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Better Accountancy for a Real Hopenhagen*

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It is questioned whether states, cities, and non-governmental organizations (NGOs) can solve the climate problem when rejecting to learn from critical scrutiny of their decisions. The Danish example of massive scale conversions from fossil to biomass sources for combustion-derived energy is a case in point, as it cannot be generalized. Historical as well as actual measurements since 1958 show that the world is living with an exceptionally high and rising level of atmospheric concentration of CO_2. Additions ("sources") and subtractions ("sinks") have, therefore, to be considered as comprehensively as possible. Biological sinks must be better protected and expanded. The role of forests in climate mitigation is generally judged too optimistically without due regard to the threat of tipping points and short-term contributions to global warming from using woody biomass for energy purposes. Under the aim of the United Nations Framework Convention on Climate Change (UNFCCC) to stabilize CO_2 concentrations in the atmosphere at a level in accord with the precautionary principle, the reporting of national emissions must comprise CO_2 emissions from the combustion of biomass, too. Since the Kyoto-phrase that "biomass fuels are considered CO_2 neutral" in the energy sector has no consistent backing in the land sector, the complexities of real forest development must be considered. Protection must be prioritized to avoid that more forests tip into becoming net sources of greenhouse gases—and forest potentials to draw down CO_2 from the atmosphere are foregone. Therefore, carbon accounting must be extended from the one-sided approach of reckoning with "Kyoto-CO_2" from fossil sources only to integrated assessments of, how to decarbonize, i.e., reduce CO_2 emissions from the use of biomass sources, too. To become sustainable, correcting erroneous accountancy is a first step to be taken. Instead of using problematic carbon calculators, integrated energy planning for clean renewables can help, e.g., at city level.

Keywords: biomass accountancy, Kyoto Protocol, UNFCCC, greenhouse gas concentrations, forests, forest industry, carbon debt, biological sinks, policy networks, IPCC, CO_2-neutral cities, systemic energy planning

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"Hopenhagen" signified hopes connected to the 2009 climate summit at Copenhagen. They were frustrated but have been revived internationally by new social movements that in Denmark brought a social democratic government into being, supported by three center-left parties. Their aim is to make possible a planned and socially sensitive transition to sustainability. A real "Hopenhagen" might emerge.

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Introduction

Regarding a Green New Deal, the American ecologist Barry Commoner proposed in 1990 a multi-sectoral ecological transformation of U.S. and world production systems within five sectors (energy sources and applications, transport, chemicals, and agriculture). It should have been financed over five to 20 years by halving military expenditures for a "peace dividend". Regarding climate change, Commoner (1990) added a question: "Is there time enough to accomplish such a massive transformation in production technology? Current computer models indicate that the most potentially catastrophic problem—global warming—could be prevented by appropriate actions over the next few decades but beginning now" (p. 200). After the turn of the century, the British economist Nicolas Stern (2006) still had to deal with the problem of lacking investments to combat climate change. He warned against waiting too long, because this raises the costs to be met later on.

Waiting? Since 1990, scientists raised attention to man-made climate issues by the United Nations Intergovernmental Panel on Climate Change (IPCC). It is now coming into its 30th anniversary and prepares the 6th integrated report, due in 2022. In 1992, the Rio Summit on Environment and Development adopted the UN Framework Convention on Climate Change (UNFCCC), which has been ratified by 197 parties. To make it operational, a protocol was developed since the 3rd Conference of the Parties (COP) in Kyoto 1997, the well-known Kyoto Protocol. It has been enacted in 2005 and has had 192 parties, yet without the U.S. and Canada. The Paris Agreement of 2015 functions directly under the framework convention.

So, the answer to Commoner's question from 1990 is no longer: "There is a little time left". It is, rather: No, the greenhouse gas concentration of the atmosphere is now over 400 ppm (parts per million) and catastrophic changes are already occurring in the global ecosystems. The task is, therefore, not only to reduce CO_2 emissions, but directly to remove carbon from the atmosphere. This is now the position of geographer David Harvey, who points at changing practices in agriculture and forestry (Harvey, 2019).

We have, however, to take a closer look at an accountancy problem in relation to the agriculture and forestry as well as the energy sector, as the interstate system is treating them: By neglecting biogenic greenhouse gases and focusing exclusively on emissions from fossil fuels, emissions are systematically underreported. Therefore, increasing parts of global forests are converted from storing and drawing CO_2 out of the atmosphere to releasing it, e.g., by industrial production of wood pellets and their incineration (Booth, 2018).

Can Governments Ever Learn up?

