International Economic Law Clinic

THE PARIS ACCORD-RELATED AGREEMENT ON ENVIRONMENTAL GOODS AND SERVICES:

ITS NECESSITY AND FEASIBILITY

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LIST OF ABBREVIATIONS

APEC	Asian-Pacific Economic Community
CAA	Civil Aircraft Agreement
CTE	Committee on Trade and Environment
CTESS	CTE Special Sessions
COPs	Conferences of the Parties
EC	European Communities
EGA	Environmental Goods Agreement
EPA	Economic Partnership Agreement
EU	European Union
FDI	Foreign Direct Investment
FTA	Free Trade Agreement
GATT	General Agreement on Tariffs and Trade
GATTS	General Agreement on Trade and Services
GEF	Global Environment Facility
GHG	Greenhouse gas
GPA	Government Procurement Agreement
GP	Government Procurement
HS	Harmonized System
IPCC	Intergovernmental Panel on Climate Change
IPR	Intellectual Property Right
IT	Information Technology
ITA	Information Technology Agreement
ITT	International Technology Transfer
LDCs	Least Developed Countries
MFN	Most Favored Nation
NDCs	Nationally Determined Contributions
NT	National Treatment
NTB	Non-Tariff Barrier
OECD	Organization for Economic Co-operation and Development
PAEGSA	Paris Accord-related Environmental Goods and Services Agreement
PTA	Preferential Trade Agreement
Taiwan	Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu
TCA	Agreement on Trade in Civil Aircraft
TiSA	Trade in Services Agreement
TRIPS	The Agreement on Trade-Related Aspects of Intellectual Property Rights
TT	Technology Transfer
UNCTAD	United Nations Conference on Trade and Development
UNFCCC	United Nations Framework Convention on Climate Change
US	United States of America
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

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EXECUTIVE SUMMARY

The catastrophic effects of climate change require stronger measures than the existing ones. Despite the success of the Paris Agreement in terms of participation, it is still necessary to undertake stronger and more effective steps to mitigate this phenomenon and further implement the goals of the Paris Agreement.

Taiwan has proposed, within the framework of the World Trade Organization, a 'Paris Accord-related Environmental Goods and Services Agreement', or 'PAEGSA', that seeks to implement the Paris Agreement through a trade facilitation framework. PAEGSA is an effort to revitalize the stalled negotiations of the Environmental Goods Agreement, and seeks to draw lessons from them. Specifically, it proposes to further strengthen the implementation of the Paris Agreement through the following main elements:

- The elimination of tariffs on goods related to carbon reduction or the ones necessary to implement the Paris Agreement;
- The inclusion of trade liberalization on climate-friendly services;
- The inclusion of government procurement, since energy industries in many WTO members are government-controlled; and,
- The inclusion of other elements, such as technology transfer and national regulation.

PAEGSA is a proposal that is not only necessary, but also more feasible than the Environmental Goods Agreement, in terms of options available to alleviate potential difficulties that may arise during its negotiation.

- **PAEGSA is necessary to implement the Paris Agreement**

PAEGSA is necessary to further implement the Paris Agreement mainly for three related reasons.

First, the regulation in the climate change regime has moved rather slowly. It started with a scientific concern in the 1960s, but it was not until 1992 that countries adopted a framework convention and not until 2015 that the Paris Agreement was signed. Admittedly, the recent Paris Agreement was a success in terms of reducing the obligation gap between developed and developing countries and achieving universal participation, compared to its predecessor, the Kyoto Protocol. However, the implementation mechanisms simply adopted information-based approaches and facilitation mechanisms, such as international cooperation in capacity building and technology transfer. In order to achieve the CO_2 emissions' reduction required to meet the Paris Agreement's goals, it is necessary to strengthen its implementation mechanisms.

Second, the international trade framework, which has stronger enforcement mechanisms and additional institutional benefits, will strengthen the implementation of the Paris Agreement. In particular, the World Trade Organization's system provides several benefits to effectively implement the diffusion of climate-friendly goods and services, as proposed in PAEGSA, such as a dispute settlement body and a forum for further trade negotiations.

Third, for the implementation of the Paris Agreement and tackling climate change, PAEGSA's approach is more effective than existing trade approaches. Countries have been linking trade and climate change governance through institutional linkages, provisions in Preferential Trade Agreements and references to trade in their Nationally Determined Contributions ("NDCs") for the Paris Agreement. However, they have not been effective enough. The institutional linkages are weak and mainly about observing negotiations and sharing views. Some Preferential Trade Agreements have climate provisions. However, they are not precise and specific enough, and are not necessarily adopted by the highest greenhouse gas emitters. Lastly, a 2017 study showed that 45% of NDCs contain direct references to trade or trade elements, but only 6% of all NDCs mention a reduction of trade barriers (Brandi, 2017).

PAEGSA's comprehensive set of trade measures will allow for more effective implementation of the Paris Agreement. For instance, its goods-plus-services coverage will balance the bargaining power of goods-producing countries and service-supplying countries.

- **PAEGSA is more feasible than the Environmental Goods Agreement**

PAEGSA will most likely face difficulties during its negotiation. However, there are options or solutions to alleviate the following major difficulties.

First, even though there is no universally accepted definition of the climate friendly sector, and climate friendly goods and services cut across many different trade sectors, commentators have proposed a number of options to alleviate this problem. Negotiators can choose to define the climate friendly goods and services with a list approach, a pre-established set-of-criteria approach, a project approach, or an integrated approach. In addition, problems such as multiple-end uses may be alleviated by focusing on single-use goods and services.

Second, even though the inclusion of a transparent government procurement is a sensitive matter, especially for developing countries, linking it with technology transfer could attract such countries. Additionally, including technology transfer is feasible because: first, WTO members have already committed to encourage technological diffusion to developing countries under fair conditions already in several multilateral agreements. And second, there are several options to operationalize diffusion of technologies, such as i) collaborative training, education and research; ii) encouraging foreign direct investment linked to technology diffusion; and iii) licensing and intellectual property rights' transfer.

Third, PAEGSA, attracts a critical mass more easily than the Environmental Goods Agreement. This is so because of: trade volume, expressed positive reactions to PAEGSA, and flexibility for trade-offs. The top exporters and importers of climate-friendly goods are limited to a relatively small number of WTO members. For the services sector that are particularly relevant to sustainable energy, such as construction, architectural, engineering and other technical services, the top exporters and importers largely correspond to the critical mass of climate-friendly goods. Furthermore, among the top exporting and importing members of climate-friendly goods and services, some of them have already expressed positive reactions to PAEGSA. Finally, the comprehensiveness of PAEGSA's coverage allows for trade-offs during the negotiation.

1. INTRODUCTION

The anthropogenic climate change is a serious issue that affects human civilization. The scientific evidence provided by the Intergovernmental Panel on Climate Change ("IPCC"), included in Annex 1, shows that warming of the climate system is unequivocal. It also shows that limiting catastrophic effects would require substantial and sustained reductions in anthropogenic CO_2 emissions. The overall global warming is, with high confidence, expected to reach 1.5°C between 2030 and 2052, unless there is a radical fall in global CO_2 emissions and non-CO_2 radiative forcing. These changes will most likely have significant global impacts, such as (IPCC, 2014):

- A rise of mean temperature in most land and ocean regions, with hot extremes and heat waves inflicting most inhabited regions;
- The probability that precipitation events will become more intense and frequent in several regions, as well as the probability of drought and precipitation deficits in some regions;
- Warming, acidification, and loss of valuable oxygen levels of the ocean, with consequences on marine biodiversity, fisheries, and ecosystems, as illustrated by recent changes to Arctic sea ice and warm water coral reef ecosystems;
- The rise of global mean sea level, which is very likely to continue well beyond 2100, at a rate which depends on future emission pathways;
- Impacts on biodiversity and on terrestrial, freshwater, and coastal ecosystems, including species' loss and extinction; and
- Increased risks to health, food security, water supply, human security, and economic growth.

As this paper will show, the current climate change legal regime has been slow in its development and lacks strong enforcement mechanisms to tackle this urgent phenomenon. There have been some attempts to use other regimes with stronger institutional and enforcement frameworks, such as the international trade legal framework. However, they have mainly aimed at environmental protection in general, and they have not been enough compared to the magnitude and urgency of climate change. More effective tools, borrowing from other frameworks such as international trade, are needed.

The plurilateral negotiations on the Environmental Goods Agreement ("EGA") provide a good example, where negotiators aimed to liberalize trade in environment-friendly goods. Negotiations started in 2014 but they reached a stalemate in 2016. As an effort to revitalize the negotiations with a stronger focus on a trade facilitation framework to implement the goals of the Paris Agreement, the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu ("Taiwan") has proposed a Paris Accord-related Environmental Goods and Services Agreement ("PAEGSA"), within the framework of the World Trade Organization ("WTO").

The main purpose of this paper is to analyze and provide reasons for the necessity of PAEGSA to further implement the Paris Agreement, and the feasibility of such proposal. Our conclusion is that PAEGSA is both necessary and doable. The paper will proceed as follows:

- Section 2 will discuss the relevant trade negotiations that lead to PAEGSA, such as the Doha Round, the Asian-Pacific Economic Community ("APEC") Initiative, and the

stalled EGA. Afterwards, it will provide an overview of the main elements included in PAEGSA.

- Section 3 will discuss three related reasons why a trade facilitation framework within the WTO is needed in order to further implement the Paris Agreement and mitigate the phenomenon of climate change. These are: firstly, the development of the climate change regime has been slow and inadequate, secondly, the international trade framework will strengthen the Paris Agreement implementation, and thirdly, PAEGSA's trade approach is more effective in implementing the Paris Agreement than existing trade approaches.

- Section 4 will explore three major difficulties that PAEGSA's negotiators may face. These are: firstly, how to define climate-friendly goods and services, secondly, how to link government procurement with technology transfer, and thirdly, how to achieve a critical mass. It will also discuss how each of them can be alleviated.

- Section 5 will give concluding remarks.

2. INTRODUCING PAEGSA

2.1. The Road to PAEGSA

PAEGSA is not the first framework proposal that seeks to address global warming through international trade. We need to explore previous related negotiations to understand PAEGSA's context and the lessons that could be drawn from them. These relevant previous negotiations are summarized in Table 1 and explained below.

Table 1. Summary of Trade Negotiations on the Road to PAEGSA

Agreement	Scope	Participants	Type of Agreement	Concluded
Doha Round Initiation	Mandate to negotiate the reduction/elimination of tariff and non-tariff barriers to environmental goods and services	All WTO members	Ministerial Declaration	November 2001
APEC Initiative	Tariff reduction on 54 environmentally friendly goods	21 APEC economies	Regional tariff-cut agreement	September 2012
EGA	Tariff-cuts on Environmental Goods	46 WTO members	Plurilateral Negotiations	Not yet concluded

Doha Round

In November 2001, the Doha Ministerial Declaration mandated negotiations in "the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services" (Paragraph 31(iii), Doha Ministerial Declaration).

Even though the mandate was not directly linked to climate change, many of the technologies that can be considered climate-friendly, according to the IPCC,[1] were negotiated in the Doha negotiations. These included wind and hydropower turbines, solar water heaters, tanks for the production of biogas, and landfill liners for methane collection.[2] Currently, the negotiations on environmental goods are being pursuit by sub-sets of WTO members, as described below.

Asian-Pacific Economic Community Initiative

In September 2012, the APEC members[3] gathered in Russia for the 20th APEC Economic Leaders' Meeting to agree, among other things, on the APEC List of 54 Environmental Goods (included in Annex 2 of this paper). The APEC members endorsed the list that members had been working on since 1995 and committed to reduce the applied tariff rates to 5% or less on those environmental goods within 3 years.[4]

This initiative has been considered significant, since it is the first time that tariff negotiations on environmental goods have been completed among a large number of countries (Vossenaar, 2016). The outcome has been positive, since most APEC members have reduced their Most Favored Nation ("MFN") - applied tariffs for national tariff lines covered by the APEC list, with a "reasonable degree of specificity and environmental credibility".[5]

This initiative also served as the basis for the negotiations of EGA (Vossenaar, 2016).

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[1] The Intergovernmental Panel on Climate Change was set up in 1988 and provides scientific basis for governments in the framework of UNFCCC.

[2] For an overview of the Doha negotiation and climate change, see the page ''Activities of the WTO and the challenge of climate change'' on the WTO website (WTO, no date of publication).

[3] Australia; Brunei Darussalam; Canada; Chile; People's Republic of China; Hong Kong, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; The Philippines; Russia; Singapore; Chinese Taipei (Taiwan); Thailand; The United States; Viet Nam.

[4] For further details, see: APEC, 2012.

[5] For further analysis, see: Vossenaar, 2016.

Environmental Goods Agreement

On 8 July 2014, a group of WTO members launched plurilateral negotiations on EGA covering environmental goods. The negotiations attracted 18 participants representing 46 WTO members.[6] The general aim was to conclude talks for a tariff-cutting deal on environmental goods (ICTSD, 2016).

The intention was to agree on a list of products to liberalize, building on nominations made by the negotiators. During the process, participants nominated around 600 tariff classifications, which was narrowed down to over 300 tariff lines and related ex-outs (ICTSD, 2016).

However, EGA negotiations came to a stalemate in December 2016. It has been argued that one of the main reasons of EGA's failure was that each member nominated its own list of products (Wu, 2014), resulting in an ever-growing list and a difficult and lengthy negotiation. Furthermore, the nomination of sensitive goods such as: bicycles, wood and gas turbines, resulted in political difficulties during the negotiations among members, such as the European Union ("EU"), China and Japan (ICSTD, 2016). In particular, on the late stage of negotiations in December 2016, China presented a new list of goods that some members including the United States of America ("US") and the EU said was "impossible to accept" (Freedman, 2016). Also, it has been argued that, by limiting the coverage to environmental goods, the negotiations allocated disproportionately large bargaining powers to major good-producing members (Chu and Lee, 2018). For example, the European Trade Commissioner expressed the view that "U.S. absence would kill the talks" (Miles, 2016).

2.2. Proposal of PAEGSA

After the stalemate of EGA, Taiwan circulated a non-paper (Document JOB/TE/49) on January,19, 2018 before the WTO Committee on Trade and Environment ("CTE"). It proposed a trade facilitation framework to support the implementation of the Paris Agreement, under the name "The Paris Accord-related Environmental Goods and Services Agreement". The non-paper is included in Annex 3.

The proposal's main goal is to further strengthen the implementation of the Paris Agreement. It also stresses the need to narrow the scope of EGA by limiting the list of goods. Specifically, PAEGSA proposes:

- **The elimination of tariffs in goods related to carbon reduction or the ones necessary to implement the Paris Agreement;**
- **The inclusion of trade liberalization in climate-related services;**
- **The inclusion of government procurement ("GP") since energy industries in many WTO members are government-controlled; and**

[6] According to the information on the page "Environmental Goods Agreement (EGA)" at the WTO website, these participants are: Australia; Canada; China; Costa Rica; European Union; Hong Kong, China; Iceland; Israel; Japan; Korea; New Zealand; Norway; Singapore; Switzerland; Liechtenstein; Taiwan; Turkey; United States. (WTO, no date of publication).

- **The inclusion of other elements, such as: technology transfer and national regulation.**

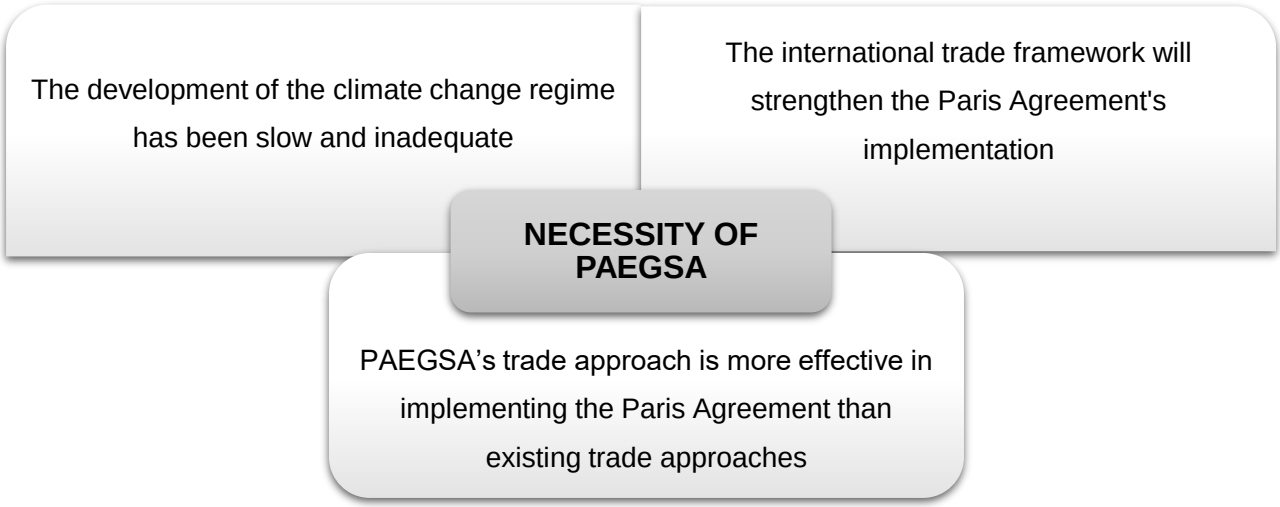
The reactions to the proposal at the CTE have been mixed.[7] For instance, Singapore, Norway and the E.U. reacted positively and were open to discuss further. Japan asked if Taiwan had any pre-existing list of products relevant to carbon reduction. However, others, such as Russia, Bolivia and Saudi Arabia expressed that the issues related to the Paris Agreement did not fall under the mandate of the WTO.

