

Environmental Goods and Services Series



# Climate-related Single-use Environmental Goods



By **Rene Vossenaar**,  
Independent Consultant



International Centre for Trade  
and Sustainable Development

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ICTSD welcomes feedback on this document. These can be forwarded to Joachim Monkelbaan, [jmonkelbaan@ictsd.ch](mailto:jmonkelbaan@ictsd.ch)

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## LIST OF ABBREVIATIONS AND ACRONYMS

ARRA	American Recovery and Reinvestment Act
CFL	Compact fluorescent lamp
CN	Common Nomenclature (European Communities)
EE	Energy efficiency
EG	Environmental good
EGS	Environmental Goods and Services
FiT	Feed-in Tariff
GHG	Greenhouse gas
GHP	Geothermal heat pump
GW	Gigawatt
GWEC	Global Wind Energy Council
HS	Harmonised System
HTSUS	Harmonised Tariff Schedule of the United States
HVAC	Heating, ventilation and air conditioning
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
LED	Light-emitting diode
MEPS	Minimum energy performance standard
MFN	Most Favoured Nation
MW	Megawatt
NGV	Natural Gas Vehicle
NTB	Non-tariff barrier
PV	Photovoltaic
RE	Renewable energy
REHC	Renewable-energy heating and cooling
RFS	Renewable Fuel Standards
SWH	Solar water heating
TERI	Tata Energy Research Institute (India)
USEPA	US Environmental Protection Agency
USITC	United States International Trade Commission
WITS	World Integrated Trade Solution (World Bank software)

## FOREWORD

Addressing climate change and energy security requires massive and rapid deployment of more efficient, cleaner technologies that promote clean growth and economic gain. Carefully crafted trade policies could contribute to a rapid diffusion and transfer of clean technologies around the world and provide new incentives for innovation and investment in climate-friendly technologies.

The elimination or reduction of tariff barriers and non-tariff barriers can contribute to the diffusion of energy efficiency (EE) and the use of renewable energy (RE) technologies by reducing the costs of associated products and components and may also provide trading opportunities, including for developing countries. However, building consensus on how the WTO negotiations could make the best possible contribution to harnessing such potential through trade liberalisation has proven to be complicated.

In particular, defining climate-related environmental goods (EGs) and identifying these goods in existing tariff classifications (in particular the Harmonised System) poses many challenges. Certain products that have multiple uses because the potential environmental benefits of trade liberalisation may be uncertain are of particular concern. It may be easier to build a broad consensus around goods with an exclusive or predominantly environmental use, as potential environmental benefits are more certain.

The purpose of this issue paper is to support public understanding of the possible environmental, trade and developmental implications of the WTO negotiations on environmental goods and services (EGS), in particular for developing countries, by analysing the specific case of climate-related single-use (EGs). This note analyses the identification of predominantly single-use EGs linked with climate-related technologies and also analyses corresponding trade flows, tariffs and Non-tariff barriers (NTBs). However, the intention of this paper is not to identify an exhaustive list of climate-related single-use EGs.

In sum, this paper looks whether trade liberalisation of climate-related single-use environmental goods could contribute to a more balanced outcome on EGS in the WTO negotiations.

This paper is based on ICTSD'S mapping exercise of commercially available technologies and goods as well as those undergoing R&D (with a strong prospect of commercialization in a five- to 10-year time horizon) in three sectors: renewable energy supply, buildings, and transport. Once peer reviewed by Intergovernmental Panel on Climate Change lead experts, these mapping studies set the stage for customs classification and a subsequent detailed analysis of their market drivers, trade flows, and trade barriers. The mapping study for the renewable energy supply, residential and commercial buildings and transportation sectors were prepared by experts from the Energy Research Centre of the Netherlands ("ECN"), the Energy and Resources Institute (TERI), India and the Energy Research Institute (ERI), China respectively. These sectors have been identified by the Intergovernmental Panel on Climate Change ("IPCC") as some of the critical sectors for mitigation of greenhouse gas (GHG) emissions.

The views expressed in this paper are those of the author and do not necessarily reflect the views of ICTSD or the funding institutions. The full version of the mapping studies as well as detailed analyses on international trade are available or will be made available shortly on [www.ictsd.org](http://www.ictsd.org).

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Development (UNCTAD). Since his retirement in March 2005, he has carried out work for UNCTAD and other institutions as an independent consultant as well as a resource person.

The paper is part of a series of issue papers commissioned in the context of ICTSD's Global Platform. One of the objectives of the Platform is to provide options for identifying and liberalizing trade in climate-friendly environmental goods and services that effectively contribute to sound environmental management while preserving developing countries' ability to promote industry and economic development. We hope you will find this paper to be stimulating and informative reading and useful for your work.



Ricardo Meléndez-Ortiz  
Chief Executive, ICTSD



## EXECUTIVE SUMMARY

Larger deployment of climate-friendly technologies and products offers the potential for environmental, developmental and trade gains. Yet building consensus on how the WTO negotiations on EGS could make the best-possible contribution to harnessing such potential through the reduction or elimination of tariffs and non-tariff barriers (NTBs) facing climate-related environmental goods (EGs) has been difficult.

Some argue that tariff liberalisation alone will have little impact on the deployment of climate-friendly technologies in developing countries if it is not implemented as part of broader strategies that include targets, incentives and regulations aimed at creating markets. Furthermore, tariffs may often be a less important factor influencing trade in climate-related EGs than NTBs and subsidies, but these have so far received little attention in the EGS negotiations.

Defining climate-related EGs poses conceptual and practical challenges. The potential environmental benefits of certain multiple-use products may be uncertain. There are only a very few cases where climate-related goods have a perfect match with a particular 6-digit Harmonized System (HS) code.<sup>2</sup> Proposed climate-related EGs defined as “ex-out” items may represent only a very small portion, if any, of trade under the provisions of a particular tariff item, making it difficult to assess the pros and cons of trade liberalisation.

The purpose of this issue paper is to help build understanding of the potential benefits of liberalising trade in a sub-set of “single-use” climate-related EGs. These are loosely defined here as goods that are used predominantly for climate-related purposes. It is not the intention to propose a specific subset of climate-related EGs or any specific negotiating approaches, but rather to facilitate a more reliable and transparent analysis.

Examples of internationally traded climate-related single-use EGs include goods used in harnessing renewable energy (such as photovoltaic (PV) cells and modules, wind turbines, and hydraulic turbines), renewable energy products (such as biofuels), products that use renewable energy (RE) as an energy source (such as geothermal heat pumps (GHPs)) and materials used for the insulation of buildings.

The trade analysis excludes “multiple-use” products. It includes “ex-out” items and components only if it can be assumed that trade in such products (recorded at 6-digit HS level) is to a reasonable extent driven by the deployment of climate-related technologies. The following products have been included: wind turbines solar PV devices; solar water heaters (SWH); bio-ethanol; certain hydraulic turbines; certain buildings insulation materials; heat pumps; thermostats; compact fluorescent lamps; and electric vehicles.

Autonomous measures implemented in different developing countries indicate that there is no one-size-fits-all strategy for tariff liberalisation for all countries and for all EGs. While import tariffs in developed countries and some developing countries are very low, some developing countries want to keep a certain level of tariff protection for finished products – most climate-related single-use EGs are finished products – to build up local capacities, which can then be reduced over time (as in India in the case of wind turbines). Some other developing countries are looking to reduce tariffs on finished products for some time to meet national RE targets while domestic manufacturing capacities develop (as in South Africa in the case of SWH). Developing countries may need a certain period of time to address possible trade-offs with a view to enabling them to participate in and benefit from trade liberalisation as pursued in the EGS negotiations.

Trade in single-use EGs may face different NTBs. These include local-content requirements and differing industrial standards and certification requirements. Trade in biofuels for instance is affected by high import tariffs on fuel ethanol, varying fuel-quality standards for biodiesel, subsidies to domestic producers and, increasingly, sustainability regulations. Biofuel certification may help provide assurance that certified biofuels contribute to net GHG reductions on a life-cycle basis, but may also act as an NTB.

Subsidies and incentives may have implications for international trade. On the one hand, they have been instrumental in creating demand, including for EGs imported from developing countries. On the other hand, subsidies and incentives aimed at strengthening manufacturing capacities may affect the opportunities for manufacturers, including in developing countries, to participate in international supply chains.

The global market for climate-related EGs is significant and has been growing, even during the recession. The global market for wind turbine installations was about US\$ 63 billion in 2009. More than 38 GW of new wind power capacity was installed in 2009, i.e. 32 percent more than in 2008 (GWEC, 2010). The solar photovoltaics market (including modules, system components, and installation) reached US\$36 billion in 2009. Grid-connected PV capacity additions increased from 5.9 GW in 2008 to 7 GW in 2009. However, due to declining solar PV prices, industry revenue was 6 percent lower than in 2008. The Biofuels market (global production and wholesale pricing of ethanol and biodiesel) reached USD 45 billion, an increase of 29 percent compared to 2008 (Clean Edge, 2010).

World trade in all selected products was around US\$ 50 billion in 2008, with PV cells and modules (HS 854140) accounting for around 60 percent (all trade figures exclude intra-EU trade). Developing country exports in these products were almost US\$ 30 billion.

The period 2004-2008 provided a favourable context for trade in climate-related EGs: world trade increased by 80 percent and renewable-energy markets were growing quickly (e.g. annual grid-connected solar PV capacity additions increased from 900 MW in 2004 to 2,600 MW in 2008 and annual wind-power capacity additions increased from 8,2 GW to 26,3 GW in 2008). World exports of PV devices were worth US\$ 30.5 billion in 2008. Chinese exports showed a spectacular growth, lifting China's participation in world exports to 39 percent in 2008, from 6 percent in 2004. In the same period the value of world exports of wind turbines increased eight-fold, to US\$ 3.3 billion, with the developing-country share increasing from less than 4 percent in 2004 to over 30 percent in 2008.

The exponential growth in developing country exports (in particular of wind turbines and PV devices) lifted their share in world exports of climate-related single-use EGs from 34 percent in 2004 to 59 percent in 2008 (all trade figures are based on COMTRADE and exclude intra-EU trade). This compares to an increase of the developing country share in world exports of manufactured products increased from 40 percent in 2004 to 46 percent in 2008.

Markets were driven largely by regulations and incentives in developed countries. Most of the increase in developing-country exports of PV devices was triggered by increased EU imports, which in turn were the result of increased demand driven by incentives (in particular feed-in tariffs). In 2008, EU imports accounted for more than half the value of world imports, of which three quarters originated in developing countries (mostly China). In the case of wind turbines, US imports accounted for almost two thirds of the increase in world trade in the period 2004-2008.

