Korea and the World Economy, Vol. 12, No. 3 (December 2011) 579-610

Trade Liberalization in Environmental Goods: Major Issues and Impacts*

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As a contribution to the debate over liberalizing trade in environmental goods (EGs), this paper discusses benefits from improving market access to EGs. In the first part of the paper, we provide an overview of the current debate, highlighting the key issues surrounding discussions on liberalizing trade in EGs. In the second part of this paper, we estimate potential gains from tariff elimination for EGs. While it can obviously be expected that lowering or eliminating tariff barriers would lead to increase in trade in environmental goods, there have not been many studies analyzing the size of the potential trade gains. For our analysis, we did simple calculations using data on tariff rates, trade values, and price elasticity for sample lists of environmental goods.

JEL Classification: F13, F18, O13, O44, P48, Q54, Q56
Keywords: environmental goods, trade liberalization, environmentally preferable products, WTO, climate change

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1. INTRODUCTION

Trade liberalization has been challenged by the anti-globalization movement, urging that it has adverse impacts on economic development, undermining the competitiveness of domestic industries and deepening the gaps between the developed and developing worlds. While these criticisms may be true for some cases, however, the conventional wisdom holds that trade liberalization leads to economic and development gains to trading countries, the finding of many analytical and empirical studies. This conventional premise also applies to trade liberalization in environmental goods and services (EGSs).

As climate change presents a daunting global challenge — both in terms of cause and effect — countries have sought ways to deal with the challenge in both domestic and international contexts. Among many answers, technological innovations and technology transfer hold great appeal as a way to effectively reduce greenhouse gas (GHG) emissions. And in light of this, special attention has been given to the role and importance of international trade in diffusing clean technologies.

As WTO/UNEP (2009) noted, technology transfer that contributes to reducing GHG emissions involves two distinct kinds of transactions. One is related to the transfer of proprietary knowledge and the other is related to the sale of goods and services. While the former is very contentious as it revolves around intellectual property rights (IPRs), discussions on improving market access to EGSs have already been undertaken. Indeed, trade barriers have long been seen among the biggest impediments to the dissemination of clean technologies and associated services. To address these barriers, at the 2001 Doha Declaration, members of the World Trade Organization (WTO) called for negotiations on "the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services to improve market access to those goods and service."[1] To fulfill this mandate, WTO

[1] See Paragraph 31 (iii) of the Doha Declaration, available at http://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_e.htm#tradeenvironment

members have devoted considerable negotiating effort.

A rationale for reducing trade barriers to EGSs is very strong. A twofold rationale noted by WTO/UNEP (2009) is as follows: First, reducing or eliminating trade barriers to EGSs should reduce their price and therefore facilitate their deployment at the lowest cost. And second, access to lower cost and more energy efficient technologies would be important for industries that must comply with climate change mitigation policies. Given the circumstances that many countries have adopted or considered a wide range of stringent policy measures to control GHG emissions and move towards a low-carbon future, we believe that the momentum towards clean technologies and technology diffusion will even get stronger. This is where our discussion starts.

As a contribution to the debate over liberalizing trade in environmental goods (EGs), this paper discusses benefits from improving market access to EGs. In the first part of the paper, we provide an overview of the current debate, highlighting the key issues surrounding discussions on liberalizing trade in EGs. In the second part of this paper, we estimate potential gains from tariff elimination for EGs. While it can obviously be expected that lowering or eliminating tariff barriers would lead to increase in trade in environmental goods, there have not been many studies analyzing the size of the potential trade gains. For our analysis, we did simple calculations using data on tariff rates, trade values, and price elasticity for sample lists of environmental goods.

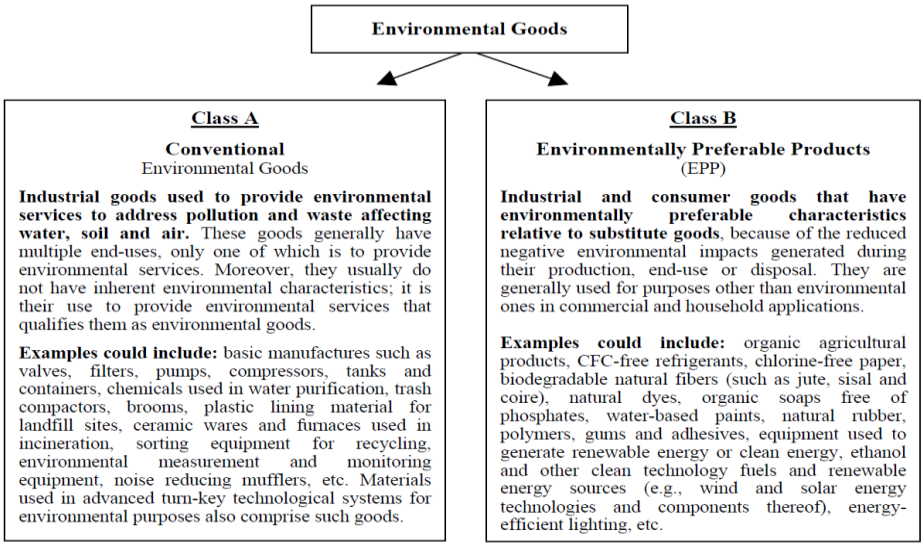
We start our discussion with a very basic but the most contentious question.

2. WHAT ARE ENVIRONMENTAL GOODS?

2.1. Defining Environmental Goods

Among several issues that have complicated the discussions on liberalizing

Figure 1 Two Classes of Environmental Goods



Source: UNESCWA (2007).

trade, a major difficulty has been to define EGs. Despite extensive debate over the years, to date no universally agreed definition of EGs has been reached.

EGs encompass a wide array of products, technologies and components. Traditionally, EGs are considered to be set of manufactured products, technologies and chemicals used in association with environmental services; that is, pollution and waste affecting water, soil, and air. Recently, discussions taking place in the EGS negotiations have further been extended to so-called "environmentally preferable products (EPPs)" which are not necessarily used for environmental purposes but have positive environmental characteristic compared to similar substitute goods. Figure 1 conceptualized EGs in two broad classes.

In grappling with the difficulty of defining environmental goods, the EGS negotiations at the WTO have evolved into three main approaches: (i) the list approach; (ii) the request and offer approach; and (iii) the project approach. The list approach aims to conclude an agreed list of environmental goods and

service for special treatment, such as tariff reductions. In the absence of an internationally agreed definition, several lists of EGs were proposed and circulated by international organizations, including the OECD and APEC, in search for a starting point for the negotiations. Referring to lists proposed by members of WTO, the WTO Special Session of the Committee on Trade and Environment (CTE) has tried to nail down a single list. We will further discuss some proposed lists of EGs later in this paper.

Recognizing the underlying difficulty of reaching agreement on a single list, some countries suggested a request and offer approach which aims to provide special treatment to specific goods and services in response to requests and offers by individual countries. Another approach is the project approach which gives special treatment to agreed types of environmental projects using any goods and services. This approach was driven by concerns of dual use of environmental products and limits embedded in the existing Harmonized System (HS) codes.[2)]

While discussions on all three approaches have been taken place in WTO negotiations, there has not been much progress due to conceptual drawbacks inherent in each approach and underlying commercial tensions.

2.2. Key Proposed Lists of Environmental Goods

While there is no internationally agreed definition of EGs, in recognition of the potential benefits of liberalizing trade in environmental goods, discussions to defining EGs have advanced since the early 1990s. Among many, the OECD, APEC, and World Bank have drawn up their own lists which include goods spanning the HS six-digit codes. And separately from these lists, several individual or a small group of members of the WTO such as Japan, Korea and Qatar prepared and submitted their own lists. In the absence of the agreed definition, those lists serve as useful sources to

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[2)] The Harmonized Commodity Description and Coding System generally referred to as "Harmonized System (HS)" is an international product nomenclature developed by the World Customs Organization. It comprises about 5,000 commodity groups.

examine the possible impacts of trade liberalization in EGs.

Among several proposed lists, the OECD and APEC lists are the ones often cited. While the OECD list covers 132 products at the HS six-digit level, the APEC list spans 104 products at the same level of the HS nomenclature. They comprise mostly conventional EGs and the two lists have 54 goods in common. According to Steenblik (2005), who compared the OECD and APEC lists, while the two exercises informed each other, the lack of overlap — only about 30 percent of the goods in the combined list are common — resulted from a difference of emphasis. The greatest areas of overlap are found in the categories of recycling equipment, incineration equipment and measuring and monitoring equipment. However, minerals and chemicals for water/waste treatment are somewhat exclusive to the OECD list while the APEC list includes relatively more products needed for environmental monitoring and assessment. The World Bank also listed 43 climate friendly technologies at the HS six digit level (World Bank, 2007) with a focus on the categories of clean coal technologies, wind energy and solar photovoltaic systems.