Against the backdrop of these reactions, it will be shown that PAEGSA is both necessary to implement the Paris Agreement, and more feasible than EGA.

3. PAEGSA IS NECESSARY TO IMPLEMENT THE PARIS AGREEMENT

In this section, the paper will provide three related reasons why PAEGSA is necessary for the implementation of the Paris Agreement. These reasons are summarized in Figure 1 and explained in sub-section 3.1, sub-section 3.2, and sub-section 3.3.

Figure 1 Three Reasons why PAEGSA is Necessary



[7] For all of the reactions, see: CTE, 2018.

3.1 The development of the climate change regime has been slow and inadequate

Despite the urgency of mitigating climate change, the development of its regulations[8] has moved rather slowly.[9] It started with the 1960s' scientific concern of global warming, but it was not until 1992 that countries adopted the United Nations Framework Convention on Climate Change ("UNFCCC") and not until 2015 that the Paris Agreement was signed.

The UNFCCC and the Kyoto Protocol

The first international instrument addressing climate change is the UNFCCC, adopted in 1992 as the legal framework for the climate regime. It aims to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (Art. 2, UNFCCC). The treaty has been ratified by 197 parties, resulting in almost universal participation.

The UNFCCC establishes only principles and a set of institutions. Furthermore, it sets a distinction between developed countries or countries in transition to a market economy (jointly known as Annex I countries) and developing countries, including China (known as Annex II countries).

In 1997, under the umbrella of the UNFCCC, the Kyoto Protocol was adopted by 192 states, excluding the U.S. This Protocol provides binding time-bound emissions targets only for Annex I countries.

The Kyoto Protocol was not considered successful, since it covered only 24% of global annual emissions measured in 2012. The main emitters, including China and the U.S., which together account for some 40% of global annual emissions, did not have any quantified emission reduction commitments (Viñuales, 2017). To address the obligation gap between developed and developing countries, the UNFCCC's Conference of the Parties ("COP") initiated several rounds of negotiations. In the Durban Platform in 2011, the parties agreed to a negotiation mandate for another legal instrument to be adopted in 2015 at the Paris COP-21.[10]

The Paris Agreement

The Paris Agreement, adopted in 2015 and in force since 2016, has been signed by 195 states and ratified by 181. Its goal is to "hold global temperature rise this century well below 2°C above pre-industrial levels and pursue efforts to limit the increase to 1.5°C" (Art. 2, Paris Agreement). It includes the following main elements:

[8] This paper limits the analysis to the regulations that directly regulate climate change, and not peripheral regulations that may have an impact on climate change such as Ozone Depletion regulations.

[9] For an analysis of the development of the climate change regime, see: Bodansky, 2001.

[10] For an analysis of these negotiations, see: Viñuales, 2017.

- Commitments undertaken by states in a bottom-up approach: each party must provide every five years a Nationally Determined Contribution ("NDC") with their own target of CO_2 emissions' reduction that will be recorded in a public registry maintained by the Secretariat;[11]
- Implementation of domestic mitigation measures to achieve the set targets (Art. 4.2, Paris Agreement);
- A review mechanism to track implementation and assess the collective progress with a global stocktaking every five years;
- A transparency mechanism to promote effective implementation (Art. 13, Paris Agreement); and
- Technology transfer and capacity-building provisions (Art. 10 and Art. 11, Paris Agreement).

The conclusion of the Paris Agreement was a success in terms of reducing the obligation gap between developed and developing countries and achieving universal participation. However, the envisioned implementation mechanisms are information-based approaches and facilitation mechanisms, such as international cooperation in capacity building and technology transfer. In order to achieve the CO_2 emissions' reductions required to meet the Paris Agreement's goals, it is necessary to strengthen its implementation mechanisms.

3.2 The international trade framework can strengthen the Paris Agreement's implementation

Shifting to other institutional frameworks, such as the WTO, to implement the Paris Agreement could strengthen its implementation. The WTO system provides several benefits to effectively implement the diffusion of climate-friendly goods and services, as proposed in PAEGSA. Removing trade barriers and allowing know-how sharing can facilitate diffusion of climate-friendly products and help countries achieve their NDCs (WTO and UNEP, 2018). The following reasons are particularly compelling:

- The WTO offers a platform for addressing linkages between trade and climate change through established committees such as the CTE. This facilitates the information and know-how sharing between members.
- The WTO provides a forum to negotiate further trade openness, including the liberalization of climate-friendly goods and services envisioned in PAEGSA. Members can launch multilateral and plurilateral negotiations within a well-established institutional framework.
- Concluded agreements allow for the benefits of such liberalization to be extended on an MFN basis to the entire WTO membership, resulting in a wider diffusion of climate-friendly goods and services.
- WTO rules offer a framework for ensuring predictability, transparency and fair implementation of such measures. In this case, PAEGSA would be concluded within such framework.

[11] The interim NDC registry of the UNFCCC's Secretariat indicates that 177 parties have submitted their NDCs. See: UNFCCC, (no date of publication).

- The WTO has a dispute settlement body that deals with disputes between members regarding trade agreements. Such body has authority to maintain surveillance over the implementation of recommendations and rulings, and to authorize suspension of concessions in the event of non-compliance. The Paris Agreement does not include a similar dispute settlement body, and thus, shifting to the trade regime for the implementation of measures would benefit from a stronger implementation mechanism.

3.3 PAEGSA's trade approach is more effective in implementing the Paris Agreement than existing trade approaches

Countries have been linking trade and climate change governance through institutional linkages, provisions within Preferential Trade Agreements ("PTAs") and references in their NDCs. However, they are not effective enough to implement the Paris Agreement. For example, at the WTO, there is still no specific framework addressing climate change. PAEGSA, by focusing on climate change while, at the same time, including goods, services, government procurement and technology transfer, would lead to a more effective implementation.

There are existing institutional linkages between trade and climate change: the UNFCCC has an observer status before the CTE in the WTO, and the WTO Secretariat attends UNFCCC COP's meetings. However, the linkage is weak, since it is mainly about observing negotiations and sharing views.

Furthermore, some countries have resorted to PTAs to contribute to the global climate change governance. Below, we provide a table with the categories of provisions that have been included in a study by Morin and Jinnah (2018) reviewing PTAs between 1947 and 2016.

This trend has continued after 2016. For instance, the E.U.-Japan Economic Partnership (2018) includes a shared commitment to sustainable development and a commitment to the Paris Agreement.[12] Furthermore, even though the United States has publicly stated its intention to withdraw from the Paris Agreement, the United States-Mexico-Canada Agreement[13] includes some indirect references to climate change. It refers to "clean technology", in a non-binding section on environmental goods and services, and to "carbon storage" in the sustainable forest management section (Vaughan, 2018).

[12] The agreement is awaiting ratification by the European Parliament and the Japanese Diet and is expected to enter into force in early 2019. See: European Commission, 2018.

[13] Finalized in 1 October 2018, pending ratification.

Table 2. Eight categories of provisions directly related to climate change

Category of Provisions	First PTA to include it	Year	Excerpt	Number of PTAs
Promotion of renewable energy	Lomé II	1979	"The Community will assist inter alia, in the [...] implementation of alternative energy strategies in programmes and projects that will [...] cover wind, solar, geothermal and hydro-energy sources"	70
Promotion of energy efficiency	Lomé II	1979	"The Community will assist inter alia, in the [...]production in the ACP States of equipment for the production and distribution of energy as well as the application of energy-saving techniques"	68
Cooperation on climate governance	EU-Poland and Hungary	1991	"Cooperation shall center on [...] global climate change"	38
Reduction of GHG emissions	Lomé IV	1989	"The Parties recognize the value of exchanging views, using existing consultation mechanisms under this Convention, on major ecological hazards, whether on a planetary scale (such as the greenhouse effect)"	31
Adaptation to climate change	China-Costa Rica	2010	"The Parties shall cooperate to [...] promote effective risk management in the agribusiness chains aiming to incorporate measures for adaptation [...] of climate change [...]"	14
Ratification or implementation of Kyoto	EU-Montenegro	2007	"Special attention shall be paid to the ratification and the implementation of the Kyoto Protocol."	13
Ratification or implementation of UNFCCC	Common Market for Eastern and Southern Africa	1993	'The Member States [...] agree to: [...]accede to the UNCED Agreements relating to the Conventions on climatic change and biodiversity'	7
Harmonization of climate regulation	EU-Ukraine	2014	'Ukraine undertakes to gradually approximate its legislation to [. . .] Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community [. . .]'	2

Source: Morin and Jinnah, 2018

There is a high degree of innovation in climate provisions in PTAs, being sometimes more specific than the Kyoto Protocol or the Paris Agreement. However, they are weakly "legalized"[14] in the sense that the obligations are not sufficiently precise and specific. Moreover, they are not necessarily adopted by the highest greenhouse gas ("GHG") emitters.[15]

Furthermore, even though the Paris Agreement does not include any specific reference to trade, some countries have made references to it in their NDCs. A 2017 study showed that 45% of NDCs contain direct references to trade or trade elements, but only 6% of all NDCs mention a reduction of trade barriers (Brandi, 2017). Furthermore, a 2016 study identified only 7% of the 162 INDCs/NDCs examined contained a reference to government procurement for achieving the emissions' targets (Elkahwagy, Gyanchandani and Piselli, 2016).

PAEGSA's proposal as envisioned provides a comprehensive set of trade measures that would allow a more effective implementation of the Paris Agreement, for the following reasons (Chu and Lee, 2018):

- Its comprehensive approach, including goods, services, government procurement and technology transfer, facilitates more effectively the diffusion and market penetration of climate-friendly goods and services and the adoption of green energy. Furthermore, it will allow for issue-linkage during the negotiations.
- Participants can achieve an effective negotiation since the goods-plus-services coverage in trade liberalization balances the bargaining powers. It will alleviate the allocation of disproportionately big bargaining powers to large good-producing members which occurred in the EGA negotiations. Furthermore, it will attract relevant service-suppliers even though their government may be reluctant to join the negotiation. For example, even though environmental issues may not come up on the top of the list of priorities for the current Trump administration, the U.S. should find PAEGSA useful, since including the liberalization of climate-friendly services will be attractive to the U.S. companies, such as General Electric and Honeywell International Inc.
- The government market of energy and public utility services is of a significant size in many countries. Thus, its opening up to innovative international technologies can be a catalyst for the transition to climate-friendlier energy production.
- It would strengthen the commitment to technology transfer undertaken in the Paris Agreement. An effective technology transfer implementation would contribute to the better diffusion of climate-friendly technologies.
- Having this comprehensive approach and set of issues provides a greater incentive for countries of different development levels to join PAEGSA, which will result in wider participation.

4. PAEGSA IS MORE FEASIBLE THAN THE ENVIRONMENTAL GOODS AGREEMENT

In addition to the above analysis that PAEGSA is a necessary framework for the purpose of implementing the Paris Agreement, this paper will also address the feasibility of PAEGSA's proposal. Similar to other trade negotiations on environmental goods and services, this paper

[14] For further analysis on the concept of legalization defined along the dimensions of obligation, precision and delegation, see: Abbott and others, 2000.

[15] For further analysis, see: Morin and Jinnah, 2018.

is aware that there are a number of difficulties which may arise in the negotiation of PAEGSA. Nevertheless, it will be argued that PAEGSA is a more feasible option, compared to EGA, because there are means or solutions to alleviate these potential difficulties.

This section will focus on three of such difficulties: how to define climate-friendly goods and services; how to link government procurement with technology transfer; and how to achieve a critical mass. In sub-section 4.1, sub-section 4.2, and sub-section 4.3, we will explain why and how each of these difficulties can be alleviated.

4.1. How to define climate-friendly goods and services

A major difficulty for moving forward with PAEGSA is that there is no universally accepted definition of the climate-friendly sector (OECD, 2015). In the trade system specifically, climate-friendly goods are found within many trade classifications in the tariff schedules. Similarly, climate-friendly services cut across many different sectors.[16] However, as discussed below, this concern has been significantly alleviated since, in recent years, the literature, commentators, and negotiators have proposed a number of options to consider.

Options to define climate-friendly goods and services.

There are several options to deal with this difficulty. In practice, negotiators typically use the list approach, where products are nominated by each participant.[17] However, there are other alternatives to define the products and services to be liberalized. Below, we provide an analysis of the advantages and disadvantages of these options.

1. List Approach:[18] creating a list of a number of goods and services to be liberalized, either by individual nomination from negotiators, or by choosing from pre-existing lists. For examples of pre-existing lists on climate-friendly goods, see Annex 4.

Advantages	Disadvantages
• Having a binding and predictable market access; • Consistency with WTO's negotiation practice; • If products are well identified in the member's tariff lines, it is easier to implement by customs officials	• Product-by-product/service-by-service analysis; • Complexities surrounding HS codes and definition of ex-outs and w/120 services classification (See Boxes 1 and 2); • Lengthy process of definition, especially if it is based on nominations from participants

[16] For climate-friendly services, see: Steenblik and Gross, 2011; and Kim, 2011.

[17] This approach has been used in the APEC Initiative, ITA, in the context of the EGA by the so called "Friends of Environmental Goods", and in general developed countries have favored this approach in negotiations (World Bank, 2007).

[18] For further analysis, see: World Bank, 2007; Santana, 2015; OECD, 2015; and Sugathan, 2013.

2. Pre-established Set of Criteria:[19] Producing a checklist of criteria to identify goods and services based on agreed principles and members' interests.

Advantages	Disadvantages
• It could be a good starting point to reach consensus when there is controversy on identifying specific goods and services; • Could provide a first stage of information-sharing between members	• Contingent on the quality of the criteria; • It requires further negotiation on identifying the goods and services that would meet such criteria, or clarifying ambiguities in the interpretation of the criteria; • Risk of a lengthy negotiation

3. Project Approach:[20] Identify and negotiate climate-friendly projects. The goods and services related to the project, would be tariff-free during the project's duration.

Advantages	Disadvantages
• Reducing the risk of greater liberalization since it is only for specific projects within a timeframe; • Avoiding the complexities surrounding HS codes and ex-outs; • Enabling dynamic coverage of changing technologies	• Lack binding and predictable market access offered on a permanent basis, therefore potentially inconsistent with WTO rules; [21] • Potentially controversial in terms of defining the criteria to choose the projects and the accepted duration of the projects

4. Integrated Approach:[22] Negotiators pre-identify the climate-friendly goods and services related to specific projects, and a designated national authority decides whether or not to provide trade liberalization.

Advantages	Disadvantages
• Reduce the risk of greater liberalization than intended since it would be for single-use goods and services related to specific climate-friendly projects; • Issue of the complexity of HS Codes, ex-outs and W/120 classification on services	• Lack binding and predictable market access offered on a permanent basis, therefore being potentially inconsistent with WTO rules;[23] • Potentially controversial in terms of defining the criteria to choose the projects and the accepted duration of the projects

[19] For further analysis, see: Sugathan, 2013.

[20] India proposed this approach during the EGA negotiation. For further analysis, see: ICTSD, 2006; World Bank, 2007.

[21] It is unclear whether this approach would be consistent with the MFN principle under GATT and GATTS on the basis of a "likeness" analysis of similar products that would not be granted the tariff-reduction. It would depend on the specifics of the agreement. For further analysis, see: UNCTAD, 2009.

[22] During the EGA negotiations, Argentina advocated this method. For further analysis, see: ICSTD, 2008; World Bank, 2007.

[23] See footnote number 21.

Other Related Considerations: 1. Dealing with the Multiple-End Use Concern.

Climate-friendly goods and services may have intrinsically dual or multiple-end uses.[24] To address this problem, an alternative is to use a single-use approach.[25] This means: firstly, to focus the liberalization in goods that are used exclusively or predominantly for climate change mitigation, including energy efficiency and increased use of renewable sources of energy; secondly, to focus only on goods identified in existing tariff classifications, or where data can provide information on trade flow; and thirdly, to focus the liberalization in services that are necessary for those goods.[26]

Advantages	Disadvantages
• Reduce risk of over-liberalization; Sets an objective criterion for the scope; • Data on trade flows is more available; • Help negotiators identify and prioritize services and goods that are less contingent to non-climate-friendly uses; • Easier to reach consensus, since its benefits for climate change are more certain	• There are not many single-use climate-friendly goods that match the proposed criteria; • Reduces the flexibility of negotiations, since options can be limited; • Effectiveness to tackle climate change through trade may be limited if the liberalization is done for a small number of goods and services

Other Related Considerations: 2. Dealing with the Future

During the negotiation, it is impossible to foresee all future changes in technology. Some products or services may lose relevance or disappear form the market, while new ones may acquire importance (Santana, 2015). This is particularly true for fast-changing climate-friendly goods and services.

