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# Paris Agreement, Precautionary Principle and Human Rights: Zero Emissions in Two Decades?

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**Abstract:** The Paris Agreement of December 2015 is subject to much criticism of being inadequate. This however neglects its very ambitious objective, which limits legally-binding global warming to 1.5 to 1.8 degrees in comparison to pre-industrial levels. This article shows, based on the overlap of unanswered questions for prognoses in natural science and the legal precautionary principle, that this objective indicates a legal imperative towards zero emissions globally within a short timeframe. Furthermore, it becomes apparent that policies need to be focused on achieving the 1.5-degree temperature limit. From a legal standpoint with regard to existential matters, only those policies are justified that are fit to contribute to reaching the temperature limit with high certainty, without overshoot, without leaving the 1.5 limit aside and without geoengineering measures, in contrast to the tendencies of the IPCC. This creates a big challenge even for the alleged forerunners of climate policies, Germany and the EU; because, according to the objective, the EU and Germany have to raise the level of ambition in their climate policies rapidly and drastically.

**Keywords:** Paris Agreement; precautionary principle; human rights; climate change; IPCC

## 1. Research Issue and Methodology: Basics of the Paris Agreement and Its Legally-Binding Nature

According to a broad scientific consensus [1–3], the Earth is facing global warming by 3 to 6 degrees Celsius compared to pre-industrial levels by the turn of the 21st Century. This is primarily caused by human-induced high greenhouse gas emissions, most of which, putting aspects of land use aside, are caused by intensive use of fossil fuels in sectors like transport, buildings, industry and electricity. The electricity sector, which is focused on almost exclusively in pioneering countries such as Germany [1,3], is just one of them. As estimated based on natural science and economics, this degree of climate change has the potential to cause massive economic damage, big migration movements, existential threats to millions of people and lastly violent disputes over diminishing resources such as food and water. So far, it is little acknowledged in political and public discourse that reducing greenhouse gas emissions [3,4] (especially, but not exclusively from fossil fuels) is also the central solution to ocean acidification as another upcoming environmental problem. Those emissions are therefore also cause for the frequently flagrant danger to marine ecosystems [5].

In December 2015, nations worldwide agreed to a new global climate agreement. Commonly, the Paris Agreement (PA) has been welcomed enthusiastically, especially after the success of the negotiations was doubtful. At the same time, there are questions on how effective it will be. Generally, all nations are required to take more ambitious measures to stop climate change (mitigation), to adapt to consequences of unavoidable climate change (adaptation) and to provide financial aid for countries harmed by climate

change (loss and damage). Still under negotiation are the details of the PA and concrete emission reduction pledges of countries, which are voluntary in their quantity and undermined by unclear calculation methods and procedures (see more on the discourse with further references [6–9]).

This study will however not focus on the much-discussed issue of further defining the details of the PA, but rather take a closer look at the overarching target and its implications. It will provide an analysis of the legally-binding target, which limits global warming to “well below 2 degrees Celsius above pre-industrial levels” and pursuing “efforts to limit the temperature increase to 1.5 °C above pre-industrial levels” (Art. 2 para. 1 PA; on nature and history of climate targets [8,10]). On the other hand, Art. 4 para. 1 PA states “In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible..., so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century.” Looking at these two indisputably legally-binding norms, potential contradictions come to mind. One is the fact that Art. 2 PA might require a more rapid decarbonization than Art. 4 PA. Another contradiction occurs as the norms potentially imply much further commitments to reduce emissions than have been the subject of public discourse. This calls for clarification.

We will do a legal interpretation of Art. 2 and 4 PA, while considering the latest estimates from natural sciences by means of a literature analysis of the emission reduction implications of those targets. (Legal norms are interpreted grammatically, systematically, teleologically and historically. This means according to their literal meaning, their relation to other legal norms, their purpose and their evolution. Usually, grammatical and systematic interpretation is applied because the other two approaches are prone to several problems. In the Anglo-Saxon legal sphere, a case law would also be used as a source of interpretation. There is, however, a lack of court judgments on the Paris Agreement, and it is a complex question as to which court and in what contexts its standards could be invoked and by whom. See more on legal interpretation with further references [3,11])

This enables us to determine the actual commitments that states made in Paris; and how possible contradictions might and must be resolved. Such analyses will show more clearly than ever to what extent states have to reduce their emissions. According to Art. 3 and Art. 4 PA, national commitments (nationally-determined contributions, NDCs) are to be reviewed regularly. NDCs serve the purpose of achieving the overall target. If not sufficient, states are legally required to raise them gradually. While much attention is paid to the NDCs and para. 2 and following of Art. 4 PA, the target in Art. 4 para. 1 PA is often overlooked (most prominently [12,13]). However, it contains specific requirements, which we will put in perspective to Art. 2 PA. This study also addresses how to cope with scientific uncertainty, the role of climate scenarios and defines “pre-industrial level”, which is elevated to a legal term in Art. 2 PA. As a reference, we will mention Germany and the EU at the end of the contribution, because they stand out as industrialized countries that seem to be making a proper effort to achieve their obligations in tackling climate change. It is therefore merited to see the result of this alleged strong ambition from the financially capable, politically apparently willing high-emitters [14,15]. This is not changed by the fact that with the PA for the first time, all countries, not only industrialized ones, are required to take concrete actions as Art. 4 para. 4 PA clearly states. In general, however, the assessment of individual countries is not the focus of this article. Rather, it analyzes the legal scope of Art. 2 and 4 PA.