According to Karl Marx, class conflict in the ancient world was a conflict between debtors and creditors. Something like this is apparently recurring in financialized neo-liberalism. The question of debt has been defined by financial and political agents who act against the "global South". They exclude, on the other hand, any question of valuing their own historical climate debt. On the contrary, credits are given to dubious environmental or climate projects favoring the carbon accounts of the global centers of accumulation. A point in case is carbon trading that was introduced by the EU in 2007 as the flagship of climate policy. But it only shifts the rights to pollute from one hand to another, unless a strong political power presses the total amount of allowances down to near zero. This can, however, not be expected without enormous pressure from grassroots and established institutions which can modify power structures.

I have dealt with this contradiction in a contribution to the 16th conference on Alternative Economic Policy in Europe, held at Crete 2010. Based upon the work of Stuart Holland, which he recently has described in his publication "Beyond Austerity" (2016), I addressed the relevance for Europe of a New Deal debt accounting model (Czeskleba-Dupont, 2010). This could have avoided the specter of a "transfer union", where northern taxpayers bail out southern "irresponsible" states, namely by financing state infrastructure projects through the European Investment Fund and Bank, financed by low interest loans from capital markets. This was a road not taken, because the German government preferred austerity politics—although it in 1930 thereby essentially contributed to expand the seats of the German fascists in parliament (Holland, 2016; Galbraith, 1987).

Stuart Holland asked regarding austerity: "Can governments ever learn up?" This guided me to a presentation of the green debt question, namely that of a carbon debt in the context of Kyoto accounting of greenhouse gases. Realistically thought, there is no such thing as an instant carbon neutrality of burning all kinds of biomass (Booth, 2018). I referred to research from the Massachusetts Center for Conservation Sciences at Manomet, which in 2010 used a marginalist time-related carbon accountancy model for the combustion of woody biomass replacing fossil fuels, and to the critical review of it by Booth (2010).

In Europe, an Austrian research group presented the carbon debt problem for a committee of the European Parliament by addressing "The upfront carbon debt of bioenergy" (Zanchi, Pena, & Bird, 2010). This article was cited by the European Parliament (EP) in its May 2011 resolution on forest protection. Unfortunately, the EU Commission did not respond to this critical message but maintained its dogma of instant carbon neutrality in burning solid biomass, although the European Environmental Agency (EEA) in September 2011 published a statement of its scientific committee with a clear critique that an expansion of biomass burning could have disastrous effects.

This critique plus other critical research results were made public by the Danish think tank Concito (2011), but several non-governmental organizations (NGOs) rejected it. The conversion from fossil fueled heat and power plants to biomass was government policy since 2010. Since then, the Red-Green Alliance made critical inroads in parliamentary deliberations on the issue. But, in summer 2015, these deliberations were stopped without result, when the government called for new elections.

Conclusion 1: States and NGOs cannot solve the climate problem, when they only pretend to do so, but reject to learn from critical scrutiny of their own decisions.

The 350 ppm Movement

Let us look at the level of social movements or NGOs and ask what message should be central.

Ex-National Aeronautics and Space Administration (NASA) scientist James Hansen, who, in 1988, made global warming a public issue, wrote 20 years later about the necessity to target CO_2 in its atmospheric concentration and asked where humanity should aim. In a shorthand, his deliberation was: "Present glacier retreat, and warming in the pipeline, indicate that 385 ppm CO_2 is already a threat". "Warming in the pipeline" meant the increase in global warming to be expected if atmospheric CO_2 concentrations remain at a dangerous high level. Therefore, Hansen et al. (2008) concluded: "An initial CO_2 target of 350 ppm, to be reassessed as the effect on ice sheet mass balance is observed, is suggested" (p. 226).

At the time of writing, 2008, the atmospheric concentration was around 385 ppm (parts of CO_2 per million parts of air), as is documented by measurements at Mauna Loa Observatory on Hawaii, established in 1958, the International Geophysical Year (see Figure 1).