Referring to the OECD, APEC and other lists, the members of the WTO have proposed their own lists. The WTO (2011) reviewed all proposals of EGs of interest, put forward by the members, and presented a comprehensive list which covers 408 EGs at the HS six digit level. Examining and comparing the products included in the WTO list with products in the composite list based on the OECD, APEC, and World Bank lists of EGs, we found that while the WTO extensive list covers many products covered by the composite list, its coverage is further extended to categories such as petroleum gases (i.e., HS 271111 natural gas, HS 271112 propane), ether-alcohols (i.e., HS 290911 acyclic ethers, HS 290930 aromatic ethers), recovered paper (i.e., HS 470710 recovered unbleached kraft paper, HS 470730 paper or paperboard made mainly of mechanical pulp), tubes and pipes (i.e., HS 730410 line pipe, HS 730421 casing, tubing and drill pipe) and many others.

While the extensive list by the WTO provides an informative overview of

which products have been proposed to be included as EGs by members, given its relatively large coverage, it is not realistic to consider this list as a good starting point for negotiations. Accordingly, the same WTO report presented a core list which covers 26 EG products as a starting point for discussion (see Appendix table A1).

While discussions on the lists above are still underway, they provide useful sources for EG related studies. Using these lists, we estimated the impacts of trade liberalizations for EGs that will be discussed later in this paper.

2.3. Major Issues Surrounding Environmental Goods Discussions

2.3.1. Divided interests over environmental goods

A major challenge in defining EGs is that countries have competing commercial interests and differing needs for environmental goods. Especially, developing and developed countries advance contending positions over the products that should be included in the liberalization list. For example, the OECD and APEC lists put an overwhelming emphasis on goods from developed countries — mostly comprising Class A EGs. Consequently, these lists have provoked criticism from developing countries, complaining that the lists are tilted towards the export interests of developed countries.

From the perspective of developing countries, the negotiations at the WTO focus too much on industrial goods with inadequate consideration of agricultural goods. Developing countries have urged that negotiations should include agricultural goods of particular interest to themselves — not just industrial products of interest to developed countries. The UNESCWA (2007) noted that developing countries want to include "environmentally preferable products" (EPPs) since developing countries generally have negative trade balances in traditional environmental goods — Class A EGs illustrated in figure 1 — while they see considerable export opportunities in EPPs which include many raw and processed natural resource based

commodities. To secure their share of commercial benefits, developing countries have become more active in the negotiations on defining EGs.[3)]

The debate has tended to be focused on export interests of EGs in the proposed lists. In fact, as Hufbauer *et al*. (2010) noted, a mercantilist approach to trade — which is 'exports are good and import are bad' — is often taken by negotiators. Hufbauer *et al*. (2010) emphasized that imports provide benefits for individual and industries as consumers by delivering lower prices, better quality and greater quality. Sharing the same view, we believe that there has been some shift in the focus on the negotiations towards the benefit of imports of EGs for the following reasons.

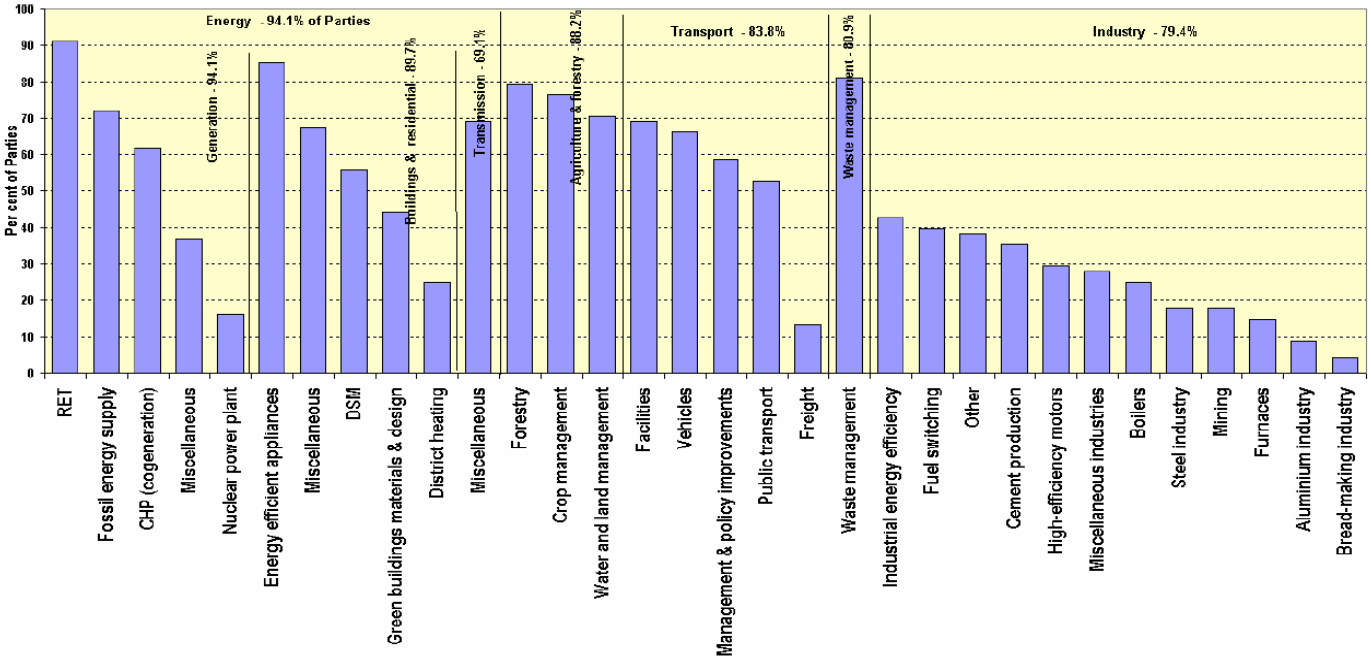
First, EGs that have importance to developing countries have been better identified in the course of international climate negotiations. There has been a growing recognition of 'win-win' benefits of lowering trade barriers to environmental goods for importing countries. This seems to be particularly true to developing countries since most of advanced clean technologies are owned by developed countries.

Summarizing information from about 70 non-Annex I parties — mostly from the developing world — in their technology needs assessments (TNAs) and national communications (NCs) — the UNFCCC (2009) identified technologies considered to be needed in relation to mitigation and adaptation by non-Annex I parties (see figures 2 and 3). For example, in the energy sector, the most commonly identified mitigation technologies relate to solar photovoltaics; biomass; micro-hydropower plants; efficient lighting and water heating (solar and biomass); water pumping (solar and wind); and fuel-conserving stoves and ovens. According to the report, non-Annex I parties considered price distortions, including both subsidies and tariffs, as major barriers to technology transfer.

Many technologies identified in need by non-Annex I parties are those for which developing countries on the whole are net importers (see table 1). And as table 2 indicates, developing countries maintain higher tariff rates for

[3)] The UNESCWA (2007) noted that several developing countries are preparing their own national or regional EG lists for proposal to the WTO.