## **2. Climate Policy between Art. 2 and Art. 4 PA: Global Zero Emissions in Just a Few Years Instead of the End of the 21st Century?**

What does it actually mean to reach a balance of emissions and sinks by the end of the 21st Century (Art. 4 para. 1 PA) and to keep global warming well below two degrees? What is the difference for implementation if staying within 1.5 degrees (Art. 2 PA)? The answers partially depend on the difficult empirical question of how much time remains for mankind to reduce its emissions to stay within the temperature limits (on the flaws of forecasts, see [16]). The possible conflict between those two norms also depends on the question of how they are legally interpreted: What is meant by “well below”

two degrees? The wording suggests about 1.7 or 1.8 degrees as a temperature limit, as it has to be significantly (“well”) below two, but more than 1.5 degrees (overlooked by [10]). “Pursuing efforts” towards 1.5 degrees does not mean that this objective can legally be easily dismissed. Rather, actual measures have to be taken, which try to reduce more emissions than necessary to stay within 1.7 or 1.8 degrees. The wording does not clarify the scope of these measures. Its wording and its evolution, meaning the negotiation process leading to the PA, however, suggest that 1.5 degrees are actually to be achieved, unless this is already impossible. We will see later in Section 4 that there is backup for this interpretation in basic rights.

Substantially, Art. 2 PA establishes a different target than all prior negotiations and also the public debate, in which the two-degree target was proposed. It goes largely unnoticed so far that this has potentially drastic consequences: much more ambitious emission reductions on a global scale. This is why the timescale of “second half of this century” for decarbonization in Art. 4 para. 1 PA might be too long to stay within the temperature limits. Therefore, what is a more realistic scenario? To determine the emission reductions correlating to a certain temperature target, the Intergovernmental Panel on Climate Change (IPCC) gives a degree of certainty and a degree of consensus among the scientific community [17]. Estimates are used, as well, in order to speak about future issues and because the development of the climate depends on numerous factors that are relevant, but not equally known (more on the resulting problems in Section 3). The IPCC context calculates climate developments in emission budgets, emission pathways or ppm, respectively ppb concentrations in the atmosphere [18]. (The abbreviations ppm and ppb stand for parts per million, respectively parts per billion, and express the amount of gas molecules in relation to the total number of molecules in dry air. Therefore, 391 ppm means 391 CO<sub>2</sub> molecules per million air molecules.)

The objective to limit global warming to well below two degrees in Art. 2 para. 1 PA calls for zero emissions globally within about two decades, according to IPCC data. In order to stay within 1.5 degrees, while assuming an equal level of global per-capita emissions, zero emissions have to be reached within a very short time. These IPCC estimates are used, e.g., by [19–22] (more optimistic [18]). These are based on greenhouse gas emissions (depending on how long a specific gas stays in the atmosphere) and findings on the relation between greenhouse gas concentration and global temperature from 2014. On the grounds of these data, the probable global warming is projected. These papers use scenarios, which stay below two degrees with 66 percent certainty and within 1.5 degrees with a 50 percent certainty, based on a remaining budget of about 250 GtCO<sub>2</sub> in 2014 ([2,23] had calculated with 1000 GtCO<sub>2</sub> from 2012 for the significantly higher target of two degrees; see also [24]). Looking at research outside of the IPCC, budget calculations frequently refer to either 1.5 degrees, 2 degrees or vaguely to below 2 degrees. However, even those calculations referring to the same temperature target with the same probability vary widely in their budget estimations (see Section 3 for the reasons) as there are various aspects that are expressed by using probabilities. In short, these are: (1) the assessed uncertainty range, used if there are multiple lines of evidence; (2) the uncertainty range resulting from the variety of parameters from different carefully-selected models; (3) the uncertainty range across arbitrarily-collected results of models [25,26]. The most recent calculations amount to varying budgets between minus 257 and 693 GtCO<sub>2</sub> to stay below 1.5 degrees with 66 percent probability [26,27] and between 590 and 1240 GtCO<sub>2</sub> from 2015 for a below-two-degree target at 66 percent probability [26]. Even though human impact on the climate system is likely to date back to the 1700s, there is no reliable data from that time. Therefore, most calculations rely on data recordings starting in the late 1800s, so this cannot account for the differences in results [27,28]. However, they differ in whether all greenhouse gases (expressed in carbon dioxide equivalents) or only carbon dioxide is included [20,24,26,29–35] (on the high variability of energy scenarios, see [16]) and which approach is taken to determine the budget (see the next section; [26,36]; on combining models, see [37]). Considering these findings and the call for a 1.5-to-1.8-degree target, Art. 2 para. 1 PA requires global zero emissions within less than twenty years based on the current rate of emissions [27]. Thus, there is *prima facie* a contradiction between Art. 2 para. 1 PA and Art. 4 para. 1 PA. The first

norm is very ambitious; the latter only to a limited extent. Especially Art. 2 para. 1 PA challenges all climate policy so far. This requires further analysis in the next sections.

