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What if... Discussing the Effects of the Paris Agreement on the Energy Markets

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Abstract

This paper establishes links between energy scenarios, future energy system pathways and greenhouse gas (GHG) emissions on the one hand and the Paris Agreement (PA) on climate change on the other. The PA's primary objective is to limit 'the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels'. The energy sector with its overwhelming contribution to GHG emissions plays a crucial role in the UNFCCC's ambitious drive to reach this objective. Despite the relevance of energy for climate change mitigation, however, historical links between carbon and energy markets have been surprisingly weak, while the lack of a solid demand for GHG emissions reductions has constantly undermined carbon and green energy markets. Only the clean development mechanism (CDM), which was established under the Kyoto Protocol in 1997 to reduce GHG emissions while contributing to sustainable development, has proven comparatively successful in mobilising efforts towards climate change mitigation in the energy sector. Based on these findings, this paper analyses components of the PA with a particular focus on Article 6, which provides the basis for the development of a mechanism similar to the CDM and a legal framework that may potentially guarantee a consistent and durable demand of GHG reductions. Introducing the basics of a reliable policy roadmap based on such considerations the paper suggests that Article 6 and its development will play a crucial role in shaping energy scenarios, future energy system pathways and associated GHG emissions.

Keywords: carbon markets, Paris Agreement, CDM, Article 6, carbon clubs

1. INTRODUCTION

Scenarios aiming to portray energy system transformation pathways towards greener and low-carbon systems have been published by a wide range of organisations, such as the International Energy Agency [1], Shell [2], the Institute of Advanced Sustainability Studies [3] and the World Energy Council [4], to mention a few, often leading to diverging conclusions. Uncertainty in terms of scenarios analyses have been the result of the legal gap in international climate change jurisdiction recently filled by the Paris Agreement (PA). Signed on December 12, 2015, under the umbrella of the United Nations Framework Convention on Climate Change (UNFCCC), the PA represents far more than a substitute of its predecessor, the Kyoto Protocol.

The PA's primary objective is to hold 'the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels' [5]. Drafted in a collaborative environment that saw all official delegation involved in the negotiations (Parties) actively seeking a high profile solution to confront climate change, the PA represents a milestone for climate change mitigation. Its provisions open up an entirely new agenda for international climate change policy. Elements such as responsibilities for all, the need of an effective action at global level and the emphasis on collaboration between Parties, represent the most relevant innovations established by the new Agreement.

Nowadays, policy-makers and key stakeholders wonder whether – and to what extent – these ambitious provisions may be translated in effective realities, while discussing the consequences that a similar implementation may lead in strategic sectors such as energy. With its overwhelming contribution to global greenhouse gases (GHG) emissions, energy (henceforth energy) represents the key sector in the debate on the feasibility of radical transformations envisaged by the PA.

Even though the Agreement still lacks clear indications about pathways of implementation, it is already possible to use it as an accountable foundation for the development of new energy-related scenarios. Understanding the key aspects of the PA that affect energy matters is, thus, of crucial relevance to facilitate accuracy of energy scenarios. This paper aims also at facilitating this understanding.

To do so, the relevance of energy as a source for GHG emissions, before recounting the history of linkages between energy and attempts to limit GHG emissions, is firstly summarized. The following section shifts attention on the PA. The Agreement is introduced under an energy-related perspective, in an attempt to provide evidence of relevant parts that constitute the foundation for an effective transformation of global energy regimes. Bearing in mind its limitations due to the current lack of

defined means for implementing different PA provisions, the paper suggests a preliminary set of policy options that, by filling the existing legal gaps, may provide the PA with the necessary tools for its full implementation. The suggested policy options are mainly focused on the implementation of Article 6 of the PA.

2. ENERGY SCENARIOS AND GREENHOUSE GASES EMISSIONS

The responsibility of climate change mitigation lies in the sectors contributing most to GHG emissions, (commonly expressed in equivalence to carbon dioxide, the largest source of GHG, therefore defined as 'carbon emissions' alike). The focus here is set on sectors with the highest GHG emissions: energy, industrial processes, agriculture, waste, land-use change and forestry, and bunker fuels. Based on data elaborated by the CAIT system of the World Resource Institute (<http://cait.wri.org/>), Table 1 offers an overview of key social and economic (macro) sectors' contribution to global GHG emissions between 1990 and 2010.