In the period 2004-2008, developing country imports of climate-related EGs increased at a slower pace than in developed countries, but still faster than developing countries' total imports of manufactured products. Developing countries made less use of subsidies to create demand for climate-related EGs and enhanced domestic manufacturing capacities. The share of developing countries in world imports shrank to 33 percent in 2008, from 44 percent in 2004. Actually, developing countries as a group became net exporters (USD 12 billion in 2008), after having registered a trade deficit of USD 2.3 billion in 2004. This is largely due to China. Excluding China, developing countries turned a USD 1.4 billion trade deficit in single-use EGs in 2004 into only a small trade surplus (USD 260 million) in 2008.

These figures require careful interpretation. A significant portion of companies exporting from developing countries are subsidiaries of transnational corporations or nationally owned companies that operate as contract manufacturers or under licensing agreements with foreign companies. In some cases exports represent very little value added. Some Central American and Caribbean countries import "wet" bio-ethanol from Brazil and Europe and export dehydrated ethanol to the US market. Assembling of imported intermediate goods may have played a relatively important role in the increase of Indian exports of PV devices. The strong increase in developing-country exports may have resulted in a significant increase in imports of components, which, in most cases, have been excluded from the definition of single-use EGs. On the other hand, there are indications that exports generated increased value added in developing countries. For example, developing country exports of solar PV devices (HS 854140 includes both finished products, such as panels and modules, and intermediate products, such as solar cells), increased three-fold whereas their imports increased "only" two-fold. This may indicate that local manufacturing capacities expanded through the solar PV supply chain.

It is unclear whether these trends will continue. Some factors may be worth considering:

- a significant portion of the rapidly increasing demand for certain EGs in developed countries may initially have been met by imports. However, the import content of demand for these EGs may fall over time as domestic production capacities increase, including in response to incentives provided through stimulus packages. For example, the import content of the US wind turbines market which peaked 64 percent in 2006, declined to 34 percent in 2008 and 32 percent in 2009 (David, 2010);
- subsidies and other incentives may be discontinued or reduced over time;
- a significant part of future additions to installed capacity may take place in large developing countries, such as China and India, which are less likely to import large quantities of finished products, in part because they already have expanded manufacturing capacity to supply export markets;
- new markets may also arise. For example, in 2009, 13 developing countries other than China collectively added 1.4 GW of installed wind-energy capacity (GWEC, 2010).

A growing number of developing countries are adopting RE targets and creating domestic market for associated products and components. Some developing countries have a competitive edge in certain technologies. Therefore many developing countries have a larger stake in the EGs negotiations than earlier on in the EGS process. Products of interest to developing countries at different levels of development need to be further explored, e.g. products associated with rural RE technologies. Only in a very few cases is there an (almost) perfect match between climate-related EGs and particular 6-digit HS codes. The pros and cons of liberalising trade in many "ex-

out” EGs are difficult to assess. There is no one-size-fits-all strategy for tariff reductions. Tariff liberalisation alone will have little impact on the deployment of climate-friendly technologies in developing countries if targets, incentives and regulations aimed at creating markets are not yet in place. Developing countries need flexibility to identify products that offer the best possible opportunities for harnessing environmental and developmental gains by liberalising trade. The EGS negotiations should pay more attention to NTBs and potentially trade-distorting subsidies.

## 1. INTRODUCTION

### 1.1 Background

The WTO negotiations on Environmental Goods and Services (EGS) seek to reduce or eliminate tariff and non-tariff barriers (NTBs) on EGS. Products and components associated with the deployment of climate-friendly technologies constitute an important sub-category of environmental goods (EGs). There is a large convergence of views in both developed and developing countries that promoting energy efficiency (EE) and the use of renewable energy (RE) are essential for climate mitigation and offers the potential for environmental, developmental (including in terms of access to energy) and trade gains.<sup>3</sup> The elimination or reduction of tariff barriers and NTBs can contribute to the diffusion of RE and EE technologies by reducing the costs of associated products and components in the domestic market and may also provide trading opportunities, including for developing countries.<sup>4</sup> Yet building consensus on how the WTO negotiations could make the best-possible contribution to harnessing such potential through trade liberalisation has proven to be complicated.

A number of factors have been suggested that may help explain why progress in the EGS negotiations has been slow:

- tariff liberalisation alone will have little impact on the deployment of RE and EE technologies in developing countries if it is not implemented as an integral part of broader policies and strategies that include targets, incentives and regulations, which may need to be supported by international cooperation to share knowledge of climate-friendly technologies and to provide financing and capacity-building (Jha, 2009). Creating markets for climate-friendly technologies may be far more important than just improving market-access conditions for associated products;
- some developing countries, in particular those with sufficiently large domestic markets, want to keep a certain level of tariff protection (at least for some time) to build up local capacities, where economically viable, to supply goods linked with the deployment of RE and EE technologies. They argue, as well, that tariff protection may also be needed to attract FDI and absorb climate-related technologies (Vossenaar and Jha, 2010 and Ratna, 2010);
- defining climate-related EGs and identifying these goods in existing tariff classifications (in particular the Harmonised System) poses considerable conceptual and practical challenges. Of particular concern are certain products that have multiple uses because the potential environmental benefits of trade liberalisation may be uncertain. Even where liberalising trade may help stimulate competition, fast-tracking products that may not have clear environmental benefits under the EGS mandate (which aims at deeper tariff cuts than in the WTO market-access negotiations) may be difficult to justify;
- many of the discussions so far have focused on tariff liberalisation. However, tariffs may often be a less important factor than NTBs and subsidies (Jha, 2009; Kirkegaard, Hanemann and Weischer, 2009). Yet NTBs and subsidies have received relatively little attention in the negotiations and in research on EGS; their implications are not yet well understood. Markets for RE technologies are often distorted by subsidies, preferential procurement policies, local-content provisions and other measures. Some have argued that the effects of tariffs and subsidies have to be addressed in conjunction with a view to establishing a level playing field (Jha, 2009);
- developing countries have often expressed concern that it may be difficult to achieve a balanced outcome of the EGS negotiations because developed countries

already have very low tariffs and larger capacity to provide subsidies and other incentives to stimulate the uptake of RE and EE technologies (including in the context of economic stimulus packages), whereas developing countries generally have higher tariffs and less capacity to provide incentives to stimulate technology deployment. This is an issue of particular concern where the environmental benefits of trade liberalisation are uncertain (e.g., in the case of many multiple-use products).

Some have argued that it may be easier to build a broad consensus around goods with an exclusive or predominantly environmental use, as potential environmental benefits are more certain. This note discusses potential trade, environmental and developmental implications (in particular for developing countries) of trade liberalisation in goods associated with the deployment of climate-related technologies (in particular RE and EE technologies). Climate-related single-use EGs that are traded internationally include, for example, goods used in harnessing renewable energy (such as photovoltaic cells and modules, wind turbines, and hydraulic turbines), renewable energy products (such as liquid and solid fuels made from biomass), alternative-fuel vehicles (which reduce transport-related CO<sub>2</sub> emissions) and materials that are exclusively or predominantly used for the insulation of buildings. Certain energy-saving products (such as energy-saving lamps) could, under certain conditions, also be considered climate-related single-use EGs.<sup>5</sup>

For convenience purposes, these goods will be referred to hereafter as “climate-related single-use EGs” (or sometimes briefly “single-use EGs”).

## 1.2 Objectives and Issues Addressed

The objective of this note is to support public understanding of the possible environmental, trade and developmental implications of the WTO negotiations on EGS, in particular for developing countries, by analysing the specific

case of climate-related single-use EGs. This note analyses both pragmatic and substantive issues involved in the identification of predominantly single-use EGs linked with climate-related technologies, in particular in existing tariff classifications. It also analyses, to the extent possible, corresponding trade flows, tariffs and NTBs. It is not the intention of this paper to propose a specific subset of climate-related EGs or any specific negotiating approaches in the context of the EGS negotiations. It is also not the intention to identify an exhaustive list of climate-related single-use EGs.

Key issues addressed in this note include:

- Which climate-related single-use EGs can be identified in tariff classifications, in particular the 6-digit HS? What single-use EGs (that are relevant from an international trade perspective) could be identified as “ex-out” items?
- What are the principal market drivers of climate-related single-use EGs and what are the implications for international trade flows?
- What are the tariff and non-tariff obstacles to trade?
- What are the benefits and possible drawbacks of focusing trade liberalisation on finished products?
- Could trade liberalisation of climate-related single-use EGs contribute to a more balanced outcome on EGS in the negotiations?

## 1.3 Definition and Practical Considerations

Single-use EGs are defined here as goods that are used exclusively or predominantly for environmental purposes (in this paper that is defined as climate mitigation, including enhanced energy efficiency and increased use of renewable sources of energy). This definition excludes “multiple-use” goods, which may have both environmental and non-

environmental applications. This is based on two considerations. First, in the case of many multiple-use products the potential environmental benefits of trade liberalisation are less certain. Second, it is difficult to know whether and to what extent trade in multiple-use products is driven by climate-related technologies. Since one objective of this note is to explore possible links with international trade, single-use EGs are included only if available tariff schedules (including at national or regional levels) or other data can provide some indication of international trade in these goods.

Certain issues must be addressed in selecting the single-use EGs, in particular the treatment of “ex-out” items and components:

- *ex-out items.* Ideally, single-use EGs should be defined at the 6-digit HS level (an example is HS 850231: wind-powered generation sets). This facilitates the analysis of trade flows that may help trade negotiators in weighing the pros and cons of tariff reductions and would also make it easier to implement possible commitments at the international level. There are only a very few cases where there is an (almost) perfect match between an EG associated with climate-related technologies and the products that are included in a particular 6-digit HS code. In practice, certain single-use EGs may need to be defined as “ex-out” items. Each internationally traded product can be assigned as an “ex-out” item to a particular 6-digit HS code (e.g., for customs purposes). However, certain single-use EGs defined as “ex-out” may represent only a very small portion, if any, of the imports and exports of all products included under a particular tariff item, and this portion may vary from one trading partner to the other. Therefore, “ex-out” items are included in the analysis only where additional data are available (e.g., more detailed national or regional tariff classifications) to provide a reasonable indication that trade in the products in question may be driven by the deployment of climate-related technologies;<sup>6</sup>
- *components.* Most single-use EGs are finished products. One issue to be addressed is whether certain components could also be considered “single-use” EGs. Components typically have applications in several end-use sectors and, in general, would not qualify as products with “single environmental use”. For example, whereas gearboxes incorporated into wind-turbines could be considered to have an environmental use, not all gearboxes incorporated in other goods do.<sup>7</sup> Still, there are certain components, such as electronic control components, that, while being applied in several end-use sectors, are predominantly used to make energy use more efficient or to facilitate RE generation. Such components could be considered single-use EGs.<sup>8</sup> The question then remains is whether such components can be identified in tariff classifications.<sup>9</sup> One example analysed in this note is programmable thermostats, which are used extensively for heating, ventilation and air-conditioning (HVAC).