### **3. Lack of Clarity in the Data: On Base Year, Certainties, Climate Sensitivity, Frictions of Scenarios and a Precautionary Principle Strengthened by Human Rights**

Scenarios based on various assumptions are the cause of the widely-varying results. The talk of probabilities and budgets therefore does not completely answer the degree of real obligation that results from Art. 2 para. 1 PA. Climate modelling, estimates and assessments are always subject to uncertainties, which further explains the widely-varying results of differing models, assumptions and scenarios [2,20,24,38]. Looking at all different models, as done in the IPCC Assessment Reports, helps to react to this phenomenon [20,39]. The models are so complex and based on so many assumptions (which are usually not very transparent for outsiders or even for the scientific community), that a comparison of all details would exceed the limits of a primarily legal analysis. Yet, it is still useful for further understanding which approaches are taken [26,27]. There are firstly budgets that include only warming induced by CO<sub>2</sub>, which is deducted from the transient climate response to cumulative CO<sub>2</sub> emissions (TCRE). It is a way to connect emissions with the global warming they are going to cause [40]. However, the use is limited, as other GHG cannot be factored in (attempts to provide models, e.g., on the N cycle have failed due to its complexity [40]). Secondly there are threshold exceedance budgets (TEB), which aim to determine how many cumulative CO<sub>2</sub> can be emitted to reach a specific temperature target. In this method, other GHG sources can be factored in (see below). The issue with this approach is that delayed climate responses are not considered; therefore, the budget will surpass the target, counting on future negative emissions to return to the target level (on the implications of this, see Section 4). Thirdly, threshold avoidance budgets (TAB) estimate with a given probability the remaining emission budget to stay below a certain temperature target either within a given time frame or until peak warming. The latter is roughly estimated at the time net zero CO<sub>2</sub> emissions are reached (on the interplay of different factors, see, e.g., [41,42]). Other gases are also considered. There are two general types of models used: (1) integrated assessment models (IAM), which exponentiate GHG emissions while attempting to grasp the economic and industrial developments; (2) Earth system modelling (ESM), which simulates the complex carbon cycle [17,27]. Further uncertainties are added to all kinds of models by a lack of truly understanding some feedbacks and physical processes associated with global warming, such as water vapor, lapse rates, clouds, snow and ice. Furthermore, natural cycles like the carbon cycle cannot yet be fully anticipated in terms of the developments and capacities of sinks and sources (this regards both terrestrial and the oceans) [43].

Therefore, the obvious question is whether a government inactive with regard to climate policies can simply follow the most favorable scenario for them. Even considering that liberal-democratic constitutions require politics to base their decisions on facts that are as sound as possible, it is quite obvious that there are political margins where research meets uncertainties [3,11,44–46]. In the following, we will see two things: For one, there are several indications that current calculations are too liberal. Therefore, realistic projections or predictions have to be based on the scenarios with smaller budgets. Secondly, from a legal point of view, politics must not take substantial risks when it comes to climate change, because of its existential role for humankind.

As we have seen, it is correct that a calculation of future climate developments involves factors that can lead to vagueness. Generally, predictions of the future can never be absolutely certain. This is especially true in view of the highly complex issues of sustainability often acknowledged. The size of the projected budgets depends on several assumptions. In order to calculate the significance of a norm like Art. 2 para. 1 PA, it is crucial whether the assumption is to lower emissions right away or whether they will continue rising for some years. One of many further factors contributing to uncertainty is the accumulation of short-lived aerosols (polluting particles) in the atmosphere, which lead to a delayed climate effect of anthropogenic greenhouse gas emissions (albedo effect). A positive side-effect of this

is that methane, which has a very high climate effect, is removed from the atmosphere within 10 years due to reactions with other chemical species. However, many human-induced CO<sub>2</sub> emission sources also produce aerosols, which have a net cooling effect due to the presence of sulfate and nitrate aerosols. Thus, reduction in CO<sub>2</sub> sources could reduce aerosols, leading to short-term warming. However, in the long-term, this would result in cooling due to the larger radiative forcing of CO<sub>2</sub> [26,37,41,43,47]. The gross national product and population development are another cause for the range of detailed predictions, respectively projections [48] (extensively on regional scenarios also [49]). Another one is the storage capacity for CO<sub>2</sub> in oceans. Oceans are especially crucial, because they warm up slowly and in several layers. The colder they are, the higher is their storage capacity for greenhouse gas emissions.

