LINKING ENVIRONMENTAL POLICIES AGAINST CLIMATE CHANGE

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Abstract

The recent COP 21 conference in Paris outlined the need to find global policy instruments to face the phenomenon of climate change, originated by greenhouse gas (GHG) emissions. In this paper, the topic of the comparison between environmental policies is revisited, following the law and economics point of view that the emissions of GHG create market failures and policy instruments may be implemented to correct these malfunctions and subsequent inefficiencies. In the Author’s opinion the climate change issue calls for a new approach that takes into account the concept of “economic global public goods” and provide for a link between different environmental policy instruments.

The first paragraph revises the traditional analysis of the choice of environmental policies in the framework of “economic global public goods”. The following part describes the comparison between taxes and tradable permits as a question of “quantity” versus “price” control. The third paragraph is about the linkage of different environmental policy instruments, with a specific reference to the joint use of cap-and-trade system and taxation scheme. And, finally, some conclusive remarks are presented in relation to the COP 21 conference in Paris in the prospect of linking different policies in the future at a global level.

Key Words: environmental policy choice, climate change, greenhouse gasses, COP 21, cap-and-trade, carbon tax, price vs. quantity.

JEL Classification: Q53; H23; H41; K32
1. Introduction

The COP 21 conference which took place in Paris in December, 2015, produced an Agreement that includes the necessary building blocks for a global link between climate change policies.
Particularly, under Article 6.2\(^1\), emissions reductions occurring outside of the geographic jurisdiction of a party to the Agreement can be counted toward achieving that party’s Nationally Determined Contribution (NDC) via Internationally Transferred Mitigation Outcomes (ITMOs). This enables linkage among Parties to the Agreement that would provide for exchanges between compliance entities within the jurisdictions of different parties.
In the next future some kind of heterogeneous links among policy instruments will take place under Article 6.2 of the Paris Agreement. The heterogeneity means that, “not only one cap-and-trade system be linked with another cap-and-trade system, but it is also possible to link a cap-and-trade system with a carbon tax system. In addition, either a cap-and-trade system or a tax system can be linked (via appropriate offsets) with a performance standard in another jurisdiction” (Stavins, 2016).
Given this global approach to the issue of climate change, increasing attention have to be addressed to the efficiency of linking different policies also on a theoretical point of view.
In this paper we are going to follow a law and economics approach. Usually the literature about the choice between environmental policies is based on a definition of the environment as a “public good” that may not be appropriated and has no market price and the comparison of different instruments considers which one perform better in correcting this malfunction and subsequent inefficiency. But dealing with the issue climate change we are going to use an “economic global public good” that is a new category that take into account the fact that climate presents economic aspects that extend to all nations, people, and generations (Kaul et al., 2003).
The issue of climate change is clearly “global” in both causes and consequences; moreover, GHG emissions have effects on global warming independently of their location, and local climatic changes are completely connected with the world climate system. “Global warming

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\(^1\) Art. 6 of Paris Agreement: “2. Parties shall, where engaging on a voluntary basis in cooperative approaches that involve the use of internationally transferred mitigation outcomes towards nationally determined contributions, promote sustainable development and ensure environmental integrity and transparency, including in governance, and shall apply robust accounting to ensure, inter alia, the avoidance of double counting, consistent with guidance adopted by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement”.”
is a *global* public-goods externality whose resolution requires an unprecedented degree of international cooperation and coordination” (Weitzman, 2016 p. 1).

In addition, the phenomenon of climate change is characterized by other important features that imply a peculiar approach in the theory of environmental policy instruments choice. First, we cannot determine with certainty both the dimension and the timing of global warming consequences and the costs of the abatement of emissions that cause it. Second, the consequences are intergenerational and persistent across time.

From these features, it comes as relevant an equity issue among countries because industrialized countries have produced the majority of GHG emissions, but the effects of global warming will be much more severe on developing countries, that historically are responsible only of a small part of the global level of emissions. On this point of view, the question becomes how to balance costs and benefits of global emission reductions, to decide what the distribution of emission reductions among countries should be and how the costs should be allocated among countries.

Given the global nature of climate change and the above mentioned equity issue, a peculiar approach is necessary in order to analyze which would be an efficient choice of the policy instruments that we are going to analyze in the next paragraph.