#### 1.4 Some Substantive Considerations

The analysis presented in this note focuses on specific climate-related single-use EGs, most of which are finished products. Yet in analysing the costs and benefits of trade liberalisation as well as the implementation of liberalisation measures at the national level, supply chain considerations may at times also play a role.

Whereas developing countries are interested in larger and less-costly access to single-use EGs (with more certain environmental benefits), there may still be important differences in strategies to achieve this. Some developing countries may find it more cost-effective to facilitate imports of finished products, including by reducing or eliminating tariffs. This may be the case of many smaller developing countries. Other developing countries believe that the best strategy to secure the long-term availability of specific climate-friendly equipment and components

is to strengthen domestic manufacturing capacities by reducing or eliminating import tariffs on key intermediate products and machinery rather than on finished products. In the longer term, tariff reductions of both finished and intermediate products may help to reduce costs and stimulate innovation.

There is no one-size-fits-all strategy for all countries and all RE sources. Countries will weigh options for enhancing domestic availability of specific climate-related EGs based on a number of factors, such as market size, access to technology, availability of intermediate products and raw materials, current climate policies and regulatory regimes, and many other factors.

Focusing tariff liberalisation on finished products may affect tariff structures and, in some cases, result in negative effective rates of protection. This may be an issue of concern to developing countries that are promoting the deployment of RE technologies at the national level and have sufficiently large markets to develop domestic manufacturing capacities across the supply chain. For example, until recently Brazil applied a zero MFN rate on imports of wind turbines (the applied rate had been reduced from 14 percent to zero percent in 2007), but a 14-16 percent rate on importable components (e.g., towers, blades, ball bearings, gear boxes, generators and motor parts).<sup>10</sup> One consideration in Brazil's decision in 2009 (in the context of a recent wind-energy auction) to increase its MFN applied rate on wind turbines with capacity of up to 3,300kVA from zero to 14 percent was to provide an incentive to manufacturers who operate globally to set up production facilities in Brazil.<sup>11</sup>

In certain cases, developing countries with a sufficiently large domestic market to develop cost-effective manufacturing capacities at different stages of the supply chain may be more interested in liberalising imports of certain intermediate products (such as solar cells, silicon ingots, gear boxes and electronic control equipment) rather than of finished products. For example, one of the objectives

of India's Jawaharlal Nehru National Solar Mission is to transform India into a solar-energy hub with a leadership role in low-cost, high-quality solar manufacturing across the supply chain, including the balance of system components. The National Solar Mission therefore recommends that concessions be made in import and excise duties on specific capital equipment, critical materials and components, and project imports.

The issue of tariff liberalisation for finished products versus tariff liberalisation for intermediate products may also be important for small developing countries, as is illustrated by the discussion, in a recent ICTSD paper, on Barbados's policy concerning solar water heaters (SWHs) and related inputs under the CARIFORUM-EU Economic Partnership Agreement (EPA) (Niles, 2010). Barbados applies high tariffs to imports under the provisions of HS 841919 (which includes SWHs),<sup>12</sup> but allows duty-free access for almost all materials that are used in the construction and repair of SWH with a view to boosting local manufacture of SWHs. HS 841919 has been altogether excluded from liberalisation via the EPA. With regard to inputs, even in cases where CARIFORUM as a group had chosen to reduce their harmonised tariff rates gradually via the EPA, Barbados has scheduled an exception to the harmonised tariff by allowing immediate duty-free access into its market. An example is HS 900290, which includes glass mirrors used for solar concentration systems.

Another issue is the timing (and sequencing) of tariff liberalisation. Some developing countries may want to keep a certain level of tariff protection for finished products to build up local capacities, which could then be reduced over time to provide an incentive to manufacturers to invest in research and development in order to reduce costs and eventually become globally competitive. Some other developing countries are looking to reduce tariffs on finished products for some time to meet national RE targets while domestic manufacturing capacities develop. For example, South Africa has set a target to install more than three million SWH systems



over the next five years. The government's policy is to develop local industry, but due to the lack of local production capacity, SWH must be imported in the short- to medium-term future (Tudor-Jones, 2009). The National Solar Water Heating Workshop<sup>13</sup> recommended that, while the local manufacturing industry is developing, duties on imported SWHs should be lowered to ensure that SWH installation targets are met.

These examples show that even where single-use EGs may be identified, different countries may have different stakes in the depth and speed of, for example, negotiated tariff reductions. This suggests the need for a high degree of flexibility in the negotiating process and the implementation of possible commitments at the national level.

### 1.5 Methodology

The note builds on technology mapping studies commissioned by ICTSD for the supply of renewable energy, residential and commercial buildings, and the transport sector. It also builds on lists of climate-related EGs proposed by WTO Members and a list of 43 climate-friendly goods published by the World Bank.

Ideally, products with "single environmental use" would find a perfect match in specific 6-digit HS codes. (Since common HS codes for almost all countries are available at the 6-digit level, this greatly facilitates an analysis of international trade flows, based on COMTRADE data). However, very few single-use EGs can be defined at the 6-digit HS level. In order to include certain "ex-out" items in the analysis, more detailed tariff classifications (e.g. at the 8- or 10-digit level) of key trading partners, in particular the United States and the European Union, have been taken into consideration. While the corresponding codes and product descriptions differ across countries and it is still not possible to carry out a trade analysis at a global scale, the greater level of product detail used in these classifications allows for the inclusion of a larger number of single-use EGs in the trade analysis.

Products have been selected primarily for illustrative purposes, based on pragmatic considerations (such as the extent to which they can be identified in existing tariff schedules and the availability of data); their current and potential importance in terms of international trade flows; and the desire to include products from different sectors (in particular RE generation, buildings and transport).

The following products are analysed in this note (this is not necessarily an exhaustive list of climate-related single EGs):<sup>14</sup>

- wind turbines (HS 850231);
- solar PV devices and light-emitting diodes (HS 854140);
- solar water heaters (HS ex-841919);
- biofuels (HS ex-220710 and HS ex-220720);
- hydraulic turbines (HS 841011 and HS 841012);
- buildings insulation materials (in particular rock wool (HS 680610); insulating materials and articles (HS 680690); multiple-walled insulating units of glass (HS 700800); and glass-fibre insulation products (HS 701939);
- heat pumps (HS 841861);
- thermostats (HS 903210);
- compact fluorescent lamps (HS 853931), and;
- electric cars and certain hybrid vehicles (HS ex-870390).<sup>15</sup>

### 1.6 Structure of This Note

Section II analyses drivers of RE and EE technology deployment that have direct implications for the production of and trade in single-use EGs as well as policies and measures that can help overcome barriers to EE improvements and the generation of RE. It also analyses international trade flows

corresponding to single-use EGs. Section III analyses in more detail classification and trade issues for selected single-use EGs.

Preliminary conclusions are presented in section IV. The analysis is complemented by a Statistical Annex.

## 2. TRADE FLOWS AND DRIVERS OF TECHNOLOGY DEPLOYMENT

This section analyses drivers of technology deployment and international trade in associated products and components, drawing largely on studies carried out for ICTSD. For illustrative purposes, it starts by showing some trade and tariff information for the single-use EGs defined in this note as a group. It should be taken into account that only one product (PV cells and modules) accounts for approximately 60 percent of world trade in the products included in this group.

### 2.1 Trade Flows

Current trade flows

PV cells and modules (HS 854140) are by far the most important item from a trade point of view, accounting for around 60 percent of world trade in all selected single of environmental use products in 2008 (Table 1). Developing countries accounted for almost 59 percent of world exports (excluding intra-EU27 trade).

**Table 1: Exports of selected single-use EGs**

HS code	Climate-related single-use EG included in the 6-digit HS code	World		Developing countries		
		Value (\$m)	Structure (%)	Value (\$m)	Structure (%)	Share in world exports (%)
2207	Fuel ethanol	4318	8.5	3687	12.3	85.4
680610	Slag wool, rock wool	908	1.8	268	0.9	29.6
680690	Mineral insulating materials	822	1.6	68	0.2	8.3
700800	Multiple walled insulating units	593	1.2	213	0.7	36.0
701939	Glass-fibre insulation products	1213	2.4	375	1.3	30.9
	Subtotal insulation materials	3536	6.9	925	3.1	26.1
841011	Hydraulic turbines < 1 MW	50	0.1	8	0.0	16.7
841012	Hydraulic turbines 1-10 MW	58	0.1	27	0.1	46.9
	Subtotal hydraulic turbines	109	0.2	36	0.1	63.7
841861	Heat pumps	1916	3.8	358	1.2	18.7
841919	Non-electrical water heaters	969	1.9	504	1.7	52.0
850231	Wind-powered generating sets	3335	6.5	1010	3.4	30.3
853931	Compact fluorescent lamps	3625	7.1	3091	10.4	85.3
854140	PV devices	30513	59.8	19460	65.2	63.8
870390	Electric vehicles	1137	2.2	70	0.2	6.2
903210	Thermostats	1528	3.0	721	2.4	47.2
	<b>Total</b>	<b>50986</b>	<b>100</b>	<b>29861</b>	<b>100</b>	<b>58.6</b>

Source: COMTRADE

Developing countries dominate exports of CFLs and biofuels and accounted for almost two thirds of world trade in PV devices in 2008. Their participation in world exports of electric vehicles, mineral insulation materials and heat pumps was low.

The number of single-use EGs analysed in this note is smaller than the number of 6-digit HS codes for the climate-related EGs included in proposals by WTO Members and a list of 43 climate-friendly goods published by the World Bank. This is because the latter include multiple-use products and some other goods, including several ex-out items that have not been included in the analysis of single-use EGs (because it was difficult to make a reasonable assessment of the extent to which trade might be driven by the deployment of climate-related technologies).