Furthermore, the issue of climate change is interlinked with other major social issues like economic growth, digitalization, international trade, globalization, automatization, etc. Development of those issues is again each dependent on many and complex variables. All this cannot be fundamentally solved by the models and scenarios on which they are based. Scenarios or models are neither a definitive prediction (which is impossible), nor are they able to consider all possibility scopes of future developments. They are even less normative (further problems such as non-transparent basic assumptions are analyzed in [16,50]; exemplary despite exhaustive and thorough work is given in [51–53]). When, due to uncertain variables and unknown events, it is not possible to determine an exact likelihood of an occurrence, budgets provide a (frequently very thorough) estimate instead of a real calculation in the stricter sense. Because it is not possible to do math with unknown probabilities, not even with great expertise.

Even if the future climate is not entirely predictable, there is a strong indication to granting the highest empirical validity to the smaller remaining budgets:

- Firstly, many calculations are based on limiting global warming to two degrees, which is less ambitious than staying “well below 2 degrees” in accordance with Art. 2 para. 1 PA. Following a two degrees pathway will not only lead to higher budgets, but also to underestimating the extent of the challenge: zero emissions within a short period of time. The longstanding discourse on the compatibility of economic growth and environmental protection for instance widely ignores this by not choosing the required level of ambition (in detail, see [3,54–56]; not discussed by [57]; on costs, see also [58]).
- Secondly, not all budgets include non-carbon-dioxide emissions. The inclusion of non-CO<sub>2</sub> emission in the scenario calculations has different implications, since they have different global warming potentials (GWP; lifetime in the atmosphere and radiative efficiency) [59]. Some models include only CO<sub>2</sub> (on TCRE, see [60]). In other scenarios, non-CO<sub>2</sub> emissions are included, but it is not yet possible to include the complexity of their varying GWP changing their amounts. Therefore, a fixed level of non-CO<sub>2</sub> emissions is chosen in current scenarios, inclining recent studies to assume that their impact is currently underestimated [17,37,41,60]. Even so, other greenhouse gases do not remain in the atmosphere as long as carbon dioxide, and they cannot be disregarded in their effect on the climate [18,59]. Concluding the need for action in terms of greenhouse gas emissions from a carbon-dioxide-only budget, the scope of the problem is artificially reduced.
- Thirdly, budget calculations become rather liberal by setting the base year of the “pre-industrial level” (Art. 2 para. 1 PA) rather late, meaning when climate change had already set in. This leads to an underestimation of human-induced global warming (IPCC data are also compiled at [23]). Generally, a baseline is needed to make consistent calculations. As mentioned earlier, a base year between 1860 and 1880 is most commonly used in calculations of the temperature limit; however, 1750 is also mentioned [20,24]. This leads to the question of when exactly industrialization, respectively the increase of emissions actually started. The IPCC draws the line initially in the year 1750 [17]. However, calculations and estimations of the average global warming are either based on the year 1850 or 1870, because there is little temperature data on the time prior to the 19th Century. However, data that do exist are limited to the Northern Hemisphere [1,17]. The increase of carbon dioxide before 1850 accounts for a temperature rise

of 0.1 to 0.2 degrees Celsius [28]. On the bottom line, defining “pre-industrial level” is merely a free-floating empirical discussion about the emissions level of the respective time. However, looking at the term “pre-industrial level” in the PA as a legal document, it seems mandatory to assume 1750 as the base year; because this is when the industrial revolution in Western countries actually started, and not as late as between 1860 and 1880.

- Fourthly, existing calculations seem also quite liberal, if comparing other assumptions on climate sensitivity. Equilibrium climate sensitivity (ECS) [18] indicates the temperature rise if CO<sub>2</sub> equivalents in the atmosphere double. It is therefore an important reference for climate modelling and lastly also in determining the temperature limit of Art. 2 para. 1 PA [17]. According to [22], the ECS is probably between 1.5 and 4.5 degrees Celsius. Newer studies by [61,62] suggest that the ECS has been underestimated and might be at the higher end of the range or even above it. Paleoclimatic research showed for instance that climate sensitivity changes with the state of the climate. In warm phases (such as we are in right now), the ECS is significantly higher, according to the calculations of [61], 4.88 degrees Celsius; thus, clearly above the IPCC range. The authors in [62] found in their study that the amount of solar radiation reflected by clouds into space is not as high as assumed so far. Instead, more radiation penetrates the cloud layer and warms the Earth more strongly. Depending on the cloudiness, climate sensitivity is up to 1.3 Kelvin higher than so far expected [47].
- Fifthly, budget calculations are based on accepting a high probability of missing the temperature limit. However, the willingness to live with success probabilities of 50 or 55 percent is astonishing (even if 100 percent certainty will obviously never be reached when dealing with future situations). Therefore, we need to consider: some critical tipping points like the melting of the Greenland or the West Antarctic ice shield, and coral bleaching will probably even occur if the temperature rise stays well below two degrees [31,63]. A target range between 1.5 and 1.8 degrees guarantees therefore by no means landing in an array, which leaves a margin for error.