An option that has been successfully used in other trade liberalization negotiations[27] is to establish a review mechanism to periodically update the coverage of the agreement. Such review mechanism could include a future period of consultations between members and relevant representatives from the private sector and international institutions, such as the UNFCCC Secretariat and the United Nations Environmental Program (World Bank, 2007).

[24] Dual or multiple-end uses means that a product or service may be used for other end-uses other than climate-friendly purposes. For example, a pipe can be used in a renewable energy plant or to transport oil (World Bank, 2007). This raises the concern of an overreaching liberalization in trade.

[25] For further analysis on single-use climate-friendly goods, see: Vossenaar, 2010.

[26] Services that are "complementary to the diffusion of climate change mitigation technologies" cutting across key mitigation sectors identified by the IPCC which are energy supply, transport, buildings, industry, agriculture, forestry and waste. For further analysis, see: Kim, 2011.

[27] The Information Technology Agreement (ITA) and the Pharma Agreement are two examples of agreements on trade liberalization of goods that have included periodical review mechanisms to update the product coverage in the future (Santana, 2015). Up to 2018, the Pharma agreement has been reviewed and updated five times, whereas the ITA has been reviewed once.

Box 1. Getting Technical on Goods: The case of HS codes, tariff lines and ex-outs.

The list of goods can be composed of products identified as HS codes, national tariff lines, ex-outs, non-HS related products, or a mixed approach (For details, see: Santana, 2015). Below, we provide a general comparative table of these three options.

Criteria	Description	Advantages	Disadvantages
HS Code	Internationally Harmonized Chapters, headings and sub-headings of products.	- Harmonized; - Negotiation is straightforward; - Easy to implement by customs agents; - Easy to track trade volumes and tariff levels.	- Broad coverage; - Potentially greater liberalization.
National Tariff Lines	Tariff lines in national tariff schedules of WTO members.	-Space for members to define it in their national tariff schedule; -Easy to implement by customs agents.	-Not harmonized; -Broader than ex-outs.
Ex-outs	Subset of products within a HS sub-heading.	-Tailored and specific. Possibility of excluding multiple uses; -Avoids unintended liberalization.	-Difficult to implement by customs agents; -Difficult to have an accepted description; -Difficult to establish trade flows.
Non-HS related products	Products that have no HS category and are negotiated in the form of narrative descriptions in specialized annexes.	-Flexible; -Tailored and specific. Possibility of excluding multiple uses; -Avoids unintended liberalization; -Addresses the problem of products not classified in the HS.	-Difficult to implement unless clearly defined; -Difficult to have an accepted description; -Difficult to establish trade flows.

Some successful negotiation cases, such as the Pharmaceutical Agreement and ITA, had a combined approach. For instance, the ITA has several products that were defined in terms of HS and ex-outs (for those products where the HS classification was not controversial) and others were included as annexes with a description of the product, regardless of where and if these products were classified in the HS. This approach was combined with an effort from the ITA participants to work in different fora, including the HS Committee, to clarify the HS classification of these products (Santana, 2015).

Box 2. Getting Technical on Services: The outdated W/120 services' classification

Another difficulty in negotiating the liberalization of trade in services lies in the classification of services in the members' schedules. In principle, WTO members are allowed to use any classification system as long as it is sufficiently precise. In practice, most WTO members use the W/120 list which adopts the sectoral approach and each classified category is mutually exclusive. This list reflects the understanding of services in the 1980s and 1990s and may not accurately reflect the current understanding and reality of the technologies related to climate change mitigation. Many key climate-friendly services would be classified as "other environmental services: CPC9406" which will make it difficult to specifically negotiate these services.

Existing proposals to update the current W/120 categorization to reflect an environmental approach are summarized below. These proposals could help alleviate the difficulty of schedules in services and the liberalization of climate-friendly services.

OECD/Eurostat's approach	UNCTAD's approach	E.U.'s approach
An informal working group of experts meeting under the auspices of the OECD and the Statistical Office of the European Community (Eurostat) has developed a more comprehensive classification of environmental services than the w/120 list. The most prominent feature is the definition of environmental services which include "services provided to measure, prevent, minimize or correct environmental damage to water, air, soil, as well as problems related to waste, noise and eco-system" (Kirkpatrick, 2006). It thus significantly expands the "environmental service" sector in the W/120 list from the old idea that environmental services are mainly about remediation to a more proactive one, where environmental damage should be prevented in the first place. (i) In the classification of the OECD/Eurostat, environmental services include services relating to: pollution management, including those related to the construction and installation of facilities for such purposes; (ii) cleaner technologies and products; and (iii) technologies and products which reduce environmental risks and minimize pollution and resource use (Kirkpatrick, 2006).	UNCTAD has proposed another classification of environmental services. It divides environmental services into 4 segments (Kirkpatrick, 2006): (i) environmental infrastructure services, such as water and waste management; (ii) non-infrastructure, commercial environmental services, for example site clean-up and remediation, cleaning of exhaust gases, noise abatement and nature and landscape protection; (iii) remediation services with environmental end-use, for example, construction or engineering services; and (iv) support services.	The then European Community proposed the alternative classification of environmental services at the WTO Committee on Specific Commitments. Its proposal, which is similar to the OECD/Eurostat's classification, divides the sector into "core" sub-sectors, which are: (i) water for human use and wastewater management; (ii) solid/hazardous waste management; (iii) protection of ambient air and climate; (iv) remediation and clean-up of soil and water; (v) noise and vibration abatement; (vi) protection of biodiversity and landscape; and (vii) other environmental and ancillary services. This proposal has garnered wide support at the WTO (Kirkpatrick, 2006).

4.2. How to link government procurement with technology transfer

Another key proposal in PAEGSA is to include government procurement and technology transfer. For government procurement, one approach is to lower information costs about procurement in the energy sector that is sometimes controlled by the government (Kim, 2011 and OECD Statistics). However, government procurement has traditionally been a sensitive matter, and states are unwilling to submit it to WTO disciplines (Blank and Marceau, 1997). The main legal instrument concerning government procurement is the Government Procurement Agreement ("GPA"). Nonetheless, it has only 20 parties. Moreover, currently, most of the GPA members have not extended the GPA obligations to the energy sector (Cottier and others, 2009 and Herve and Luff, 2012).[28] Without WTO disciplines, some countries that procure renewable energy technologies impose too demanding requirements on companies or set arbitrary, non-transparent conditions.[29]

One of the main issues for the inclusion of government procurement in PAEGSA is, thus, how to attract WTO members, in particular, developing countries. One possible solution is to allow developing countries to condition government procurement on technology transfer.[30] Such linking would be a significant trade-off for developing countries to offer transparent access to their bids. Technology transfer may even lead developing countries to achieve a qualitative structural transformation as traders and exporters (Gehl Sampath and Roffe, 2012).

The proposal of PAEGSA to include technology transfer, especially with regard to the renewable energy technologies, is feasible for two reasons: first, the obligations of technology transfer already exists in several multilateral agreements and frameworks; and second, there are several options to operationalize diffusion of technologies.

Multilateral Instruments and Frameworks on Technology Transfer in Renewable Energy Technologies

Several multilateral instruments and frameworks already include relevant provisions on technology transfer in renewable energy technologies. United Nations Conference on Trade and Development ("UNCTAD") lists 40 such multilateral instruments (UNCTAD, 2001). The key instruments and frameworks are summarized in Table 3.

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[28] For further details on how climate-friendly goods and services in general, and renewable energy related goods and services in particular, can be promoted through government procurement, see: Herve and Luff (2012); and, van Asselt and others (2006). For a principled approach to the covered goods, services, and state trading entities, as opposed to the schedule method, see: Wang (2007); and Cottier and others (2009).

[29] For further details, see: Broecker and Beraldi (2017); and Atkinson (2012).

[30] There is no consensus on a definition for the process of what is usually referred to as "technology transfer", and this is a highly politicized issue. This report adopts the 2002 definition by the IPCC: "a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as governments, private sector entities, financial institutions, non-governmental organizations (NGOs) and research/education institutions" (Philibert, 2004). For further discussion, see: Yülek and Taylor (2012).

Table 3 Multilateral instruments/frameworks on technology transfer related to renewable energy		
The UNFCCC Framework		
UNFCCC	Art 4.5	• The UNFCCC includes a wide commitment to realize technology transfers. It has been further specified and implemented by the Paris Agreement and the Technology Mechanism established therein.
Paris Agreement	Art 10	
The WTO Framework		
TRIPS	Art 7	• "Technology Transfers" as one of TRIPS agreement's general objectives.
	Art 8	• Recognizes that measures "may be needed to prevent the abuse of intellectual property rights by right holders or [...] practices which [...] adversely affect the international transfer of technology", provided they comply with TRIPS requirements. For example, adequate compensation (Art. 31, TRIPS).
	Art 66.2	• States that "developed country members shall provide incentives to enterprises and institutions in their territories" to encourage technology transfer to least developed countries ("LDCs"). • Further specified by TRIPS Council Decision of February 19, 2003 (IP/C/28) on the "Implementation of Article 66.2", which obliges developed members to annually submit a report to the TRIPS Council on actions taken for the implementation of Art. 66.2. Members often include projects carried out within the UNFCCC framework.
Working Group on Trade and Technology Transfer		• Established as part of the 2001 Doha Agenda.
		• Based on the 2018's report of the Working Group on Trade and Transfer of Technology (WT/WGTTT/2018), its main focus is to analyze the link between trade and international technology transfers. However, the report does not include suggestions to operationalize transfers.

This demonstrates that all WTO members participating in the UNFCCC, the Agreement on Trade-Related Aspects of Intellectual Property Rights ("TRIPS"), as well as the WTO Working Group on Trade and Technology Transfer have already undertaken the commitment, within and outside the trade framework, to encourage technological diffusion to developing countries under fair conditions. Including a similar commitment in PAEGSA does not add an additional burden on its participants. The added value would be to adapt the commitment and operationalize it taking into consideration the particularities of the renewable technology field.

Options for Operationalizing International Diffusion of Renewable Energy Technologies

PAEGSA is also feasible, because there are many options for operationalizing international diffusion of renewable energy technologies. These options will suit different learning conditions and absorptive capacity of each country (Gehl Sampath and Roffe, 2012). In what follows, this paper will focus on three options. The selection is based on the practice of international organizations, especially in the climate change regime, as well as top exporters and importers of climate-friendly goods and services.

1. Collaborative Training, Education, and Research[31]

This option includes capacity building, education, and research projects to transfer knowledge. This can be realized either unilaterally, from technologically savvy countries, or in a collaborative learning manner. It can also include private actors. It may include the movement of nationals from developing countries to developed countries, expert missions in the recipient country, or a combination of those. It may also include collective funding for research and development ("R&D") on carbon-saving energy technologies (Barrett, 2001).

Examples
• On 15 November 2018, Japan held a "Japan-Thailand Government-Private Workshop on Clean Energy Technology" in Thailand. The aim was to share information on successful examples of cases for global energy transition. It also included representatives from private companies.[32]
• Canada has developed a project called "Solar Technology for the West African Economic and Monetary Union". The purpose was to establish the Institute for Training in Applied Solar Technology at the University of Ouagadougou, as a regional center of excellence in advanced solar technologies in West Africa. It supports the training of 500 high-level technicians and 100 engineers, of which at least 20% are women. It also engages with other academic capacity-building institutions in the region (IP/C/W/646/Add.4).

Advantages	Disadvantages
• Possible knowledge-sharing effects. especially for countries with some technological level that allows a minimum absorptive capacity; • The least disputed option, since it is not intrusive on companies' intellectual property rights; and • Developing countries such as China and India strongly support the outflow of technical staff.	• Long-term knowledge process that does not necessarily lead to direct product development (Kirchherr and Urban, 2018); and • Not a priority for developed countries, when it entails movement of foreigners to educational establishments / offering grants and temporary employment to graduates and professionals.

[31] For further analysis, see: Hoekman and others, 2005.

[32] For further information, see: METI, 2018.

2. Encouraging Foreign Direct Investment linked to Technology Diffusion

This option entails encouraging foreign direct investment ("FDI") into the host countries for technological diffusion.

Examples
• A number of U.S. agencies financed a solar project in Zambia involving American firm First Solar and French firm Neoen. The project supports the development of a 47.5-megawatt (MW) solar photovoltaic power plant. The project will be Zambia's first utility scale independent power producers (IP/C/W/646).
• The UNFCCC's Global Environment Facility ("GEF") funds are often linked to other loans from international institutions or with national or bilateral funds, or even private investment. The aim of this link is to support renewable energy projects. The Special Climate Change Fund, established under the Marrakesh Accords, the Least Developed Countries' Fund, established under the UNFCCC, and the Adaptation Fund, established under the Kyoto Protocol, also serve similar projects (Philibert, 2004).

Advantages	Disadvantages
• Enables: the transfer of formal intellectual property rights ("IPRs"), tacit knowledge and experience in management, and related processes in clean energy projects; • LDCs with low absorptive capacity favor this option, since technology must be built from the initial stage; and • Have proven particularly successful when provided through fiscal relief measures, subsidies and joint ventures (Kirchher and Urban, 2018).	• Does not always lead to knowledge diffusion, e.g. China has been accused of using only Chinese subcontractors and not enough local elements (Yunnan Chen, 2018); and • Especially when foreign investors maintain the operation of the project after construction and for a long time, the outcome is mere hardware transfer (Kirchher and Urban, 2018).[33]

3. Licensing and Intellectual Property Rights' Transfer

Another option is that developed countries offer financial incentives to companies to enable licensing or transfer in IPRs. This can be done through giving these incentives to renewable energy technology companies in developed countries, or to subsidiaries and licensees in developing countries. Licensing, and in general IPRs' transfer, become available for developing countries. They may also integrate countries into a fair and transparent system of international renewable technology diffusion.[34]

[33] However, Siemens Gamesa for example, in the bid recently won to build India's largest ever wind turbine order of 300 MW, has agreed to limit its maintenance commission for 10 years. See: Siemens Gamesa, 2018.

[34] Srinivas (2009) notes that this option was used by countries that have successfully moved up the technological ladder, such as Japan and Korea.

Examples
• China has suggested the establishment of the "Multilateral Technology Acquisition Fund", in the framework of the UNFCCC, which would provide funding for the acquisition of IPRs and other forms of technology transfer (OECD, 2009).
• Mexico, China, Brazil and India receive around 75% of funding from the Clean Development Mechanism of the UNFCCC, and many of these funding projects include licensing (Dechezleprêtre and others, 2009).

Advantages	Disadvantages
• If IPRs are well protected, this option will motivate companies to innovate and shift their incentives from FDI to licensing (Hoekman and others, 2005); • Better for middle-income and large developing countries, which already have some technological capacity to reproduce these technologies and participate in relevant markets;[35] • May lead to more R&D in recipient countries with strong imitative abilities; and • There is a high percentage of companies that are willing to offer more flexible licensing terms when licensing to developing countries with limited financial capacities (UNEP, EPO, and ICTSD, 2009).	• Unsettled conflicts in multilateral fora, such as the UNFCCC, the WTO and World Intellectual Property Organisation, as to what extent IPRs' holders' rights can be limited in favor of user's IPRs (Gehl Sampath and Roffe, 2012); • Studies often find that strong IPRs' protection does not enable diffusion of climate change mitigation technologies in LDCs (Hoekman and others, 2005); and • It may neglect the importance of informal forms of knowledge diffusion, such as tacit knowledge and experience.[36]

Other Related Considerations: Creating Multilateral Monitoring and Review Mechanisms

Technological learning and endogenous capacity development in the receiving countries are hard to monitor and measure (Gehl Sampath and Roffe, 2012). The effectiveness of technology transfer will strongly depend on the way in which it is implemented, and how the learning process is monitored. These considerations provide rationales for using international agreements to develop monitoring and surveillance mechanisms to increase the impacts of diffusion policies. Such mechanisms could also serve as a database for successful practices and methodological exchange and dissemination (Hoekman and others, 2005). Finally, they would ensure transparency and accountability for a more effective cooperation and compliance.

[35] For further analysis, see: Shabalala, 2014.

[36] See argument by the EU in its last "Report on the Implementation of Article 66.2 of the TRIPS Agreement" to the TRIPS Council, WTO Document IP/C/W/631/Add.7.