Table 1 GHG emissions per sector (MtCO₂e), 1990-2010

Year	Energy	Industrial process	Agriculture	Waste	Land-use change and forestry	Bunker fuels
1990	22,715	1,114	4,010	1,146	3,335	591
1995	23,456	1,283	4,544	1,224	2,741	669
2000	25,252	1,469	4,620	1,297	2,778	789
2005	29,099	1,970	4,870	1,376	3,203	921
2010	32,183	2,493	5,213	1,469	2,759	1,023

Table 1 gives a clear indication of energy's overwhelming contribution to global GHG emissions compared to other macro-sectors. Energy's share has constantly remained close to three quarters of total global GHG emissions. An extensive number of key sub-sectors is embedded within energy, including electricity and heat, manufacturing and construction, transportation, other fuel combustion, and general fugitive emissions. Using the same data source of Table 1, Table 2 divides energy-related GHG emissions according to sub-sectors over the same time periods chosen for Table 1.

Table 2 Energy-related GHG emissions per sub-sector (MtCO₂e), 1990-2010(1)

Year	Electricity/heat	Manufacturing and construction	Transportation	Other fuel combustion	Fugitive emissions
1990	8,421	4,519	3,925	3,910	1,939
1995	9,044	4,471	4,239	3,770	1,936
2000	10,232	4,537	4,833	3,642	2,018
2005	12,217	5,317	5,403	3,893	2,292
2010	13,863	6,091	5,804	3,952	2,497

Table 2 shows a general increase in GHG emissions over time for all energy-related sub-sectors. Most of the energy-related sub-sectors register higher GHG emissions than macro-sectors other than energy reported in Table 1. Energy sub-sectors, therefore, play key roles in a complete analysis and assessment of the current and future sector emissions' distributions given the PA's primary objective. For instance, the electricity/heat sub-sector, representing roughly one third of energy emissions, is responsible for between 20% and 25% of global GHG emissions. The emissions of this sub-sector alone contribute more to global GHG emission than any of the non-energy sectors outlined in Table 1. Traditionally, efforts to reduce GHG emissions, with special reference to those related to energy, relied upon two key components: the availability of adequate technologies to enhance low-carbon transitions [6] and the capability to raise financial flows to support the adoption of these technologies. The second component itself has been largely based on two main instruments: the establishment of carbon taxes [7] and the establishment of carbon markets [8].

Over time, carbon markets have become a key tool adopted by policy-makers in an attempt to stimulate the advent of steady low-carbon systems. Their expansion across many areas of the world has led to increasing levels of expectation concerning their efficacy as drivers for reducing GHG emissions.

Yet the effective impact of carbon markets often appears to lack evidence and their efficacy as tools adopted for major transitions in sectors such as energy appears to be limited up to date. A review of their history in relationship with energy markets can help to better understand their frequent 'failure' as well as those elements that led to some promising innovations.

3. HISTORY OF CARBON AND ENERGY MARKETS LINKS PRE-PARIS

Carbon and energy markets have not been as closely intertwined as the importance of energy for GHG emissions suggests. For example, while carbon trading may result in more efficient use of energy resources without directly impacting fossil fuel prices [9] different studies noticed a general inefficiency of carbon markets compared to energy markets, as a result of the lack of binding agreements, which to date have increased the uncertainty of the first ones [10][11].

However, there is evidence that industrial production impacts positively (or negatively) on carbon markets during periods of economic expansion (or recession), thereby confirming the existence of a link between the macroeconomy and the price of carbon [12]. Establishing a carbon market with the carbon price driven by the need to limit emissions may revolutionise this system whereby the price of

carbon may be a more important driver for economic expansion than vice versa (a true ‘carbon-macroeconomy’).

This is more obvious when analysing studies that suggest closer links between carbon and energy markets [13][14]. Specifically, an increase in carbon price tends to be followed by an increase in energy price. All studies analysing the interlinkages between carbon and energy markets, however, point towards the need to strengthen carbon markets to encourage change energy markets by reducing uncertainty. To increase the efficacy of carbon markets, appropriate investment decisions need to be encouraged, associated (financial) regulation needs to be clearly defined and the legal system and information disclosure policy improved [10][11].