The annex compares the set of selected single-use EGs with a broader (100) set of 6-digit HS codes, which together represented over USD 300 billion of world exports (excluding intra-EU trade) in 2008 (Table A.1).<sup>16</sup> This captures much more than actual trade in relevant

products and components.<sup>17</sup> First, most 6-digit HS codes include unrelated products. Second, in the case of components, total trade under the provisions of a particular 6-digit HS code is included, although only a small part, if any, may be related to the deployment of renewable energy technologies and products (see Jha, 2009). Whereas trade in single-use EGs is also overestimated, the margin of error is much smaller. This is precisely why the trade analysis focuses on single-use EGs. In 2008, world exports (excluding intra-EU trade) of the set of single-use EGs analysed in this note represented 16 percent of world exports of all products listed in the Annex; for developing countries as a group it was 23 percent.

#### Some Trends

Developing-country exports of single-use EGs increased strongly in the period 2004-2008, driven largely by the exponential growth in exports of wind turbines and PV devices, lifting the share of developing countries in world exports (excluding intra-EU trade) of single-use EGs from 34 percent in 2004 to 59 percent in 2008 (Table 2).<sup>18</sup>

**Table 2: Developing country shares in world exports of single-use EGs**

	2004	2005	2006	2007	2008
World exports (excluding intra-EU trade), in USD millions					
- All products	20728	23745	31735	37417	50986
- PV devices	10331	11751	14696	19536	30513
- Wind turbines	561	1104	2467	2803	3335
- Other	9835	10890	14572	15077	17138
Exports of developing countries, in USD millions					
- All products	6977	9271	14437	18898	29861
- PV devices	3612	4629	6790	10807	19460
- Wind turbines	20	66	285	525	1010
- Other	3345	4576	7361	7565	9391
Developing country shares in world exports: percentage (%)					
- All products	34	39	45	51	59
- PV devices	35	39	46	55	64
- Wind turbines	4	6	12	19	30
- Other	34	42	51	50	55

Source: COMTRADE

These trade figures have to be interpreted carefully. In some cases exports represent very little value added.<sup>19</sup> For example, some Central American and Caribbean countries import “wet” bio-ethanol from Brazil and Europe and export dehydrated ethanol to the US market.<sup>20</sup> In some countries, the PV exports result largely from assembling imported PV cells. On the other hand, trade figures expressed in value terms may hide strong price (and exchange-rate) fluctuations. For example, since prices of PV panels have fallen, recent trade flows expressed in value terms underestimate the growth in import demand for PV panels.<sup>21</sup> In fact, in 2009, EU imports of PV devices from outside the EU declined 3 percent in value (euro) terms, but the volume of imports (weight) increased by 53 percent.<sup>22</sup>

Markets for climate-related single-environmental-use EGs have been driven largely by regulations and incentives in developed countries, resulting in strongly increased import demand in the period 2004 to 2008. In developing countries, imports of climate-related single-use EGs also increased (slightly faster than total imports of manufactured products), but at a slower pace than in developed countries. One reason for this difference could be that developing countries have made less use of subsidies and other incentives to create markets for climate-related EGs.<sup>23</sup> Since the growth in imports of climate-related single-use EGs lagged behind

that of world imports of these goods, the share of developing countries in world imports shrank to 33 percent in 2008, from 44 percent in 2004. Actually, developing countries as a group became net exporters (USD 12 billion in 2008), after having registered a trade deficit of USD 2.3 billion in 2004. This is largely due to China. Excluding China, developing countries turned a USD 1.4 billion trade deficit in single-use EGs in 2004 into only a small trade surplus (USD 260 million) in 2008.

Again, trade figures must be considered carefully. The strong increase in developing-country exports of single-use EGs may have resulted in a significant increase in imports of components, which, in most cases, have not been taken into account (components, in general, have been excluded from the definition of single-use EGs used in this paper).<sup>24</sup> On the other hand, there are indications that single-use exports have generated increased value added in developing countries. In the case of solar PV devices (HS 854140 includes both (almost) final products, such as solar PV panels and modules, and components, such as PV solar cells), for example, developing country exports increased three-fold whereas their imports increased “only” two-fold. This may be an indication that local manufacturing capacities expanded throughout the supply chain.<sup>25</sup> Between 2004 and 2008, the value of developing-country imports for every dollar of exports fell from 56 to 36 dollar cents.<sup>26</sup>

**Table 3: Developing country imports, import share and trade balance for single-use EGs**

	2004	2005	2006	2007	2008
Imports (USD millions)					
World imports	21295	25288	33024	39632	54916
Developing country imports	9321	10965	13368	15164	17909
Developing country trade balance	-2344	-1694	1069	3734	11951
Share of developing countries in world imports (%)					
	44	43	40	38	33

Source: COMTRADE

It is unclear whether these trends will continue. Some factors may be worth considering:

- a significant portion of the rapidly increasing demand for certain EGs, such as wind and solar energy equipment, in developed countries in the period 2004 to 2008 may initially have been met by imports. However, the import content of demand for single-environmental EGs may fall over time as domestic production capacities increase, including in response to incentives provided through stimulus packages. Investment incentives to manufacturers and informal barriers to trade may have attracted foreign companies to set-up local production capacities in importing countries;
- subsidies and other incentives may be discontinued or reduced over time. They may also contribute to erratic market developments, as is illustrated by the exponential growth (in 2008) and subsequent contraction (in 2009) of Spanish imports of PV cells and modules (see section III);
- a significant part of future additions to installed capacity may take place in large emerging economies, such as China and India. These countries are less likely to import large quantities of finished products, in part because they already have expanded manufacturing capacity to supply export markets. In 2009, China and India independently announced plans to expand their solar power capacities to 20,000 MW each by 2020. If these plans move forward, Asia will become a major market for solar energy equipment after several years of expanding manufacturing capacity;

Similarly, China added more new wind-energy capacity than any other country (and the EU) in the 2009, but imports of wind turbines have been relatively small and declining (average annual imports fell by almost two thirds, from USD 314 million in 2006-2007 to USD 108 million in 2008-2009).<sup>27</sup>

## 2.2 Tariffs and Non-Tariff Barriers (Ntbs)

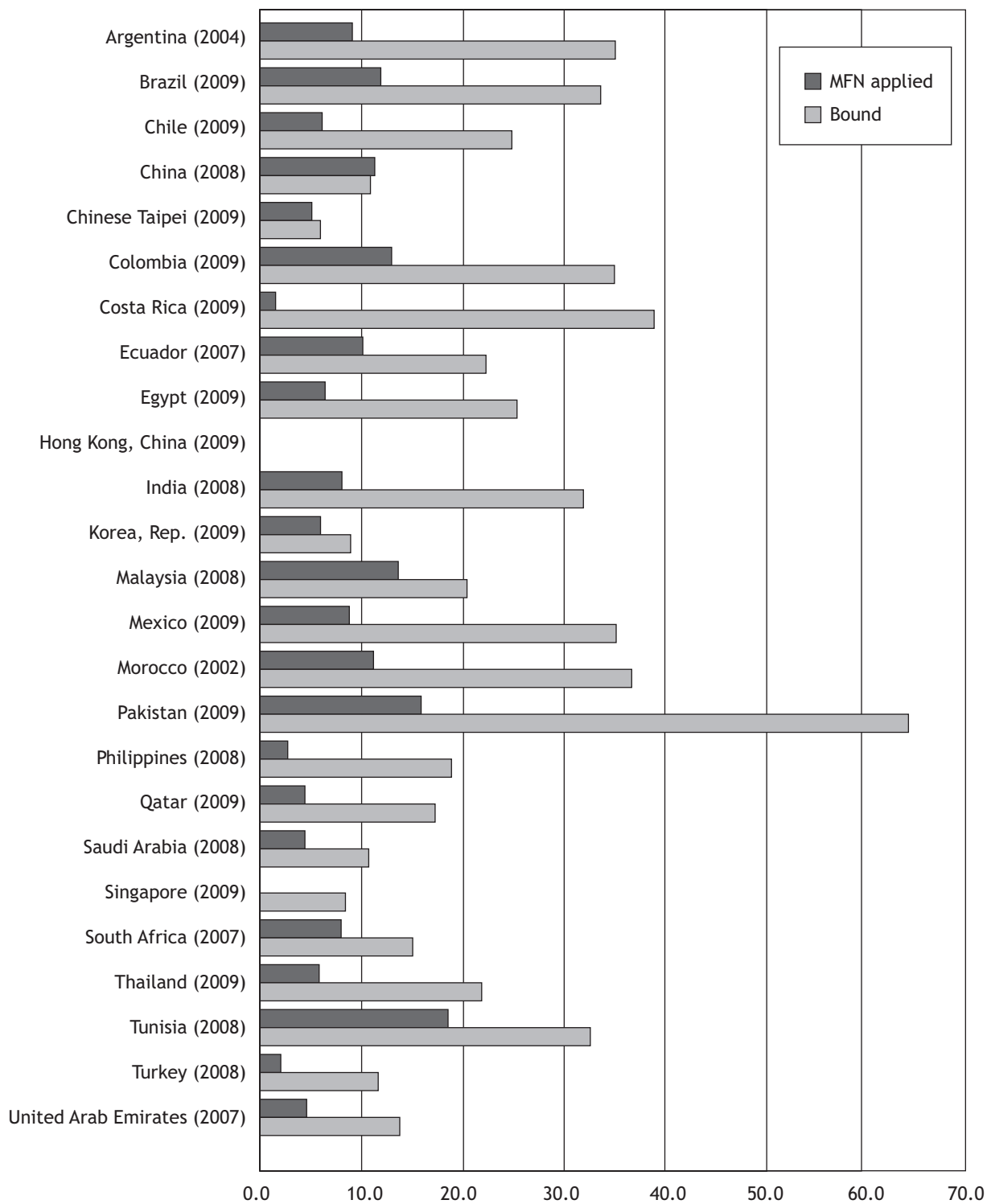
### Tariffs

MFN applied tariffs in developed countries are very low. Some developing countries also have very low tariffs. In most developing countries, however, MFN applied rates are more significant. This includes some large emerging economies that have used tariff protection to support the development of domestic capacities to manufacture products associated with the deployment of RE technologies. In China, for example, MFN applied tariffs on single-environmental EGs<sup>28</sup> are mostly in the 8 to 12 percent range and the simple average is close to 10 percent. In India, most MFN applied tariffs are either 7.5 or 10 percent, with a simple average of 8 percent. In Brazil, the simple average of MFN applied rates is around 12 percent.

Simple average tariffs on single-use EGs (excluding bioethanol and electric vehicles) as a group in 25 developing countries are shown in Figure 1.