Box 3. Getting Technical on Government Procurement: Compatibility of Technology Transfer with the GPA

A difficulty in the setting of TT requirements in countries' GP is that they can be considered local development offsets. Arts. III:8(a) GATT and XIII.1 GATS exempt the field of GP from their disciplines (Arrowsmith, 2011, Kuntze and Moerenhout, 2013). However, the GPA reintroduces them for its members, as Art. IV.1 & IV.2 GPA imposes NT and MFN restrictions on GP. Para. 6 of the same Art. IV explicitly prohibits all local development offsets, such as local content, technology licensing, investment and counter-trade requirements (as defined in Art. I.(l) GPA).
Consequently, WTO members are not limited to set TT offsets in their GP, unless they are a GPA member. However, offsets will be consistent with the GPA, if posed: i) by developing countries, ii) based on GPA exceptions, or iii) for non-GPA covered sectors. The table below provides further details on these three options:

Option	Description & GPA Provision	Conditions of Application	Considerations
Developing Countries Exemption	- GPA Art. V.1, V.3 and V.3(b), V.4, V.6 A developing country can, upon agreement of the GPA Parties (Art. V.1 "Parties shall accord"): (i) Adopt offsets as a transitional measure for a certain period, or (ii) Be granted an implementation period for a certain GPA clause, 5 years for LDCs and so long as needed for developing countries, maximum 3 years. -The GPA Committee can, upon request from the developing party, extend the above periods, or, in case special unforeseen circumstances occur, approve new transitional measures.	- Negotiation during accession - Offsets must respond to country's development needs and be applied in a non-discriminatory manner among Parties. - Transitional measures (Art. V.3) must be in accordance with a country's annexes to Appendix I, and - Implementation Periods (Art. V.4) shall be listed in the country's Annex 7 to Appendix I. - Offsets as transitional measures must be stated in the notice of intended procurement - cannot be condition for award. - The country shall take steps during the transition/implementation period, to ensure GPA compliance at the end of this period and notify the Committee.	- Only justified based on the "infant industry" argument (Collins, 2018). - Firms in less developed countries often do not have the size or the technological knowledge to compete with more technologically advanced multinationals from developed countries.
GPA Exceptions	- Art. III of the GPA allows parties to impose offsets for limited prescribed reasons. -Parties have already been posing defence procurement offsets for national security reasons based on Art.III.1 (Collins, 2018). -It can be argued that, when a country does not have domestic technologies to tackle climate change, measures to acquire such technologies are necessary to protect "human, animal or plant life or health", "public morals, order or safety" as well as "intellectual property", and might not constitute "arbitrary or unjustifiable discrimination". (Van Calster, 2002).	– The measures must be relevant and necessary to tackle climate change. Based on the Appellate Body's ruling in the case "*Brazil – Retreaded Tyres"* made under GATT Art. XX(b), which contains the same wording, it can be argued that measures against global warming and climate change fall within the scope of "human, animal or plant life or health" (Kennedy, 2012 and Herve and Luff, 2012). – Offset shall not be applied in an arbitrary or unjustifiable way, discriminating between Parties where the same conditions prevail or a as disguised restriction on international trade.	- Applicable to all GPA parties - Requires authoritative interpretation of the current Exceptions Clause of the GPA (Art. IX:2 of the WTO Agreement), or Declaration by the GPA Committee. - PAEGSA could elaborate in clarifying the justifiability of TT conditions as exceptions.
Procurement not Included in Members' Schedules	Parties could negotiate to: - Not include in their Annexes based on GPA Art. II:4 climate friendly goods, services and relevant procuring entities (often STEs and generally private public utility entities controlled by the state, (Cottier 2009)); or - Include in the Annexes an exemption from applicability for TT offsets, as done e.g. by Canada in its GPA Annex 2 for economic development of various listed provinces and territories (Collins, 2018).	- Upon reciprocal negotiation among parties. - Unilateral decisions of individual GPA members. - Since the GPA relies on a positive list approach (Collins, 2018), TT offsets are not prohibited by the GPA, only if these goods and services or the entities procuring them are not included in the schedules. The GPA prohibition is only applicable if both the plaintiff and the host state have ratified the agreement and the latter has included the relevant procurement in its schedules (Kuntze and Moerenhout, 2013).	-Most entities administering renewable energy projects have not been integrated into Appendix I of the GPA (Collins, 2018), since they often fall under Annex 3, the category of entities less annexed to the GPA.

4.3. How to achieve a critical mass

From the perspective of implementing the Paris Agreement, PAEGSA should have as much participation as possible. It is highly desirable that cheap, efficient climate-friendly goods and services are available in as many countries as possible, including developing countries. But from the perspective of the feasibility of concluding an agreement, too many negotiators may make it impossible to successfully conclude the negotiation. One way to balance these two perspectives is to focus on the participation of the critical mass related to the scope of PAEGSA while remain open to other interested WTO members.

As such, achieving a critical mass will be another major difficulty for the PAEGSA's negotiation. To fully ascertain that attaining a critical mass is feasible, it would require a thorough examination of several political and economic factors, such as: each state's governmental positions and domestic political economy. At this stage, PAEGSA, as envisioned by Taiwan, attracts a critical mass more easily than EGA. This is so because of three reasons: trade volume, positive reactions to Taiwan's proposal, and flexibility for trade-offs.

Trade volume

In terms of trade volume of climate-friendly goods and services, a critical mass for PAEGSA is limited to around 20 WTO members. Most of them have participated in the EGA negotiations.

For trade volume, Vossenaar (2010) has provided statistics concerning the top exporters and importers of climate-friendly goods based on previous studies by the World Bank and the International Centre of Trade and Sustainable Development ("ICTSD"). The statistics are shown in Table 4 and Table 5 below.

In addition, the Clean Energy Manufacturing Analysis Center ("CEMAC") has focused on the global manufacturing supply chains of clean energy technologies. It has produced the first-of-its-kind study quantifying the economic impacts of the clean energy manufacturing sectors in the countries that represent the largest global manufacturing centers. Figure [2] below shows the balance of trade in four clean technology end-products, which are: wind turbine components (nacelle, blades, and tower), crystalline silicon ("C-Si") photovoltaic ("PV") modules, light duty vehicle ("LDV") lithium ion battery cells, and light emitting diodes ("LED") packages for lighting, and other consumer products.

From this set of data, the top exporters and importers of climate-friendly goods and components are limited to a relatively small number of WTO members. In the case of exporters of climate-friendly goods in the World Bank's list, only 16 WTO members constitute 100% of the export volume. In the case of importers of the same goods, the number increases to 22, which is still a relatively small group. This also holds true in the case of climate-friendly goods in the ICTSD's list. The study by CEMAC largely supports this figure. The countries that represent the largest global manufacturing centers for the four technologies in Figure 2 are: Brazil, Canada, China, Germany, India, Japan, Malaysia, Mexico, South Korea, Taiwan, United Kingdom, and United States.

Table 4 Top exporters and importers of 43 climate-friendly goods in the World Bank's list

Top Exporters of 43 climate-friendly environmental goods (World Bank) in 2008			Top Importers of 43 climate-friendly environmental goods (World Bank) in 2008		
	USD	%		USD	%
E.U.	40,734	26.6	EU	31,959	19.9
China	26,954	17.6	US	25,285	15.7
U.S.	19,739	12.9	China	20,503	12.8
Japan	19,649	12.8	Korea	6,354	4.0
Korea	7,232	4.7	Canada	5,667	3.5
Taiwan	6,254	4.1	Japan	5,588	3.5
Mexico	508	3.3	Hong Kong	4,851	3.0
Singapore	3,262	2.1	Mexico	4,685	2.9
Canada	3,133	2.0	Turkey	3,649	2.6
Malaysia	2,897	1.9	Taiwan	3,444	2.3
India	2,759	1.8	India	3,190	2.1
Switzerland	2,617	1.7	Singapore	3,081	2.0
Thailand	2,225	1.5	Switzerland	2,667	1.9
Turkey	1,261	0.8	Thailand	2,644	1.7
Norway	1,213	0.8	Australia	2,530	1.6
Turkey	2,101	0.9	UAE	2,499	1.6
			Brazil	2,247	1.6
			Malaysia	2,099	1.4
			Vietnam	1,670	1.3
			Norway	1,581	1.0
			South Africa	1,434	1.0
			Qatar	1,264	0.9
All	**236,792**	**100**	**All**	**160,779**	**100**

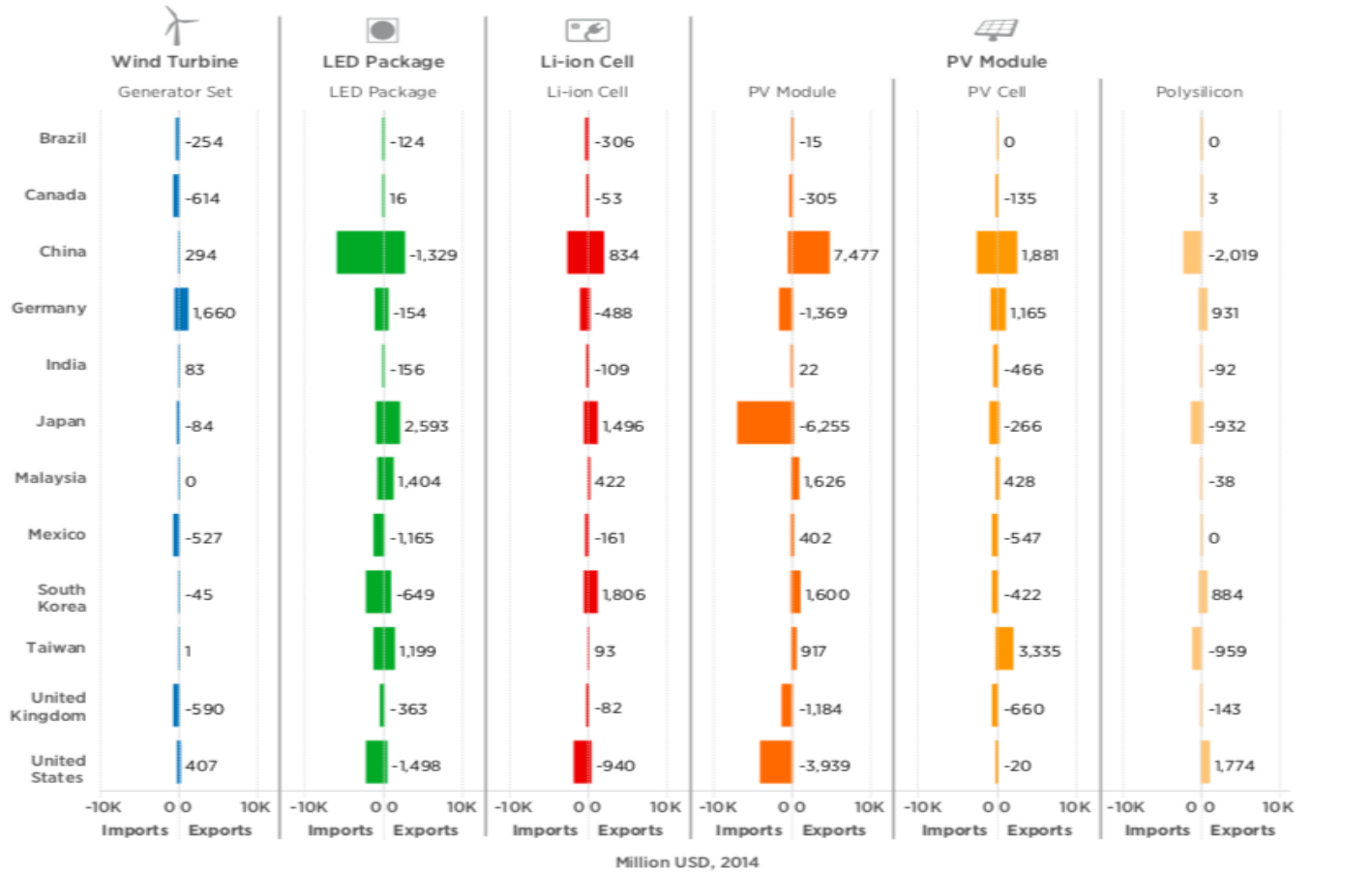
Source: Vossenaar, 2010

Table 5 Top exporters and importers of climate-friendly goods in the ICTSD studies

Top Exporters of Climate-friendly products and components (ICTSD Studies) in 2008			Top Importers of Climate-friendly products and components (ICTSD Studies) in 2008		
	USD	%		USD	%
E.U.	59,960	25.3	E.U.	49,418	19.9
China	48,851	20.6	U.S.	41,065	16.5
Japan	31,053	13.1	China	28,177	11.3
U.S.	27,303	11.5	Hong Kong	11,267	4.5
Korea	9,827	4.2	Korea	11,148	4.5
Taiwan	7,396	3.1	Japan	10,468	4.2
Singapore	5,633	2.4	Canada	8,241	3.3
Mexico	5,013	2.1	Mexico	6,778	2.7
Switzerland	4,756	2.0	Taiwan	6,491	2.6
Brazil	4,635	2.0	Russia	6,315	2.5
Canada	4,261	1.8	Singapore	5,844	2.4
India	3,872	1.6	India	5,022	2.0
Malaysia	3,292	1.4	Thailand	4,130	1.7
Israel	3,011	1.3	Switzerland	3,871	1.6
Thailand	2,571	1.1	UAE	3,858	1.6
Turkey	2,101	0.9	Brazil	3,753	1.5
			Australia	3,574	1.4
			Turkey	3,333	1.3
			Malaysia	3,112	1.3
			Norway	2,506	1.0
			Vietnam	2,306	0.9
			South Africa	2,150	0.9
All	**236,792**	**100**	**All**	**248,651**	**100**

Source: Vossenaar, 2010

Figure 2 Balance of Trade in Select Clean Energy Technology End Products



Source: CEMAC, 2017

The list of the critical mass members for climate-friendly goods goes hand in hand with the trade volume of services that are necessary for those goods. The statistics on climate-friendly services are more difficult to find, but Monkelbaan's study (2013), which focuses on the trade in sustainable energy services, provides a good start. In this study, Monkelbaan has identified the services sectors that are particularly relevant to sustainable energy, which are construction services, architectural services, engineering services, and other technical services. He has also provided the list of top exporters based on the data from WTO in 2007, which is shown in Table 6 and Table 7 below.

Table 6 Top exporters and importers of construction services

Exporters	Value (million USD)	Importers	Value (million USD)
E.U.	26,142	**E.U.**	18,743
Japan	7,224	**Japan**	4,765
U.S.	4,139	**Russia**	4,034
China	2,593	**Kazahkstan**	1,941
Russia	2,209	**China**	1,1619
Turkey	882	**Azerbaijan**	1,499
India	828	**Angola**	1,323
Malaysia	811	**Malaysia**	1,087
Singapore	566	**U.S.**	1,039
Egypt	203	**India**	774

Source: Monkelbaan, 2013

Table 7 Top exporters and importers of architectural, engineering and other technical services

Exporters	Value (million USD)	Importers	Value (million USD)
E.U.	39,212	**E.U.**	25,169
India	7,360	**India**	2,746
U.S.	5,020	**Canada**	2,560
Canada	4,066	**Brazil**	1,708
Brazil	3,033	**Russia**	1,616
Norway	2,144	**Kazakhstan**	1,289
Russia	1,571	**Singapore**	977
Singapore	1,398	**Norway**	579
Australia	955	**South Korea**	531
South Korea	253	**Australia**	370

Source: Monkelbaan, 2013

From the above statistics, we can conclude that the top exporters and importers of construction services and architectural, engineering and other technical services largely correspond to the critical mass of climate-friendly goods.

Positive Reactions to Taiwan's proposal from Top Exporting and Importing Members

Among the top exporting and importing members of climate-friendly goods and services identified above, some of them have already expressed positive reactions to Taiwan's proposal of PAEGSA. From the report of the meeting at the CTE on June, 28, 2018 (CTE, 2018), the following WTO members have shown interest in PAEGSA:

- E.U. ("The representative of the European Union noted that Chinese Taipei's non-paper was an important contribution to keep alive the EGA-related debate on how trade could contribute to the implementation of the Paris Agreement. A number of elements raised in the paper were welcome, in particular the discussion on services related to environmental goods … The European Union looked forward to continuing this exchange.") (CTE, 2018);
- Singapore ("The representative of Singapore noted that Singapore remains interested in this area and open to engaging in the different elements outlined in the proposal.") (CTE, 2018); and
- Norway ("The representative of Norway said that … Norway was ready to engage in discussion on the liberalization of environmental goods and services at any time") (CTE, 2018).

Additionally, even there are some members that have not expressed their specific interest in PAEGSA, there are some indications that they could be interested in the approach of PAEGSA in linking trade of goods and services with climate change. For instance, the United States-Mexico-Canada Agreement[37] includes some indirect references to climate change by referring to "clean technology", in a non-binding section on environmental goods and services. It also mentions "carbon storage" in the sustainable forest management section (Vaughan, 2018).

Flexibility for Trade-Offs

To get a critical mass to be involved in the negotiation and conclusion of an agreement, negotiators may need to be ready to make some trade-offs. This is one of the lessons drawn from the Information Technology Agreement's ("ITA") negotiation. As explained by Adlung and Mamdouh (2016), the final agreement of ITA was reached only after the U.S. made the concession to further liberalize alcoholic beverages, in response to the E.U.'s persistent request.

For this dynamic of trade-offs required in trade liberalization negotiations, the comprehensiveness of PAEGSA's coverage is especially useful. In particular, the inclusion of climate-friendly services, government procurement, and technology transfer will allow more room for trade-offs than limiting the negotiations only to goods.

[37] Finalized on October 1, 2018, pending ratification.

5. CONCLUSION

The climate change phenomenon is urgent and with a high likelihood of global devastating consequences. Despite this being widely recognized, stronger actions are still required to mitigate this phenomenon.

Section 2 of this paper shows that the idea of linking the benefits of trade and environmental protection, in general, is not new. Within the WTO framework, members acknowledged its specific importance already at the Doha Round in 2001 and have made efforts to strengthen this link ever since. The APEC Initiative, the stalled EGA and climate-change provisions in some PTAs are examples of this. However, they have not been sufficient, given the magnitude and urgency of the consequences of climate change.