### 2. Different environmental policies to face climate change consequences

The set of policies that are considered in the environmental policies choice literature corresponds to a range of instruments. The main are command and control (CAC) and market-based (MB) type of instruments; these last are essentially taxes, that are fees imposed on emitters proportionate to the total amount of emissions released into the environment, and cap-and-trade systems, that provide a number of permits equal to the allowed total emissions.

We can define a first category of environmental instruments, called Command-and-Control (CAC), as instruments that are implemented by an institution, usually a public agency, that defines conduct standards and determines the enforcement system. CAC policies are divided into two phases as follows: the phase of “command”, in which the agency sets the standard, for example the maximum level of permissible emissions, and the phase of “control”, in which the agency monitors and enforces the standard compliance.

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2 As Cropper and Oates (1992) explain “… The determination of environmental policy is taken to be a two-step process: first, standards or targets for environmental quality are set, and, second, a regulatory system is designed and put in place to achieve these standards. This is often the environmental decision making proceeds. Under the
As to the US experience, the Environmental Protection Agency (EPA) activity provides a clear example of implementation of this kind of policies. In fact, this institution performs its tasks through the setting of preventive standards, the enforcement of polluting emission thresholds, and the carrying out of inspections and, possibly, of actions brought to the federal courts. For what concerns the European Community, a unified standard setting system has not been established, but CAC policies are defined at national level (Faure, 2010). Following the environmental policy choice theory, the decision to develop such system is based on the fact that centralized agencies assure a cost-effectiveness calculation on the base of the expected damage and of the marginal cost of different level of preventive care. The organization based on a centralized structure presents the benefit of a continual oversight of problems and a broad array of regulatory tools (Porrini, 2005).

Because CAC policies typically require polluters to take specific actions to reduce emissions by installing a particular technology or meeting a specific performance (emissions) standard, this kind of policies have been criticized as not providing the flexibility and not taking into consideration that different productions face different compliance options. Moreover, CAC policies do not provide an incentive for firms to innovate by going beyond the reductions required by the standard. On the other side, the first kind of MB instruments are taxes, and particularly the so called “carbon tax” on GHG emissions generated by burning fuels and biofuels, such as coal, oil, and natural gas. For what concerns the economic rationale, after the introduction of that form of taxation, the relative prices of goods and services change: goods made by a high carbon intensive production become more expensive, whereas less carbon intensive products become cheaper. Thus, carbon tax provides through prices a strong incentive for individuals and firms to adjust their conduct, with the final result of a reduction in the emissions themselves because, by decreasing fuel emissions and adopting new technologies, both consumers and businesses can diminish the entire amount they have to pay in carbon taxes (Nordhaus, 2007). The second kind of MB instruments are cap-and-trade permit systems. In this case, the regulatory authority stipulates the allowable total amount of emissions (cap) and the right to emit becomes a tradable commodity. Under a cap-and-trade system, prices are allowed to fluctuate according to market forces.

Clean Air Act, for example, the first task of the EPA was to set standards in the form of maximum permissible concentration of the major air pollutants. The next step was to design a regulatory plan to attain these standards air quality.”
Both MB policy instruments present advantages and drawbacks in the specific case of climate change.

On one hand, cap-and-trade system entails significant transaction costs, which include search costs, such as fees paid to brokers or exchange institutions to find trading partners; negotiating costs; approval costs; and insurance costs. Conversely, taxes involve a low level of transaction cost over all stages of their lifetime.

Carbon taxes can be seen as a policy instruments that dynamically offer an incentive to reduce emissions through technological and procedural improvements because the efficient diffusion of environmental friendly technology lead to reductions in tax payment. On the other hand, a cap-and-trade system, when an emission goal is fixed, is able to self-adjust because with the efficient diffusion of environmental friendly technology there will be a decrease in permits demand and in their price.

In the Table 1, the main differences among carbon tax, tradable permit system and CAC are summarized.