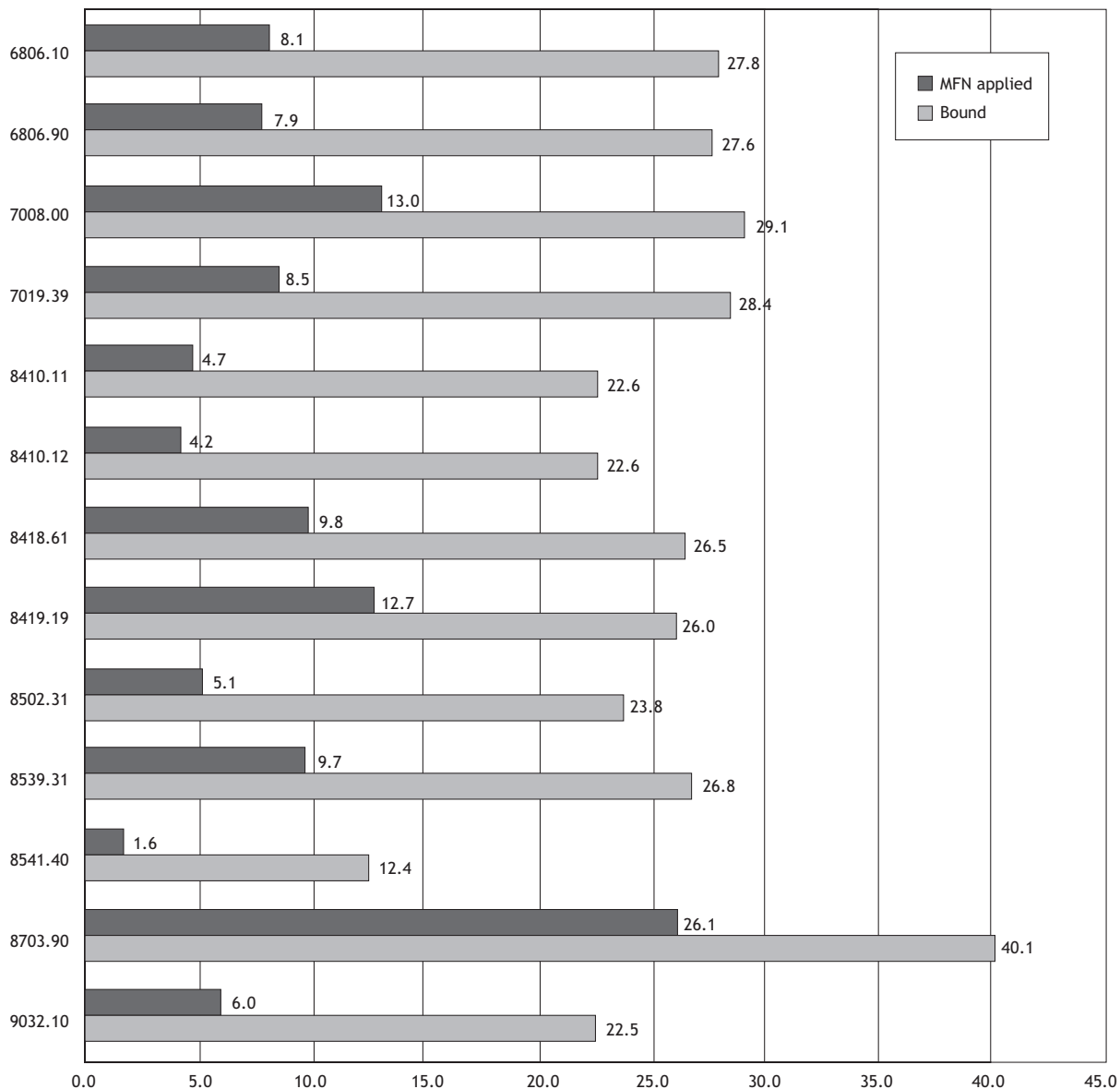
The simple average of tariffs applied in 25 developing countries in each of the single-environmental EGs analysed in this paper are shown in Figure 2. On average, tariffs on solar PV and wind turbines are quite low. Tariffs on imports of electric vehicles are, on average, very high.

**Figure 1: Tariffs on single-use EGs in 25 developing countries**  
(Excluding HS 2207 and HS 870390)



Source: WTO Tariff Download Facility (accessed in April 2010)

Figure 2: Simple average tariffs on selected single-use EGs in 25 developing countries



Source: WTO Tariff Download Facility (accessed in April 2010)

### Non-tariff barriers (NTBs)

Trade in single-use EGs may face different NTBs. These include:

- local-content requirements (in both developed and developing countries). These have been applied, for example, in the wind-energy sector, and are increasingly used for solar-energy projects;
- differing industrial standards and certification requirements. These may affect several categories of EGS, including wind turbines, PV panels and heat pumps;
- political quid-pro-quo expectations may exist, in principle, in cases wherein governments provide subsidies and other incentives. These governments may seek to ensure maximum benefits for domestic industries and employment, for example through local-content provisions or through informal pressure, especially when such incentives are provided through stimulus packages;
- trade in biofuels is affected by high import tariffs on fuel ethanol, varying fuel-quality standards for biodiesel, subsidies to domestic producers and, increasingly, sustainability regulations.



Subsidies and certain other incentives may also have implications for trade. These include, for example:

- feed-in electricity tariffs (see below);
- government subsidies (e.g. grants, tax credits, preferential loans, loan guarantees) for residential installation of RE equipment and EE improvements, productive capital, and for the production of renewable-energy-based electricity or “renewable” fuels.

Subsidies and incentives may have implications for international trade. On the one hand, they have been instrumental in creating demand for single-use EGs, including, in some cases, for EGs imported from developing countries (as is shown in the previous section). On the other hand, subsidies and incentives aimed at strengthening manufacturing capacities may affect the opportunities for manufacturers, including in developing countries, to participate in international supply chains. For example, the American Recovery and Reinvestment Act of 2009 (ARRA) created a 30-percent Advanced Energy Manufacturing Tax Credit (MTC)<sup>29</sup> and authorised the Department of Treasury to award \$2.3 billion in tax credits for qualified investments in advanced energy projects, to support new, expanded, or re-equipped manufacturing facilities located in the United States (e.g. for solar energy, wind energy, fuels cells, advanced batteries, hybrids and geothermal heat pumps).<sup>30</sup>

### 2.3 Policies and Measures

RE technologies and systems are unlikely to be widely deployed unless they become cheaper than fossil-fuel alternatives or if policies to support their uptake are adopted (IPCC, 2007). Such policies include:

- economic instruments such as GHG taxes, tradable emission permits and fiscal incentives;
- policy targets for renewable energy;
- renewable portfolio standards (which require electricity providers to obtain a minimum percentage of their power from renewable energy resources by a certain date);
- feed-in tariffs to encourage the deployment of RE technologies for electricity generation. These are typically implemented through government legislation that obliges electric utilities to buy electricity generated from renewable sources at above-market rates (usually set by the government);
- regulations (e.g. making the installation of solar water heating (SWH) equipment in certain buildings mandatory in building codes);
- quality standards and certification of manufacturers and service providers.

With regard to EE technologies, high energy prices generally stimulate demand for energy-efficient products. However, there are many obstacles to the implementation of EE improvements. To help overcome these obstacles, many developed and developing countries have implemented regulatory requirements, in particular, minimum energy performance standards (MEPS), and mandatory energy labelling. EE requirements in building codes and incentives for building renovations may stimulate demand for insulation materials and the replacement of inefficient HVAC for more efficient models. Fiscal incentives and subsidies (including in the context of stimulus packages, as in Japan) also drive demand for certain energy-efficient products.

### 3. KEY SINGLE-USE ENVIRONMENTAL GOODS

This section provides a short analysis of salient issues with respect to each of the single-environmental EGs related to climate-friendly technologies. These cover, in particular:

- definition and classification issues;
- technology aspects;
- specific policies and measures (beyond the generic policies and measures listed in section II);
- trade flows and market drivers; and
- tariffs and NTBs.

#### 3.1 Wind Turbines

Global installed wind-energy capacity has been growing faster than that of any other RE technology. Of particular importance are wind turbines, which harness the power of the wind and use it to generate electricity.<sup>31</sup>

HS 850231 (wind-powered generation sets) is one of the very few 6-digit HS codes that includes only single-use EGs associated with the deployment of RE technologies. The Global Wind Energy Council (GWEC) estimates that the global market for wind turbine installations was worth about USD 63 billion in 2009. More than 38 GW of new wind power capacity was installed in 2009 (32 percent more than in 2008).

From 2004 to 2008, the value of world exports of wind turbines increased eight-fold, to USD 3.3 billion (excluding intra-EU trade), with the developing-country share increasing from less than 4 percent in 2004 to over 30 percent in 2008. India and China (which started exporting in 2007) accounted for 85 percent of total developing country exports.<sup>32</sup> Tariffs and other policy measures had helped these countries develop domestic manufacturing capacities.<sup>33</sup>

US imports accounted for almost two thirds of the increase in world trade in the period 2004 to 2008. A United States International Trade Commission (USITC) study found that between 1998 and 2005 US imports of wind turbines were closely correlated with annual changes in US wind-energy capacity installations, although that correlation has subsequently weakened, largely as a result of a rise in domestic manufacturing (USITC, 2009). The Chinese market has also grown rapidly and, in 2009, China added more new capacity (13.8 GW) than any other country (and even the European Union as a whole). Compared with the United States, in China and the European Union capacity additions seem to have had much smaller impacts on imports.<sup>34</sup> Chinese imports of wind turbines are relatively small and have been falling in recent years. China introduced a 70 percent local-content requirement in 2004, when most of turbines in the then very small Chinese market were imported. However, this requirement was abolished in 2009 (GWEC, 2010). Large capacity additions in the EU have generated only relatively modest imports from outside the EU.

More than three quarters of global wind power additions in 2009 were concentrated in just five countries: China, the United States, Spain, Germany and India. Yet, wind power may become one of the most ubiquitous renewable-energy technologies. Apart from China and India, various developing countries have been developing wind energy capacity (or are planning to do so) and may therefore have a stake in the EGS negotiations. In 2010, 13 other developing countries collectively added 1.4 GW of installed capacity.<sup>35</sup> These countries are, in descending order: Turkey, Brazil, Chile, Morocco, Mexico, Republic of Korea, Taiwan, Egypt, Costa Rica, Nicaragua, Tunisia, Iran, Kenya, Argentina and Jamaica (GWEC, 2010). Some indicators of accumulated and newly installed wind energy capacities, imports and tariffs are presented in Table 4.