In section 3 and section 4, this paper argues that the proposal of PAEGSA, as a comprehensive trade facilitation framework to liberalize trade in climate-friendly goods and services, is needed and is also more feasible than EGA.

PAEGSA is necessary because:

- The regulation in the climate change regime has been slow and inadequate;
- The international trade framework, which has stronger enforcement mechanisms and additional institutional benefits, will strengthen the implementation of the Paris Agreement; and,
- For the implementation of the Paris Agreement, PAEGSA's approach is more effective than existing trade approaches.

Moreover, PAEGSA is more feasible than EGA because:

- Negotiators have a variety of options for defining "climate-friendly goods and services";
- There is a variety of options for operationalizing technology transfer which will attract countries to agree on making government procurement more transparent;
- PAEGSA as currently envisaged makes it easier to reach a critical mass.

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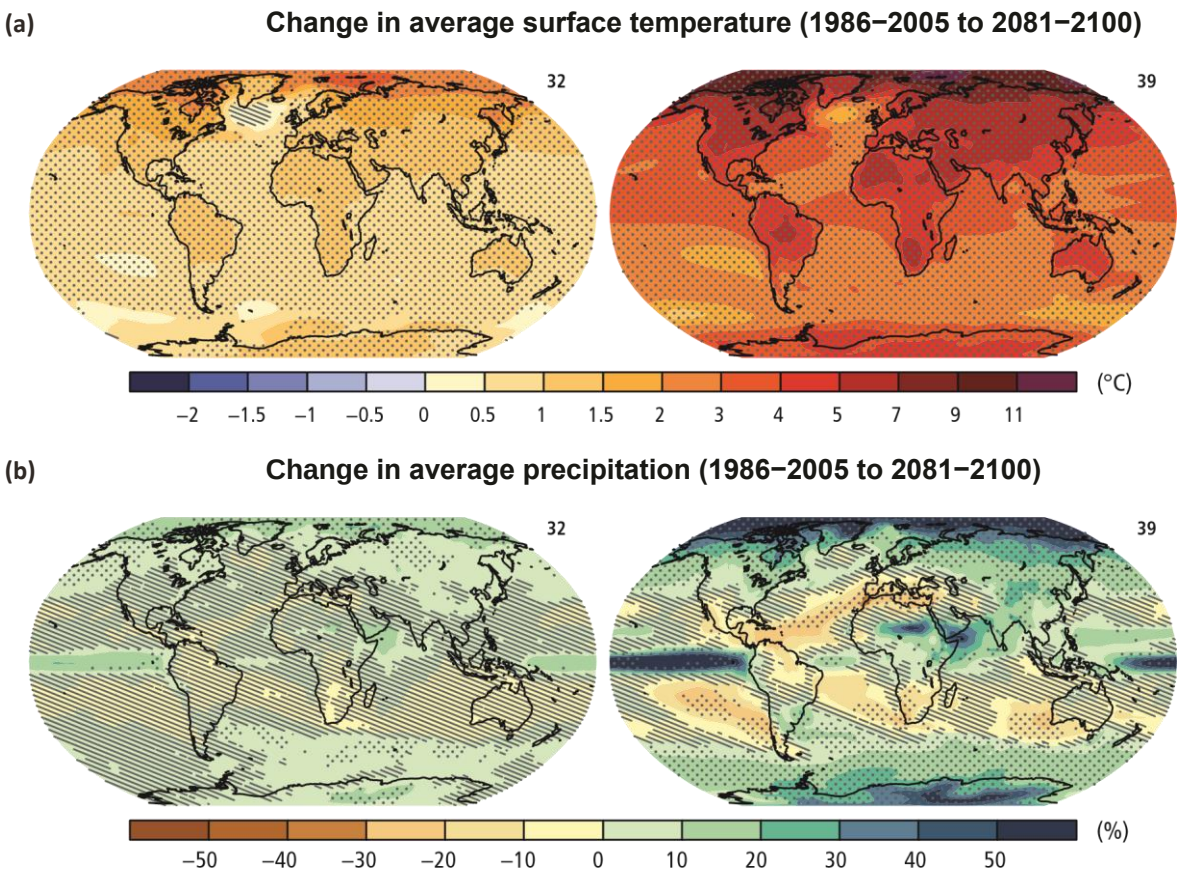
ANNEX 1. IPCCC Statistics

A. Effects of anthropogenic CO2 emissions on climate change

According to calculations of the IPCC, derived from the Synthesis Report of its Fifth Assessment (IPCC, SR5, Summary for Policymakers, 2014), Figures A below provide an estimation of the changes in average surface temperature and precipitation levels for 2081–2100, relative to the evolution of the same figures for 1986–2005:

Figure A

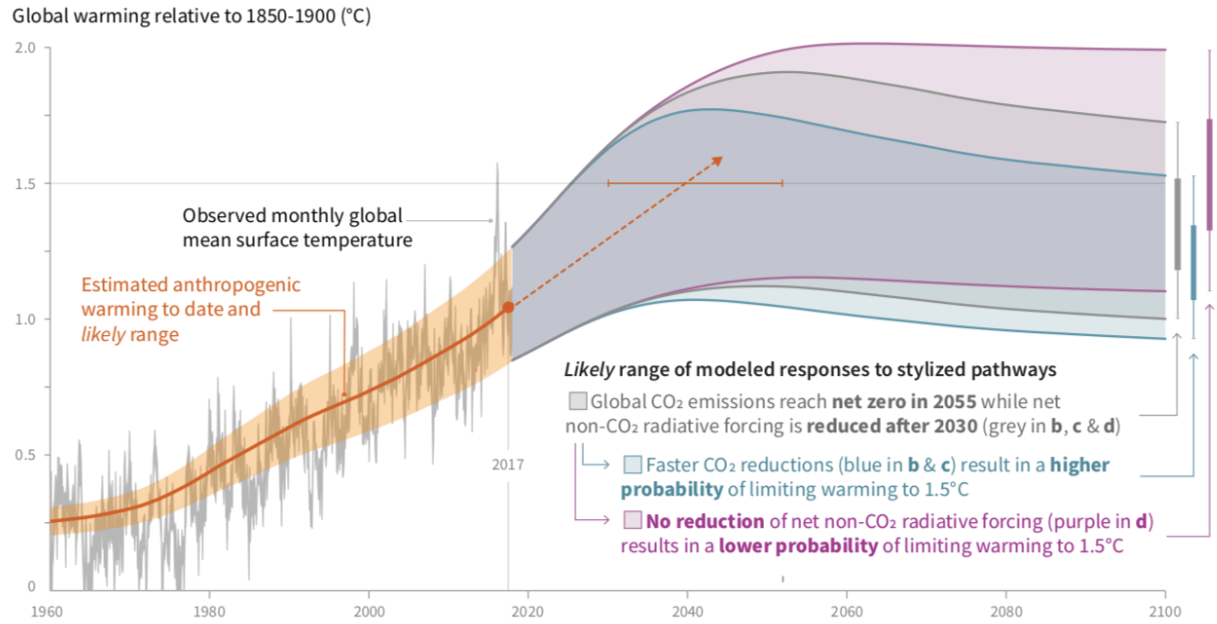


Source: IPCC SR5, 2014.

According to the report, surface temperature is projected to rise over the 21st century under all assessed emission scenarios. According to figure set 1.(a), the surface temperature in some regions, such as the north pole and the central part of big mainland continents, will rise much more than the target of 2°C set by the Paris Agreement. With respect to figure set 1.(b) on precipitation levels, one can note an unevenly dispersed evolution to extreme numbers, compared to the levels existing up to 2005.

An important part of this change is due to anthropogenic factors, which the IPCC has tried to measure, as shown in the following Graph A, derived from the IPCC's 2018 "Special Report on Global Warming of 1.5 °C (SR15)" (IPCC, 2018).

Graph A



Source: IPCC, 2018.

According to Graph A, human activities are estimated to have caused approximately 1.0°C rise in the global temperature so far. Both reports observe a clear human influence on the climate system and warn that recent anthropogenic emissions of greenhouse gases are the highest in history.

Based on this 2018 report (IPCC, 2018), overall global warming is expected with high confidence to reach 1.5°C between 2030 and 2052, unless there is a radical fall in global CO_2 emissions and non-CO_2 radiative forcing. The above table demonstrates that the anthropogenic sources include not only CO_2 emissions, but non-CO_2 factors as well, which includes mainly methane, nitrous oxide and aerosols emissions. It also provides a differentiated estimation, based on whether CO_2 and non-CO_2 factors get reduced or not, within the reasonable levels of expectations, based on current commitments.

B. Estimated Impact of Climate Change on Humans and on the Planet

These changes will most probably have significant impacts, based on moderate scientific models produced by the IPCC.

First of all, it is expected with high confidence that, apart from a rise of mean temperature in most land and ocean regions, hot extremes will inflict most inhabited regions and heat waves will occur more often and last longer.

Secondly, precipitation events are expected to become more intense and frequent in several regions with medium confidence, as is also the probability of drought and precipitation deficits in some regions.

Furthermore, the ocean will most probably continue to warm and acidify, as well as lose valuable oxygen levels, with consequences on marine biodiversity, fisheries, and ecosystems, and their functions and services to humans, as illustrated by recent changes to Arctic sea ice and warm water coral reef ecosystems.

At the same time, global mean sea level will rise, and this is very likely to continue well beyond 2100, at a rate which depends on future emission pathways. Of course, a slower rate of sea level

rise enables greater opportunities for adaptation in the human and ecological systems of small islands, low-lying coastal areas and deltas.

Moreover, global warming will have significant impacts on biodiversity and on terrestrial, freshwater, and coastal ecosystems, including species loss and extinction as well as inability to deliver several of their services to humans so far.

Of course, climate-related risks to health, livelihoods, food security, water supply, human security, and economic growth are also projected to increase. The following Figure B is a depiction derived by the above mentioned 2014 report (IPCC, 2014), on how different regions are expected to be affected, together with an estimation of potential for risk reduction, as depicted in the graphs' margins, differentiated with diagonal lines.

Figure B

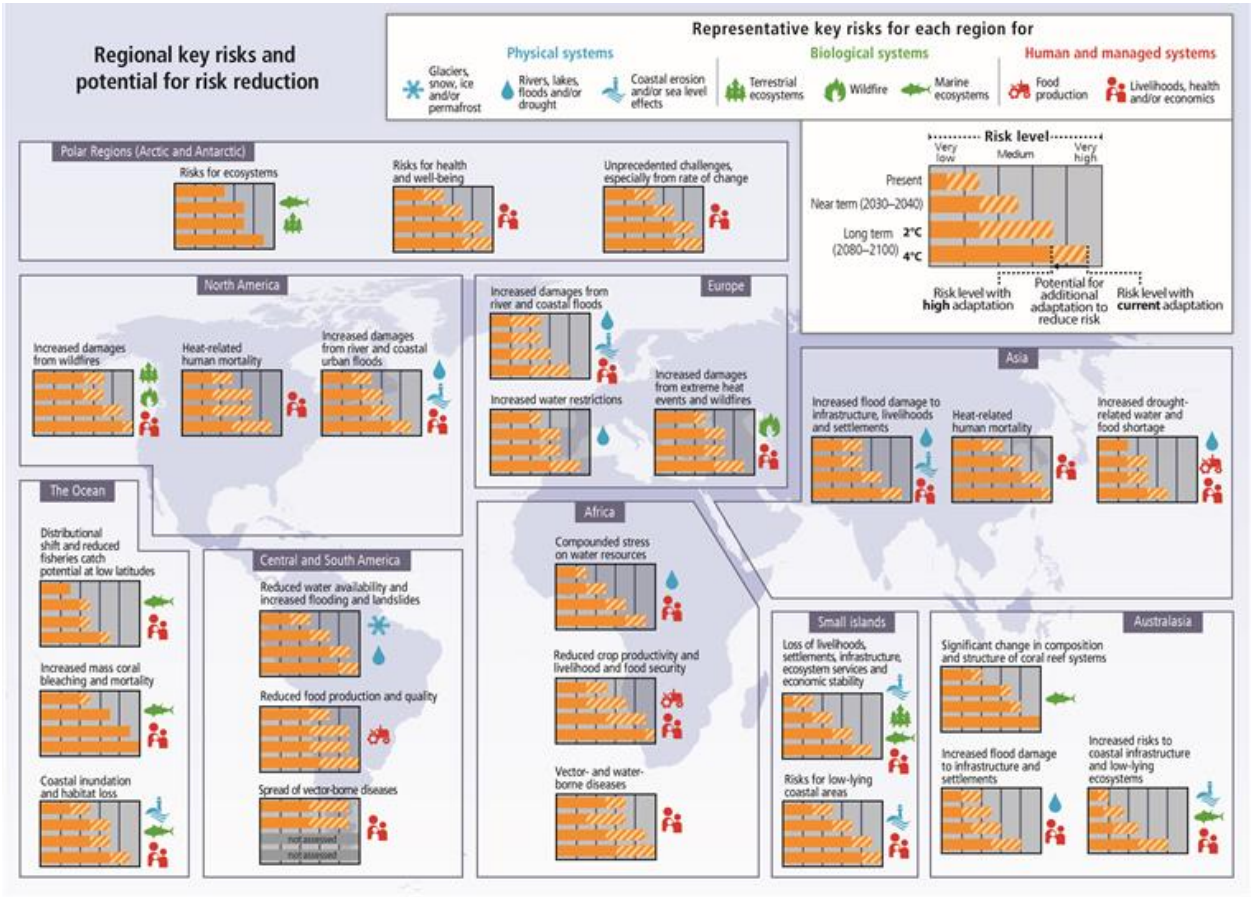


Figure SPM.8 | Representative key risks[14] for each region, including the potential for risk reduction through adaptation and mitigation, as well as limits to adaptation. Each key risk is assessed as very low, low, medium, high or very high. Risk levels are presented for three time frames: present, near term (here, for 2030–2040) and long term (here, for 2080–2100). In the near term, projected levels of global mean temperature increase do not diverge substantially across different emission scenarios. For the long term, risk levels are presented for two possible futures (2°C and 4°C global mean temperature increase above pre-industrial levels). For each timeframe, risk levels are indicated for a continuation of current adaptation and assuming high levels of current or future adaptation. Risk levels are not necessarily comparable, especially across regions. *(Figure 2.4)*

Source: IPCC SR5, 2014.

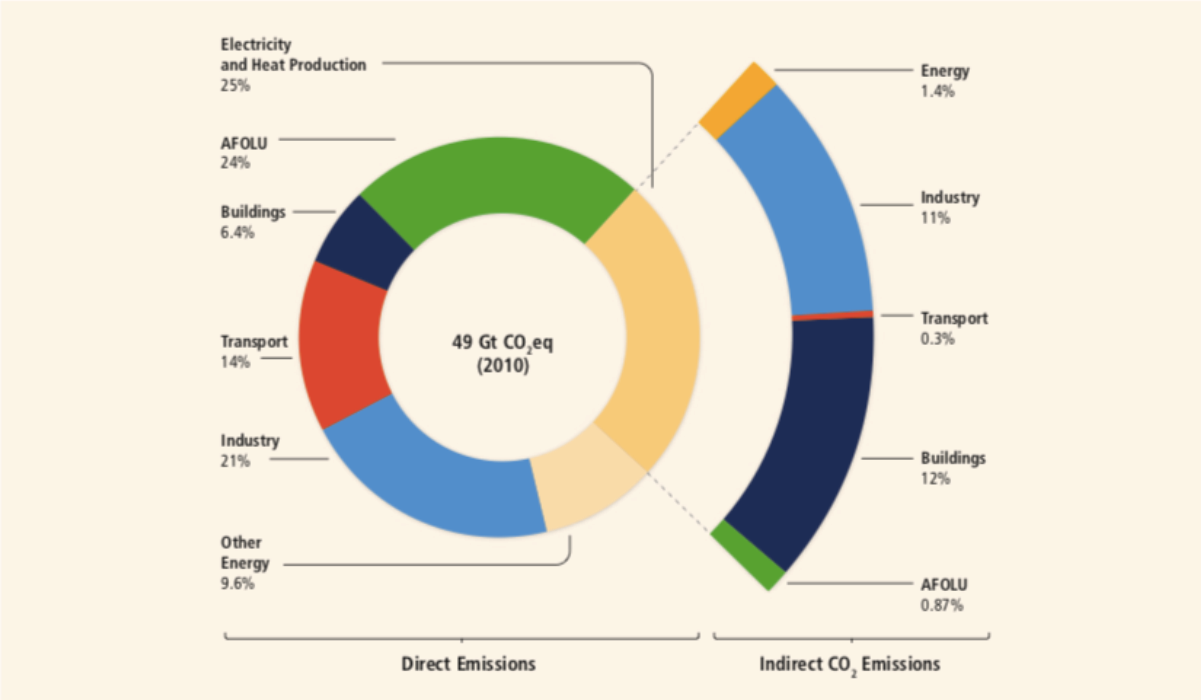
The above 2014 report (IPCC, 2014) also analyses possible mitigation and adaptation measures which could be taken. According to the report, rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence) are necessary. As mentioned, "these systems transitions are unprecedented in terms of

scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options." This can be further elucidated, if one takes into consideration which sectors of the economy contribute the most to anthropogenic GHG emissions, as is estimated with the two Graph B and Graph C below, derived from the Contribution of Working Group III to the Fifth Assessment Report: "Climate Change 2014: Mitigation of Climate Change", Summary for Policymakers (IPCC WGIII, 2014).