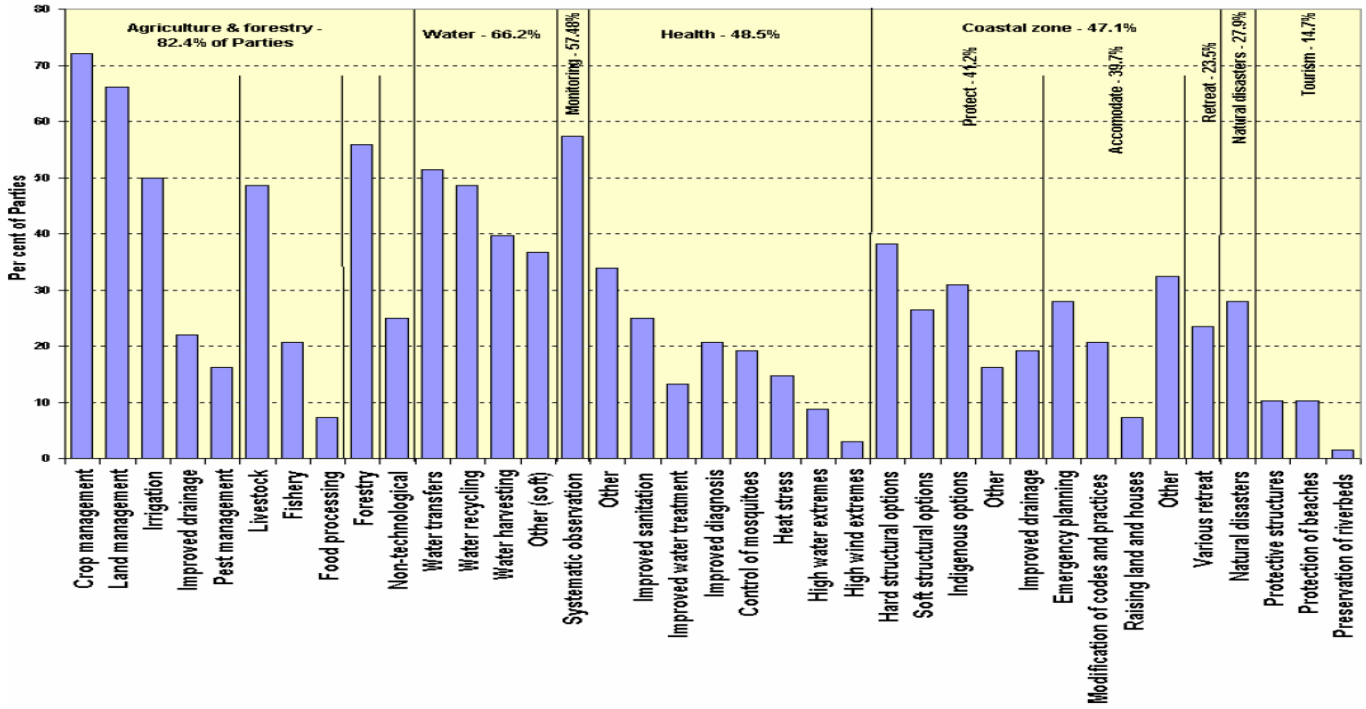
Figure 2 Sectors, Subsectors and Technologies Commonly Considered by Parties in Their Technology Needs Assessments in Relation to Mitigation



Abbreviations: RET = renewable energy technology, CHP = combined heat and power, DSM = demand-side management.

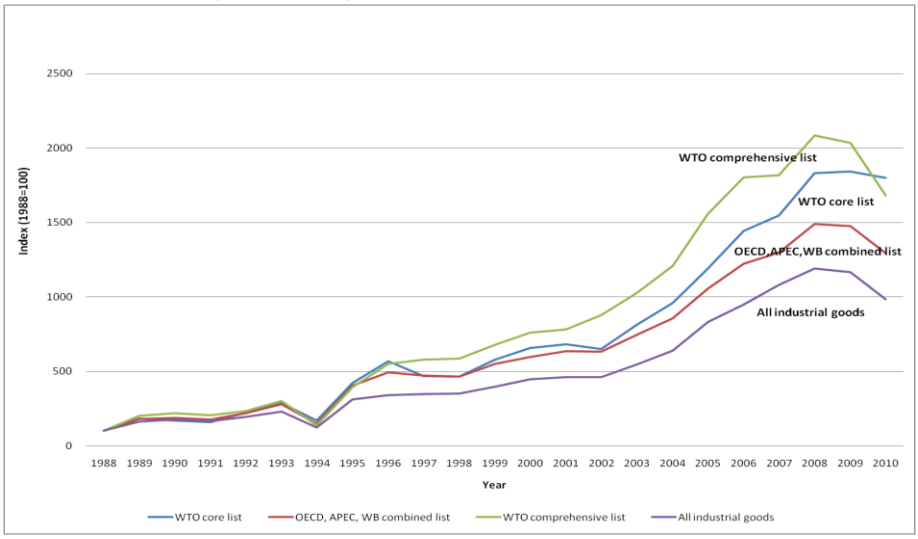
Source: UNFCCC (2009).

Figure 3 Sectors, Subsectors and Technologies Commonly Considered by Parties in Their Technology Needs Assessments in Relation to Adaptation



Source: UNFCCC (2009).

Figure 4 Growth of World Imports of EGs by Selected Lists (1988-2010)[4)]



Source: Authors' calculations based on import data from TRAINS database (accessed through the WITS on July 10, 2011).

technologies and related products in need than developed countries. As pressure from both public and private sectors for transition to a low-carbon future has intensified, it is expected that the governments will seek stronger domestic climate policies. Such policies will lead to increased demand for clean technologies and products — areas where trade has already been growing faster than trade of industrial goods (see figure 4) in both developed and developing countries. This implies that lowering tariff barriers, and thereby reducing prices, would benefit domestic consumers and industries in need of those products.

Second, in addition to potential benefits for importers, lowering trade barriers would also benefit exporters in both developing and developed countries. Recently, a number of developing countries have surged as big

4) Using the lists discussed earlier, we compared imports of EGs included in each list with imports of all industrial goods over the past two decades. For this comparison, import data of each list were indexed to 1988. As figure 4 shows, we found that growth in imports of EGs has been faster than growth in imports of industrial goods.

Table 1 Top 15 Exporting and Importing Countries of Environmental Goods from the WTO Core List (2009)[a]

	Country	Exports from World			Country	Imports from World	
		Value (mill.$)	Share of World Total			Value (mill.$)	Share of World Total
1	European Union[b]	34,248.0	19.3	1	European Union[b]	28,802.2	16.3
2	Japan	22,842.5	12.9	2	United States	21,228.9	12.0
3	China	21,813.2	12.3	3	China	19,552.7	11.1
4	United States	17,651.9	10.0	4	Korea, Rep.	11,068.1	6.3
5	Korea, Rep.	6,786.0	3.8	5	Taiwan	7,585.6	4.3
6	Mexico	4,811.7	2.7	6	Japan	5,170.8	2.9
7	Taiwan	4,764.0	2.7	7	Hong Kong	4,169.6	2.4
8	Singapore	3,272.5	1.8	8	Canada	3,830.4	2.2
9	Switzerland	2,959.1	1.7	9	Singapore	3,430.2	1.9
10	Canada	2,585.1	1.5	10	Mexico	3,327.9	1.9
11	Malaysia	2,215.2	1.3	11	India	2,636.7	1.5
12	India	2,065.2	1.2	12	Turkey	2,490.1	1.4
13	Turkey	1,563.5	0.9	13	Thailand	2,421.9	1.4
14	Thailand	1,144.5	0.6	14	Australia	2,413.4	1.4
15	Brazil	1,041.5	0.6	15	Russia Federation	2,215.3	1.3
Memorandum							
	World	177,187.1	100.0		World	176,877.5	100.0
	WTO High Income Members[c]	63,384.3	35.8		WTO High Income Members	63,566.9	35.9
	WTO Developing Members[d]	37,190.2	21.0		WTO Developing Members	42,765.3	24.2
	WTO LDC Members[e]	10.4	0.0		WTO LDC Members	379.9	0.2
Selected Countries Belonging to EU							
	Germany	28,247.3			Germany	18,990.3	
	Italy	7,798.5			France	6,687.8	
	France	5,667.0			Italy	6,112.8	
	Netherlands	5,133.5			United Kingdom	4,682.8	
	United Kingdom	4,849.3			Netherlands	3,932.6	

Notes: a. The WTO core list covers 26 products at the HS six-digit level. Details of each product are described in Appendix 1 table. b. Intra-EU trade not included. c. WTO high income members include 21 members which are: Australia, Bahrain, Brunei, Canada, European Union, Hong Kong, Iceland, Israel, Japan, Korea, Kuwait, Macao, New Zealand, Norway, Qatar, Saudi Arabia, Singapore, Switzerland, Taiwan, Unites Arab Emirates, and Unites States. d. WTO developing members include 59 members which are: Albania, Antigua and Barbuda, Argentina, Armenia, Barbados, Belize, Bolivia, Botswana, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Dominica, Dominican Rep., Ecuador, Egypt, El Salvador, Fiji, Gabon, Georgia, Grenada, Guatemala, Guyana, Honduras, India, Indonesia, Jamaica, Jordan, Kyrgyz Rep. Macedonia, Malaysia, Mexico, Moldova, Mongolia, Morocco, Namibia, Nicaragua, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Romania, South Africa, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Swaziland, Thailand, Trinad and Tobago, Tunisia, Turkey, Uruguay, and Venezuela. e. WTO LDC members include 31 members which are: Angola, Bangladesh, Benin, Burkina Faso, Burundi, Cambodia, Central African Rep., Chad, Congo, Djibouti, Gambia, Guinea, Guinea-Bissau, Haiti, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Rwanda, Senegal, Sierra Leone, Solomon Islands, Tanzania, Togo, Uganda and Zambia.