Table 4: Installed wind-energy capacity, wind turbine imports and import duties

	Installed capacity (MW)		Imports of wind turbines in 2008 (USD m)	Tariffs on wind turbines (HS850231)			
	End of 2009	Additions in 2009		MFN Applied		Bound	
				Rate	Range*	Rate	Range*
United States	35064	9996	2679.1	2.5		2.5	
European Union	74767	10163	106.0	2.7		2.7	
Canada	3319	950	545.2	0.0		6.2	
China	25805	13803	189.3	8.0		8.0	
India	10926	1271	2.3	7.5		25.0	
Brazil**	606	264	121.7	0.0		35.0	
Chile	168	148	15.3	6.0		25.0	
Costa Rica	123	50	25.5	0.0		45.0	
Egypt, Arab Rep.	430	65	0.7	5.0		10.0	
Korea, Rep.	348	112	102.2	8.0		n/a	
Mexico	202	117	85.4	10.0	0-20	37.5	35-40
Morocco	253	119	0.2	2.5		30.0	
Taiwan	436	78	90.9	10.0		10.0	
Tunisia	54	34	..	30.0	17-42	30.0	17-42
Turkey	801	343	285.0	1.4	0-2.7	13.6	12.8-14

Source: GWEC, *Global Wind Energy Outlook 2009*, COMTRADE and WTO Tariff Download Facility.

\* Where more than one national tariff position exists.

\*\* In 2009, Brazil increased its MFN applied tariff on wind turbines with capacity of up to 3,300 kVA from zero to 14 percent.

MFN applied tariffs in developing countries are, on average, quite low (5 percent). Tariff protection may have played some role in supporting the development of manufacturing capacities in India and China (more important in the latter case were local-content requirements). Some smaller developing countries installing wind energy capacity (e.g. Egypt, Costa Rica and Morocco) apply zero or low import duties, as does Turkey (Table 4).

A recent study for the World Resources Institute (WRI) found that formal and informal non-tariff barriers that distort investment decisions, rather than import tariffs, are the principal obstacles to global integration in the wind-energy industry (Kirkegaard, Hanemann and Weischer, 2009).

### 3.2 Solar Cells and Panels

Solar energy is emerging as an important source of energy due to its numerous environmental and economic benefits as well as its proven and reliable technologies. Photovoltaic (PV) power, which is used for grid-connected systems and off-grid systems (predominantly in developing countries), has been experiencing high growth rates and, as a consequence, costs are generally declining.<sup>36</sup> China and some other developing countries have become important producers and exporters of solar PV devices.

Photovoltaic (PV) cells, whether assembled in modules or made up into panels, form part of HS 854140, which also includes light-emitting diodes (LEDs). The whole 6-digit HS code is

considered to pass the “single environmental use” test because LEDs can also be considered climate-related EGs. Moreover, trade in PV cells and modules seem to make up a large portion of trade in all goods included in HS 854140 (The EU classification breaks down the 6-digit HS code into LEDs and “other” (CN 85414090); the latter – which excludes the LEDs – accounted for 93 percent of total imports under HS 854140 in 2007-2009).<sup>37</sup>

Solar PV installed capacity has increased rapidly in recent years. The global solar PV market, measured by annual capacity additions, was 5.4 GW in 2008. The EU has the largest solar PV market. Germany is the market leader, although in one year (2008) Spain added far more capacity. In early 2009 it was feared that the global PV market might contract (following the fast growth in

the previous year and as a result of several factors, including the economic recession and the reduction of incentives). The market showed signs of overcapacity and prices were falling sharply. However, the market showed resilience and is reported to have grown in terms of new capacity additions in 2009. Long-term prospects are good: under the IEA 450 Policy scenario installed solar capacity would grow by 15 percent per year until 2030.

World exports (excluding intra-EU trade) were USD 30.5 billion in 2008. Chinese exports showed a spectacular growth, lifting China’s participation in world exports to 39 percent in 2008, from 6 percent in 2004. Other developing countries roughly maintained their share in world exports, implying that China’s gains in market share came largely at the expense of developed country exports.

**Table 5: Exports of PV devices (HS 854140), 2004-2008 (Excluding intra-EU trade, in USD millions)**

	2004	2005	2006	2007	2008
World	10331	11751	14696	19537	30513
China	644	1258	2460	5252	11745
Japan	4629	4796	5199	5472	6190
Taiwan	1175	1403	1689	2580	4002
EU27, excl. intra-EU	689	764	1073	1260	2027
United States	1193	1298	1298	1582	1976
Korea, Rep. of	317	315	422	563	805
Malaysia	793	844	1004	1068	749
India	87	94	134	213	529
Developing countries	3612	4629	6790	10807	19460
As a share of world exports (excluding intra-EU trade),%					
Developing countries	35.0	39.4	46.2	55.3	63.8
- China	6.2	10.7	16.7	26.9	38.5
- Other developing countries	28.7	28.7	29.5	28.4	25.3

Source: COMTRADE

Most of the increase in developing-country exports was triggered by increased EU imports, which in turn were the result of increased demand driven by incentives (in particular Feed-in tariffs). In

2008, EU imports accounted for more than half the value of world imports (excluding intra-EU trade), of which three quarters originated in developing countries (Table 3).<sup>38</sup>

**Table 6: Imports of PV devices (HS 854140), 2004-2008**

	2004	2005	2006	2007	2008
EU imports as a share of world imports (%)	26	30	33	40	51
Imports from developing countries as a share of total EU imports from outside the EU (%)	45	41	49	62	74

Source: COMTRADE

PV modules may continue to provide market opportunities for developing countries, but there is a need to assess how certain developments may affect competitiveness, in particular: (a) the decline in PV module prices; (b) the reduction of incentives (e.g. for residential installation of PV modules) in key markets (such as Germany); and (c) increased manufacturing capacities in developed countries (driven by incentives).<sup>39</sup>

Solar cells and panels enter most markets duty-free. As much as 99.5 percent of the world's solar PV panel imports in 2008 (in value terms and excluding intra-EU trade) enjoyed zero MFN applied rates (for developing-country importers alone this portion was 98.5 percent).

### 3.3 Solar Water Heaters

Solar water heating (SWH) is one of the simplest and least expensive ways to harness renewable energy. SWH systems are made in many (small and large) developing countries.

Solar water heaters are included in HS 841919, which also covers other non-electric water heaters. The United States is the largest import market. The HTSUS breaks HS 841919 down into three 10-digit codes: instantaneous water heaters (HTSUS 8419.19.00.20), solar water heaters (HTSUS 8419.19.00.40); and "other" non-electric water heaters (HTSUS 8419.19.00.60). Solar water heaters accounted for less than 5 percent, in value terms, of all water heaters imported into the US under the provisions of HS 841919 in the period 2006-2008. Most imports of solar water heaters (HTSUS 8419.19.00.40) came from China, but imports under HTSUS 8419.19.00.60 ("other"), mostly from Mexico, were far more important.

The US statistics suggest that solar water heaters may account for only a very small portion of trade in all products included in HS 841919. On this account, it may be difficult to consider HS 841919 as representative of "single-use" environmental EGs. Solar water heaters have nevertheless been included in the analysis because solar water heating (SWH) is a relatively simple technology (to reduce the use of other sources of energy, e.g. natural gas and electricity) that may be deployed in developing countries, even without large subsidies. In China, for example, SWH capacity has been developed without subsidies or low-interest loans to manufacturers, installers or end-users of SWH systems. (China accounted for more than half of the SWH capacity in operation worldwide by the end of 2007). Some developing countries have announced ambitious targets.

Currently, developing-country imports of all products included in HS 841919 are very low: only slightly above USD 200 million in 2008, accounting for only 22 percent of world imports (excluding intra-EU trade). The United States is the largest market. Qatar is the largest developing country importer. There are large differences in MFN rates applied across developing countries. Several developing countries have MFN applied rates of 20 percent or more; these include Argentina, Brazil, Colombia, China, Ecuador, Malaysia and Tunisia.

### 3.4 Biofuels

Biofuels could make an important contribution to future CO<sub>2</sub> savings in the transport sector. Biofuels that contribute to reduced GHG emissions on a life cycle basis and meet sustainable development criteria can help

advance sustainable development.<sup>40</sup> So-called first-generation biofuels include bio-ethanol and biodiesel. Second-generation biofuels, based on lingo-cellulosic biomass, are still undergoing R&D.

Ethyl alcohol (ethanol), included in HS 2207, is used in beverages, industrial applications, and as a fuel. It is not possible to know from trade statistics at the 6-digit HS level how much of internationally traded ethyl alcohol is used for fuel, although it could be assumed that denatured ethyl alcohol (HS 2207.20) is largely not used for beverages. The United States has designated 10-digit HTSUS codes for US imports of undenatured and denatured ethyl alcohol for fuel use (see below). Some other countries, e.g. Australia and New Zealand, also have separate tariff lines for fuel bio-ethanol.

World exports of ethyl alcohol (HS 2207) were worth USD 4.3 billion in 2008, with Brazil accounting for more than half of this (Table A.4). Brazil's share in exports of fuel ethanol is likely even higher. Although imports play a small role in the US market, the United States is the leading importer of ethyl alcohol (if intra-EU trade is excluded), followed by the European Union.

Unlike biodiesel, ethanol is not an industrial product in the WTO context. Nonetheless, Brazil has informally proposed to include ethanol in the EGS negotiations. The removal or reduction of import duties in key markets could have significant impacts on trade. The United States applies an ad valorem tariff of 2.5 percent, but there is a secondary duty of 14.27 U.S. cents per litre (USD 0.54 per gallon). The MFN applied (and the bound) tariff for imports of undenatured ethyl alcohol applied by the European Union is 19.2 euro cents per litre (EUR 19.2 per hectolitre); for denatured ethyl alcohol it is 10.2 euro cents per litre. The ad valorem equivalents of these tariffs have been estimated at 63 and 39 percent respectively (Erixon, 2009).<sup>41</sup> Australia applies a 5 percent ad valorem tariff plus an AUD 0.38143 (USD 0.34) per litre excise tax on imported ethanol, which is refunded to domestic producers but

not on imported volumes. In April 2010, Brazil reduced its MFN applied rate from 20 percent to zero.

Biofuel markets are affected by government support measures and trade restrictions. The Global Subsidies Initiative (GSI) found that by 2006 government support to biofuels in OECD countries (in particular for biofuel facilities, production-related payments and exemption of biofuels from fuel-excise taxes) had reached USD 11 billion a year (GSI, 2006). One of the recommendations of the GSI is to eliminate barriers to trade in biofuels.