First, Graph B depicts GHG emissions by economic sector. As can be seen, buildings, agriculture forestry and other land use, as well as transport and industry account for the biggest emissions production, either directly, or indirectly, through their electricity needs and heat production.

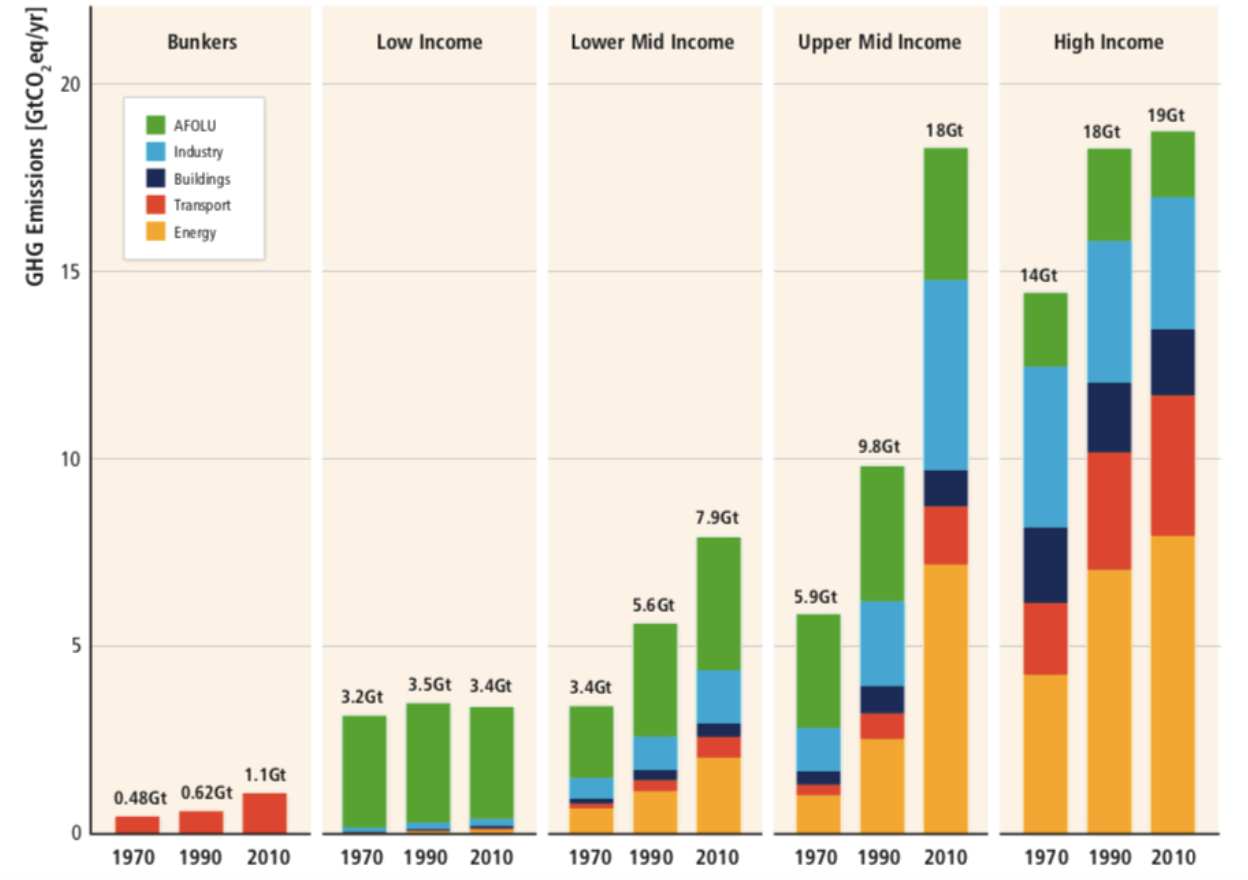
Graph B

Greenhouse Gas Emissions by Economic Sectors



Source IPCC WGIII SPM, 2014.

Graph C



Source: IPCC AR5 WGIII, Full Report, 2014.

If one wants to break this contribution down to different countries, Graph C, taken from the same Assessment Report, Contribution of Working Group III, Full Report, (IPCC, AR5, WGIII, Full Report, 2014) demonstrates that higher income countries are responsible for the biggest levels of these emissions, and especially in the sectors of industry, buildings and energy, while the lower income countries contribute primarily due to their agriculture, forestry and other land use.

ANNEX 2. APEC List of 54 Environmental Goods

HS (2002)	HS (2007)	HS (2012)	HS Code Description	EX-OUT / ADDITIONAL Product Specification
	441872		Other Assembled Flooring Panels, Multilayer, of Bamboo (44187210)	
840290	840290	840290	Steam or other vapour generating boilers (other than central heating hot water boilers capable also of producing low pressure steam); super-heated water boilers. [Ca, J, NZ, K] Steam or other vapour generating boilers (other than central heating hot water boilers capable also of producing low pressure steam); super-heated water boilers; Parts: [US] Parts for super-heated water boilers and steam or other vapour generation boilers (other than centra heating hot water boilers) [HK] Super-heated water boilers and parts of steam generating boilers [S, BD]	Parts for 840219x. [Ca, J, NZ, K, Au] Parts for biomass boilers. [US] Management of solid and hazardous waste [BD]
840410	840410	840410	Auxiliary plant for use with boilers of heading 84.02 or 84.03 (for example, economisers, super-heaters, soot removers, gas recovers'); condensers for steam or other vapour power units. [C, J, NZ, K, Au, Ru, M, BD] Auxiliary plant for use with boilers of heading 8402 or 8403 (for example, economizers, super-heaters, soot removers, gas recovers'). [US] Auxiliary plant for use with steam or other vapour generating boilers, super-heated water boilers and central heating boilers. [HK] Auxiliary plant for steam, water and central boiler [S]	Auxiliary plant for use with 840219x. [Ca, J, NZ, K, Au] For central heating boilers of heading 8403 [M, BD]

840420		840420	Auxiliary plant for use with boilers of heading 84.02 or 84.03 (for example, economisers, super-heaters, soot removers, gas recovers'); condensers for steam or other vapour power units.	
840490	840490	840490	Parts for auxiliary plant for boilers, condensers for steam, vapour power unit. [Ca, J, NZ, K] Auxiliary plant for use with boilers of heading 8402 or 8403 (for example, economizers, super-heaters, soot removers, gas recovers'); condensers for steam or other vapour power units; Parts. [US, Au, Ru] Parts for subheading 840410100 [M, BD]	Air pollution control [BD]
840690	840690	840690	Parts for steam and other vapour turbines. [Ca, J, NZ, K, Au, BD] Parts of steam turbines. [US, M]	Optional ex-outs may include parts suitable for use with stationary steam turbines over 40MW; stationary steam turbines not over 40 MW, other vapour turbines; parts for 840681x and 840682x. [Ca, J, NZ, K, Au] Parts for 840681x and 840682x. [US] Renewable energy plant [BD] Only for stator blades, rotors and their blades [R]
841182	841182	841182	Other gas turbines of a power exceeding 5,000 kW. [Ca, J, NZ, US, Au, Th, S, BD] Gas turbines, except turbo-jets and turbo-propellers, of a power exceeding 5,000 kW. [HK] Turbojets, turbo-propellers and other gas turbines of a power exceeding 5,000 kW [M]	Possible ex-out may include gas turbines that burn natural gas [Au] Gas turbines for electrical generation from recovered landfill gas (exceeding 5,000 kW) [BD] Of a power exceeding 5000 kW but not exceeding 50 000 kW [R]
		841199	Parts of gas turbines.	Parts for 841181 and 841182.

	841290	841290	Engine and motor parts, nesoi [US] Parts of the engines & motors of 8412.10-8412.80 [S, BD]	Wind turbine blades and hubs [US] Only for civil aviation [R]
841780	841780	841780	Other industrial or laboratory furnaces and ovens, including incinerators, non-electric [Ca, J, NZ, K, Au, Ru, M, BD] Industrial or laboratory furnaces and ovens, including incinerators, nonelectric, and parts thereof: Other, except parts. [US] Municipal Waste Incinerator (ex-84178090); incinerators for radioactive waste (84178020) [Ch]	Optional ex-outs may include: waste incinerators; heat or catalytic incinerators. [Ca, J, NZ, K, Au, M] Waste incinerators; Heat or catalytic incinerators [US] Waste incinerator; Flue gas treatment system for incinerator [BD]
841790	841790	841790	Industrial or laboratory furnaces and ovens, including incinerators, non-electric: Parts. [Ca, J, NZ, K, Au, Ru, M] Industrial or laboratory furnaces and ovens, including incinerators, nonelectric, and parts thereof: Parts. [US] Parts [BD]	Optional ex-outs may include: parts for 841780x. [Ca, J, NZ, K, Au] Parts of waste incinerators and heat or catalytic incinerators. [US, BD]
841919	841919	841919	Instantaneous or storage water heaters, non-electric (other than instantaneous gas water heaters). [Ca, J, NZ, K, HK, BD] Instantaneous or storage water heaters, non-electric: Other [US, Au] Solar water heaters [S] Solar water heaters (84191910) [Ch]	Solar water heaters. [Ca, J, NZ, US, K, HK, Au, BD] Excluding other - - Domestic; of copper and other [M]
841939	841939	841939	Dryers, other:	Sludge driers.
841960	841960	841960	Machinery for liquefying air or other gases.	
841989	841989	841989	Machinery, plant or laboratory equipment, whether or not electrically heated (excluding furnaces, ovens and other equipment of heading 85.14), for the treatment of materials by a process involving a change of temperature such as heating, cooking, roasting, distilling, rectifying, sterilising, pasteurising, steaming, drying,	Evaporators and dryers, for water and waste water treatment. Condensers and cooling towers. Biogas reactors; digestion tanks and biogas refinement equipment. [Ca, J, NZ, Au]

			evaporating, vaporising, condensing or cooling, other than machinery or plant of a kind used for domestic purposes; instantaneous or storage water heaters, non-electric. [Ca, J, NZ, Au] Industrial machinery, plant or equipment for the treatment of materials, by process involving a change in temperature, nesoi. [US] Machinery, plant or laboratory equipment - Other machinery, plant and equipment: Other. [Ru] Chlorine dioxide generator; Other Machinery, Plant & Equip For Treat of Mat. B (84198990) [Ch] Other machinery, plan or laboratory equipment [S]	Evaporators and dryers, for water and waste water treatment. Condensers and cooling towers. Anaerobic biogas reactors, digestion tanks and biogas refinement equipment. PV cell coaters. [US]
841990	841990	841990	Parts of machinery, plant and equipment [BD] of heading No 84.19. [Ca, J, NZ, CT, Au, Ru] Parts of machinery, plant or laboratory equipment for the treatment of material involving temperature change (except domestic machinery), nesoi. [US] Parts of machinery, plant or laboratory equipment of heading 84.19 [S] Parts, other [M] Parts of Water Heaters (84199010) [Ch]	Optional ex-outs may include: Parts for 8419.19 ex, including for solar boiler/water heater; insulation, temperature sensor for solar boiler/water heater; Differential temperature controller for solar boiler/water heater; Evacuated glass tubes for solar boiler/water heater; Heat pipes for solar boiler/water heater. Parts of 841940x, 841950x, 841960, 841989x [Ca, J, NZ, CT, Au] excluding 8411990100, 841990200, 841990300 [M] Solar water heater parts [BD]
842121	842121	842121	Filtering or purifying machinery and apparatus for liquids: for filtering or purifying water. [Ca, J, NZ, K, Au, Ru, S] Water filtering or purifying [M] machinery and apparatus. [US, BD] Household filtering or purifying water machinery and equipment (84212110), Device for the removal of Heavy metal ions for indus-	Waste water management [BD]

			try uses; Membrane bioreactor; High rate anaerobic reactors; reverse osmosis filters for industry uses; Water purification Machine; EDI ultra-pure water equipment (ex-84212190) [Ch]	
842129	842129	842129	Filtering or purifying machinery and apparatus for liquids: other. [Ca, J, NZ, US, K, Au] Other [M] Press Filters (84212910); etching solution recycling equipment for printed circuit board; equipment for the recycling and treatment of reclaimed water; ion exchanger; complete sets of equipment for alkali recovery of black liquor; aerator; electrodialysis device (ex-84212990) [Ch]	Refrigerant recovery and recycling units. [US] excluding oil filter and for use in oil drilling operation [M]
842139	842139	842139	Filtering or purifying machinery and apparatus for gas (other than intake air filters for internal combustion engines). [Ca, J, NZ, K, S] Filtering or purifying machinery and apparatus for gases, nesoi. [US, Au, Th] Laminar flow units [M] Filtering Purifying Machines For Gases Nes, Househ (84213910); Electrostatic Dust Collectors For Industry Uses(84213921); Baghoused Dust Collectors For Industry Uses (84213922); Cyclone Dust Collectors For Industry Uses (84213923); Other Dust Collectors for Industry Uses (84213929); Flue Gas Desulfurization Apparatus (84213940); Spraying Saturator; Concentrated adsorption - catalytic combustion equipment; Activated carbon fiber - granular activated carbon equipment; (ex-84213990) [Ch]	Optional ex-out may include: Catalytic converters / Gas separation equipment / Pneumatic fluid power filters rated at 550 kPa or greater / Industrial gas cleaning equipment / Electrostatic filters (precipitators). [Ca, J, NZ, K] Excluding other filters of a kind used as components in motor vehicles. [Au] Catalytic converters / Dust collection and air purification equipment / Gas separation equipment / Pneumatic fluid power filters rated at 550 kPa or greater / Industrial gas cleaning equipment / Electrostatic filters (precipitators) / Ozone disinfection equipment. [US] possible ex-out: air purifier and laminar flow units [M] Laminar flow units, catalytic converter and carbondyoxide removal unit imported to use at natural gas service station [Th]

842199	842199	842199	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases: parts (other than of centrifuges and centrifugal dryers): filtering or purifying machinery and appartatus for water and parts thereof. [Ca, J, NZ, K] Parts for filtering or purying machinery and apparatus forliquids or gases [US] Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases: parts (other) [Au] for subheading 842129300 [M, BD] Parts Of Household Filtering and Purifying Machines For Gases (84219910) [Ch]	Parts for 842121 and 842129 [Ca, J, NZ, K], excluding parts for other filters of a kind used as components in motor vehicles [Au]. Parts for 842121, 842129x and 842139 [US]. Excluding for subheadings 842123100, 842129510 [M, BD].
847420	847420	847420	Crushing or grinding machines.[Ca, J, NZ, US, K, CT, Au, Ru] Crushing/grinding machines for earth/stone/ores/other mineral substance, in solid (incl. powder/paste) form [S] Machinery for sorting, screening, separating, washing, crushing, grinding, mixing or kneading earth, stone, ores or other mineral substances, in solid (including powder or paste) form; machinery for agglomerating, shaping or moulding solid mineral fuels, ceramic paste, unhardened cements, plastering materials or other mineral products in powder or paste form; machines for forming foundry moulds of sand. Crushing or grinding machines, mixing or kneading machines [M]	excluding concrete or mortar mixers [M, Au]
847982	847982	847982	Mixing, kneading, crushing, grinding, screening, sifting, homogenising, emulsifying or stirring machines not elsewhere specified in Chapter 84. [Ca, J, NZ, K, CT, S] Mixing, kneading, crushing, grinding, screening, sifting, homogenizing, emulsifying or stirring machines. [US, Ru, BD] Waste sorting, screening, crushing, grinding, shredding, washing and compacting devices. Agitator for wastewater treatment; flash mixer and flocculator. [Au] Dosing and mixing equipment for water treatment (ex-84798200);	Waste sorting, screening, crushing, grinding, shredding, washing and compacting devices. Agitator for wastewater treatment; flash mixer and flocculator. [Ca, J, NZ, K, US, CT] Other machines and mechanical appliances: Mixing, kneading, crushing, grinding, screening, sifting, homogenising, emulsifying or stirring machines. [Au] Waste compactor machines [BD]