Similar critiques have been raised by analyses on the (up to date) biggest and oldest carbon market: the European Union’s Emissions Trading System (EU-ETS). Activated in 2005, the EU-ETS is based on an allowances regulation and has already registered three main revision phases, often led by deep structural crises [15]. Key elements of EU-ETS instability appear to lie once again in the weakness of its legal and administrative structure as well as the excess of influence of other political and economic interests over primary objectives, with special reference to the energy-related sectors [16].

Conversely, one mechanism specifically designed to support carbon markets that rarely received positive coverage in this context, although it has demonstrated significant transformative potentials, is the clean development mechanism (CDM) [17][18]. Established under the Kyoto Protocol in 1997, its main aims are to reduce GHG emissions while contributing to sustainable development in developing countries [18]. The CDM has received criticism regarding its effectiveness in reducing GHG emissions [19], its market-oriented and neo-classical logic [20] and its elaborate approval system [21], to mention a few.

Despite its shortfalls, however, it leveraged over \$300bn of direct project investment in China alone [17]. Under the CDM, China effectively developed and expanded its nascent wind energy industry with its wind energy capacity growing from 764MW in 2004 to 75,564MW in 2012 (nearly a 100 fold increase). Compared to similar figures [22] in the US (from 6,725 to 60,007 – a nine-fold increase) and Germany (from 18,415MW to 31,210MW – less than a two-fold increase), it is evident that the multi-billionaire financial bulk transferred to China under the CDM, of which \$215bn (71%) were used for energy projects, were not only applied as a means of stimulating nascent industries but to effectively develop technological innovation systems [23][17]. Moreover, Chinese CDM projects registered relevant impacts in terms of employment creation in the energy sector with a net total contribution of about 3 million jobs directly and indirectly related to CDM-founded activities between

2005 and 2012 [24]. These findings are in line with the IEA's suggestion that emerging economies 'could deliver greatest, fastest advances towards climate change goals' [1].

Further evidence shows that the CDM contributes significantly to large- and small-scale hydroelectric developments in India and China [25][17]. The examples of China and India provide evidence that state level policies play a crucial role in affecting the location of renewable energy CDM projects. Areas with experience of developing renewables – and a related knowledge base in the same technology deployment/management- also tend to be more successful in attracting larger CDM projects [26].

The impact of CDM on the diffusion of clean energy technologies is also evident. In Malaysia, for example, 69% of all CDM projects were renewable energy projects. The number of energy-related CDM projects had dramatically increased towards the end of the CDM cycle, which contributed significantly to GHG emission reductions. The CDM acted as a catalyst to reduce the cost of renewable energy projects [27]. In Brazil, CDM projects in general have contributed to the diffusion of clean technology, especially renewable energy technologies, and to the promotion of triple line sustainable development [28].

It is evident that the CDM carbon market has allowed developing countries, to change their energy development pathways and associated energy scenarios as a result of the opportunities that the CDM provides. Depending on the preferred development pathways, countries have used the CDM system either to bolster specific sub-sectors (or other macro-sectors) and to build on their strengths, or to diversify their climate-related actions into a wider portfolio of sectors, thus attempting to engage in a multi-policy approach. To conclude, the CDM has proven successful in triggering change in some countries' energy trajectories.

While the experience of the CDM contains a variety of positive signals, evidence from carbon markets and ETS are more ambiguous, with uncertainty being highlighted as one of the key factors limiting their success. The signature of the Paris Agreement has been hailed by several commentators as the beginning of a new era in the global efforts for a radical reduction of GHG emissions [29][30]. The PA therefore represents a significant opportunity to overcome ambiguity and uncertainty which to date have characterised attempts in the field of climate change mitigation.

Understanding the PA in its key elements, with special reference for those aspects most connected with the development of robust carbon markets thus becomes of primary importance to define new, low-carbon energy scenarios (and beyond).

