. The GCFD represents a viable path to that goal and will also prevent a return to fossil fuels. GCFD will also ensure that global carbon neutrality is achieved in a credible and socially just way. Moreover, it will be much more cost-effective than if each country pursued carbon neutrality through its own administratively and financially demanding policies as now. People in developed countries should, and perhaps must, take responsibility not only for decarbonizing their own country, but also for global decarbonization.

The standard of living and carbon footprint of the vast majority of people in developed countries will remain above the global average for a long time to come. There is no denying that even with GCFD, these people will pay a heavy price for decarbonization. But there is no way to avoid this. At present, governments in developed countries are funding a number of often ineffective climate subsidy programs from their national budgets. They cover them through increased standard tax collections, national carbon taxes or ETS revenues. The cost of national carbon-free measures is expected to continue and rise significantly. They will fall much more heavily on people than if GCFD were adopted.

GCFD will effectively decarbonize the global economy and preserve a wide range of products for export to developed countries. In addition, it will allow global trade to operate carbon-free. The availability of a wide range of low-cost, low-carbon imported products will contribute to maintaining a high standard of living for people in developed countries.

Ongoing global climate change is already leading, and will increasingly lead, to significant local climate change in many places on the planet. For many people, living conditions in their current homes will become harder to bear. Pressure for migration, especially to developed countries, will increase significantly. By adopting the GCFD, the carbon dividend can make a significant contribution to reducing the need to migrate by enabling local populations to adapt to changed conditions. In addition, the GCFD will provide a more significant mitigation of climate disruption compared to the current approach, hence reducing migration pressure.

- The introduction of GCFD will bring long-term economic benefits to virtually all people **compared to the current approach to climate protection**. It can prevent a number of local and global social crises due to escalating climate change and further increases in social inequalities. GCFD represents a win-win strategy. The only "losers" are those (fossil fuel extractors) who would lose under any form of global decarbonization. But GCFD will give them good conditions to cope as best they can.
- GCFD might appeal most to **people in developing countries**, who would appreciate a not inconsiderable dividend for them. Many developing countries are heavily deforested due to the large consumption of wood for cooking. For a few tens of dollars from the dividend, a simple solar cooker could be purchased and its production could become a job in local workshops. Each household could soon use the dividend to buy a few photovoltaic panels, a

battery, a refrigerator, or an electric bicycle. In developing countries, there is not yet a strict requirement for reliability of electricity supply. Small domestic PV systems could cover the requirements of most people satisfactorily. Carbon taxation will make fossil fuels unaffordable for many people in developing countries. Conversely, the availability of significant amounts of solar radiation may cause developing countries to skip the fossil carbon-based stage of development almost entirely. They will develop decentralized infrastructure based on renewables.

- **Countries with an ETS or carbon tax already in place would be** given the opportunity to phase out these administratively burdensome, carbon leaky systems by adopting the GCFD. International trade would not be complicated by carbon tariffs and could function better than it does now.
- **Right-minded people might appreciate the** simplicity, systemicity and efficiency of the market instrument used. The adoption of the GCFD would eliminate inefficient subsidy programs and reduce taxes. The flow of money from the collected carbon fee would be clearly defined.
- **Left-leaning people** might be attracted by the global social aspects of GCFD, which is helping significantly in the elimination of poverty in the world. Reducing population growth in developing countries and closing the global social scissors, see Figure 19, would significantly reduce migration pressures.



**Figure 19:** The tightening of the global social scissors. One of the effects of GCFD.

- **Environmentalists** would rejoice at the direct impact of GCFD on the behavior of each individual and on the decarbonization of the global economy. They would no longer be preoccupied with climate protection issues, allowing them to focus more on solving many other planet's environmental problems.
- **Activists** could demonstrate for a very specific demand, i.e. for the earliest possible adoption of the GCFD concept as the most effective tool to address the climate crisis. Politicians would know clearly what is being asked of them. The despair resulting from the current failure to address the climate crisis (climate grief) could be replaced by hope for an effective solution.
- **Climatesceptics** (climate deniers) might appreciate that, thanks to GCFD, there is no longer a need to inefficiently subsidize climate

protection. Pro-climate measures will not be chosen by politicians tied to "green" lobbyists, but by people or companies themselves doing business in a fair, subsidy-free market. They will put **their own money** into the most effective pro-climate measures. This will make climate protection significantly cheaper and more effective. The main reason for their "climate scepticism" will disappear. They might even start to care about the real causes of the current global warming.

- **Politicians and officials** would be relieved of the complex agenda of subsidy programs and carbon fee collection with the adoption of GCFD. They could devote much more time to addressing other serious community problems and improving the public realm.
- **Fossil fuel extractors might** appreciate the GCFD's good long-term predictability of the inevitable decline in production. They will decide on the best timing based on their own economic analyses. A functioning market will not be distorted by subsidies and will be well predictable, miners will be able to plan responsibly for the most appropriate alternatives to ensure sufficient employment for their employees in the zero-emission energy sector.
- It can be expected that the concept of GCFD will be critically discussed in a number of academic papers. The **IPCC** could include the conclusions of the discussions in its Summary for Policymakers, and thus significantly help to get the GCFD concept into the minds of world policy leaders.
- **Responsible UN staff could** give the GCFD concept sufficient space for expert discussion at the COP climate summits. They could promote the GCFD not only as an effective tool for climate protection but also as an important tool for helping the developing world.