These points strongly suggest that a smaller budget, requiring decarbonization within just a few years, is called for in Art. 2 para. 1 PA in light of empirically-realistic predictions or projections. This allows for further legal assertions. There are two legal aspects that further underline the obligation to take low risks of substantial damage, which means taking fast and drastic climate protection measures:

1. It has to be pointed out that governments cannot accept staying within 1.7 to 1.8 degrees, but have to aim at 1.5. As said before: the obligation to make “efforts” towards the 1.5-degree target does legally not allow for an easy dismissal of this objective. Rather, actual measures have to be taken to achieve more reductions than probably required for a 1.7- or 1.8-degree target.
2. Human rights contain the obligation for climate protection to secure elementary preconditions of freedom, which are life, health and subsistence [3,6,46,64–69]. This obligation is at the same time explicitly recalled in the preamble of the PA: knowing that unrestricted anthropogenic global warming interferes with food and water security and will therefore (alongside more natural catastrophes) increase the likelihood of migration movements and wars over shrinking resources. This may endanger the foundations of human civilization [2]. While it is true that balancing human rights obligation to climate change is *prima facie* left to political margins (for instance, due to the contradicting freedom rights of enterprises and consumers), which is only limited by those balancing rules that have to be complied with, one of these rules states that political margins of decision-making end where political action or non-action will endanger the liberal-democratic system as such [3] (on further rules, see also [44,46]). This is exactly the effect unchecked climate change might have. For this reason, ambitious climate policies are obligatory in view of human rights.
3. This raises the question how strongly and how quickly emissions have to be reduced. It is obvious that all those developments described are well possible, however not in all details definitely certain to occur. However, basic rights protect not only against certain dangers, if the danger is at the

moment of occurrence irreversible; and exactly this is the case with climate change. Otherwise, the protection provided by basic rights runs empty [3,11,69]. Human rights thus contain a precautionary principle; even if this were disputed, it remains undisputed that the precautionary principle (also) exists independently of human rights on national, EU and international law. This is manifest, e.g., in the Framework Convention on Climate Change (UNFCCC) in Art. 3 para. 2 UNFCCC, in the Treaty on the Functioning of the European Union (TFEU) in Art. 191 TFEU or in the German Constitution in Art. 20 lit. a Grundgesetz (German Constitution, GG). Precaution means taking measures in view of long-term, cumulating or uncertain damages [3,9,70,71]. All this applies to climate change. The connection to human rights only served to emphasize (and provide grounds for litigation) what is already enshrined in the precautionary principle: the bigger the impending damage in its occurrence, the more ambitious the necessary protection measures have to be; which also includes measures at the cost of mentioned goods like economic freedom. Therefore, in dealing with existential dangers, it is not enough to accept moderate probabilities for their defense, even if 100 percent certainty can of course never be reached regarding future events.

4. Furthermore, as we will see in Section 4, it is not allowed from the legal point of view to calculate TABs based on an overshoot or on geoengineering measures.

Therefore, it is a legal obligation in the debate on the level of ambition required by the PA to focus on the rather pessimistic figures. This means, accordingly, taking extensive measures (globally) for a short-term decarbonization. Furthermore, using the balancing rules derived from human rights guarantees for freedom and preconditions of freedom (suitability, necessity, efficiency, polluter-pays principle and many more), it is possible to determine not only a common obligation to preserve the climate, but also draw rough conclusions for burden sharing. Ostensibly, this might not seem important, given that the objective is zero emissions for all states anyhow. It is however to answer questions of allocation of expenses for globally necessary measures in mitigation, adaptation and loss and damage. EU member states like Germany have emitted high amounts of greenhouse gases per capita, which are still in the atmosphere. This increases the urgency for action in these countries to go beyond the required, respectively increased, obligation to bear the costs of measures taken in the Global South. This is elaborated on in [3,11,20,21] and briefly in the second to last paragraph. It is not possible to make a more exact statement, as much as some would wish to do so. If we stated that “maximum” efforts are required, the degree of obligation would still remain unclear. Should we not turn off all electric appliances, which are not directly essential to our lives right away? Should we not reduce the supply of animal food products to a tenth of what it is now immediately? Those questions are far from only touching on technology, but imply, besides the commitment to resolve the remaining unclarity, a balancing process that sometimes, we have to endure drastic interventions for an effective climate protection. Determining the exact extent of actions under the premises of limited (!) fact-based and balancing-related vagueness, can only be done by elected politicians in order to preserve the democratic process and the system of checks and balances. Therefore, neither constitutional lawyers nor engineers will do. Yet, as seen above, the margin of action remains quite limited. More generally on liberal democratic checks and balances under given circumstances [3,11,44,46]. It follows that even the 10 to 20 years on average remaining to achieve decarbonization are rather too generously estimated (in view of the statements in Section 2). This is despite the already drastic efforts needed to meet the huge challenge of reaching zero-emissions within one or two decades in all sectors including aspects like fuels, agriculture and plastics (on the issue of economic feasibility of decarbonization in contrast to a business-as-usual scenario with all its possible catastrophic consequences, see [72] with further references) [3].