4. THE UNFCCC PARIS AGREEMENT AND ITS POTENTIAL EFFECTS ON ENERGY

While the PA medium- to long-term outcomes cannot be forecasted at this stage, it is undeniable that a new and challenging phase in the global low-carbon transition has been launched. The main driver for change lies in the PA's primary objectives summarised in Article 2.

To reiterate, Article 2 states that the primary objective of the PA is to hold 'the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels'. Meeting this objective is thus a binding target for the countries adhering to the Agreement. Representing the quantification of the aggregate GHG reductions objective, the range established by Article 2, thus being the ultimate source of demand for reductions actions. Limiting global temperatures within the range established by the PA implies a dramatic reduction in current GHG emissions, therefore requiring unprecedented efforts to avoid business-as-usual anthropogenic GHG emissions pathways.

The PA defines the basic rules to facilitate the process of change required by its objective. These legal provisions state that all the Parties shall, by means of the principles of equity and common but differentiated responsibilities and respective capabilities, as well as by independently establishing and maintaining their contributions towards the common objective, become accountable for their emissions [5].

A hybrid process has, therefore, been established, where bottom-up, country-based, voluntary pledges supposedly correspond to a top-down general objective. A multi-functional governance of the process, involving Parties, international institutions and key stakeholders, is described throughout the document.

At first sight, the key means of implementation tool established by the PA to fulfil its ambitious objectives appears to be described in Article 4, which is focused on the obligation for all the Parties to engage in Nationally Determined Contributions (NDC) pledges. Despite their 'mandatory' nature, NDCs are characterised by a variety of flexible and voluntary elements. Firstly, each Party is free to determine its obligation both in quantitative and qualitative terms. This implies that each party can freely pick and choose the shape and size of its obligation in all its aspects. Different NDCs can: (a) determine the overall amount of their obligations; (b) establish different baseline scenarios to calculate their pledges; (c) determine the temporal length for their implementation; (d) define the methodologies to be adopted for their implementation; (e) and focus on different GHG resources (or

varieties of resources). Moreover, no compensation fee is foreseen in case of failure to fulfil the NDC's 'obligations'.

The NDC method is generally defined as a 'bottom-up' approach, aimed at facilitating the widest possible participation of Parties in the Agreement. It can therefore be seen as a compromise between the need for radical action in terms of GHG emission reductions and the national interests of participating countries. As a consequence, the NDC' approach does not offer clear guarantees for the fulfilment of the PA's primary objectives, while the analysis of the first round of NDC submissions confirms a high degree of uncertainty.

More in detail, the UNFCCC requested for the Parties participating to the Paris negotiations to submit an anticipatory intended NDC (or INDC) with the aim to establish a baseline of NDC potentials. A report by UNFCCC published on May 2016 [31], aimed at reviewing the possible impacts of the submitted (I)NDC shall be considered a first step in the direction of the PA's objectives but the level of left uncertainty is still extremely high. Mainly due to the different choices made by the Parties in establishing their first (I)NDC, uncertainty lies on a variety of different elements of both quantitative and qualitative nature.

Affected by the application of different methodologies, baseline scenarios, reference years and involved sectors, uncertainty of the (I)NDC effectiveness is predominately the result of two elements: the dis-alignment between their aggregate pledges and the PA's primary objective; and the absence of obligation tools for their implementation.

These uncertainty elements are perceived as potential lock-ins for the entire structure of the PA. For instance the dis-alignment between the current (I)NDC's pledges and the overall objective, visually represented in Figure 1, appears to be by far the biggest limits and lock-in of the new international climate framework.