## 9. CONCLUSION - IT WON'T BE EASY AT ALL

**J:** Achieving significant mitigation of climate change can be likened to climbing an imaginary 9,000 meters high hill, where representatives of all countries must reach. Today, we see that many countries have already built a base camp at 1000 meters above sea level. Several climate-active countries have already sent representatives to the top. They are now at 2000 m, but they only have equipment appropriate for altitudes up to 3000 m. That is where the bread will be broken. Go on and risk danger and failure? Stay camped at 3000 m? Give up and go back? Or bring anequipment up to 9000 m and, together with representatives of other countries, start climbing the top meter by meter as fast as realistically possible?

**M:** *By equipment up to 3000 m, do you mean the current political approach to climate protection and by equipment up to 9000 m, do you mean your concept of GCFD that includes everyone in the team, even the weakest?*

**J:** Yes.

**M:** *At the end of Chapter 5, you asked a question about the fundamental compatibility of parliamentary democracy and effective global climate protection. You should try to answer it.*

**J:** Notice that there is more and more talk in policy circles about adaptation to climate change rather than mitigation. It's as if climate protection is being gradually phased out. I have serious doubts that the current approach to climate protection is compatible with democracy in a sustainable way. I think that people will continue to put individual interests before collective interests in the future. This may be exploited by some political forces, and global climate protection may be rejected by democratic means in some countries, with a knock-on effect in other countries.

**M:** *But the concept that you have introduced in this book will ensure that individual benefit becomes also planetary benefit...*

**J:** ... and the contradiction between individual and collective interests will disappear.

**M:** *You talk about your proposal being apolitical but requiring the consent of many countries. It requires a first initiating political decision.*

**J:** Yes, a single initial agreement by a sufficient number of countries would be enough and the whole system would then operate stably and efficiently outside the realm of politics. The same is already the case for many other apolitical processes in global society, such as world trade or tourism, which operate on the basis of accepted global agreements and rules. I am convinced that it is within the competence and power of the UN to organize such a meeting of representatives of the governments of a sufficient number of countries.

**M:** *You need will and driving force to do something. These are so far drowned out by other interests. The global climate disruption has*

*probably not manifested itself sufficiently yet. Scientists' warnings alone are clearly not enough. We need to acknowledge the as yet poorly functioning link between the scientists' analysis of climate disruption and the technical implementation of solutions.*

**J:** This link is represented by the socio-economic-political environment that should encourage the most effective transformation of the global society to a zero-emission one. The International Energy Agency report shows how this will be unprecedentedly challenging. To do this, we need to create the best possible, fair and well-motivated environment. This cannot be discounted. In the existing system of climate protection, there are still many unanswered questions that we deserve to have answered. For example, what should be the main driver for effective global decarbonization?

**M:** *And also, where is an unimaginable amount of money going to be found for this?*

**J:** And then there are the issues of implementing global decarbonization. Who will optimize and plan, coordinate and manage the whole complex gigantic project? How not to drown in bureaucracy and prevent opportunities to cheat? How to deal with the influence of powerful actors who will be economically damaged by decarbonization?

**M:** *And how do we keep democracy and peace in all this? The atmosphere may be everybody's, but the wealth under the ground historically belongs to individual countries. I remember in school we were told that fossil fuels would run out one day. I was a bit worried about that, but at the same time I thought it was fair in a way.*



**J:** Of course, we didn't know then that the opposite problem would occur. How to make sure that this wealth stays in the Earth.

**M:** *If we were running out of fossil fuels, it would be easier because there would be no more arguing about how to solve the climate problem.*

**J:** So, try to imagine our planet and the same planet B, but where fossil fuel resources are running out. Economists don't see running out of resources as a tragedy. Increasing scarcity will cause their price to gradually rise to the point where they are no longer in demand or a replacement is found...

**M:** ... *similarly, on our planet, an ever-increasing carbon fee would keep these resources in the ground.*

**J:** But the difference is who gets rich on which planet. On planet B, huge profits will flow into the pockets of the owners of the remaining fossil resources. In our case, the carbon fee collected would be distributed as a 100% dividend in a socially sensitive way. The situation on our planet would therefore be much better for ordinary people than on Planet B.

**M:** *And then that climate change cannot be perceived positively. Every book should contain at least one positive message. You got it.*

**J:** The second positive news is that the appropriate instrument to address the climate crisis, the GCFD, is available. As a first step, we need to familiarize ourselves with it and critically evaluate it.

**M:** *Dad, can we get the chicken to start laying duck eggs?*

**J:** I can't predict that and I can only hope. But going back to the title of our book, the subtitle should be more like "How to get humanity to accept and enforce the chicken laying duck eggs". If we have a serious problem, let us not settle for a solution that is a compromise of external pressures, as is often the result of political negotiations. The best solutions often lie elsewhere, are often already tried and tested, and just need to be adapted appropriately. Let us stop playing the global climate protection show and take it at the right common beginning.

**M:** *Why not the right end, as they say?*

**J:** The rope has ends. We are at the beginning of an unprecedentedly difficult task. I read an interesting idea recently: "If we look at the world from the perspective of its possible end, we may see its new beginning."

**M:** *Here's to a fresh beginning!*



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# THE WORLD ACCORDING TO MY DAD

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