Source: Authors' calcualtions based on trade data from UN COMTRADE database (accessed through the WITS on June 24, 2011).

Table 2 Tariff Rates Comparison for Environmental Goods by the Proposed Lists and Selected Countries and Groups

Country	Tariff Year	MFN Bound Rate (%)[a]				Effective Applied Rates (%)[b]			
		All Industrial Goods[c]	WTO Core List[d]	Combined List[e]	WTO Compre-hensive List[f]	All Industrial Goods[c]	WTO Core List[d]	Combined List[e]	WTO Compre-hensive List[f]
Selected Developing Countries									
Brazil	2010	30.23	30.32	29.97	32.53	7.81	10.93	11.52	8.38
China	2010	4.38	3.02	5.25	7.57	3.51	2.76	4.47	6.79
India	2009	28.85	23.33	28.68	27.57	7.08	7.07	7.78	8.13
Mexico	2010	35.26	35.00	34.85	36.78	3.80	4.19	3.52	5.13
Russia Federation	2010	n/a	n/a	n/a	n/a	3.74	1.63	2.27	2.36
Selected Developed Countries									
Australia	2010	8.98	6.61	9.50	10.93	1.88	1.66	1.82	1.95
Canada	2010	3.92	4.61	4.22	4.43	1.03	0.56	0.37	0.79
European Union	2010	2.46	8.63	11.05	12.94	1.58	2.18	3.09	4.02
Japan	2010	1.51	0.00	0.81	0.50	0.97	0.00	0.23	0.20
Korea	2010	6.06	5.50	8.60	8.01	3.42	5.46	6.35	4.32
United States	2010	2.48	1.36	1.46	2.66	1.60	1.10	1.05	1.34
Memorandum									
World	2010	8.15	6.57	9.39	10.19	2.74	2.29	3.03	3.32
WTO High Income Members	2010	3.61	2.70	3.95	4.46	1.51	1.19	1.55	1.50
WTO Developing Members	2010	15.96	13.88	18.22	21.00	4.12	3.87	4.85	5.84
WTO LDC Members	2010	42.11	46.42	49.47	40.04	8.91	4.84	6.75	8.69

Notes: a. MFN bound rate data for Russia Federation are not available. Tariff rates are weighted average. b. The effective applied rates take account of preferential trade agreements. c. Classified as a WTO HS-industrial which covers 5,170 products. d. Tariff rates for goods included in a WTO core list that covers 26 products at the HS six-digit level. Tariff rates are weighted average. e. The composite list based on OECD, APEC, and World Bank lists of environmental goods. The composite list covers 211 products at the HS six-digit level; but due to the data availability, 195 products are covered for these calculations. Tariff rates are weighted average. f. The WTO list covers 408 products at the HS six-digit level; Tariff rates are weighted average.

Source: Authors' calculations; for tariff rates, TRAINS (accessed through the WITS on July 2, 2011).

exporters of certain environmental goods in the world market. In table 1, we listed top 15 exporting and importing countries for the 26 EGs that are identified in the WTO core list.[5)] While the European Union holds the lion's share of both world exports and imports for identified goods, we found

[5)] Detailed descriptions of 26 EGs included in the WTO core list are found in Appendix table A1.

that several developing countries — including China, Mexico, Malaysia, India, Turkey, Thailand, and Brazil — are ranked among the top 15 exporting countries (highlighted in grey in table 1). Notably, China is the top exporter of wind turbine towers, static converters, solar batteries for energy storage in off-grid photo voltaic systems and other items. Mexico is the top exporter of a product line that covers solar water heaters. According to Jha (2008), who conducted empirical analysis and econometric modeling on 153 environmental products, dynamic comparative advantage is shifting in favor of developing countries for a number of categories of environmental goods. With this shift, developing countries are likely to benefit from tariff liberalization.[6)]

Using the lists of environmental goods prepared by WTO, OECD, APEC, and the World Bank, we compared bound and applied tariff rates for the identified lists of environmental goods in table 2.[7)] Our examination of existing tariff barriers for EGs by each list suggests that developing countries maintain higher rates for both bound and applied tariffs than developed countries (highlighted in green in table 2). Although tariff rates are already very low in most developed countries (see table 2), the large exporters among developing countries would benefit from lower tariffs rates in both developed and developing countries.

An interesting finding from table 2 is that both bound and applied rates on average for the lists of EGs tend to be higher than comparable tariffs for all industrial goods. This may imply that the trade gains from eliminating tariffs on $100 million of EGs trade would be greater than the gains from eliminating tariffs on $100 million of general industrial goods trade. Accordingly, and given the increasing recognition of mutual benefits from liberalizing trade in EGs among WTO members, we suggest that the negotiations on EGs might be a good candidate for an “early harvest” in the protracted Doha Round.

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6) Dynamic comparative advantage is a weighted average of the revealed comparative advantage of all the tariff lines for a particular country in a particular sector.
7) Each list referred to in table 1 will be discussed in detail later this paper.

Third, trade liberalization in EGs could realize economies of scale by bringing technological innovation and learning opportunities into countries. As an example, the reduction of certain import tariffs has encouraged the adoption of energy-efficient lighting in Ghana (WTO/UNEP 2009). An increase in trade flows creates larger market for individual EGs firms, which leads to profits from economies of scale and provides producers the opportunity to learn and benefit from advances in other parts of the world.

2.3.2. Dual-use issue

In the debate over defining EGs, dual-use became a thorny issue. The current classification systems are not specific enough to isolate EGs and, therefore, dual-use is inherent to most of goods classified under the current systems. While countries want liberalization to be confined to HS six-digit categories that have a single end-use, out of some 440 entries of environmental goods — at the HS six digit level — submitted to and compiled by the WTO, only a half a dozen are purely singularly used for environmental purposes (UNCTAD, 2011). Indeed, multiple-end uses are a common feature in current classification systems. Let's take an example. While we use pipes in building a wind turbine tower, we also use them in building a coal fired power plant. In this case, a challenging question is that whether we could consider pipes as EGs. Is there enough justification to classify a pipe as an environmental product? Even though greater specificity would be added to the HS tariff codes, it should be very difficult to avoid dual-use problems for many products.[8)]

Moreover, as Hufbauer and Kim (2010) noted, EGs are nestled in a wide range of industrial and trade classification nomenclatures. Under the existing HS codes, EGs are often lumped together with unrelated products. For example, solar photovoltaic panels are categorized as "Other" under the sub-classification for light-emitting diodes (LEDs) (World Bank, 2007). Unless the current classification systems are overhauled to subdivide beyond

8) For further discussion, see ICTSD (2007) which provides useful discussions on trade liberalization in EGs and dual use issues.

HS six-digit codes to reflect products with a single use for environmental purposes, it will not be possible to avoid free-rider benefits from trade liberalization in EGs.[9)]

2.3.3. Process and production methods (PPMs)

Another controversial issue is whether products could be considered "environmental" based on the way they have been processed or produced. For example, let's assume that carbon footprint for a ton of hot-rolled steel plate produced by firm A is much less owing to the application of advanced technology in the production process than one by firm B. In this case, we may be tempted to say that steel product from firm A is cleaner and more climate-friendly than one from firm B. While this sounds quite reasonable, the current WTO rules do not allow members to differentiate among "like products" based on their process and production methods (PPMs). For this reason, WTO members have sought to avoid including "environmentally preferable products" (EPPs) in the negotiations. While the legal complexity and tracing difficulties embedded in PPM issues suggest multiple difficulties, there might be some potential to increase the specificity of HS codes in reflection of PPMs if eco-labeling or certification become common.

All in all, while several issues remain to be addressed, given the changing circumstances and greater emphasis on environmental concerns, we believe that there are opportunities for countries to narrow the gaps in their negotiating positions.