Biofuel standards and certification requirements may also affect markets for biofuels.<sup>42</sup> Questions have arisen about the magnitude of the GHG emissions savings associated with switching to biofuels and doubts about the environmental sustainability of certain biofuels. The US Renewable Fuel Standard (RFS), which mandates increasing amounts of "renewable" fuels in the U.S. gasoline supply (almost entirely ethanol), includes sub-quotas for cellulosic ethanol and "advanced biofuels", which are defined as those that decrease GHG emissions by at least 50 percent compared with gasoline. In 2010, the EPA confirmed the qualification of sugarcane ethanol from Brazil as an advanced biofuel (EPA calculations showed that sugarcane ethanol from Brazil reduces GHG emissions compared with gasoline by 61 percent, using a 30-year payback for indirect land use change (ILUC) emissions).

In the EU, the 2009 Renewable Energy Directive, which commits every Member State to reach the same target of a 10 percent share of renewable energy in total energy consumption in the transport sector by 2020, only permits biofuels with high GHG savings to be counted for the national targets.<sup>43</sup> The initial threshold of 35 percent savings compared to petrol and diesel will rise to 50 percent by 2017. The Commission encourages industry, governments and NGOs to set up voluntary certification schemes to guarantee that biofuels sold under the label are sustainable and produced under the criteria set by the Renewable Energy Directive (European Commission, 2010).

This certificate will apply to biofuels produced in the EU and imported biofuels. Biofuels can still be imported without a certificate but these biofuels cannot receive national public support such as tax relief.

#### Tariff classifications

Effective July 2008, the HTSUS includes 10-digit codes for US imports of undenatured and denatured ethyl alcohol for fuel use (2207.10.60.10 and 2207.20.00.10 respectively). US Imports under these items accounted for around 71 percent (in value terms) of total US imports under the provisions of HS 2207 in the period July 2008-March 2010, but this

portion has been falling (from over 90 percent in the third quarter of 2008 to only around 20 percent in the last two quarters). Direct imports from Brazil represented around 50 percent of US imports during the third quarter of 2008, but practically disappeared since then – the result of a decision to stop allowing importers to draw back the duty on ethanol by exporting an equivalent volume of jet fuel.<sup>44</sup> Total US imports of fuel ethanol fell from USD 545 million in the third quarter of 2008 to only around USD 82 million per quarter, on average, in the period 2008-IV to 2010-I). The United States also imported ethyl alcohol for fuel use from Costa Rica, El Salvador, Jamaica and Trinidad and Tobago.<sup>46</sup>

**Table 7: US imports of ethyl alcohol, including fuel ethanol, 2008-III to 2010-IV, in USD million**

		2008 III	2008 IV	2009 I	2009 II	2009 III	2009 IV	2010 I
220710	Undenatured ethyl alcohol	578	139	64	104	193	158	113
2207103000	- For beverage purposes	3	3	4	2	9	5	7
2207106010	- For fuel use	538	107	41	78	152	31	10
2207106090	- Other	36	29	20	24	33	122	96
220720	Ethyl alcohol, denatured	9	10	15	19	22	8	10
2207200010	- For fuel use	6	8	13	16	19	5	8
2207200090	- Other	3	2	2	3	3	2	2
2207	Ethyl alcohol	587	150	79	122	216	166	123
	- For fuel use	545	116	54	94	171	37	19
	Fuel ethanol as a portion of total imports of ethyl alcohol (%)	93	77	68	77	80	22	15

Source: Data compiled from USITC, using the USITC Trade and Tariff DataWeb.

Biodiesel is part of HS 382490, which includes a very large number of unrelated chemical preparations. The availability of specific national and regional tariff lines for biodiesel in the EU and the United States makes it possible to identify imports of biodiesel into these markets. In this context, biodiesel could be a meaningful “single-use” item. Some other countries, e.g. Australia, South Africa and New Zealand have separate tariff lines for biodiesel in their national tariff schedules.

As from 1 January 2012, the HS will have a new provision within heading 27.10 for mineral oils mixed with biodiesel, and a new heading for biodiesel (HS 38.26: Biodiesel and mixtures thereof, not containing or containing less than 70% by weight of petroleum oils or oils obtained from bituminous minerals) in Chapter 38 (heading 38.26).<sup>47</sup>

In the EU a separate code for biodiesel (CN 38249091: fatty-acid mono-alkyl esters (FAMAE))

was introduced effective January 2008. EU import statistics indicate that biodiesel imports under the provisions of CN 38249091 accounted for almost half of total imports under the HS 382490 in 2008 and 2009. Yet the bulk of EU biodiesel imports come from only a few countries, in particular the United States, Argentina, Malaysia, Canada and India.

Imports from the US have fallen dramatically after antidumping and countervailing duties were imposed by the EU in 2009. In the case of EU imports, HS 382490 may be a reasonably good indicator of biodiesel imports from countries such as Argentina, Indonesia and Malaysia, but a very poor indicator of imports from most other trading partners.

**Table 8: EU-27 imports of biodiesel and other products included in HS 382490**

	Imports (USD million)						Biodiesel as a share of all HS 382490 imports (%)
	HS 382490			Biodiesel (CN 38249091)			
	2008	2009	Average	2008	2009	Average	
All (excl. intra-EU)	2811	2071	2441	1334	1000	1167	48
Argentina	76	545	310	65	537	301	97
Canada	14	94	54	2	77	40	74
India	18	23	20	7	14	10	51
Indonesia	133	114	124	116	94	105	85
Malaysia	53	100	77	28	70	49	64
United States	1854	542	1198	1105	189	647	54
All other	663	653	658	11	19	15	2

Source: EC Export Expand Helpdesk

In the United States, the 10-digit HTSUS code for biodiesel is 382490.40.20. US biodiesel imports accounted for almost one third of the value of all US imports under the provisions of HS 382490 in the period 2006 through 2009. Most biodiesel imports came from Argentina, Indonesia and Malaysia. Biodiesel accounted for approximately 95 percent of all imports under the provisions of HS 382490 from these countries.

Biodiesel probably represents only a very small part of developing country imports of all products included in the 6-digit code HS 382490. For the reasons given above, HS 382490 is not included in the trade analysis presented in this note.

### 3.5 Hydraulic Turbines

Small and micro hydropower accounted for more than half of the renewable electric power capacity (excluding large hydropower) existing in developing countries in 2008<sup>46</sup> (REN21, 2009).

The hydro-power sector does not have its own HS codes, but hydraulic turbines may be considered EGs that are specifically relevant to this sector (although hydraulic turbines may also be used for agricultural irrigation), in particular micro (<1 MW) and small (1-10 MW) hydraulic turbines (HS 841011 and HS 841012 respectively).<sup>48</sup>

There is not much international trade in micro and small hydraulic turbines (together they accounted for just over USD 100 million in 2008 (Table A.4). Most trade takes place in HS 841090: parts. Developing countries account for around one third (in value terms) of world exports (excluded intra-EU trade) in 2008. China is a relatively large exporter of small hydraulic turbines. Developing countries play a more important role in imports of hydraulic turbines. The largest developing country importers in 2008 were, in descending order, Turkey, Viet Nam, United Arab Emirates, Morocco, Qatar, India, Algeria, Malaysia, Panama, the Dominican Republic, Mexico and Pakistan (Table A.4). As shown in Figure 1, MFN applied rates in developing countries are, on average, low.



### 3.6 Building-Insulation Products

Good insulation makes an important contribution to energy savings and enhanced comfort in residential and commercial buildings. A variety of building-insulation products are commercially available, such as foamed plastic, fibreglass, rock wool, cellular concrete and cellulose. Some of these products, in particular plastics, also have other applications and cannot be considered single-use EGs. An ICTSD study on the buildings sector identifies four 6-digit HS items as predominantly single-use (Vossenaar and Jha, 2010). These are rock wool (HS 680610); insulating materials and articles (HS 680690); multiple-walled insulating units of glass (HS 700800); and glass-fibre insulation products (HS 701939).<sup>49</sup>

International trade in buildings insulation products may be relatively small and concentrated on regional markets. Large companies may use subsidiaries or joint ventures rather than direct exports to supply foreign markets. Most trade in insulation products is between developed countries. Developing countries accounted for only 28 percent of world exports (excluding intra-EU trade) in 2008 (Table A.4).

Tariffs facing insulation materials are not very high, but may nevertheless be an important cost element. Improved insulation in developing countries requires that inexpensive materials be locally available. Import liberalisation may play a role, in particular if it provides a stimulus for cost-effective local production of building insulation materials.

### 3.7 Efficient Lighting

Very large energy savings are possible in residential and commercial settings when fully commercialised lighting technologies are deployed. Tariff schedules, including at the 6-digit HS level, allow for the identification of energy-efficient light bulbs. One prominent example is the compact fluorescent lamp (CFL), which has its own 6-digit HS code (HS 853139).<sup>50</sup>

A study of the buildings sector carried out for the ICTSD found that the share of energy-efficient lamps in worldwide trade (including developing country imports) increased in 2002-2008. China accounts for 80 percent of world exports excluding intra-EU trade (Table A.4) and has played an important role in market transformation,<sup>51</sup> as have multilateral efforts to help developing countries set up certification mechanisms for high-quality products.<sup>52</sup>

Government interventions, in particular regulations and incentives, are an important driver of the introduction of energy-efficient lighting systems. Several governments, including in developing countries, have taken measures to phase out inefficient lamps through regulations and subsidies to promote their replacement by more efficient ones. Several developing countries (e.g., Argentina, Brazil, Colombia, Egypt, Malaysia, Mexico, Pakistan, the Philippines, Tunisia and South Africa) apply MFN tariffs of more than 10 percent on CFLs.

### 3.8 Heat Pumps

Heat pumps have many functions, such as heating (in the residential and commercial buildings sector) and recovering heat or as an integral part of an industrial process. Heat pumps allow the more efficient use of energy. Geothermal heat pumps (GHPs) specifically use renewable energy. Heat pumps, in particular GHPs, could be considered “single environmental use”. If sold as an entire unit for heating only, heat pumps are classified under HS 841861.<sup>53</sup> This item includes GHPs.<sup>54</sup>

In many developed countries, demand for heat pumps has been driven largely by incentives (such as tax credits). Heat pumps have gained market share. For example, almost half of all electricity-heated homes in Sweden and around 60 percent of new single-family houses in Switzerland are equipped with a heat pump. Demand in many countries may have slowed down in recent years, in part because fewer new houses were constructed. World exports (excluding intra-EU trade) were USD 1.9 billion

in 2008 (down from USD 2.4 billion in 2007). China is the largest importer (Table A.4). MFN applied tariffs in developing countries are relatively high (Figure 2) with several countries applying rates of more than 10 percent (for example, in Brazil, China, Malaysia, Mexico and South Africa).