In a few months’ time, it will become clear whether the resulting legal requirements and the exclusion of overshoot and geoengineering will also be taken into account in the IPCC Special Report; if this is not the case, the projections and recommendations made there will remain legally problematic.

#### 4. Results: Legal Interpretation and Resolution of the Relationship between Art. 2 and 4 PA

Substantially, Art. 2 PA has a very ambitious indication. Its indication is different from the two-degree target, which had been grounds for negotiations and public discussion until then. So far, this fact has had little attention, despite the drastic consequences; that is to say short-term immense emission reductions on a global scale. The additional target of Art. 2 para. 1 PA to pursue efforts to limit global warming to 1.5 degrees adds severity to the already strong indication. Parties to the PA “aim to reach” peaking emissions “as soon as possible” and neutralize emissions completely within the second half of the 21st Century according to Art. 4 para. 1 PA. This, however, will not be soon enough to stay within the targets of Art. 2 para. 1 PA. Therefore, there is a legal contradiction between Art. 2 para. 1 and Art. 4 para. 1 PA, which requires determining the priority through legal interpretation. Some arguments suggest a priority of Art. 2 para. 1 PA. They are mainly the result of systematic interpretation, thus a norm interpretation, which considers the connection between different norms.

- In favor of the priority of Art. 2 para. 1 PA standing firstly, that it is an overarching objective. Art. 4 PA deals subordinately with concrete strategies in order to achieve this objective. Art. 3 and Art. 4 para. 1 PA literally state this twice. The point of orientation, and accordingly the prior norm, is therefore Art. 2 PA.
- From the perspective of history and the purpose of the norm, Art. 4 para. 1 PA means above all (even if the wording includes all states, due to the term “Parties”) that developing countries and emerging countries (not, however, industrialized countries) should still have time to reduce their emissions. This is also reflected in Art. 4 para. 4 PA. For developing countries, this is not possible without violating Art. 2 para. 1 PA. Anyhow, the fact that primarily one group of states is meant shows two things: Art. 4 para 1 PA has a rather operative and serving character. For industrialized countries in particular, it is highly doubtful whether Art. 4 para. 1 PA is intended to stand in contradiction to Art. 2 para. 1 PA.
- A third, systematic point can be framed as follows: if interpreting the norm hierarchy in favor of Art. 4, Art. 2 would still be violated. If, on the other hand, interpreting in favor of Art. 2, Art. 4 PA is not violated; it is rather overachieved, as Art. 4 PA does not prohibit being faster than formulated. The phrase “keep well below 2 degrees” in Art. 2 PA underlines also that emissions cannot rise indefinitely and then brought back to a level accommodating the temperature level. Art. 3 PA clearly states that states have to comply with Art. 2 PA by continually increasing their level of ambition (on the current level of efforts in the following chapter). It reads: “As nationally determined contributions to the global response to climate change, all Parties are to undertake and communicate ambitious efforts as defined in Articles 4, 7, 9, 10, 11 and 13 with the view to achieving the purpose of this Agreement as set out in Article 2. The efforts of all Parties will represent a progression over time, while recognizing the need to support developing country Parties for the effective implementation of this Agreement”.
- A fourth systematic reason speaks for the priority of Art. 2 PA over Art. 4 PA: the PA is in its legal systematic interpretation a concretization of the UNFCCC, respectively implementing a legal treaty within the UNFCCC. Especially, Art. 2 UNFCCC contains the overarching objective of all international climate law to prevent dangerous anthropogenic disruptions of the global climate. This disruption can, as shown previously, only be prevented if Art. 2 para. 1 PA is treated priority to Art. 4 para. 1 PA, because the indications in Art. 4 para. 1 PA would allow for such a substantial global warming. According to the Art. 31 para. 3 Vienna Convention on the Law of Treaties, such a systematic interpretation of the PA in light of other legal acts of international law is explicitly part of the interpretation process. This is all the truer as human rights guarantees also point in that direction, as seen earlier.