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3 “The implementation of an emission trading system is very complicated and requires technical steps, including treatment of sinks, monitoring, and enforcement. On the other hand, taxation is a very well-known instrument by policy makers, not very costly because it does not require monitoring and enforcement organization” (Porrini, 2016, p. 31).
Table 1
Comparison between carbon tax, cap-and-trade and command and control policies

<table>
<thead>
<tr>
<th></th>
<th>CO₂ tax</th>
<th>Cap and trade</th>
<th>Traditional regulation (e.g., source-specific emissions standards)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certainty over CO₂ price or cost?</td>
<td>Yes. The tax establishes a well-defined price.</td>
<td>No. But price volatility can be limited by design features such as a safety valve (price cap) or borrowing.</td>
<td>No.</td>
</tr>
<tr>
<td>Certainty over emissions?</td>
<td>No. Emissions vary with prevailing energy demand and fuel prices.</td>
<td>Yes, in its traditional form (over capped emissions sources). No, with the use of additional cost containment mechanisms.</td>
<td>No: regulating the rate of emissions leaves the level uncertain.</td>
</tr>
<tr>
<td>Efficiently encourages least-cost emissions reductions?</td>
<td>Yes.</td>
<td>Yes.</td>
<td>No, but tradable standards are more efficient than non-tradable standards.</td>
</tr>
<tr>
<td>Ability to raise revenue?</td>
<td>Yes. Results in maximum revenue generation compared to other options (assuming cap-and-trade alternative includes substantial free allocation of allowances).</td>
<td>Traditionally—with a largely free allocation—no. Growing interest in a substantial allowance auction suggests opportunity to raise at least some revenue now and possibly transition to a complete auction that generates maximum revenue in the future.</td>
<td>No.</td>
</tr>
<tr>
<td>Incentives for R&amp;D in clean technologies?</td>
<td>Yes. Stable CO₂ price is needed to induce innovation.</td>
<td>Yes. However, uncertainty over permit prices could weaken innovation incentives.</td>
<td>Yes and no. Standards encourage specific technologies, but not broad innovation.</td>
</tr>
<tr>
<td>Harm to competitiveness?</td>
<td>Yes, though if other taxes are reduced through revenue recycling, competitiveness of the broader economy can be improved.</td>
<td>Yes (as with a tax), but giving firms free allowances offsets potentially harmful effects on profitability.</td>
<td>Somewhat. Regulations increase the cost of manufacturing but, unlike taxes or tradable permits, do not raise the price of fossil energy.</td>
</tr>
<tr>
<td>Practical or political obstacles to implementation?</td>
<td>Yes. New taxes have been very unpopular.</td>
<td>Yes. Identifying a reasonable allocation and target is difficult.</td>
<td>Yes. Setting the level of the standard is difficult.</td>
</tr>
<tr>
<td>New institutional requirements?</td>
<td>Minimal.</td>
<td>Yes, but experience with existing trading programs suggests that markets (for trading permits and exchanging information across firms and time periods) arise quickly and relatively inexpensively.</td>
<td>Minimal (unless tradable).</td>
</tr>
</tbody>
</table>

In the next paragraph the two policy instruments, namely taxes and cap-and-trade, will be considered in the context of the debate about “price” versus “quantity” control.

3. **Carbon tax versus tradable permit system as a question of “quantity” versus “price” of GHG emissions**

Environmental taxes and cap-and-trade system are both MB policy instruments, but their implementation is different: taxes fix the marginal cost for carbon emissions and allow quantities emitted to adjust, whereas tradable permits fix the total amount of carbon emissions and allow price level to change according to market forces. Because of these differences, the former are defined as “price” instruments for the correlated effect to increase the price of certain goods and services, thereby decreasing the quantity demanded; while cap-and-trade permits are defined as “quantity” instruments for the feature to directly fix the quantity through the number of permits.

The literature on environmental policy choice describes as alternative instruments taxes price control instruments and cap-and-trade quantity control ones.

Many contributions compare the relative performance of price and quantity instruments under uncertainty, starting with the seminal contribution of Weitzman (1974), who analyzed the optimal instrument choice under a static partial equilibrium framework, consisting of a reduced form specification of abatement costs and benefits from abatement. The important character of his setup is that, an agency issues either a single price order (fixed price) or a single quantity order (fixed quantity), and these fixed policies result in different expected social welfare outcomes under uncertainty. Specifically, Weitzman shows that, with imperfect information about the abatement costs, the relative slopes of the marginal benefit (damage) function and the marginal cost function determine whether one instrument is preferred to another. If the expected marginal benefit function from reducing emissions is flatter than the marginal cost of abatement, then a price control is preferred. If, however, the marginal benefit function is steeper, then a quantity control is preferred.