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9) In many countries, HS codes often go beyond the six-digit level at national custom levels (i.e., at the 8 or 10-digit code). While such narrow codes — and "ex-outs" submitted to the WTO by members — might help capture specific goods, however, there is no harmonization beyond the six-digit level at the international level. For more information, see ICTSD (2007).

3. ANALYSIS ON POSSIBLE TRADE GAINS FROM REMOVING TARIFF BARRIERS TO EGS

3.1. Literature Survey

A number of studies have highlighted the potential trade gains from liberalization in the area of low-carbon goods. For example, looking at four basic clean energy technologies, namely wind, solar, clean coal and efficient lighting, in 18 top GHG emitting developing countries, the World Bank (2007) estimated that the removal of tariffs for those technologies would result in trade gains of up to 7 percent and the removal of both tariffs and non-tariff barriers could boost trade by as much as 13 percent. Also, using a combined schedule of OECD, APEC, and World Bank lists of EGs that covers 211 products at the HS six-digit level, Hufbauer and Kim (2010) estimated that tariff elimination on EGs would increase the world imports of EGs by about $56 billion, accounting for around 12 percent of the world's total imports of 211 products.

It should be noted that the impacts of liberalization in EGs vary across products and across countries, depending on existing levels of tariff and non-tariff barriers, and on the import elasticity of demand.

3.2. Scope, Data, and Methodologies

To assess the effects of trade liberalization in EGs, the first thing to be determined is which EGs are to be examined. In the previous section, we discussed several proposed lists of environmental goods. While those lists have differences in product coverage, they serve as useful sources for studying the possible consequences of trade liberalization. For our analysis, we focus on the WTO core list of EGs that covers 26 products at the HS six-digit level mainly for two reasons.[10] First, in our view, a short list better

[10] The detailed descriptions of 26 EGs included in the WTO core list are summarized in Appendix table A1.

serves as a launching pad for negotiations, which is the reason why the WTO put forward the core list in the WTO Special Session of the Committee on Trade and Environment (CTE). Second, when more products are included in the analysis, it is harder to calculate import demand elasticities for each country. Using a short list, we were able to calculate and apply the simple average elasticity of each country for the 26 EGs on a whole (see Appendix table A2). However, as a check on these results, we also did some calculations based on a composite list of OECD, APEC and World Bank lists of EGs.

For trade data, we used the United Nations COMTRADE database for import data and UNCTAD TRAINS database for weighted average tariff data, both accessed through the World Integrated Trade Solution (WITS).

In addition, to examine the impacts of tariffs, import demand elasticity data at tariff line level are essential. For import demand elasticity data, we used the World Bank's Global Monitoring Report database which measures the percentage change in import volume due to a 1 percent increase in import price. To our knowledge, this dataset is the most updated and perhaps the only existing comprehensive dataset at the HS six digit level. The database contains import elasticities for more than 4,600 goods at the HS six digit level for more than 150 countries.[11)]

In an earlier study, Gary Hufbauer and Jisun Kim (2010) estimated the impact of cutting the current effective applied tariff rates to zero, using the price elasticity of import demand for given environmental products. For their calculations, the authors combined OECD, APEC, and World Bank lists of environmental goods into a single composite list which covers 211 products at the HS six-digit level. In this paper, we followed the exercise done by Hufbauer and Kim (2010) but tried to be more specific, using a shorter list of products, together with updated trade data and import demand elasticity by each selected country.

[11)] The import demand elasticities of the World Bank were calculated based on a methodology that is consistent with trade theory (i.e., imports are a function of prices and factor endowments). For more details, see Kee *et al*. (2010).

3.3. Estimated Impacts of Tariff Elimination for EGs

Assuming the current effective applied tariff rates are cut to zero, we calculated the trade impacts. For our calculations, we used two versions of the average price elasticity for all 26 environmental goods included in the WTO core list. One version is the value –1.39, namely the world average price elasticity for all 26 products; the other version is country average price elasticity for all 26 products.[12] For the latter one, we have selected 11 countries — five developing countries (namely Brazil, China, India, Mexico and Russia Federation) and six developed countries (namely Australia, Canada, European Union, Japan, Korea and the United States) — which are major importing and exporting countries of EGs. Multiplying the effectively applied tariff rates expressed in percentage points by the elasticity and then by current import values, we were able to calculate possible trade gains from tariff cuts.

As seen in table 3, while import gains vary by country, our estimates show that imports gains for developing countries would be greater than developed countries, since developing countries start with higher tariff rates (and greater price elasticity in many cases). Applying a single value of –1.39 — the world average price elasticity for all 26 products at the HS six digit level in the WTO core list, we estimated that the imports of EGs could rise by about $3.7 billion, accounting for around 3.6 percent of the total imports of 26 products for all eleven selected countries — 5.2 percent of the total imports of 26 products for all five selected developing countries and 2.9 percent for all six selected developed countries.

We also estimated the import gains by each selected country, applying a value of country average price elasticity for all 26 products. We estimated that the imports of EGs for all eleven selected countries could rise by about $6.9 billion, accounting for around 6.8 percent of the total imports of 26 products for all eleven selected countries — 8.9 percent of the total imports of 26 products for all five selected developing countries and 5.9 percent for

[12] Import demand elasticity for 26 products by country could be found in Appendix table A2.

Table 3 Tariff Rates and the Iimpact of Proposed Tariff Elimination on Import of Environmental Goods for Selected Countries (WTO Core List)[a]

Country	Tariff Year	MFN Bound Rate (%)	MFN Applied Rate (%)	Effective Applied Rates (%)[b]	Binding Coverage (%)	Impacts of Tariff Elimination for Environmental Goods						
						Imports from World (mill.$, 2009)	When Assumed Price Elasticity Applies					
							World Avg.[c]	Import Gains		Country Avg.[d]	Import Gains	
								Value (mill. $)	Percent		Value (mill. $)	Percent
Selected Developing Countries												
Brazil	2010	30.32	11.31	10.93	100.0	1,839.3	–1.39	279.4	15.2%	–3.23	649.3	35.3%
China	2010	3.02	2.94	2.76	100.0	19,552.7	–1.39	750.1	3.8%	–1.41	760.9	3.9%
India	2009	23.33	7.13	7.07	88.0	2,636.7	–1.39	259.1	9.8%	–5.35	997.3	37.8%
Mexico	2010	35.00	4.23	4.19	100.0	3,327.9	–1.39	193.8	5.8%	–1.23	171.5	5.2%
Russia Federation	2010	n/a	2.53	1.63	n/a	2,215.3	–1.39	50.2	2.3%	–1.26	45.5	2.1%
Subtotal						**29,571.9**		**1,532.7**	**5.2%**		**2,624.6**	**8.9%**
Selected Developed Countries												
Australia	2010	6.61	2.26	1.66	96.0	2,413.4	–1.39	55.7	2.3%	–2.59	103.8	4.3%
Canada	2010	4.61	1.28	0.56	100.0	3,830.4	–1.39	29.8	0.8%	–1.79	38.4	1.0%
European Union	2010	8.63	4.37	2.18	92.0	28,802.2	–1.39	872.8	3.0%	–1.39	872.8	3.0%
Japan	2010	0.00	0.00	0.00	100.0	5,170.8	–1.39	0.0	0.0%	–16.66	0.0	0.0%
Korea	2010	5.50	5.52	5.46	92.0	11,068.1	–1.39	840.0	7.6%	–1.90	1,148.2	10.4%
United States	2010	1.36	1.72	1.10	100.0	21,228.9	–1.39	324.6	1.5%	–9.10	2,125.0	10.0%
Subtotal						**72,513.8**		**2,122.9**	**2.9%**		**4,288.1**	**5.9%**
Total (All Selected Countries)						**102,085.7**		**3,655.5**	**3.6%**		**6,912.7**	**6.8%**
Memorandum												
World	2010	6.57	2.77	2.29	79.9	176,877.5	–1.39	5,630.2	3.2%			
WTO High Income Members	2010	2.70	1.46	1.19	89.7	63,566.9	–1.39	1,051.5	1.7%			
WTO Developing Members	2010	13.88	4.59	3.87	96.8	42,765.3	–1.39	2,300.5	5.4%			
WTO LDC Members	2010	46.42	5.23	4.84	56.6	379.9	–1.39	25.6	6.7%			

Notes: a. These calculations use a WTO core list that covers 26 products at the HS six-digit level. Tariff rates are weighted average. b. The effective applied rates take account of preferential trade agreements. c. simple average of price elasticity for 26 environmental goods for all countries. d. simple average of price elasticity for 26 environmental goods for each country. e. For the European Union, we used the world average price elasticity for all 26 products due to some difficulties in calculations of price elasticity for all EU members.