One issue has to be added on the side-lines. Neither Art. 2 para. 1, nor Art. 4 para. 1 PA explicitly contain a statement regarding the phase-out of fossil fuels in electricity, heating, transportation, plastics and mineral fertilizers in favor of renewable energy, energy efficiency and frugality, despite the

problematic role of fossil fuels. The statement to neutralize emissions that they do contain could, at first sight, intend to employ geoengineering, instead of phasing out oil, gas and coal. Geoengineering refers to interventions in the atmosphere or the oceans (or storing sequestered CO<sub>2</sub> underground, e.g., from coal power plants), in order to reduce solar radiation or increase the storage capacity for greenhouse gases [73,74]. The discussion of these technologies is too complex to be reflected in this paper en passant. However, when those options prove to be impossible to implement, at the latest, a phase out of fossil fuels and the transition to 100 percent renewable energy, increased energy efficiency and maybe even frugality will become imperative (and in their quantity limited, directly available compensation measures like rewetting dried wetlands to neutralize emissions; which will remain even after the complete phase-out of fossil fuels). All timelines indicated by Art. 2 para. 1 PA suggest this. Respective technologies are currently not ready for the market, which is why the discussion about possible high costs and risks (and their compatibility with Art. 2 para. 1 PA, the precautionary principle and human rights) is rendered unnecessary for the most part (on the controversy on negative emissions, see [3,23,25,73–76]). This remains true, even in view of the abovementioned TEBs, which assume an emissions and temperature overshoot before withdrawing GHGs from the atmosphere [26,37,40,41,43,60]. After all that has been said, the risk associated with counting on technologies that are not yet in place goes both against the precautionary principle and the provisions in Art. 4 para. 1 PA. They clearly state that “balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases” is to be reached between 2050 and 2100.

The findings above are not invalidated by the possibility that reaching the target of Art. 2 para. 1 PA might just not exist and therefore the issue of the relationship between the norms is allegedly solved differently. Even though the impossible cannot be legally required, as seen elsewhere in more detail [3,11], this is probably not the case with the target of Art. 2 para. 1 PA. It would only be defined as impossible, if natural laws suggested that. As far as we know today, this impossibility does not (yet) exist. Furthermore, the findings cannot be dismissed by the popular statement, e.g., in [77] that it was useless to define targets at all, because Art. 2 para. 1 PA contains one and is legally binding (see below and in Section 3).

Equally false is the indication that not all objectives in law are also legally binding; because, in contrast to other objectives e.g., to generally protect the climate, Art. 2 para. 1 PA is clearly and unmistakably formulated. Art. 3 and Art. 4 para. 1 PA underline that Art. 2 para. 1 PA contains the binding basis of all climate measures (overseen by [8,10]). Even less valid is the counter-argument that most states envisaged Art. 2 para. 1 PA merely as soft (media-effective, but without legal consequences) lyrics when they adopted it; because law applies in its wording and the system of norms and not some motivational findings in their evolution.

Some might finally counter: Is the PA not rendered insubstantial by the exit of the U.S.? Art. 28 PA states on the matter: “(1) At any time after three years from the date on which this Agreement has entered into force for a Party, that Party may withdraw from this Agreement by giving written notification to the Depositary. (2) Any such withdrawal shall take effect upon expiry of one year from the date of receipt by the Depositary of the notification of withdrawal, or on such later date as may be specified in the notification of withdrawal”; whereas the withdrawal will not affect the whole existence of the Agreement, because there is no termination intended, after it has once entered into force. If the ratification of the U.S. itself is called into question, an immediate exit would be possible. This, however, has not been done. If questioning a ratification, which has already been deposited (as was done in October 2016), would merit a withdrawal under international law and at the time call off the entry into force due to the lower amount of emissions that are globally accounted for, is highly doubtful. Disregarding these legal observations, the question of legality must be raised in light of human rights protection, if states with high emissions withdraw from international climate policy efforts.

## 5. Discussion and Concluding Remarks: The Paris Objective and Climate Policy up to Date

Disregarding the far-reaching and legally-binding target of limiting global warming to 1.5 to 1.8 degrees, national contributions are not sufficient, financial pledges to cover the costs caused by implementing the Agreement are vague and sanction mechanisms within the framework of the PA are simply non-existent [3,7,76,78]. Essentially, all states will miss the ambitious temperature limit of Art. 2 para. 1 PA by far, based on their national climate targets and still more drastically their policy instruments. The Emissions Gap Report of the UN Environmental Program evaluates whether the sum of all NDCs submitted so far will account for the necessary paradigm change to achieve the PA objectives. The basis is firstly the two-degree target (not yet adapted to Art. 2 PA “well below” 2 degrees) and secondly the 1.5-degree target. This shows that current efforts are not enough [13,21,23,26,29,75,79].