			Recycling equipment for waste plastics /rubber /broken tire (84798200) [Ch]	
847989	847989	847989	Machines and mechanical appliances having individual functions, not specified or included elsewhere in this Chapter: Other. [Ca, J, NZ, US, CT, Ru] Other machines & mechanical appliances, other than Machines & mechanical appliances for treating metal, incl. Industrial catalysers, electric wire coil-winders/ Mixing/ kneading/ crushing/ grinding/ screening/ sifting/ homogenising/ emulsifying/ stirring machines [S] Air Humidifiers Or Dehumidifiers (84798920); Machines For Squeezing Radioactive Waste (84798950); Suction Machine; Mud Scraper; Sand suction machine; Trash compactor;Vacuum extruder for making hollow brick with Gangue and fly ash; (Fan) muffler (ex-84798999) [Ch]	Optional ex-outs may include; trash and other waste presses; shredders; dust collection and storage devices; water and wastewater collecting and sampling equipment; chlorine generators; equipment for solid/liquid separation; flocculation or thickening of sewage sludge; machinery and apparatus for landfill gas monitoring; anaerobic digesters for treatment of organic waste including production of biogas; machinery and apparatus for landfill leachate treatment; machinery, apparatus and vehicles for composting; soil sampling equipment; soil remediation equipment; machines and appliances for oil spill recovery; and aquatic weed harvesters. [US, CT] Excluding machines and mechanical appliances used as components in motor vehicles. [Au]
847990	847990	847990	Parts of the mach. and mech. appls. of 84.79 [Ca, J, NZ, CT, US, Ru] Parts of Machines & mechanical appliances having individual functions, not specified/incld. elsewhere in this Ch. [S] Parts Of Air Humidifiers Or Dehumidifiers (84799020) [Ch]	Parts for 847982x and 847989x. [US, CT] Excluding machines and mechanical appliances used as components in motor vehicles. [Au]
850164	850164	850164	AC generators (alternator), of an output exceeding 750 kVA	To be used with turbines and generators in combination to produce electricity from renewable energy fuels [BD]
850231	850231	850231	Other electric generating sets: Wind-powered. [Ca, J, NZ, US, K, HK, Ru, M] Wind-powered electric generating sets [S]	Amorphous Transformers [BD]

			Wind-powered electric generating equipment [T] Electric generating sets and rotary convertors: Wind-powered [BD] Wind-Powered Electric Generating Sets (85023100) [Ch]	
850239		850239	Electric generating sets and rotary convertors: other. [Ca, J, NZ, K, Ru, BD] Generating sets, electric, nesoi. [US, Au] Biogas generator sets; Gas Generator (ex-85023900) [Ch]	Optional ex-outs may include: combined heat and power systems using biomass and/or biogas; Portable solar power generation equipment; solar power electric generating sets; Small hydro powered generating plant; Wave power generating plant; and Gas turbine sets for biomass plants [Ca, J, NZ, K] and for waste heat applications [Au] Small hydro, ocean, geothermal and biomass gas turbine generating sets. [US] For heat recovery systems [BD]
850300	850300	850300	Parts suitable for use solely or principally with the machines of heading 8501 or 8502. [Ca. J, NZ, CT, Au, Ru, Th, M, BD] Parts for 850231 and optional ex-out may include: 850239x. Parts suitable for use solely or principally with the machines of heading 85.01 or 85.02 Parts of the generators and generating sets listed under HS 850231 (for renewable energy systems). Relevant parts include for instance nacelles and blades for wind turbines. [S] Parts of Wind-Powered Electric Generating Sets (85030030) [Ch]	Parts for 850231 and optional ex-out may include : 850239x.[Ca, J, NZ, K, CT, Au] Parts for 850161, 850162, 850163, 850164, 850211x, 850212x, 850213x, 850220x, 850231 and 850239x. [US] Combined cycle generator parts [BD]
		850490	Parts for electrical transformers, static converters and inductors	Parts for 850440x Not magnetic ferrite memory [R]
851410	851410	851410	Resistance heated furnaces and ovens Industrial or laboratory electric furnaces and ovens (including those	Optional ex-outs may include: waste incinerators and heat or catalytic incinerators. [Ca, J, NZ, K, CT, Au]

			functioning by induction or dielectric loss); other industrial or laboratory equipment for the heat treatment of materials by induction or dielectric loss: resistance heated furnaces and ovens [M] Controlled Atmosphere Heat Treatment Furnace (85141010); Industrial / Lab Electric Resistance Heated Furnace (85141090) [Ch]	
851420	851420	851420	Furnaces and ovens; functioning by induction or dielectric loss. Industry / Lab Electric Induction or Dielectric Fu (85142000) [Ch]	Optional ex-outs may include: waste incinerators and heat or catalytic incinerators. [Ca, J, NZ, K, CT, Au]
851430	851430	851430	Other furnaces and ovens. [Ca, J, NZ, K, CT, Au, Ru, M] Industrial or laboratory electric furnaces and ovens, nesoi. [US] Industrial & Laboratory Electric Furnaces & Ovens (85143000) [Ch]	Optional ex-outs may include: waste incinerators and heat or catalytic incinerators. [Ca, J, NZ, US, K, CT, Au]
851490	851490	851490	Parts of industrial or laboratory electric furnaces and ovens; other laboratory induction or dielectric heating equipment. [Ca, J, NZ, K, CT, M] Parts for industrial or laboratory electric furnaces and ovens (including those functioning by induction or dielectric loss); parts for other industrial or laboratory equipment for the heat treatment of materials by induction or dielectric loss. [US, Au, Ru]	Optional ex outs include: Parts for 851410x, 851430x and 851430x. [Ca, J, NZ, K, CT, Au] Parts for 851410, 851420 and 851430. [US]
854140	854140	854140	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes. [C, J, NZ, US, K, HK, CT, Au, Th, S, M, BD] Diodes, transistors and similar semiconductor devices; photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes; mounted piezo-electric crystals: Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes [M] Solar Cells (85414020) [Ch]	Photovoltaic cells, modules and panels. [Ca, J, NZ, US, K, HK, CT, Au, BD] Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes [M]
854390	854390	854390	Parts of the machines and apparatus of 85.43 [Ca, Ja, NZ, K, CT, Au, Ru, S]	Parts for 854389x. [Ca, Ja, NZ, K, CT, Au]

			Parts of other machines / apparatus of heading 85.43 (85439090) [Ch]	
		901380	Optical devices, appliances and instruments, nesoi	Solar heliostats.
		901390	parts and accessories for optical devices, appliances and instruments, nesoi	Parts for solar heliostats
901580		901580	Other surveying, hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances, excluding compasses, not elsewhere specified in 90.15 [Ca, J, NZ, K, CT] Surveying instruments and appliances, hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances nesoi [US, Au]	
902610	902610	902610	Instruments for measuring or checking the flow, level, pressure or other variables of liquids or gases. [Ca, J, NZ, K] Instruments and apparatus for measuring or checking the flow or level of liquids. [US, CT, Au, BD] Instruments and apparatus for measuring or checking the flow, level, pressure or other variables of liquids or gases (for example, flow meters, level gauges, manometers, heat meter), excluding instruments and apparatus of heading 9014, 9015, 9028 or 9032. For measuring or checking the flow or level of liquids [M] Instruments / Apparatus For Measure / Checking Liq (90261000) [Ch]	Air quality monitors; and dust emissions monitors. [Ca, J, NZ, K] Excluding gauges of a kind used as components in motor vehicles. [Au] Air quality monitoring; automated air quality monitoring [BD]
902620	902620	902620	Instruments and apparatus for measuring or checking pressure. [Ca, J, NZ, K, CT, Au] Instruments and apparatus for measuring or checking pressure of liquids or gases, nesoi. [US] For measuring and checking pressure [M]	Excluding gauges of a kind used as components in motor vehicles. [Au]

			Other Instruments / Apparatus For Measuring / Chec (90262090) [Ch]	
902680	902680	902680	Other instruments and apparatus [Ca, J, NZ, K, CT, Au, M] Instruments and apparatus for measuring or checking other variables of liquids or gases, nesoi. [US]	Excluding gauges of a kind used as components in motor vehicles. [Au]
902690	902690	902690	Parts and accessories [M] for articles of subheading 9026. [Ca, J, NZ, CT, K] Parts and accessories for instruments and apparatus for measuring or checking the flow, level, pressure or other variables of liquids or gases, nesoi. [US] Instruments and apparatus for measuring or checking the flow, level, pressure or other variables of liquids or gases (for example, flow meters, level gauges, manometers, heat meters), excluding instruments and apparatus of heading 90.14, 90.15, 90.28 or 90.32 [Au] Parts of liquid and gas measurement/ test instrument (90269000) [Ch]	
902710	902710	902710	Gas or smoke analysis apparatus Automatic NOX and NO2 sampler and measuring apparatus; Automatic SO2 sampler and measuring apparatus (ex-90271000) [Ch]	Air pollution emission monitoring systems
902720	902720	902720	Chromatographs and electrophoresis instruments	
902730	902730	902730	Spectrometers, spectrophotometers and spectrographs using optical radiations (ultraviolet, visible, infrared)	
902750	902750	902750	Other instruments and apparatus using optical radiations (UV, visible, IR) [Ca, J, NZ, CT, Au, K, S] Instruments and apparatus for physical and chemical analysis using optical radiations (ultraviolet, visible, infrared), nesoi. [US]	

			Automatic on-line monitor on UV absorption water quality; Automatic infrared oil content analyzer (ex-90275000) [Ch]	
902780	902780	902780	Instruments and apparatus for physical or chemical analysis not elsewhere specified in 90.27. [Ca, J, NZ, CT, K] Instruments and apparatus for physical and chemical analysis, nesoi. [US, Au] Other Mass Spectrograph (90278019); PM10 automatic sampler and measuring apparatus; Automatic ammonia online monitor; Automatic TOD online monitor; Automatic BOD online monitor; Noise spectrum analyzer; Environmental noise monitor (ex-90278099) [Ch]	Optional ex-out may include: For analysing noise, air, water and hydrocarbons and heavy metals in soil. [Ca, J, NZ, CT, Au, K]
902790	902790	902790	Microtomes; parts and accessories of instruments and appliances of 9027. [Ca, J, NZ, K, CT, Au, S] Microtomes; parts and accessories for instruments and apparatus for physical or chemical analysis . [US] Instruments and apparatus for physical or chemical analysis (for example, polarimeters, refractometers, spectrometers, gas or smoke analysis apparatus); instruments and apparatus for measuring or checking viscosity, porosity, expansion, surface tension or the like; instruments and apparatus for measuring or checking quantities of heat, sound or light (including exposure meters); microtomes: microtomes; parts and accessories [V] Microtomes; Parts & Access Of Instruments / Applia (90279000) [Ch]	Optional ex-outs may include: Parts for 902710 and 902780x. [Ca, J, NZ, K, CT, Au]
903149		903149	Other measuring and checking instruments, appliances and machines, not specified or included elsewhere in this chapter: ..Other optical instruments, appliances and machines elsewhere specified for measuring or checking. [Ca, J, NZ, K, CT] Measuring or checking instruments, appliances and machines, nesoi. [US] Other optical instruments and appliances: Other [Au]	Optional ex-outs include: Profile projectors; Vibrometers; Hand vibration meters. [US]

			Optical Grating Measuring Device (90314920); Other Optical Instruments & Appliances (90314990) [Ch]	
903180	903180	903180	Other instruments, appliances and machines. Other instruments, appliances and machines, not elsewhere specified in heading 90.31 [Th]	Optional ex-out may include: Vibrometers, hand vibration meters. [Ca, J, NZ, K, CT, Au] Instruments for measuring oxygen in oxygen censer operating with catalytic convertor [Th]
903190	903190	903190	Parts and accessories [M] of the instruments and appliances and machines of 9031. [Ca, J, NZ, K, CT, Au] Parts and accessories for measuring or checking instruments, appliances and machines, nesoi; parts and accessories for profile projectors. [US] Other measuring and checking instruments, appliances and machines, not specified or included elsewhere in this chapter; profile projectors: Parts and accessories [V] Parts & Accessories Of Instruments / Appl / Machin (90319000) [Ch]	Optional ex-out may include: Parts for 903180x. [Ca, J, NZ, US, K, CT, Au]
903289	903289	903289	Automatic regulating or controlling instruments, other. [Ca, J, NZ, K, Au, Ru, BD] Automatic regulating or controlling instruments and apparatus (excluding thermostats, manostats and hydraulic types), nesoi. [US] Other: Electrically or electronically operated and other [M]	Optional ex-outs may include: Heliostats, temperature sensor for solar boiler/water heater; Differential temperature controller for solar boiler/water heater. [Ca, J, NZ, K, Au] Light sensor; Sensor (elevators, escalators, etc.) [BD]
903290	903290	903290	Parts and accessories [M] for nominated articles of subheading 9032. [Ca, J, NZ, K, CT] Parts and accessories of automatic regulating or controlling instruments and apparatus. [US, Au, Ru]	

903300	903300	903300	Parts and accessories (not specified or included elsewhere in this Chapter) for machines, appliances, instruments or apparatus of Chapter 90. [Ca, j, NZ, US, CT, Au, Ru, Th, S] For subheading 902140 and 902150 and other [M]	Parts of the CH 90 products above, not elsewhere specified. [US]

Source: *APEC Website*

ANNEX 3. Proposal of PAEGSA

RESTRICTED

JOB/TE/49

WORLD TRADE ORGANIZATION

19 January 2018

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Committee on Trade and Environment Original: English

NON PAPER – PROPOSING TRADE FACILITATION FRAMEWORK TO SUPPORT IMPLEMENTING THE PARIS AGREEMENT[38]

Circulated by the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu

1 BACKGROUND

1.1. The Paris Agreement was adopted in December of 2015. A total of 195 UNFCCC members have signed the Agreement, of which 168 have ratified as of October 2017[39]. In June 2017, the United States declared its intention to withdraw from the Agreement. It must be added, however, that the small number of other countries not currently participating in the Paris Agreement have shown no signs of negativity towards trade mechanisms designed to facilitate global carbon reduction.

1.2. The adoption of the Paris Agreement in 2015 created a new context for the interface between climate change and trade policy. We believe that various measures with trade consequences should be contemplated in the national climate pledges put forward under the Agreement. Green energy as an alternative form of energy provision simply increases our choices, and there are few grounds for objection to this.

1.3. We are convinced that trade and trade policies have a very important role to play in achieving WTO Member's green growth and sustainable development objectives. Liberalization commitments on environmental goods and environment-related services can promote a predictable and transparent business climate, foster trade, help to attract investment, provide opportunities for small and medium-sized enterprises, and help to tackle climate change issues.

1.4. It is widely agreed that climate change is going to be a major common concern for humankind for centuries to come. The Paris Agreement in December of 2015 was achieved by a global effort, bringing together for the first time in history nearly all the world's nations into a single agreement

[38] This paper is a topic of interest to Chinese Taipei, aiming to reflect and discuss further with Members in the Committee on Trade and Environment.

[39] In June of 2017, the United States announced its intention to withdraw from the Agreement. However, the US did not object to the efforts to tackle climate change. Instead, President Trump stated that the US will "begin negotiations to re-enter either the Paris accord or an entirely new transaction on terms that are fair to the United States, its businesses, its workers, its people, and its taxpayers."

on tackling the truly global issue of climate change. Box 1 below summarizes key content of the Agreement.

Box 1: Key Elements of the Paris Agreement

- To keep global temperatures well below 2˚C above pre-industrial levels and to pursue efforts to limit them even more, to 1.5˚C above pre-industrial levels before 2100.
- To limit the amount of greenhouse gases emitted by human activity to the same levels that trees, soil and oceans can absorb naturally, beginning at some point between 2050 and 2100.
- To review each country's contribution to cutting emissions every five years so they scale up to the challenge.
- For rich countries to help poorer nations by providing "climate finance" to adapt to climate change and switch to renewable energy.

1.5. Despite the global consensus to move towards carbon reduction and clean energy, very few efforts have been made so far by the international trade community. For instance, WTO Members' average tariff rate on wind turbines is up at around 10%. We see also that the present coverage of green energy-related service sectors by WTO Members' GATS commitments is limited. Moreover, with energy industries in many WTO Members being government-controlled, the very limited coverage of the WTO Government Procurement Agreement (GPA) promises little help in achieving the global carbon reduction goals. Finally, for least developed countries (LDCs) that are dependent on foreign assistance to adopt green energy, the critical technology transfer they need remains difficult to obtain.

1.6. All these trade hurdles restrict the market penetration of green energy in particular, and carbon reduction businesses in general, throughout the world. The relationship between trade policy and climate policy needs to improve significantly in the future, especially with a view to implementing the Paris Agreement. To make trade policy supportive of climate action, our belief is that the WTO may need to consider establishing a comprehensive trade mechanism/initiative which can go a long way towards facilitating the implementation of the Paris Agreement.

1.7. Please note that this technical paper is proposed for discussion purposes only. It is without prejudice to the positions of the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu on relevant issues.

2 EXPERIENCES OF THE NEGOTIATIONS ON TRADE AND THE ENVIRONMENT

2.1. The negotiations on trade and the environment are part of the Doha Development Agenda launched at the Fourth WTO Ministerial Conference in Doha, Qatar, in November 2001. WTO Members have been negotiating certain aspects of the link between trade and the environment, in particular the relationship between the WTO's Agreements and those of other agencies, as well as the market access for environmental goods and services. Paragraph 31(iii) of the Doha Declaration mandated negotiations on "the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services". Clearly, there is a need for convergence if the negotiations are to advance on substantive issues.