Sources: Author's calculations; for tariff rates, TRAINS (accessed through the WITS on July 2, 2011); for trade values, UN Comtrade (accessed through the WITS on July 2, 2011); for price elasticity, Kee *et al*. (2010).

Table 4 Tariff Rates and the Impact of Proposed Tariff Elimination on Import of Environmental Goods for Selected Countries (List of OECD, APEC, and World Bank)[a]

Country	Tariff Year	MFN Bound Rate (%)	MFN Applied Rate (%)	Effective Applied Rates (%)[b]	Binding Coverage (%)	Impacts of Tariff Elimination for Environmental Goods			
						Imports from World (mill.$, 2009)	Assumed Price Elasticity[c]	Import Gains	
								Value (mill.$)	Percent (%)
Selected Developing Countries									
Brazil						9,742.3	–2.54	2,850.7	29.3%
China	2010	5.25	4.80	4.47	100.0	61,824.2	–2.54	7,019.4	11.4%
India	2009	28.68	7.93	7.78	92.2	12,752.5	–2.54	2,520.0	19.8%
Mexico	2010	34.85	3.56	3.52	100.0	19,333.6	–2.54	1,728.6	8.9%
Russia Federation	2010	n/a	3.30	2.27	n/a	12,297.7	–2.54	709.1	5.8%
Subtotal						**115,950.3**		**14,827.8**	**12.8%**
Selected Developed Countries									
Australia	2010	9.50	3.08	1.82	97.9	12,666.4	–2.54	585.5	4.6%
Canada	2010	4.22	1.02	0.37	100.0	22,240.3	–2.54	209.0	0.9%
European Union	2010	11.05	5.59	3.09	91.5	86,172.4	–2.54	6,763.3	7.8%
Japan	2010	0.81	0.53	0.23	100.0	24,466.5	–2.54	142.9	0.6%
Korea	2010	8.60	6.44	6.35	89.5	27,468.4	–2.54	4,430.4	16.1%
United States	2010	1.46	1.66	1.05	100.00	89,266.3	–2.54	2,380.7	2.7%
Subtotal						**262,280.3**		**14,511.9**	**5.5%**
Total (All Selected Countries)						**378,230.6**		**29,339.7**	**7.8%**
Memorandum									
World	2010	9.39	3.73	3.03	79.0	699,767.7	–2.54	53,855.5	7.7%
WTO High Income Members	2010	3.95	1.99	1.55	89.4	238,897.2	–2.54	9,405.4	3.9%
WTO Developing Members	2010	18.22	5.75	4.85	96.5	173,662.6	–2.54	21,393.5	12.3%
WTO LDC Members	2010	49.47	7.50	6.75	53.0	1,813.6	–2.54	310.9	17.1%

Notes: a. The composite list based on OECD, APEC, and World Bank lists of environmental goods. The composite list covers 211 products at the HS six-digit level; Tariff rates are weighted average but due to the data availability, 195 products are covered for these calculations. b. The effective applied rates take account of preferential trade agreements. c. simple average of price elasticity for 26 environmental goods for all countries.

Sources: Authors' calculations; for tariff rates, TRAINS (accessed through the WITS on July 2, 2011); for trade values, UN Comtrade (accessed through the WITS on July 2, 2011); for price elasticity, Kee *et al*. (2010).

all six selected developed countries. Looking by each selected country, in most cases, the imports gains when country average price elasticity applies are greater than ones when a single value of –1.39 applies — noticeable in some of developing countries such as Brazil and India which are found to expect more than 30 percent increase in imports when country specific average price elasticity applied.

For the world, applying a single value of –1.39 — the world average price elasticity for all 26 products at the HS six digit level in the WTO core list — we estimated that the imports of EGs for the world could rise by about $5.6 billion, accounting for around 3.2 percent of the world's total imports of 26 products. This result may not seem significant but that's because we only include 26 products in our calculations. Moreover, as table 3 shows, a value of average elasticity for each country is greater than the world average and this may imply that import gains should be much higher if we could calculate the world import gains by aggregating each country's import gains based on average elasticity of each country for the products.

To further examine the magnitude of import gains, in table 4, we updated the analysis reported by Hufbauer and Kim (2010) which uses an extended list of EGs, that is, a composite list based on OECD, APEC and World Bank lists that covers 211 products. For calculations, we applied the same single value of –2.54 used by Hufbauer and Kim (2010) for the average elasticity for all 211 products. For the world, the imports of EGs were estimated to rise by about $54 billions, accounting for around 8 percent of the world's total imports of all 211 products. For the selected developing countries, the imports were estimated to rise by about $15 billions, accounting for around 13 percent of the total imports of all 211 products for all five selected developing countries. And for the selected developed countries, the imports were estimated to rise by about $15 billions, accounting for around 6 percent of the total imports of all 211 products for all six selected developed countries.

4. FINDINGS AND CONCLUSION

According to WTO (2011), all members agree that a successful outcome of the negotiations on EGSs would deliver a triple-win in terms of trade, environment, and development for WTO members:

- The negotiations can benefit the environment by improving the ability of countries to obtain high quality environmental goods at low cost and increase production and trade. And, better access to safe water, sanitation or clean energy would lead to improved quality of life for people.
- Better access to EGSs provides developing countries with the tools needed to address environmental priorities as part of their on-going development strategies.
- Liberalizing trade in EGs trade would make these products less costly, create new markets, and stimulate innovation and technology transfer by encouraging the use of environmental technologies.

While the negotiations need to address a number of challenging issues discussed earlier, along with many other experts, we share these views. For several reasons, we are hopeful that progress can be made in the near term.

1. The definitional complexity surrounding environmental goods has caused a deadlock in the negotiations. Perhaps the best answer is to start with a short list and a small number of countries. We suspect that the WTO core list could serve a starting point, but it should be enlarged to add some agricultural EPPs to gain support from developing countries.

2. In the Doha negotiations, countries focus too much on their own export interests, and worry too much about the impact of liberalization on domestic industries and on tariff revenue. While export interests have likewise been a dominant factor in the negotiations on EGs. Fortunately, the growing awareness of the immediate and long-run dangers associated with climate

change, and emphasis on sustainable development, have shifted some attention to import interests. In fact, non-Annex I parties — mostly from developing world — under UN climate talks have expressed their needs across a wide range of clean technologies and have identified tariffs as one of impediments to technology transfer. If greater voice is accorded to these import interests, that will help offset concerns about the weakened competitiveness of domestic industries and lower tariff revenue.

3. In addition, as some developing countries have surged as big exporters in clean technologies, the argument over an undue tilt towards the export interests of developed countries is losing some of its force.

4. As pressure from both public and private sectors for transition to a low-carbon future has intensified, governments will seek stronger domestic climate policies. This will lead to increased demand for clean technologies and products. Over the past two decades, EGs trade has grown faster than trade of industrial goods on a whole. Demand for EGs will certainly get stronger, which means that lowering tariff barriers resulting in lower prices will benefit domestic consumers and industries that need those products.

5. While import gains vary by country, our estimates show that imports gains for developing countries on the whole would be greater than for developed countries, since developing countries maintain higher tariff rates (and greater price elasticity in many cases). Applying a single value of –1.39 — the world average price elasticity for all 26 products at the HS six digit level in the WTO core list, we estimated that the imports of EGs for the eleven selected countries could rise by about $3.6 billion, accounting for around 3.6 percent of the total imports of 26 products for all eleven selected countries — 5.2 percent of the total imports of 26 products for all five selected developing countries and 2.9 percent for all six selected developed countries.

We also estimated the import gains by each selected country, applying a value of country average price elasticity for all 26 products. We estimated that the imports of EGs for all eleven selected countries could rise by about $6.9 billion, accounting for around 6.8 percent of the total imports of 26

products for all eleven selected countries — 8.9 percent of the total imports of 26 products for all five selected developing countries and 5.9 percent for all six selected developed countries. Looking by each selected country, in most cases, the imports gains when country average price elasticity applies are greater than ones when a single value of –1.39 applies — noticeable in some of developing countries such as Brazil and India which are found to expect more than 30 percent increase in imports when country specific average price elasticity applied.