In the law and economics literature, Kaplow and Shavell (2002) deal with the standard context of a single firm producing externality, but they consider also the case of non linear corrective tax and multiple firms jointly create an externality, demonstrating the superiority of taxes to permits.
Despite the results of the majority of contributions that a taxation system is preferable to cap-and-trade system in terms of economic efficiency, this policy obviously faces political opposition. On the supply side of the market, companies oppose taxes, as a cost that imply a revenue transfer to the government and also as a factor that can imply negative effect on competition in an international context; on the demand side, consumers pay at the end a higher price on the products and environmental groups oppose taxes because, unlike cap-and-trade system, fail to guarantee a particular reduction in the emissions level. But, when we take into account the case of climate change, the situation is different. “The first point is that climate change consequences generally depend on the stock of greenhouse gases in the atmosphere, rather than annual emissions. Greenhouse gases emitted today may remain in the atmosphere for hundreds of years. It is not the level of annual emissions that matters for climate change, but rather the total amount of carbon dioxide and other greenhouse gases that have accumulated in the atmosphere” (Pizer, 1999).

Moreover, considering the issue of climate change as a “global public goods”, the two instruments should be considered in their “global” implementation. In this sense, a tax system would need to be coordinated among countries (Faure, Weishaar, 2012). In the international context, it should assume the form of a globally harmonized domestic tax system. In this case, every nation (and not the single company) would pay the tax to an international agency, which receives and redistributes the tax revenues. And, once an international harmonized domestic tax system would be implemented, an adequate compensation for the losing countries from the gaining countries should be negotiated with positive effects in terms of the equity issue⁴.

On the other hand, to face climate change effects, it would be necessary to implement an international cap-and-trade system based on the setting of quantitative limits of emissions agreed at a global context with an allocation of emission permits to every nation (and not the single company) allowing the trade among countries, in order to minimize abatement costs. The starting allocation of permits would be set through either an auction or a grandfather allocation: whereas under an auction, government (or the international community) sells the emission permits, and under the grandfather rule, the allocation of emission permits is based on historical records.

⁴ Nordhaus (2006) hypothesizes the institution of an harmonized carbon tax (HCM), essentially equivalent to a “dynamic Pigouvian pollution tax for a global public good” and points out 10 different reasons to prefer it to a quantitative approach.
As in the case of Kyoto Protocol, in the global warming context, quantitative limits set targets on the time path of GHG emissions of different countries. Countries then can administer these limits in their own fashion, and the mechanism may allow transfer of emission allowances among countries.

For what concerns the implementation of cap-and-trade systems at an international level, the European Union Emissions Trading Scheme (EU-ETS) was established more that 10 years ago and is actually the most extensive system of this kind in the world. “The EU-ETS was developed as a way of meeting the EU’s greenhouse gas emissions reduction targets in the most efficient and cost-effective manner. To do so, the EU-ETS sets a limit (a cap) on the total emissions certain EU sectors (mostly heavy industry and aviation) are allowed to use during predefined trading periods. Permits are then distributed amongst polluters where one permit equals one tonne of carbon dioxide equivalent. These permits can then be traded between market participants. As such, the total amount of pollution is set by an external authority, but market participants determine the permit allocation thereby optimizing efficiency” (Carraro, 2015)\(^5\).

There is a general increasing consensus at an international level that the issue of climate change should be dealt by using policy instruments based on quantity control (permits system) or price control (taxes) and over the past few years, more and more countries around the world decided to implement alternatively these kind of instruments, at national and supra-national levels (Howe, 1994), as we can see in Figure 1.

Fig. 1
In a world that is implementing different market-based instruments, the possibility to link taxes and permits could be seen as a solution to face the climate change consequences at a global level, as we will see in the following paragraph.