If assuming the usually discussed parameters for burden sharing (primarily capacity and historic responsibility for emissions produced since 1990; see also on this Art. 4 para. 4 and 9 PA), the EU states such as Germany would have to reduce more emissions than they are currently emitting. Financing the rest of emission reductions in the Global South would imply double-digit billion dollar amounts annually; possibly raised even more by high payments for adaptation and compensation for climate-change damages. This may (according to one of the calculations) add up to a minus 162 percent emission reduction obligation even for the two-degree target (plus a lower probability for the 1.5-degree target) and a target year of 2050 for Germany (based on [2,80], and in detail, see [21]). In practice, this means, e.g., zero-emissions plus two-digit billion-Dollar obligations for Germany per year just for mitigation measures in the Global South. If assuming the “well below 2 degrees” or the 1.5 degrees of the PA, these figures increase further. The deficiencies of climate policies compared to Art. 2 para. 1 PA by states like Germany and the EU as a whole (but practically in all other states, as well) is already anticipated in Art. 4 PA. Because considering the very ambitious legally-binding target in Art. 2 para. 1 PA, it seems rather contradictory to allow states to submit voluntary national emission reductions to implement the overall objective. However, these NDCs have to be increased over time. This, i.e., more rapid and drastic contributions to reduce emissions, must happen right now for two reasons: Firstly, any delay will mean that the already extremely ambitious target will be even less achievable. Secondly, the parties to the Paris Agreement have scheduled an initial review of their reduction commitments for 2018.

Referring to the EU, or Germany, as a good example in terms of climate policies has not even had merit in the past, despite some singular successes [11,56,72,76,78,79]. That the negotiating parties have not reached a better result in Paris bears witness that: In Paris, the EU has pledged minus 40 percent greenhouse gas emissions by 2030 as the (supra-)national climate contribution according to Art. 4 para. 2 PA. This is far from the level of ambition of the EU-supported temperature limit in Art. 2 PA. If Western industrialized countries had pledged significantly higher reduction targets and higher financial support of developing countries in mitigation, adaptation, as well as loss and damage, clearer climate obligations for the global community would have been feasible. It is a fact that for instance the EU and Germany still account for per capita emissions of a multiple of what is climate friendly in terms of the temperature limit. This is especially remarkable since political and public communications and discussions suggest that the multiple measures taken already constitute a reversal of this harmful trend. The achieved relative emission reductions (on an absolute high level) since 1990 are largely based on statistical euphemisms, which translate (taking the emissions of per capita consumption) into an increase of emissions (to prevent repetition, see again a more detailed contribution with further references in [11,72,78,81]). How the EU could, along with other progressive states, address fossil fuels in all sectors and within the timelines implied by Art. 2 para. 1 PA (if necessary, combined with border adjustments to states, which do not participate) is not shown in detail here in this study to avoid repetition [3,4,58,76,82–84] (as a starting point of the debate. see [84]; for an overview on emissions trading, see [85]).

One obvious explanation about why (aside from complex behavioral research findings; on those, see [3,50]) the scope of Art. 2 para. 1 PA is neglected will be sketched here in short, as it has been elaborated elsewhere [3,55,57,72,76,86–88]. The temperature limit of Art. 2 para. 1 PA raises, if implemented seriously, the issue of compatibility with economic growth. Economic growth as the basis of modern society is challenged as soon as a more frugal lifestyle becomes part of climate policy, besides improved technologies in order to achieve the ambitious targets. However, economic growth is currently crucial for central social institutions like employment, retirement funds and the banking system [3,55]. However, this does not change the findings on the obligations from Art. 2 para. 1 PA, especially considering the devastating economic consequences of climate change.

Therefore, as much as the PA can be criticized in its details and degree of concrete obligation towards each state, it still represents the effort of the state community to ambitiously address climate change. States have committed to the legally-binding Paris long-term objective, which requires them to not only gradually, but also drastically increase their reductions pledges. Frequently, the argument is raised that more ambition will lead to less compliance among states and more exits from the PA after the U.S. One might also inquire whether it would not be sufficient to stay somewhere in the range of two degrees or on the contrary to be sure and say one degree of global warming is all we should aim for. From a legal point of view, however, this debate no longer really makes sense, because Art. 2 PA now delivers a binding objective. Regardless of this, it is a basic aporia of sustainability that easily-attainable goals are usually not sufficient ecologically, and conversely, hard-to-reach goals do not have a majority (whereby “aporia” literally means that the problem is unsolvable [11,76]. Some additional remarks: As with most all normative targets, they are defined to pursue a certain objective. In the case of climate change, the goal is laid out in Art. 2 of the UNFCCC to be the “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner”. The state community agreed that, based on scientific evidence, this level was at two degrees in 2009 (Copenhagen Accord, Decision 2/CP.15, FCCC/CP/2009/11/Add.1) and well below, based on new findings, two degrees, to make certain rather at 1.5 degrees. This is done in view of different conflicting objectives such as securing economic development, human rights, etc., and the physical possibility (one degree, e.g., has already been past and is not a feasible target anymore).

All in all, the PA forces a holistic discussion about the future of human economies and societies, which becomes unavoidable. If states currently try to achieve those rises in ambition since COP 23 of November 2017 in many small working groups, according to the Talanoa principle derived from Fijian, hope remains that the dimension of the problem is adequately reflected. A clear obligation to do so exists.

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