For the world, applying a single value of –1.39 — the world average price elasticity for all 26 products at the HS six digit level in the WTO core list — we estimated that the imports of EGs for the world could rise by about $5.6 billion, accounting for around 3.2 percent of the world's total imports of 26 products. This result may not seem significant but that's because we only include 26 products in our calculations. Moreover, as table 3 shows, a value of average elasticity for each country is greater than the world average and this may imply that import gains should be much higher if we could calculate the world import gains by aggregating each country's import gains based on average elasticity of each country for the products.

6. When we used a composite list based on OECD, APEC and World Bank lists that covers 211 products for our calculations, total EGs imports were estimated to rise by about $54 billion, accounting for around 8 percent of world total imports of all 211 EGs. This result seems widely consistent with what other studies (i.e., World Bank, 2007) have estimated.

7. It should be noted that while developing countries have expressed their interests in "environmentally preferable products" (EPPs), the list of products used for our calculations focuses on conventional environmental goods. Therefore, we believe that it is worth extending our exercise to cover EPPs in our future studies.

8. While we see great opportunities in the negotiations on liberalizing trade in EGs, the stalled Doha round has dimmed the prospect of meaningful outcome from the negotiations on EGs in the near future. In our view, the stalled Doha trade negotiations and UN climate talks on the post-Kyoto

regime provide us a clear example that reaching a global agreement is a formidable challenge. Given the uncertainties in the stalled Doha Round and to expedite the process of the negotiations, it might be worthwhile to move on EGS negotiations in an "early harvest". For this purpose, several venues in bilateral, plurilateral and regional contexts could serve better in that they may deal with the issues more effectively. In fact, some countries and initiatives are already underway. For example, the United States has been talking with Canada, the European Union and Australia about eliminating tariffs on some green technologies including solar, wind and related energy technologies to spur their use. Also, discussions on improving market access to EGs are underway within regional initiatives like APEC, East Asian countries, and G-20 countries.[13)]

In sum, while there are several difficult issues to be addressed, the changing circumstances suggest that there are great opportunities to make tangible progress in the negotiations. In our view, lowering trade barriers to EGs could benefit both developing and developed countries as both importers and exporters, and this notion now enjoys wider recognition.

13) For example, a Global Agenda Council formed by the World Economic Forum has proposed a Sustainable Energy Free Trade Area (SEFTA) within the G-20 (World Economic Forum, 2010).

APPENDIX

Table A1 WTO Core List of Environmental Goods

	HS Code		Description	Category
	4601		**Plaits and similar products of plaiting materials, whether or not assembled into strips; plaiting materials, plaits and similar products of plaiting materials, bound together in parallel strands or woven, in sheet form, whether or not being finished artic**	
1	460120		Mats, matting and screens of vegetable materials	***Waste Management and Water Treatment,*** *Waste Management, Recycling and Remediation*
	7308		**Structures (excluding prefabricated buildings of heading 94.06) and parts of structures (for example, bridges and bridge sections, lock gates, towers, lattice masts, roofs, roofing frameworks, doors and windows and their frames and thresholds for doors, shutters, balustrades, pillars and columns), of iron or steel; plates, rods, angles, shapes, sections, tubes and the like, prepared for use in structures, of iron or steel**	
2	730820		Towers & lattice masts	***Renewable Energy,*** *Renewable Energy,* ***Renewable Energy,*** *Renewable Products and Energy Source*
	7321		**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**	
3	732111		Cooking appliances and plate warmers: For gas fuel or For both gas and other fuels.	***Environmental Technologies,*** *Cleaner or More Resource Efficient Technologies and Products*
	7324		**Sanitary ware and parts thereof, of iron or steel**	
4	732490		other, including parts	***Waste Management and Water Treatment,*** *Waste Water Management and Potable Water Treatment* ***Environmental Technologies, Carbon Capture and Storage,*** *Efficient Consumption of Energy Technologies*
	8402		**Steam or other vapour generating boilers (other than central heating hot water boilers capable also of producing low pressure steam); super-heated water boilers**	
5	840290		parts	***Environmental Technologies, Carbon Capture and Storage,*** *Efficient Consumption of Energy Technologies* ***Waste Management and Water Treatment,*** *Management of Solid and Hazardous Waste and Recycling Systems* ***Waste Management and Water Treatment,*** *Waste Management, Recycling and Remediation*
	8404		**Auxiliary plant for use with boilers of heading 84.02 or 84.03 (for example, economisers, super-heaters, soot removers, gas recoverers); condensers for steam or other vapour power units**	
6	840410		Auxiliary plant for use with boilers of 84.02 or 84.03	***Waste Management and Water Treatment,*** Waste Management, Recycling and Remediation ***Waste Management and Water Treatment,*** Management of Solid and Hazardous Waste and Recycling Systems ***Environmental Technologies, Carbon Capture and Storage,*** Efficient Consumption of Energy Technologies
	8405		**Producer gas or water gas generators, with or without their purifiers; acetylene gas generators and similar water process gas generators, with or without their purifiers**	
7	840510		Producer gas or water gas generators, with or without their purifiers; acetylene gas generators and similar water process gas generators, with or without their purifiers	***Air Pollution Control*** ***Renewable Energy,*** Renewable Energy ***Waste Management and Water Treatment,*** Waste Water Management and Potable Water Treatment ***Environmental Technologies, Carbon Capture and Storage,*** Efficient Consumption of Energy Technologies
	8406		**Steam turbines and other vapour turbines**	
8	840681		Turbines for marine propulsion: Of an output exceeding 40 MW	***Renewable Energy,*** *Renewable Energy*
	8409		**Parts suitable for use solely or principally with the engines of heading 84.07 or 84.08**	
9	840999		other: other	***Air Pollution Control*** ***Environmental Technologies, Carbon Capture and Storage,*** *Efficient Consumption of Energy Technologies* ***Environmental Technologies, Carbon Capture and Storage,*** *Noise and Vibration Abatement*
	8410		**Hydraulic turbines, water wheels, and regulators therefor**	
10	841011		Hydraulic turbines and water wheels of a power not exceeding 1,000 kW .	***Renewable Energy,*** *Renewable Energy* ***Environmental Technologies, Carbon Capture and Storage,*** *Efficient Consumption of Energy Technologies*
11	841012		Hydraulic Turbines and Water Wheels, Power 1, 000-10, 000kw	***Environmental Technologies, Carbon Capture and Storage,*** *Efficient Consumption of Energy Technologies*
12	841090		Hydraulic turbines, water wheels, and regulators ; parts, including regulators	***Renewable Energy,*** *Renewable Energy* ***Environmental Technologies, Carbon Capture and Storage,*** *Efficient Consumption of Energy Technologies*