4. The issue of linking carbon tax and cap-and-trade system

The linkage of regional, national, and sub-national policies is based on the connections among policy systems that allow for emission reduction efforts to be redistributed across systems. Most of the literature focuses on the linkage of different cap-and-trade systems or different carbon taxes. “Initially separate cap-and-trade systems can be linked, and previously distinct carbon tax systems can be harmonized (that is, the rates can be set equal). Linkage and harmonization can yield cost savings. Linking separate emissions pricing programs yields greater abatement effort in the region with the initially lower emissions price and less abatement effort in the region with the initially higher emissions price, thus spurring equal abatement at overall lower costs. Linking once-separate cap-and-trade programs allows for further (cross-jurisdictional) reallocations of abatement effort and thereby yields further cost reductions beyond those generated by separate programs” (Goulder, Schein, 2013, p. 20).

Also the European Commission has indicated that linking the European Union Emissions Trading System (EU ETS) with other cap-and-trade systems “offers several potential benefits, including... supporting global cooperation on climate change” (European Commission, 2014).

In fact, since the launch of the EU ETS in 2005, emissions trading has spread rapidly around the world. Linking among different ETS systems refers to the acceptance of allowances and emissions-reduction credits from other systems for compliance in one’s own. Links between existing ETSs have already been proposed and established on subnational and national levels, such as the link currently being negotiated by the EU and Switzerland.

Part of the literature about the linkage of cap-and-trade systems consider the case of the emission reduction credit systems, like the Kyoto Clean Development Mechanism (CDM) (Jaffe, Ranson, Stavins, 2009). The CDM, defined in Article 12 of the Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction credits which can be counted towards meeting Kyoto targets. This mechanism, that is seen by many as new instrument that can stimulate
sustainable development and emission reductions, while giving industrialized countries some flexibility in how they meet their emission reduction or limitation targets. But less has been written about linking disparate systems, such as cap-and-trade together with tax system (Metcalf, Weisbach, 2010).

As seminal contributions, some authors suggested the use of a “hybrid” permit policy (Weitzman 1978; Roberts and Spence 1976). This is a system where the government sells permits at a specified threshold price, the quantity of emissions is fixed as long as the marginal cost (e.g., the price of the permit) lies below the threshold price and works like a tax system by fixing marginal cost when marginal cost hits the threshold. When the threshold is set high, such a combined mechanism functions like a pure permit system (since additional permits are never sold) and when the number of permits is set low, it functions like pure tax mechanism (since additional permits are always sold).

For example, firms that are subject to a carbon tax might be allowed to pay taxes at a higher level than they owe based on their emissions, and sell certified Emission Tax Payment Credits (ETPCs) to firms that are operating under a cap-and-trade program. Within the cap-and-trade program, firms could use ETPCs just as they would the equivalent quantity of allowances for purposes of compliance.

Conversely, firms under a cap-and-trade program could sell allowances to other firms required to pay a carbon tax, allowing the purchasing firms to lower their tax obligation by the amount of allowances they submit for retirement.6

Likewise, either a carbon tax or a cap-and-trade system could be linked with policies that provide subsidies for emissions reductions, which could be traded like an emission reduction credit system to be used in place of allowances to comply with a cap-and-trade program, or as ETPCs for compliance with a carbon tax.

Links can involve direct or indirect exchanges of units, and can be one-way or two-way (Bodansky et al., 2014). Both an ETS and a carbon tax can be designed to generate tradable units. In an ETS, tradable units are the basic tools. In a carbon tax system, companies could theoretically be allowed to pay more than their compliance obligation and receive tradable carbon tax credits in return. The government could also decide to allocate a number of carbon tax credits for free to compensate households or certain industries. Carbon tax credits in excess of one’s own compliance threshold could then be traded within the tax regime or with a different system such as an ETS.

6 About this point, Heindl et al. (2014) develop an economic model.
So linking carbon tax with cap-and-trade based on ETSs regimes can take various forms, as we can see in Figure 2.

**Fig. 2**
Various forms of link between cap-and-trade (ETS) and carbon tax that involve direct or indirect exchanges of units, and can be one-way or two-way. Source: Haugh et al. (2015, p. 15)
Some forms of linkage between carbon taxes and cap-and-trade systems have been implemented in some countries around the world.