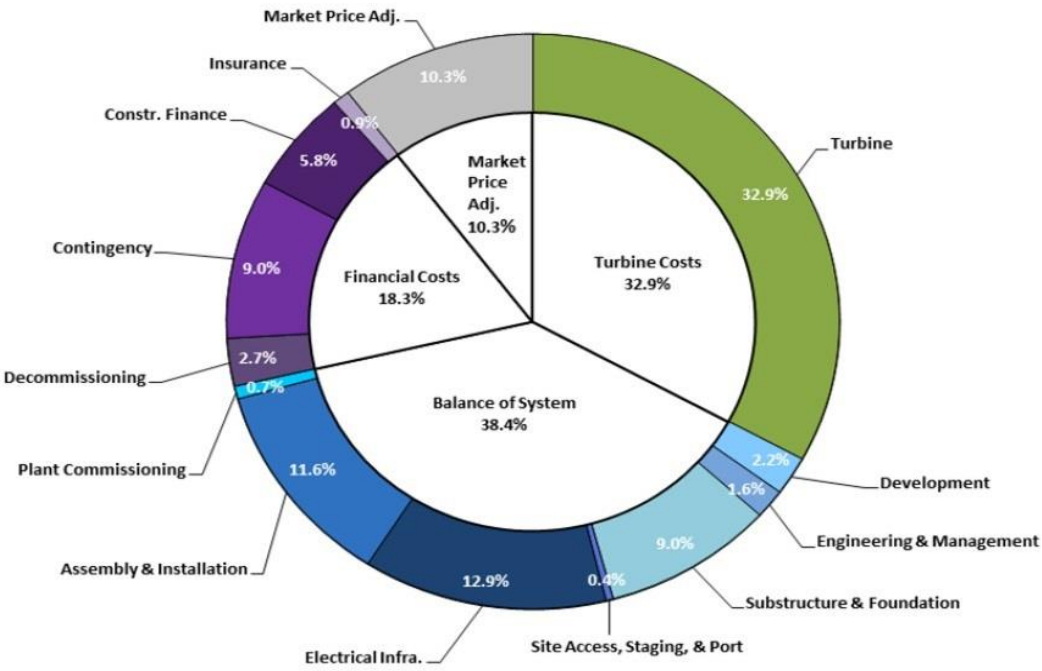
2.2. Negotiation on the plurilateral Environmental Goods Agreement (EGA) was initiated in 2014, with 18 participants representing 46 WTO Members engaged in seeking to eliminate tariffs on a number of important environment-related products. But the negotiation did not go through at the WTO EGA Ministerial Meeting in December 2016. Retrospectively, we have observed the following difficulties with the EGA negotiation.

2.3. Firstly, the coverage of the negotiation was too broad. Although we understand that coverage is a result of compromises, such a long list of goods evidently deflects the focus of the negotiation away from the initial environmental considerations. In pursuit of a trade framework to support the Paris Agreement, it may well be better to concentrate on a smaller range of goods and establish an easily identifiable focal point.

2.4. The second challenge of the EGA was that it covered goods only. In reality, there is a strong complementary link between environmentally relevant goods and services, and in many cases services account for the largest part of the value.

2.5. For instance, Figure 1A shows the value-added chart of the offshore wind-power industry, which is an important green energy source for many countries. Typically, the "goods" in this case are the wind turbines, whose value-added contributes only one-third of the total value. Another two-thirds of the offshore wind-power value comes entirely from services, mainly offshore maritime engineering and system engineering.

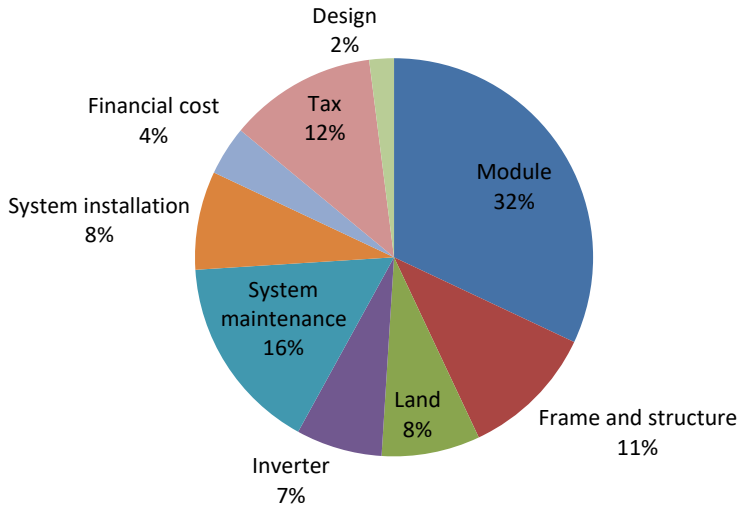
Figure 1A: Cost Analysis of Offshore Wind-Power Industry



Source: US National Renewable Energy Laboratory

2.6. Another example is solar power. In Figure 1B, we can see that, although solar panels (or modules) and inverters are goods, and together they add up to 50% of the value-added, it would still be very difficult for countries to adopt this green energy without the support of system engineering and services. Indeed, for a large-scale solar energy system to be established, a grid system is needed to control the flow and to calculate the price of two-way energy transmission. This involves mostly services, because solar panels alone simply cannot be effective.

Figure 1B: Cost Analysis of Solar Power 20-Year Life-Cycle System (500kw)



Source: Industrial Technology Research Institute

2.7. Another example that highlights the importance of services is not a green energy system, but a smart home or office energy-saving system. In this case, the so called "goods" are only a smart meter and some electronic sensors, with a large majority of the value-added coming from system and control services.

2.8. The examples in paragraphs 2.5, 2.6 and 2.7 above suggest that a trade framework with the various goods-related services included would be more effective at achieving the key objectives of market penetration and the adoption of green energy. Since the EGA covers only goods, the outcome can only lead to the reduction of tariffs on goods. Wind turbines for example offer limited help on their own in facilitating the adoption of offshore wind power effectively.

2.9. Another difficulty with the EGA is its negotiation modality. Since the EGA is a plurilateral negotiation and covers a wide variety of goods but no services, certain larger producers have disproportionately greater bargaining power in the negotiation: their threats of withdrawal from the negotiation always imply an unachievable critical mass, thereby making large producers pivotal.

3 INITIAL THINKING ON THE PARIS ACCORD-RELATED ENVIRONMENTAL GOODS AND SERVICES AGREEMENT

3.1. Taking into account the experiences of the EGA negotiation to date, if Members are considering a new initiative that focuses on properly tackling climate change, we offer the following preliminary thinking on the possible architecture of such an initiative. For the purpose of facilitating the discussion, we can give the initiative a temporary name *The Paris Accord-related Environmental Goods and Services Agreement (*PAEGSA).

3.1 Coverage

3.2. The PAEGSA coverage of goods should be narrow in order to ensure that it is properly dedicated to responding to the climate change challenge. In addition, environment-related services should be included. In practice, we should go through the following steps.

3.3. The first task would be to narrow down the spectrum of goods listed in the EGA. Secondly, if there are goods items not included in the EGA, but which are closely related to carbon reduction or to the Paris Agreement, then they can be added. For instance, sustainable transportation may well have a place in it.

3.4. Thirdly, we should consider a trade deal that covers both goods and services, to ensure that examples such as offshore wind power or solar power systems can be accommodated effectively. There may be some items that are very close to being pure services (e.g., smart grids, or smart home energy saving) which should also be included.

3.5. The inclusion of services has the added side benefit of balancing the bargaining powers. In practice, in every large carbon reduction contract (such as the construction of a 1 Gigawatt (GW) offshore wind farm, or a 1 GW solar panel energy grid) consisting of both goods and services, it is nearly always the case that it is the system services provider who casts the largest bid in the first place. Thus, the services provider takes the leadership in the first stage of the contract bidding game. In the second stage, when the contract is implemented, the goods producer has to negotiate with the services provider, who has already got the contract, to determine the price of the goods to be sold to the services provider. This is very different from the goods only case, where a tariff cut by some countries directly lowers the import prices of such goods. When both services and goods are combined, there is a negotiation between goods producers and services providers, and the tariff will be taken into account endogenously in the second stage bargaining process. In short, this goods-plus-services coverage lessens the problem of goods producers' disproportionate bargaining power in the negotiation.

3.2 Other Elements

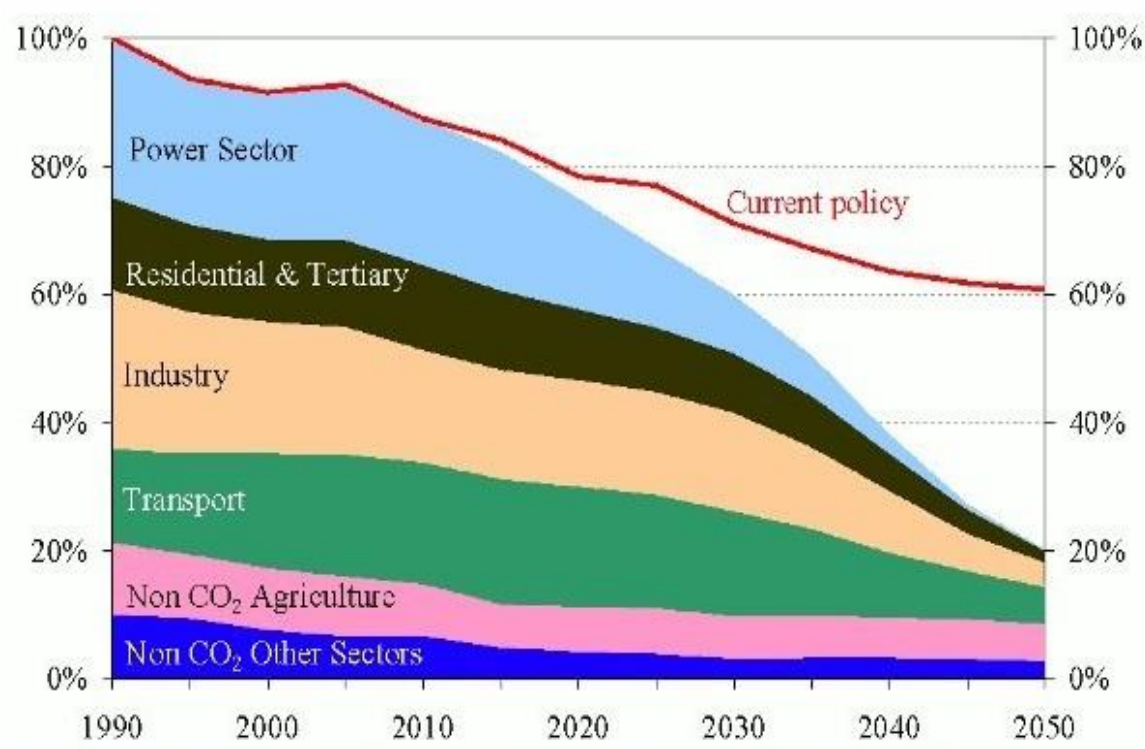
3.6. PAEGSA may also include other items, such as public procurement, technology transfers, or domestic regulations. For instance, we understand that electricity companies are sometimes controlled by the government. In these cases, therefore, the green energy projects are likely to go through government procurement. It may thus be necessary for PAEGSA to include the market access of public procurement, so that carbon reduction has a greater chance of gaining market penetration.

3.7. On the other hand, technology insufficiency is of one the hurdles holding back many developing country Members and LDCs from adopting green energy. Therefore, another way of maximizing the carbon reduction effort is the provision of some kind of technology transfer promises by developed country Members, which is also compatible with Article X of the Paris Agreement. Although governments do not own the technologies themselves, they can encourage their firms to lay out technology transfer promises of "first construction date plus 'x' years" or "patent date plus 'y' years" and to place these promises in the public domain. This could significantly reduce the transaction costs of negotiating between green energy providers and demanders, thereby helping to build greater market penetration for global carbon reduction.

3.3 Future Roadmap

3.8. A good starting point for discussing the issue of carbon reduction is to examine the plan of a particular Member. Here, the European Union plan is a useful reference. Figure 2 shows the percentage of carbon reduction planned for various sectors by 2050 and the impact on global carbon reduction corresponding to the range of different goods and services covered by PAEGSA. If Members are more ambitious, then the coverage can be broader. On the other hand, if Members are concerned about some adverse effect from PAEGSA, such as a negative impact on domestic industries, or difficulty in specifying service sectors, etc., then of course the corresponding goods or services items can be narrowed.

Figure 2: Main Sectors Responsible for Greenhouse Gas Emissions in the EU



Source: https://ec.europa.eu/clima/policies/strategies/2050_en.

3.9. We understand that any negotiation of a new trade agreement may take time to complete, and PAEGSA is not expected to be effective immediately. A reasonable first step may be experience sharing by the Members of large economic scales who have relatively more advanced energy/carbon reduction capacities and more transparent and better-conducted governance systems. In the meantime, small and developing country Members' interests can also be reflected throughout the process of discussion with an eye on clarifying the scope and architecture of the future negotiation.

3.10. Moreover, given the suspension of the EGA and the slowdown of the Doha Round, the WTO urgently needs new energy and impetus. Initiation of a brand-new negotiation like the PEAGSA, aimed at tackling such topically relevant issues as climate change and international trade liberalization will be a key achievement for the multilateral trading system.

ANNEX 4. Existing Lists of Climate-Friendly Goods.

A. The World Bank 43 Climate-Friendly Goods.

HS	Product Description
392010	PVC or polyethylene plastic membrane systems to provide an impermeable base for landfill sites and protect soil under gas stations, oil refineries, etc. from infiltration by pollutants and for reinforcement of soil
560314	Nonwovens, whether or not impregnated, coated, covered or laminated: of manmade filaments; weighing more than 150 g/m2 for filtering wastewater
701931	Thin sheets (voiles), webs, mats, mattresses, boards, and similar nonwoven products
730820	Towers and lattice masts for wind turbine
730900	Containers of any material, of any form, for liquid or solid waste, including for municipal or dangerous waste
732111	Solar driven stoves, ranges, grates, cookers (including those with subsidiary boilers for central heating), barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel
732190	Stoves, ranges, grates, cookers (including those with subsidiary boilers for central heating), barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel—Parts
732490	Water saving shower
761100	Aluminum reservoirs, tanks, vats and similar containers for any material (specifically tanks or vats for anaerobic digesters for biomass gasification)
761290	Containers of any material, of any form, for liquid or solid waste, including for municipal or dangerous waste
840219	Vapor generating boilers, not elsewhere specified or included hybrid
840290	Super-heated water boilers and parts of steam generating boilers
840410	Auxiliary plant for steam, water, and central boiler
840490	Parts for auxiliary plant for boilers, condensers for steam, vapor power unit
840510	Producer gas or water gas generators, with or without purif
840681	Turbines, steam and other vapor, over 40 MW, not elsewhere specified or included
841011	Hydraulic turbines and water wheels of a power not exceeding 1,000 kW
841090	Hydraulic turbines and water wheels; parts, including regulators
HS	**Product Description**
841181	Gas turbines of a power not exceeding 5,000 kW

841182	Gas turbines of a power exceeding 5,000 kW
841581	Compression type refrigerating, freezing equipment incorporating a valve for reversal of cooling/heating cycles (reverse heat pumps)
841861	Compression type refrigerating, freezing equipment incorporating a valve for reversal of cooling/heating cycles (reverse heat pumps)
841869	Compression type refrigerating, freezing equipment incorporating a valve for reversal of cooling/heating cycles (reverse heat pumps)
841919	Solar boiler (water heater)
841940	Distilling or rectifying plant
841950	Solar collector and solar system controller, heat exchanger
841989	Machinery, plant or laboratory equipment whether or not electrically heated (excluding furnaces, ovens etc.) for treatment of materials by a process involving a change of temperature such a heating, cooking, roasting, distilling, rectifying, sterilizing, steaming, drying, evaporating, vaporizing, condensing or cooling.
841990	Medical, surgical or laboratory stabilizers
848340	Gears and gearing and other speed changers (specifically for wind turbines)
848360	Clutches and universal joints (specifically for wind turbines)
850161	AC generators not exceeding 75 kVA (specifically for all electricity generating renewable energy plants)
850162	AC generators exceeding 75 kVA but not 375 kVA (specifically for all electricity generating renewable energy plants)
850163	AC generators not exceeding 375 kVA but not 750 kVA (specifically for all electricity generating renewable energy plants)
860164	AC generators exceeding 750 kVA (specifically for all electricity generating renewable energy plants)
850231	Electric generating sets and rotary converters; wind-powered
850680	Fuel cells use hydrogen or hydrogen-containing fuels such as methane to produce an electric current, through an electrochemical process rather than combustion
850720	Other lead acid accumulators
853710	Photovoltaic system controller
HS	**Product Description**
854140	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light-emitting diodes
900190	Mirrors of other than glass (specifically for solar concentrator systems)

900290	Mirrors of glass (specifically for solar concentrator systems)
903210	Thermostats
903220	Manostats

B. Single-Use Climate Friendly Goods

HS Code	Description
HS 850231	Wind turbines
HS 854140	Solar PV devices and light emitting diodes
HS ex-841919	Solar water heaters
HS ex-220710 and HS ex-220720	Biofuels
HS 841011 and HS 841012	Hydraulic turbines
HS 680610	Buildings insulation materials
HS 680690	Insulating materials and articles
HS 700800	Multiple-walled insulating units of glass
HS 701939	Glass-fiber insulation products
HS 841861	Heat pumps
HS 903210	Thermostats
HS853931	Compact fluorescent lamps
HS ex-870390	Electric cars and certain hybrid vehicles

Source: Vossenaar, 2010