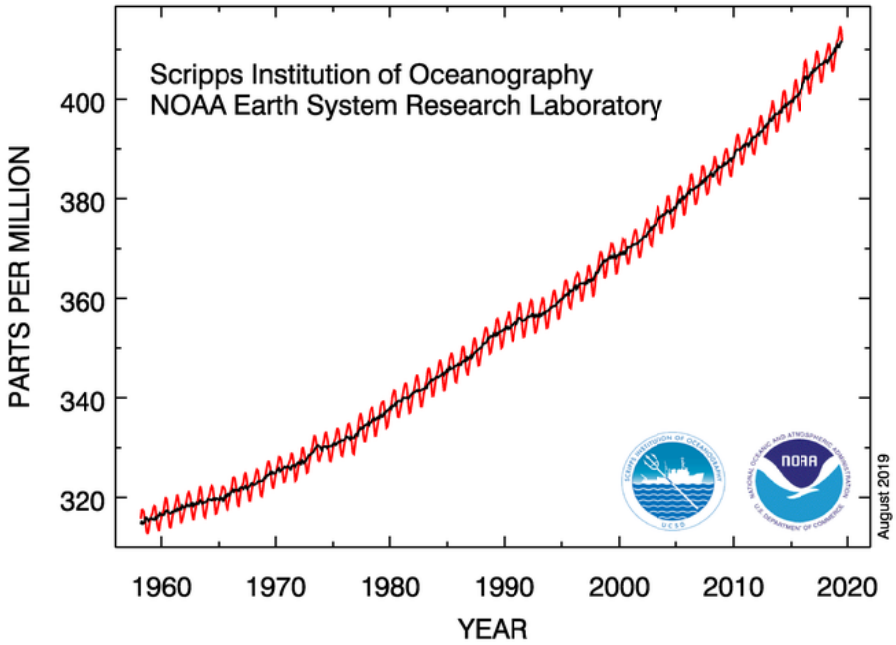

Figure 1. Atmospheric CO_2 at Mauna Loa Observatory.

In August 2019, the air concentration had risen from under 320 ppm in 1958 to 412 ppm—and its steady increase continues in an unbroken trend. The yearly red oscillations around the rising black trend show circular time, namely, the seasons of the northern hemisphere.

2016 marked the year, when summer air concentrations of CO_2 did no longer dip under 400 ppm (see Figure 2).

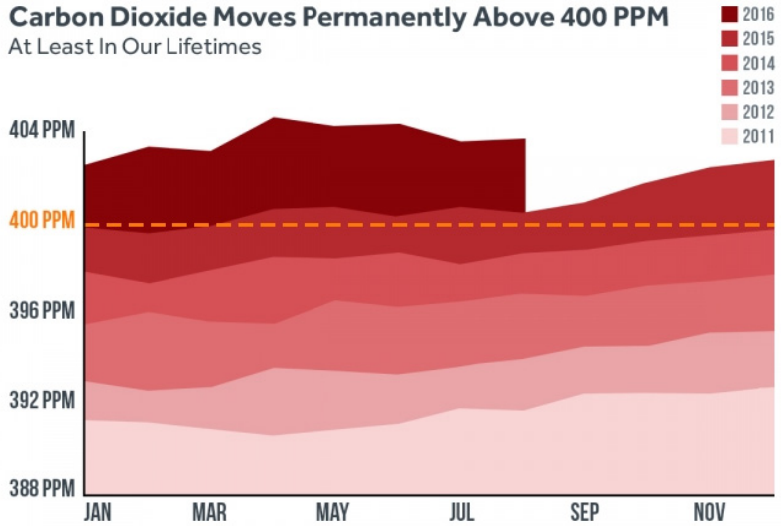

Figure 2. The world passes 400 ppm threshold permanently (Source: Brian Kahn, https://www.climatecentral.org/news/world-passes-400-ppm-threshold-permanently-20738).

In his 2014 analysis of the contradictions of capital, geographer David Harvey (2014) wrote:

> With climate change, there are simply too many "deniers" in positions of power to permit ameliorative actions.... It has been left to some of the poorer and immediately threatened countries, like Bolivia and the Maldives, to plead the cause of climate justice. (p. 259)

Around COP 15 in Copenhagen, the president of the Maldives was depicted as sitting under water. Less known is the fact that Bolivia hosted an alternative climate summit at Cochabamba in 2010. European participation was curtailed by a stop of airplanes caused by long-range transport of particle masses from an erupted Islandic volcano. Yet, the people's summit edited a declaration for system change (https://pwccc.wordpress.com/2010/04/24/peoples-agreement/).

In 2019, David Harvey made up his mind. He describes in a 20-minute-podcast on global warming that and why the transgression of the 400-ppm mark "*has changed everything*"—alluding to the title of Naomi Klein's book of 2014. This is seen against the long-term trend of concentrations 800,000 years back, published by National Oceanic and Atmospheric Administration (NOAA) (see Figure 3).

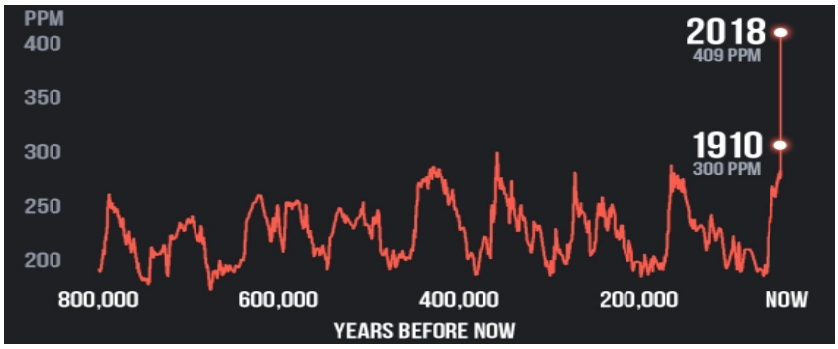

Figure 3. Changing our atmosphere: 800,000 years of carbon dioxide.