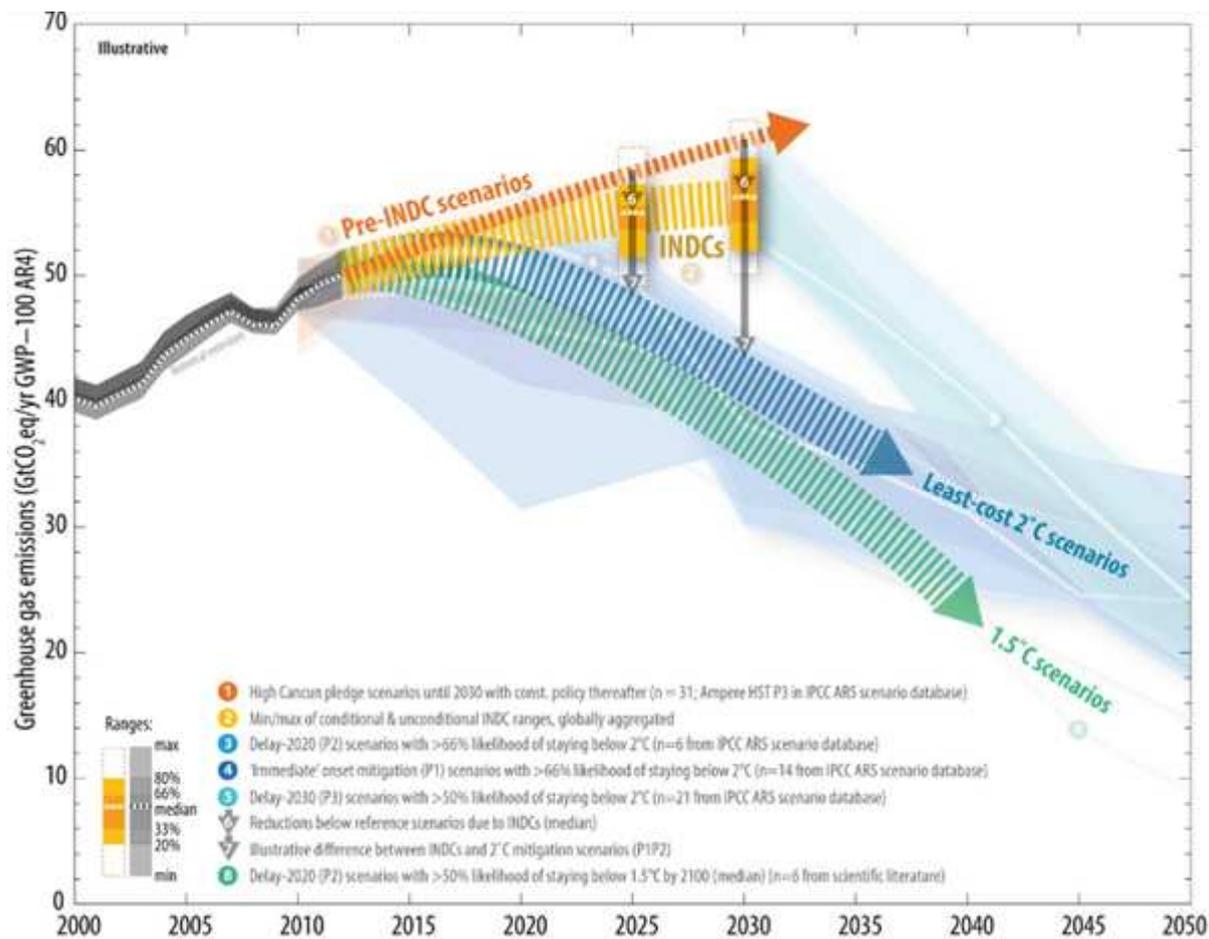


Fig. 1 comparison between forecasted (I)NDC and other emissions scenarios [31]

Even in the best case scenario (assuming that all the different pledges to be met), represented by the yellow curve in Figure 1, GHG emissions fail to be reduced in line with the PA’s primary objectives. While showing some progress in comparison to the business-as-usual scenario (orange curve), they clearly appear insufficient to fulfil both the 2°C and the 1.5 °C (blue and green curves), potentially leading instead to an increase in global aggregate GHG emissions.

Together with the lack of common enforcement criteria, the dis-alignment between the current (I)NDC pledges and the primary objective of the PA has been identified by different institutes and commentators as the biggest limitation and source of uncertainty for a full implementation of the Agreement [32][33][34]. It thus represents one of the key obstacles hindering systemic low-carbon transformation that would entail radical changes in the entire energy sector. While it is possible to foresee some positive adjustments of the (I)NDCs over time, it is unlikely that Parties will voluntarily compromise over targets they deem to be excessive. The political bottom-up approach for the definition of the mitigation pledges adopted by the PA appears therefore incompatible with its own objective.