HS Code			Description	Category
8411			**Turbo-jets, turbo-propellers and other gas turbines**	
13	841181		Other gas turbines of a power not exceeding 5,000 Kw	***Renewable Energy,*** *Renewable Energy* ***Environmental Technologies, Carbon Capture and Storage***, *Efficient Consumption of Energy Technologies* ***Others,*** *Environmentally Preferable Products based on End-Use or Disposal Characteristics*
14	841182		Other gas turbines of a power exceeding 5,000 kW	***Renewable Energy***, *Renewable Energy,* ***Environmental Technologies, Carbon Capture and Storage,*** *Efficient Consumption of Energy Technologies* ***Others,*** *Environmentally Preferable Products based on End-Use or Disposal Characteristics*
8418			**Refrigerators, freezers and other refrigerating or freezing equipment, electric or other; heat pumps other than air conditioning machines of heading 84.15**	
15	841861		Other refrigerating or freezing equipment; heat pumps: Compression-type units whose condensers are heat exchangers	***Renewable Energy,*** *Renewable Energy*
8419			**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**	
16	841919		Instantaneous or storage water heaters, non-electric: other	***Renewable Energy***, *Renewable Energy*
17	841950		Heat exchange units	***Renewable Energy,*** *Renewable Energy* ***Environmental Technologies, Carbon Capture and Storage***, *Gas Flaring Emission Reduction, Efficient Consumption of Energy Technologies* ***Environmental Technologies,*** *Heat and Energy Management*
8479			**Machines and mechanical appliances having individual functions, not specified or included elsewhere in this Chapter**	
18	847989		other machines and mechanical appliances: other	***Air Pollution Control*** ***Waste Management and Water Treatment***, *Management of Solid and Hazardous Waste and Recycling Systems* ***Renewable Energy***, *Renewable Products and Energy Source*
8502			**Electric generating sets and rotary converters**	
19	850231		other generating sets: Wind-powered	***Renewable Energy,*** *Renewable Energy* ***Renewable Energy***, *Renewable Products and Energy Source*
8504			**Electrical transformers, static converters (for example, rectifiers) and inductors**	
20	850410		Ballasts For discharge lamps or tubes	***Environmental Technologies, Carbon Capture and Storage,*** *Efficient Consumption of Energy Technologies*
8537			**Boards, panels, consoles, desks, cabinets and other bases, equipped with two or more apparatus of heading 85.35 or 85.36, for electric control or the distribution of electricity, including those incorporating instruments or apparatus of Chapter 90, and numerical control apparatus, other than switching apparatus of heading 85.17**	
21	853710		For a voltage not exceeding 1,000V	***Renewable Energy,*** *Renewable Energy*
8541			**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**	
22	854140		Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes.	***Renewable Energy,*** *Renewable Energy* ***Renewable Energy***, *Renewable Products and Energy Source*
9001			**Optical fibres and optical fibre bundles; optical fibre cables other than those of heading 85.44; sheets and plates of polarising material; lenses (including contact lenses), prisms, mirrors and other optical elements, of any material, unmounted, other than such elements of glass not optically worked**	
23	900190		other	***Renewable Energy,*** *Renewable Energy*
9002			**Lenses, prisms, mirrors and other optical elements, of any material, mounted, being parts of or fittings for instruments or apparatus, other than such elements of glass not optically worked**	
24	900290		other	***Renewable Energy***, *Renewable Energy*
9027			**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**	
25	902730		Spectrometers, spectrophotometers and spectrographs using optical radiations (UV, visible, IR)	***Environmental Technologies,*** *Environmental Monitoring, Analysis and Assessment Equipment*
9032			**Automatic regulating or controlling instruments and apparatus**	
26	903210		Thermostats	***Environmental Technologies,*** *Environmental Monitoring, Analysis and Assessment Equipment* ***Environmental Technologies, Carbon Capture and Storage,*** *Gas Flaring Emission Reduction, Efficient Consumption of Energy Technologies*

Source: WTO (2011)

Table A2 Price Elasticity of Import Demand for WTO Core List EGs by Country[a]

Country code	Country	Elasticities for WTO core list [b]		Country code	Country	Elasticities for WTO core list [b]
ALB	Albania	-1.0690		KGZ	Kyrgyzstan	-0.9862
ARE	U.Arab E	-0.8732		KIR	Kiribati	-1.0498
ARG	Argentina	-2.0026		KNA	St. Kitts & N.	-1.0420
ARM	Armenia	-1.1089		KOR	Korea, Rep.	-1.9046
ATG	Antigua	-1.0689		LBN	Lebanon	-1.9080
AUS	Australia	-2.5865		LCA	St. Lucia	-1.0479
AUT	Austria	-3.0459		LKA	St. Lanka	-1.2854
AZE	Azerbaijan	-1.0435		LSO	Lesotho	-1.0569
BDI	Burundi	-1.2463		LTU	Lithuania	-1.1779
BEL	Belgium	-1.3555		LUX	Luxembourg	-1.2105
BEN	Benin	-1.1386		LVA	Latvia	-1.0530
BFA	Burkina	-1.2153		MAC	Macau	-1.1138
BGD	Bangladesh	-1.4816		MAR	Morocco	-1.2135
BGR	Bulgaria	-1.0656		MDA	Moldova	-1.0567
BHR	Bahrain	-1.1166		MDG	Madagascar	-0.9264
BHS	Bahamas	-0.9566		MDV	Maldives	-0.9733
BLR	Belarus	-1.0517		MEX	Mexico	-1.2275
BLZ	Belize	-1.0156		MKD	Macedonia	-1.1269
BMU	Bermuda	-0.9959		MLI	Mali	-1.1925
BOL	Bolivia	-1.0888		MLT	Malta	-1.0971
BRA	Brazil	-3.2292		MNG	Mongolia	-1.0744
BRB	Barbados	-1.0331		MUS	Mauritius	-1.1125
BRN	Brunei	-1.0806		MWI	Malawi	-0.9804
BWA	Botswana	-1.1857		MYS	Malaysia	-1.0600
CAF	C. African R.	-0.9155		NAM	Namibia	-0.9767
CAN	Canada	-1.7936		NCL	Caledonia	-0.9184
CHE	Switzerland	-2.1300		NER	Niger	-1.4023
CHL	Chile	-1.3695		NGA	Nigeria	-2.0446
CHN	China	-1.4050		NIC	Nicaragua	-0.9561
CIV	Cote dl.	-1.2708		NLD	Netherlands	-2.3959
CMR	Cameron	-1.5452		NOR	Norway	-2.1213
COG	Congo	-1.1587		NPL	Nepal	-1.1100
COL	Colombia	-1.5595		NZL	New Zealand	-1.5888
COM	Comoros	-0.9909		OMN	Oman	-1.1045
CPV	Cape Verde	-1.0438		PAN	Panama	-1.3271
CRI	Costa Rica	-1.4291		PER	Peru	-1.9263
CYP	Cyprus	-1.0164		PHL	Philippines	-1.3327

Country code	Country	Elasticities for WTO core list [b]		Country code	Country	Elasticities for WTO core list [b]
CZE	Czech R.	-1.0760		PNG	Papua N. Guinea	-1.0296
DEU	Germany	-3.2181		POL	Poland	-1.2545
DMA	Dominica	-1.0329		PRT	Portugal	-2.0297
DNK	Denmark	-1.4441		PRY	Paraguay	-0.9752
DZA	Algeria	-1.4897		PYF	French Poly	-1.0551
EGY	Egypt	-1.8969		ROM	Romania	-1.1335
ESP	Spain	-1.9921		RUS	Russia	-1.2636
EST	Estonia	-1.0144		RWA	Rwanda	-0.9246
ETH	Ethiopia	-1.4766		SAU	Saudi Arabia	-1.0767
FIN	Finland	-1.5754		SDN	Sudan	-2.1288
FRA	France	-3.6680		SEN	Senegal	-1.0214
GAB	Gab on	-1.0458		SGP	Singapore	-1.0298
GBR	Great Britain	-2.4722		SLV	El Salvador	-1.1595
GEO	Georgia	-1.1580		SUR	Surinam	-1.0058
GHA	Ghana	-1.1221		SVK	Slovakia	-1.0838
GIN	Guinea	-1.2464		SVN	Slovenia	-1.2519
GMB	Gambia	-1.2306		SWE	Sweden	-2.0791
GRC	Greece	-1.5046		SWZ	Swaziland	-1.0785
GRD	Grenada	-0.9969		SYC	Seychelles	-1.1431
GRL	Greenland	-1.0899		TCD	Chad	-1.3777
GTM	Guatemala	-1.1251		TGO	Togo	-1.4505
GUY	Guyana	-1.0595		THA	Thailand	-1.2421
HKG	Hong Kong	-2.0802		TKM	Turkmenistan	-1.0013
HND	Honduras	-1.0033		TTO	Trinidad & T	-1.2156
HRV	Croatia	-1.1478		TUN	Tunisia	-1.1431
HUN	Hungary	-1.3916		TUR	Turkey	-1.2311
IDN	Indonesia	-0.9863		TWN	Taiwan	-1.2888
IND	India	-5.3548		TZA	Tanzania	-1.1320
IRL	Ireland	-1.9056		UGA	Uganda	-1.1016
IRN	Iran	-1.8830		UKR	Ukraine	-1.3995
ISL	Iceland	-1.1455		URY	Uruguay	-2.6737
ISR	Israel	-4.1185		USA	United States	-9.0974
ITA	Italy	-3.2881		VCT	St. Vincent & G.	-1.0277
JAM	Jamaica	-1.1621		VEN	Venezuela	-1.9034
JOR	Jordan	-1.2030		ZAF	South Africa	-2.6441
JPN	Japan	-16.6622		ZMB	Zambia	-1.1386
KAZ	Kazakhstan	-1.3115		ZWE	Zimbabwe	-1.4795
KEN	Kenya	-1.1261				

Source: Authors' calculations based on *Kee et al* (2010).

Notes:

a. The WTO core list comprises of 26 products at the HS six digit level. However, price elasticity data for products 840681 and 850231 are not available for all countries.

b. Simple average. For our simple average calculations, we did not include products at the HS six digit level which price elasticity data are not available.

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