These figures on atmospheric concentrations deserve more attention, Harvey argues, because they indicate the absolute masses of change—and not only the rate of change in yearly emissions. His podcast is labeled "*CO_2 emissions and climate change*", but he wants to change emphasis away from emissions. Otherwise, mainstream rhetoric drives politicians into verbal competition around percentages of emissions reductions. But the common base year 1990 for reduction commitments in the Kyoto 1-period (2008-2012) is often replaced by other reference years, yielding better reduction profiles. And Harvey stresses: The level of atmospheric concentrations is not directly taken into consideration.

As James Hansen did in 2008, Harvey makes a case that the massive air concentrations of CO_2 should be brought down to a lower level. Hansen et al. (2008) also pointed out, as Harvey does, that "improved *agricultural and forestry practices offer a more natural way to draw down* CO_2" than technocratic visions of carbon capture and storage (p. 11). Harvey favors ideas of improving the vegetational up-take and storage of CO_2 in the upper Earth crust by plants with very deep roots—not six inches, where plowing interferes with deposition of carbon in the humus layer, but six feet. This resembles wild strains (Nørretranders, 2010). Subsidies to agriculture and forestry in the U.S. and the EU should be re-directed to do the job. After all, it was vegetation and fauna supported by it, that generated the huge fossil fuel reserves in underground storage, part of

which industrialism with accelerating capital accumulation brought up into the air. Storing carbon back into the earth is a necessary reverse movement in reproducing a damaged natural resource base.

In an interview at COP 21 in Paris Bill McKibben, protagonist of the climate movement "*350 ppm*", stated that the movement had driven "home the understanding that we need to leave 80% of known carbon reserves under the ground". This was accomplished, he alleged, by campaigning for "divestment", the change of financial investments away from the fossil fuel sector (see https://www.climate-change.tv/11162). Contrary to this social movement, the Paris Agreement did not at all mention the problem of fossil fuel reserves—as well as the question, what to do about it (former climate negotiator Pablo Solon, interviewed at Copenhagen, Spring 2015; Czeskleba-Dupont, 2015a).

Conclusion 2: In retrospective, we must realize that the world is living with an exceptionally high level of atmospheric concentration of CO_2. Analytically, both additions to these levels ("sources") and possible subtractions ("sinks") have to be considered as comprehensively as possible. Politically, biological sinks must be better protected and essentially expanded. Social governance (Commoner) is needed to change the face of the earth, as it is transformed by land use.

Scientific Perspectives Before and After COP 15

As part of the international or rather: interstate system (I. Wallerstein), diplomats must find appropriate language between competing interests and often come to water down decisive messages. Also, messages from the UN IPCC reports. The global climate movement of 2018/19, therefore, is more than welcome when trying to back up science.

Three months before COP 15 at Copenhagen, then chairman of the IPCC, Rajendra Pachauri, on his part showed restrictions from within the scientific community: When asked if he supported calls to keep atmospheric carbon dioxide concentrations below 350 parts per million (ppm), he said: "As chairman of the Intergovernmental Panel on Climate Change (IPCC) I cannot take a position because we do not make recommendations". "But as a human being I am fully supportive of that goal. What is happening, and what is likely to happen, convinces me that the world must be really ambitious and very determined at moving toward a 350 target", he told the French press agency AFP (https://web.archive.org/web/20090901090952/http://www.google.com/hostednews/afp/article/ALeqM5hacayDuUcngLmhNkplHB5VtG5GNw).

Pachauri could, however, officially talk about yearly global emissions of CO_2 and conclude that they should top in 2015 at the latest. Then, there would still be a chance to fulfill the goal of the UN Framework Convention on Climate Change to stabilize "greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (UNFCCC, 1992, Art. 2). This had namely been an acknowledged result of the IPCC report from 2007—acknowledged by the diplomatic process, where governments participate in finding the language for publishing selected results from the IPCC working groups in their final volumes aimed at policymakers.