In Ireland, the carbon tax has been introduced few years ago, specifically for those sectors outside of the EU ETS, as well as excluding most emissions from farming. Tax applies to petrol, heavy oil, auto-diesel, kerosene, liquid petroleum gas, fuel oil, natural gas, coal and peat, as well as aviation gasoline.

Since 1991, Sweden’s carbon tax has been introduced as part of energy sector reform, with the major taxed sectors (natural gas, gasoline, coal, light and heavy fuel oil, liquefied petroleum gas, and home heating oil). Over the years, carbon tax exemptions have increased under the EU ETS, with the most recent increase in exemption starting from 2014 for district heating plants participating in the EU ETS.

Another example is the Mexico’s carbon tax introduced in 2012, that covers fossil fuel sales and imports by manufacturers, producers, and importers. This tax is not on the full carbon content of fuels, but rather on the additional amount of emissions that would be generated if the fossil fuel were used instead of natural gas. Companies liable to pay the tax may choose to pay the carbon tax with credits from CDM projects developed in Mexico, equivalent to the value of the credits at the time of paying the tax.\(^7\)

We can finally outline that linkage between environmental policies presents some economic advantages and these advantages are key motivating forces to try to develop these kind of link also at a global level.

First of all, linkage allows for voluntary exchanges across different systems, and thereby facilitates cost-effectiveness, that is, achievement of the lowest-cost emissions reductions across the set of linked systems, minimizing both the costs for individual countries as well as the overall cost of meeting the collective cap.

Linked systems may also provide regulatory stability as an advantage for affected firms, in the sense that it may be more difficult to introduce changes in an emission-reduction scheme when those changes require some sort of coordination with other countries with linked emissions systems.

\(^7\) “Under Mexico’s recently established carbon tax on fossil fuels (initially set at $3.50 per ton carbon dioxide equivalent [tCO2e]), firms may elect to use offset credits from CDM projects developed in Mexico to meet all or part of their tax liability. The precise form of the interaction between these two instruments is still being developed. South Africa also plans to allow offsets to be used in lieu of tax payments when its carbon tax goes into effect, currently planned for 2016” (Bodansky et al. 2015, p. 12).
There are also administrative benefits from the linkage that come from sharing knowledge about the design and operation of a carbon-pricing system to find the best practice, but also from the reduction of administrative costs through the sharing of such costs and the avoidance of duplicative services.

“The possibility of linkage also raises concerns, including that there will be distributional impacts within jurisdictions, that is, the creation of both winners and losers. Also, linkage can bring about the automatic propagation from one jurisdiction to another of some design elements, in particular, cost-containment mechanisms, such as banking, borrowing, and price collars. In this and other ways, linkage raises concerns about decreased autonomy” (Stavins, 2016).

Despite the above mentioned single national experiences and the economic advantages that we have just sketched, we cannot find till now so many researches that develop theoretical models based on the joint use of the two MB instruments, taxes and cap-and-trade system, that are still considered mainly as alternative.

5. Final considerations post COP 21

Recently, countries across the globe committed to create a new international climate agreement by the conclusion of the UN Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP 21) in Paris in December, 2015. In this conference, parties have agreed to publicly show what post-2020 climate actions they intend to take under a new international agreement, that includes their Intended Nationally Determined Contributions (INDCs). INDCs are the primary means for governments to communicate internationally the policy choice they will take to address climate change, considering its domestic circumstances and capabilities. Till now climate negotiations have presented a coordinated global policy as their goal, but we have been heading towards a low coordinated system among local, national, or regional policies because different countries are undertaking different policies. In this sense, one important step could be to promote a system characterized by the linkage of environmental policies that till now have been considered as alternative, such as carbon taxes and cap-and-trade permits.

8 In the law and economics literature many theoretical models have been developed about the complementarity of different forms of regulation, such as liability and safety regulation: see Boyer, Porrini (2011).
As a conclusive remark, in the near future, the challenge to reduce globally GHG emissions can be addressed also by the linkage between heterogeneous climate policy instruments as a way to reach a solution for climate change issue in the long term. In this direction more contributions in the theory of environmental policy choice is necessary and might prove useful in elaborating and implementing the Paris Agreement, but also in preparation of the Twenty-Second Conference of the Parties (COP-22) in Marrakech, Morocco in November 2016.

References