Conversely, Article 6 may prove a more effective driver for low-carbon transformations with associated radical changes in the energy sector. Article 6 of the PA has been identified as a tool capable of guaranteeing a robust and steady development of carbon markets and indirectly as a potential stimulator for a radical shift in financial flows which are deemed necessary to promote the radical low-carbon transformation envisaged by the PA's primary objective [35][36].

5. FRAMING A POLICY ROADMAP BASED UPON ARTICLE 6

In general terms, Article 6 aims 'to contribute to the mitigation of GHG emissions and support sustainable development', [5] within a framework of voluntary cooperation between Parties and/or entities embedded within them. In doing so, Article 6 defines, inter alia, a cooperative mechanism identified by the vast majority of commentators as a mechanism to facilitate the linking of carbon markets and possibly merging them in a single, global structure. The mechanism is described in paragraphs 4-7 of the Article. These paragraphs clearly state its four key aims: (a) to promote mitigation and sustainable development; (b) to engage authorised public and private entities to participate in mitigating actions; (c) to reduce emissions levels of either the host Party or the Party acquiring the mitigation outcomes; (d) to reduce emissions on aggregate.

The mechanism defined within Article 6 is similar to the structure of the Kyoto Protocol's CDM, with two key differences compared to its predecessor: (a) it is to be embedded within a much more ambitious Agreement [29]; (b) it is to be potentially extended in all its aspects to any actor, with no more differentiation between actors 'bound to buy' and actors 'bound to sell' carbon credits [36]. The existing similarities between the new mechanism and the CDM have led several commentators to identify in Article 6 the key guaranteeing a robust and steady development of carbon markets, therefore possibly stimulating the huge amount of financial flow necessary to promote the radical low-carbon transformations envisaged by the PA's primary objective. More in detail, the mechanism envisaged by Article 6 may become the tool for linking, and possibly merging, different emission trading schemes and carbon markets, thus potentially stimulating a much greater impact of them in terms of emissions reductions compared to past experiences [37][38].

In addition the requirements introduced in paragraph 4 of the Article apparently bind the Parties (or entities) that voluntarily decide to cooperate under its framework to raise their individual and aggregate ambitions concerning GHG reductions. Assuming for this rise in ambitions to be linked with the PA's objectives Article 6 may therefore become a reliable alternative to the limits posed by the NDC approach, while at the same time boosting the carbon markets' potentials and increasing certainty over them.

Finally the voluntary cooperation envisaged by Article 6 may lead to the establishment of a structure enjoying a potentially high degree of autonomy towards the UNFCCC. It is in fact established in paragraph 2 of Article 6 for the voluntary cooperation to be 'consistent with the guidance adopted by' the UNFCCC bodies rather than being controlled by them. The opportunity given by a similar interpretation may not only lead to the establishment of peculiar rules to be applied only within the Parties engaged in the cooperative action, while also potentially extending the cooperating members to entities other than Parties, by this being in accordance with the need for a greater engagement of public and private entities (paragraph 4 of Article 6).

While Article 6 may in principle represent the legal framework for the development of a system based on the above-listed assumptions, its theoretical framework can be identified within the 'carbon club' literature. Despite its variety of interpretations and terminologies included the 'carbon club' literature shares a set of elements strictly related to Article 6, these including: (a) envisaging voluntary participation for the club's members [39][40]; (b) catalysing greater emissions reduction ambition [39][41]; (c) involving not only states, but also subnational jurisdictions, firms, and civil society organizations [40][42]; reducing when not avoiding free rider and compliance problems [42][44]; (d) forming a group of jurisdictions that develop harmonized standards for carbon market operations [39][45][46]; (e) complementing the UNFCCC actions [41][43].

The existing similarities between Article 6 and the 'carbon club' literature suggest the opportunity for developing a synergic approach to the rules, modalities and procedures still requiring to be defined to effectively implement the mechanism and the other elements framed by the Article. While Article 6 provides those 'minimum participation rules' required for the establishment of an effective 'carbon club' [47] the literature concerning this latter may offer key elements in completing the legal structure concerning the Article. As a consequence of the merging of Article 6 and the 'carbon club' conceptualisations a new political framework to effectively support the implementation of Article 6 and the whole PA can thus be envisaged.