Today, the concept of a climate budget is applied to goals of limiting global warming, e.g., at 1.5 °C and then calculating at a time certain, by which amount of greenhouse gases the given atmospheric concentration

can be enlarged, without transgressing the temperature limit. As is stated by Mercator Research Institute on Global Commons and Climate Change:

> The concept of the carbon budget is based on a nearly linear relationship between the cumulative emissions and the temperature rise. Nevertheless, this does not mean that the earth would necessarily be 1.5 °C warmer at the very point in time when the remaining carbon budget for staying below the 1.5 °C threshold was used up. This is due to, among others, the fact that there is a time lag between the concentration of emissions in the atmosphere and the impact thereof on the temperature. (https://www.mcc-berlin.net/en/research/co2-budget.html)

In the institutional context of the EU Commission, both natural and social scientists, especially economists, have been engaged in policy networks helping politicians to combat climate change. The launching of EU's Emission Trading Scheme (EU ETS) in 2007 has been a result of such scientific advisory work, in this case of neo-liberal persuasion, promoting trading with the right to pollute with CO_2. The total amount of allowances (carbon credits) depended upon a "cap" on them, which must be defined politically and, indeed, has been sharpened somewhat in recent years.

In a document of 2010, a "number of scientists across Europe" analyzed the shortcomings of the Copenhagen Agreement of 2009 and developed perspectives for intervention to reach the goal, contained in it, of maintaining global mean temperature rise at less than 2 °C (Fee et al., 2010).

An IPCC special report of 2018 has explained in detail, what difference it makes to aim at a 1.5-degree ceiling for global warming, as opposed to two degrees using the concept of a (still) available carbon budget. In 2010, the concept of a carbon budget was not yet publicized. To reduce CO_2 emissions effectively, the EU related scientists recommended "a massive investment in carbon-free energy technologies and supporting infrastructure ... in order to achieve an emissions peak within the next 3 to 5 years and to be on a pathway consistent with a 2 °C limit" (Fee et al., 2010, p. 16).

In case of a postponement of emissions peaking beyond 2015, a very rapid transition would be necessary. But "the turnover time in the energy system and other sectors of society is expected to be too long" to support such a rapid transition. So, "a delay in the transition to a low emission society reduces the economic and technical feasibility of ... maintaining a 2 °C limit" (p. 18).

On likely impacts of climate change, the expert group quotes the 2007 IPCC report, working group 2 on ecosystems & biodiversity, that the terrestrial biosphere at global warming above 2.5 °C is likely to become a net carbon source. This tipping message, based upon the contribution of Andreas Fischlin to the IPCC report, was propagated by the International Union of Forest Research Organisations (IUFRO) (Czeskleba-Dupont, 2009).

At Forest Day 3, a side-event of COP 15 in Copenhagen, IUFRO held a seminar on the tipping of forests (tropical as well as boreal) with global warming. On this occasion, a representative of the European forest industry refused the question as academic and aired that the forest industry had a firm grip on the EU Commission not to interfere politically, which meant that the Commission after 2010 postponed its original intention to formulate binding criteria for the sustainability of solid and gaseous biomass, as it had done for biofuels.

The elimination of the forest tipping question made the big scale conversion of coal burning facilities into incinerators of woody biomass seem unproblematic: Questioning the future balance of forests between sink and

source and its effects upon on the atmospheric concentration of CO_2, as the tipping question did, makes it clear that there is no assurance for a later pay-back of the actual carbon debt incurred by the incinerators of woody biomass at present. How do we call a suggestion to get credits from a bank without later pay back? Bank robbery. The same has happened by this way of realizing the EU climate policy of 2007 in the energy sector.

In terminology, the expert report of 2010 reveals an important detail on measurements of greenhouse gases (GHG), calling them "Kyoto-GHG", i.e., only emissions from fossil fuels and not from biomass are counted (Fee et al., 2010, Fig. 3.1). Explanation follows.

Conclusion 3: The surmounting of critical levels of atmospheric concentration especially of CO_2 has gradually come into the forefront of public explications of the science of global warming. From a personal confession of the IPCC chairman in 2009 to transparent calculations of the carbon budget to maintain global warming under 1.5 degrees (IPCC, 2018). Before this progress, the role of forests in climate mitigation was, however, judged too optimistically without due regard to possible dangers for global warming of using woody biomass for energy purposes. As if any initial carbon debt from the combustion of biomass would be paid back in due time.

Different Reporting: UNFCCC vs. Kyoto Protocol: Chasing Fossil Fuels Eliminates Question of Substitutes

"Kyoto-GHG" was the name proper for an accounting rule enshrined in IPCC's guidelines of 2006, which removed biomass CO_2 emissions from reports on the energy sector. The guidelines stated:

> Biomass is a special case: Emissions of CO_2 from biomass fuels are estimated and reported in the AFOLU sector (Agriculture, Forestry and Land Use). In the reporting tables, emissions from combustion of biofuels are reported as information items but not included in the sectoral or national totals to avoid double counting. (Chapter 2, p. 33)

The rule may avoid double counting, but does it avoid underreporting? Firstly, there are bigger emissions from power and heat plants combusting biomass than fossil fuels, partly because of the molecular differences between hydrocarbons (with natural gas or methane being the most energy efficient) and biomass' carbohydrates (Czeskleba-Dupont, 2012); but also, because the bigger water content of the fuel and other factors make the combustion of biomass in large scale plants less efficient. Secondly, it is not enough to assess the energy content of the fuel and to take the corresponding amount of core stem wood as the only loss incurred at forests. There is a bigger amount of CO_2-storage in the forests including soil carbon, which is foregone by extracting trees (Booth, 2018).

These questions are not considered, when, e.g., Danish researchers and authorities mechanically apply the IPCC rule in reporting on emissions from the energy sector:

> CO_2 emission from combustion of biomass fuels is not included in the total CO_2 emission data, because biomass fuels are considered CO_2 neutral. The CO_2 emission from biomass combustion is reported as a memo item in the Climate Convention reporting [to UNFCCC, Czeskleba-Dupont]. In 2014, the CO_2 emission from biomass combustion was 14,721 Gg. (Nielsen et al., 2016, p. 106).

The Danish Statistical Authority has in its first "Green National Account for Denmark 2014/2015" published a time series from 1990 to 2014, showing that the 2014 GHG-emissions from biomass had increased more than fivefold (Danmarks Statistik 2017). Almost 50% of the wood pellets combusted in Denmark have

been imported. Russia and the Baltic countries have been main sources, but North America is also on the radar (in the UK sourcing from the United States plays already a big role). By that way, a comprehensive and true, if any, reporting from the forest sector cannot be expected, as North America is not even covered by Kyoto rules.

It must be remembered that the IPCC 2006 rules resulted from a stalemate of the Kyoto process in year 2000, when COP 6 at Hague ended in late November without a final agreement. A compromise formulation of meeting leader Pronk, that "'in principle, new ways of managing agriculture and forestry can bind CO_2 and are considered', was rejected" (Danish newspaper Information cited by Danielsen 2015, p. 399; Czeskleba-Dupont, 2015b). German minister of the environment, Jürgen Trittin, meant that it would have been a "*Sinksgiving Day*". Already in 1998, German government counsellors had published a substantial critique of the Kyoto Protocol of 1997 because of its heavy reliance on biological systems (German Advisory Council on Global Change [WGBU], 1998). This had, indeed, only been introduced by the Australian delegation to the Kyoto negotiations after midnight December 7 (Flannery, 2006). The Australians won, at last, acceptance of the meeting.

Regarding COP 6 at Hague, Friends of the Earth International casted the "blame for this fiasco" on the United States and the Umbrella Group (comprising Australia, Japan and Canada), "which fought tooth and nail to exploit every loophole in the Kyoto Protocol. The Group demanded a giant 'free gift' of existing forests and farmlands to count towards their Kyoto targets" (Third World Network at https://www.twn.my/title/failure.htm, accessed August 23, 2019).

In many economic doctrines, natural resources and potentials are treated as a "free gift". This has been opposed by ecologist Barry Commoner stating as an informal law of ecology that there is "no free lunch" (Commoner, 1971, Chapter 1). The assumption of CO_2-neutral combustion of forest biomass amounts to demanding such a free lunch based upon a catch-all phrase on the combustion of all kinds of biomass. When the turnover-time of reproducing biomass, e.g., in agriculture is limited, CO_2-neutral combustion may occur. But, as physicist Bent Sørensen (2000) added in his standard work on renewable energy: "the lag time for trees (between the time of combustion and completed regrowth, Czeskleba-Dupont) may be decades or centuries, and in such cases the temporary carbon dioxide imbalance may contribute to climatic alterations" (p. 477).

We must add a note on terminology: Accounting greenhouse gases, mainly CO_2, without CO_2 from biomass, has been and should be called "Kyoto-GHG". But it seems confusing, when this is called the "UN method"—and not more precisely the method of the UN IPCC as of 2006. This method is also followed, when CO_2 from the combustion of biomass is treated as a separate "*memo item*", as is done in reports to the UNFCCC. But the more accurate world of statistical bureaus, who in their Green National Accounts are reporting biomass emissions parallel to other emissions, is also part of the international or interstate system. The UN Statistical Commission has, thus, adopted a corresponding inclusive standard (Andriianets & Rørmose, 2015).