Based on the synergy between Article 6 and the literature on 'carbon clubs' this new political framework, hereby defined as 'Carbon Alliance', would be characterised by a set of 'minimum participation rules', these including: (a) free and voluntary participation of the Alliance's members; (b) establishment of an aggregate level of emissions reduction ambitions in line with the PA's objectives; (c) transparent, equitable and sound distribution of ambitions between the parties; (d) implementation of a single mechanism for the certifications of the emissions reduction; (e) freedom to exchange the certifications within and between the Alliance's members; (f) multi-level governance characterised by the interactions of the Alliance's and its members' rules.

A new system based upon these points may effectively stimulate a low-carbon transition in line with the PA. For instance point (a) would guarantee the opportunity for a high degree of autonomy for the Alliance's members in establishing the rules governing the Alliance' structure. Points (b) and (c) would help aligning the ambitions of the Alliance to the overall objectives of the PA, while at the same time reducing uncertainty over the demand of reductions and therefore stimulating the development of carbon markets and other forms of reductions exchange. Points (d) and (e) would set economic incentives for reduction actions, promote the harmonisation of members' carbon markets, stimulate the development of alternative forms for exchanging reductions and enhancing transparency. Thanks to the experience gained throughout more than ten years of application, the adoption of the 'CDM model' to establish the rules and methodologies of the new mechanism would moreover accelerate its implementation process and stimulate the participation of those actors already familiar with its procedures. Finally point (f) would guarantee the necessary flexibility to the Alliance, by offering to its members the opportunity to adapt its rules to their own needs and priorities.

The uncertainty surrounding the future developments of the PA does not allow understanding whether and to what extent a similar proposal may become an effective policy roadmap towards a low-carbon transition, nevertheless encouraging signals have been recently registered. While a similar proposal has not yet been discussed at the climate negotiations table, various elements composing it have been already defined by scholars and specialists [39][48][49], and some of them have been included in the 'networked carbon markets' initiative developed by World Bank.

6. CONCLUSIONS

Biased by the evidence of the past decades, when GHG emission limitation policies failed to seriously impact the key sources of emissions, current energy scenarios (and investors) fail to take the full potential of carbon markets and international climate policy into account. The PA has huge potential to drive a radical transformation of carbon markets thus opening-up credible windows of opportunity for substantive low-carbon transformations which require entirely new energy scenarios. By establishing the pillars for the evolution of a single mechanism linking the present and future carbon markets worldwide, Article 6 of the PA possibly represents the key element for this transformation process. It is therefore of primary relevance for those actors who aim at defining reliable energy scenarios for the next decades.

Article 6 consists of general provisions requiring procedures, methodologies and rules to be aligned with the primary objective. While there is no guarantee for these rules to be correctly established in

the near future, different, and sometimes diverging, groups of interests are currently acting at international policy level in the attempt to address their establishment towards specific interests. Similar conflicts of interest that may undermine the structure of the mechanism can be overcome only by stepping up efforts to merge ambitions and tools to radically reduce global GHG emissions with the common goal (and primary objective) to limit global average temperature to well below 2°C above pre-industrial levels.

At present, the lack of instruments to determine a clear demand for GHG emission reduction represents the biggest lock-in for the transformation process to happen. The PA's provisions aiming at guaranteeing a robust GHG emission reduction demand, represented by the (I)NDC, appear to be insufficient, thus limiting any chance to determine reliable scenarios concerning the evolution of sectors responsible for GHG emissions, such as energy. Once again, Article 6 appears to offer a reliable opportunity to overcome these weaknesses but its current status of mere legal provision maintains a high degree of uncertainty at the present stage.

Hypotheses for transforming Article 6 in the key tool for designing a reliable policy roadmap for the full implementation of the PA are now on the table, with the one introduced in Section 5 of this paper representing a feasible option in this sense. Understanding how these hypotheses may impact the energy sector, and to what extent actors engaged in energy may benefit from them, becomes thus of paramount importance for the entire sector. Following, when not participating to, the development of the whole PA and specifically of Article 6 during the next steps of the international climate change negotiations needs to be considered a priority for any actor interested in understanding scenarios and possible pathways for energy in the coming decades.

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