Finally, the European Court of Justice in March 2019 received a lawsuit from a group of individuals, NGOs and scientists. See http://www.eubiomasscase.org.: "The case argues that not only are the uncounted CO_2 emissions from biomass burning undermining efforts to address climate change, but subsidies for biomass are increasing demand and driving increased logging of forests in Europe and North America" (Press release). More specifically, the complaint is aiming at the new EU Directive on Renewable Energy (RED 2), which is pressing member states to use their full potential of biomass for energy purposes. It is not known, whether the Court will take the case, but reasons to do this can be found in the Århus Convention on transparency in

environmental matters, dating back to 1998. This Convention should promote "access to environmental information, public participation in environmental decision-making" and in case of doubt "access to justice". The Aarhus Convention Compliance Committee found, however, after 10 years of complaints that the EU because of insufficient mechanisms to ensure review of EU acts does not comply with the access to justice provision (Pánovics, 2017). This is directly relevant for the EU biomass case and may give it a chance at the European Court.

Conclusion 4: Under the purpose of the UNFCCC to stabilize CO_2 concentrations in the atmosphere at a level in accord with the Precautionary Principle, the reporting of national emissions must comprise CO_2 emissions from the combustion of biomass, too. Since the perspective of a second Kyoto period after 2012 was abandoned, there is no globally binding treaty. Therefore, the Kyoto-phrase that "biomass fuels are considered CO_2 neutral" in the energy sector has no consistent backing in the land sector. Instead, the complexities of forest development must be considered. Forest resources must not be considered as "free gifts" of nature. Their need of protection must be prioritized to avoid more forests tipping into becoming net sources of GHG to the atmosphere and forest potentials to draw down CO_2 from the atmosphere are foregone.

For a Real Hopenhagen Without Erroneous Carbon Accountancy on Woody Biomass

The IPCC report of August 2019 on "climate change and land" admits that "the production and use of biomass for bioenergy can have co-benefits". But it adds that energetic use also can have "adverse side effects, and risks for land degradation, food insecurity, GHG emissions and other environmental and sustainable development goals". It also admits that "the use of residues and organic waste as bioenergy feedstock can mitigate land use change pressures associated with bioenergy deployment". But again, it adds that "residues are limited and the removal of residues that would otherwise be left on the soil could lead to soil degradation" (Summary for Policy Makers, B 3.3). This diplomatically balanced statement is a novelty compared to the 2006 guidelines from IPCC, cited above. It finally supports the community of critical voices, which in Denmark at least since 2011 has accompanied the large-scale conversion of fossil fuel driven power and heat plants to biomass fuels (other than straw, which was the original feedstock in some utilities in the early 1990s, with its short rotation).

As the frontpage of the Danish journal 'Information' stated on August 9, 2019: "More than half of Denmark's renewable energy stems from use of biomass and counts—on paper—as climate neutral. We cannot recommend other countries to do the same, says professor in energy planning". Brian Vad Mathiesen of Aalborg University says directly: "The model we have in Denmark, where we have converted our power plants and heat sector to using biomass, is not sustainable". We come back to his recommendations of, what to do instead.

The actual situation in Denmark and especially its capital Copenhagen is, on the other hand, characterized by a severe dilemma, when cities receive their power and heat supplies from utilities converted to biomass. They calculate with huge CO_2 paper-reductions from this conversion: emissions from the combustion of biomass are simply not considered - or counted as zero. This casts a shadow of doubt over otherwise laudable efforts of people and institutions to become CO_2-neutral cities within the next 10 years or so—Copenhagen in 2025.

This procedure should be corrected, as biopiracy from centers of power is morally outdated. However, the city of Copenhagen is in October 2019 host to a major rally of over 100 mayors from big cities around the world, organized in the C40 network. When nation-states and their cooperative institutions, such as the EU and UN so far have failed to curb the rising problem of global warming, there is a focus on big cities as rescue. The C40 network does a good job in this respect. But it is not sustainable to applaud to the way, the city of Copenhagen makes its carbon accounting and to generalize it throughout the world.

The Danish city planner journal *Byplan Nyt* paved the way for that in espousing that in missing backing from the EU and nation-states "210 mayors cannot be wrong" (Editorial Byplan Nyt, 2019).

In reality, all three levels are wrong. C40 has together with the World Resources Institute (WRI) and ICLEI, Local Governments for Sustainability—a global network of more than 1,750 local and regional governments committed to sustainable urban development—adopted the problematic methodology for carbon accounting. Their 2014 rules state: "CO_2 emissions from biomass combustion shall be accounted for but reported separately as an information item because the carbon embedded in biomass is part of the natural carbon cycle" (WRI, 2014, p. 153). Referring to the IPCC Guidelines of 2006, this means that emissions from biomass combustion are not added to fossil emissions.

The IPCC report of August 2019 on "climate change and land" comments the latter dualism pragmatically as follows: "Land is simultaneously a source and a sink of CO_2 due to both anthropogenic and natural drivers, making it hard to separate anthropogenic from natural fluxes" (IPCC, 2019, SPM, A 3.1). This regards the complexities of terrestrial ecosystem developments as part of the interactions between man and environment and its societal determinants. Regarding CO_2-outputs from chimneys and tale-pipes it is clear, that also biogenic emissions (Gunn et al. 2011) are drivers of a rising CO_2 concentration in the atmosphere and not only fossil fuel. Comprehensive action for decarbonization is needed to also reduce these emissions.

Denmark's new center-left government under social democratic leadership has won its majority in summer 2019 not the least because of the need for systematic new initiatives in climate politics. This was articulated by the ambitious goal of reducing Denmark's CO_2-emissions in 2030 by 70% of the amounts of 1990. This is the reference year of the Kyoto Protocol and the accounting method is that from the IPCC guidelines of 2006. In the diplomatic race to deliver stronger contributions to the goal of the 2015 Paris Agreement, this sounds good.

But carbon accounting in "Kyoto-GHG" or "Kyoto-CO_2" should be abandoned in favor of realistic accounts, including emissions from biomass. The concretization of CO_2-accounting on regional or city level is the proof of the pudding. After all, it would be an anti-scientific, serious ideological mistake to continue a policy, where burning woody biomass is understood as a green initiative—from city utilities to private wood stoves that pollute their environments, e.g., with dioxins that enhance noxious effects from polycyclic aromatic hydrocarbons (PAH's) and (ultra-)fine particles, to name only a few components. This was a policy promoted by the bourgeois governments of Denmark since 2001, which should be rolled back.

A strategy how to do this has been developed by an international research group with participation of Danish researchers as Brian Vad Mathiesen of Aalborg University, mentioned above. The strategy is described in a 2019 paper "From Carbon Calculators to Energy System Analysis in Cities". The aim of the strategy is to decarbonize cities, that is, to reduce the use of carbon-containing fuels generally, not only fossil ones. Point of departure is that cities "already are becoming more integrated via energy sector coupling", e.g., through

decentralized renewable energy and electric vehicles. A change in methodology is seen as possible to enhance this development.

Carbon accountancy can, namely, be lifted up to a higher level: “Today, cities often use simple methods to assess their low carbon targets, e.g., carbon calculators, and these methods use annualized carbon reduction potentials. For example, reductions from heat savings in buildings or fuel demand in transport”. This method is too simplistic and isolated in energy sectors. In contrast, the researchers “describe a methodology that goes beyond carbon calculators and assesses highly renewable energy systems”.

In a planning perspective, they declare: “The future energy system will be highly electrified, and this requires that local energy sectors are integrated, creating numerous synergies via energy storages and flexibility” (Mathiesen, Drysdale, & Lund, 2019, p. 2). How this can be done, is demonstrated with the Danish case of Sønderborg city. Instead of yearly data on energy sectors, hourly needs and deliveries of services are calculated so that storage needs can be addressed. Energy, town, and regional planners should read the study.

The advanced method employed in the Sønderborg study should also be used in big cities. On the way to that goal, I recommend clearing the table in carbon accounting and revise calculations by integrating time-sensitive biomass emission and capture into carbon reduction assessments. This change is easier accomplished in a perspective of the complex energy systems to be established because it makes the negative effect less onerous of realizing that there are still more millions of carbon dioxide to be reduced. The systemic transition makes it possible, since it must be more comprehensive than only filling new wine in old baskets, as it happened with power and heat plants.

The public controversy around the issue of biomass overconsumption has recently become alive again in Denmark. According to economics professor at the University of Copenhagen and earlier chairman of the official Climate Council, Peter Birch Sørensen, this has good reasons: “The official climate accounting does not mirror the real climate effect of using wood for energy purposes—and the Danish politics with taxes and duties has aggravated the problem” (daily ‘Politiken’, 11.8.19). In a deep oversight article, where he and energy planners Brian Vad Matthiesen and Henrik Lund from Aalborg University are interviewed together with agro-ecologist Jørgen Eivind Olesen from Aarhus University, who share the critique, Birch concludes: “In practical life, Denmark’s big consumption of biomass contributes to accelerating global warming” (weekly ‘Mandag Morgen’ 19.8.19). Thus, the worst case envisaged by physicist Bent Sørensen (2000) has been realized: “The lag time for trees (between the time of combustion and completed regrowth, Czeskleba-Dupont) may be decades or centuries, and in such cases the temporary carbon dioxide imbalance may contribute to climatic alterations” (p. 477).

Conclusion 5: Carbon accounting must be extended from the one-sided approach of reckoning only with “Kyoto-CO_2” from fossil sources to integrated assessments of, how to reduce CO_2 emissions from the use of biomass sources, too. The Danish example of massive scale conversions from fossil to biomass sources for combustion-derived energy cannot be generalized internationally. To become sustainable, correcting erroneous premises is a first step to be taken.

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