### 3.9 Control Equipment

To the extent that certain components are generally applied to make energy use more efficient, one could argue that they might, in principle, be included among single-use EGs. One example is automatic regulating thermostats, which are included in HS 903210.<sup>55</sup> Developing countries account for some 47 percent of world exports (excluding intra-EU trade). Mexico and China together account for more than 70 percent of developing country exports (Table A.4).

MFN applied rates in developing countries are generally quite low (5 percent or less), except for Argentina and Brazil (18 percent). The simple average of MFN applied tariffs in 25 developing countries is 6 percent.

#### 3.10 Electric Cars

Alternative-Fuel Vehicles (AFVs) such as hybrid cars, electric vehicles (EV), natural gas vehicles (NGVs), clean-diesel vehicles and hydrogen fuel-cell vehicles (FCVs)<sup>56</sup> may make an important contribution to future CO<sub>2</sub> savings in road transport. All AFVs could, in principle, be considered climate-related single-use EGs. This section focuses on EVs because it is easier to link this category of AFVs with tariff classifications. The analysis also includes full hybrid vehicles and plug-in hybrid electric vehicles (PHEVs).<sup>57</sup>

Electric vehicles for the transport of persons are hidden within HS code 870390 (this is a basket item which includes all vehicles which are not named in other 6-digit codes).<sup>58</sup> It is therefore not possible to know from trade statistics at the 6-digit HS level what

percentage of exports and imports correspond to electric cars. Trade statistics for HS 870390 (Table A.4) do not suggest that exports and, in particular, imports are correlated closely with developments in electric car markets. The Philippines is the largest import market of products included in HS 870390 (Table A.4).<sup>59</sup>

The EU uses a more detailed tariff line (CN 8703.90.10) for “cars with electric motors”. EU trade statistics show that cars with electric motors currently represent only a relatively small share of all trade under HS 870390. This share is even smaller for trade with non-EU27 members (10 to 14 percent, in value terms in the period 2007 to 2009). Electric car manufacturing and trade is very incipient and it may be too early to carry out a trade analysis based on available trade figures.

MFN applied rates for vehicles are quite high in most developing countries (the simple average for 25 developing countries is 26 percent, see figure 2). In almost all countries applied rates for vehicles included in HS 870390 are the same as for other vehicles (HS 870321 - HS 870333). Therefore, lowering tariffs on electric vehicles could, in principle, help to make electric cars more attractive vis-à-vis petroleum-based vehicles (although even allowing electric cars to be imported duty free in most countries might not compensate for the high costs). Domestic taxes and incentives may be more effective for promoting electric cars. In any case, other measures are needed to facilitate the market penetration of electric cars, such as the creation of an electricity-charging infrastructure. Also, most regions do not currently generate enough low-CO<sub>2</sub> electricity to enable electric cars to contribute significantly to large CO<sub>2</sub> reductions (IEA, 2009a).

The ability of electrically driven vehicles to penetrate automobile markets will depend to a large extent on the availability of cost-effective components, e.g. for energy storage. The further development of battery technologies is therefore of critical importance. Lithium-ion (Li-ion) batteries may become the dominant choice within a few years given their technical

advantages over other battery types (IEA, 2008).<sup>60</sup> Lower tariffs on nickel-metal-hydride (NiMH) and Li-ion batteries (which form part of HS 8507.80) may also reduce the cost of electric cars. Certain batteries could, in principle, be considered single-use EG (some batteries

may also be used in other climate-related technologies, such as off-grid solar equipment). Only a small part of Li-ion batteries may be used for electric cars. Here too, it may be too early for a reliable trade analysis based on current trade flows.

## 4. CONCLUSIONS

A discussion on “single-use” EGs, in particular those related to climate strategies, may be a useful exercise. It may contribute to some confidence building in the negotiations on EGs:

- single-use EGs generally have clear environmental benefits (unlike many multiple-use products). Several key single-use EGs allow for a transparent analysis of the potential benefits of trade liberalisation (from an environmental, trade and developmental perspective);
- a growing number of developing countries are adopting national RE targets and taking measures aimed at creating a domestic market for associated products and components. In addition, some developing countries have a competitive edge in certain technologies and have become exporters of single-use EGs. Therefore, possible implications of market-access negotiations are becoming more relevant;
- with regard to trade, it would appear that developing countries (taken together) have been able to significantly increase their participation in world exports in single-use EGs and to gradually reduce a deficit in trade in such products. While this is largely on account of China, some other developing countries, such as Brazil and India have a competitive edge in certain single-use EGs;
- from a development perspective, some developing countries have made progress in building manufacturing capacities across the supply chain, or are considering strategies to do so (for example in the area of SWH).

However, a number of issues may need to be addressed:

- only in a very few cases is there an (almost) perfect match between single-use EGs associated with climate-related technologies and the products that are included in a particular 6-digit HS code. A

larger number of single-use EGs could be defined as ex-out items, but these often represent only a very small portion, if any, of current trade in products included in existing tariff classifications. In such cases, the pros and cons of possible trade liberalisation may be difficult to assess. If the objective of selecting single-use EGs is to enhance public understanding of the potential benefits of trade liberalisation, from an environmental, developmental and trade perspective, single-use EGs that can be defined only as ex-out items should be carefully selected;

- whereas many developing countries have demonstrated their intention to promote the uptake of climate-friendly technologies through the wider dissemination of single-use EGs, there is no one-size-fits-all strategy to achieve this. Many developing countries have already implemented a variety of autonomous tariff liberalisation measures,<sup>61</sup> in some cases to facilitate imports of finished products and in other cases to facilitate imports of intermediate products with a view to promoting the development of domestic manufacturing capacities. (It may be more difficult to link liberalisation of intermediate products with the EGS negotiations, as it involves multiple-use issues). Developing countries may need a certain period of time to address such trade-offs with a view to enabling them to participate in and benefit from trade liberalisation as pursued in the EGS negotiations;
- incentives are expected to continue to play an important role in promoting the deployment of RE technologies. Certain incentives and measures that benefit domestic equipment manufacturers may have implications for the opportunities of developing country producers to participate in global supply chains. This suggests that the possible implications of tariffs, NTBs and subsidies may need to be addressed in conjunction;

- in most cases, whether a specific product could be considered a single-use EG depends on specific conditions. For example, many countries do not currently generate enough low CO<sub>2</sub> electricity to enable electric vehicles to contribute significantly to large CO<sub>2</sub> reductions.

Recommendations:

- developing countries need flexibility to identify products that offer the best possible opportunities for harnessing environmental and developmental gains by liberalising trade;
- whereas the potential environmental benefits of well-defined single-use EGs are generally

clear, in many cases trade negotiators need to make their own judgement on how to deal – for the purposes of the negotiations – with classification issues (including whether and how to define certain “ex-out” items), taking into account specific national objectives and conditions. This again suggests that a high degree of flexibility may be desirable;

- the efforts of developing countries to promote the deployment of climate-friendly technologies need to be supported by international cooperation in sharing knowledge of climate-friendly technologies, financing and capacity building.

## ENDNOTES

- 1 The author is grateful to Ronald Steenblik (OECD) for his feedback and comments.
- 2 The Harmonized Commodity Description and Coding System (HS) of tariff nomenclature is an internationally standardized system of names and numbers for classifying traded products developed and maintained by the World Customs Organization (WCO) and used for WTO negotiations.
- 3 The benefits of the deployment of RE and EE technologies go beyond climate change: they include, for example, lower fossil-fuel imports, reduced air pollution, increased access to energy (including in rural areas), improved quality of products and production processes, opportunities for low-carbon growth and employment, and market opportunities for companies that are in a position to respond to growing demand for climate-related technologies, products, and services.
- 4 For a discussion on the developmental, environmental and trade benefits of liberalising trade in renewable-energy products see, for example, OECD (2006), in particular Chapter 2 (Liberalising Trade in Renewable-Energy Products and Associated Goods).
- 5 This paper includes compact fluorescent lamps which find a perfect match in a specific 6-digit HS code, thereby avoiding conceptual and pragmatic problems involved in using energy efficiency criteria to define environmental goods in the context of the EGS negotiations.
- 6 For example, a windmill pump is clearly a climate-related single-use EG. It is part of HS 841381, which includes other pumps. WTO Members may agree to reduce tariffs only on windmill pumps by defining these pumps as an “ex-out” item. However, windmill pumps may account for only a very small portion of trade in HS 841381 (an analysis of global trade is possible only at the 6-digit HS level). By way of example, the Harmonized Tariff Schedule of the United States breaks down HS 841381 into various sub-positions, including 8413.81.00.30 (Household water systems, self-contained; and windmill pumps). In the period 2007-2009, imports of pumps under the provisions of this 10-digit HTS code accounted for just 1 percent of the value of US imports of pumps included in HS 841381, and windmill pumps were only an (unknown) part of this. Therefore wind pumps are not included in the sample of climate-related single-use EGS defined for the purposes of the trade analysis presented in this note.
- 7 In specific cases studies it would be justified to define certain components as climate-related single-use EGs. For example, a USITC study on the US wind energy sector found that the strong increase of US imports under the provisions of HS 730820 (towers and lattice masts) from USD 41 million in 2003 to USD 944 million in 2008 was driven largely by the strong growth in newly installed wind energy capacity over the same period (USITC, 2009). This example cannot be generalized, as in other countries trade in towers included in HS 730820 may be driven by, for example, the telecommunications sector.
- 8 There are some very important components in terms of both climate policies and trade, but which may be somewhat difficult to label as “climate-related single-use EGs”, such as heat-exchange units (HS 841950), static converters (HS 850440) and control boards (HS 853710).
- 9 The ICTSD technology mapping study of the buildings sector analyses several other electronic control components. While they have been assigned (as “ex-out” items as to

- 6-digit HS codes, it is very difficult to make any judgement on whether trade may (to a reasonable extent) be driven by the deployment of climate-friendly technologies.
- 10 In China and India tariff rates applied to wind turbines are roughly the same as those applied to key components (around 8 in China and 7.5 percent in India).
  - 11 This tariff increase was a national exception to the MERCOSUR Common External Tariff. The bound tariff is 35 percent. The Brazilian government preferred the tariff increase over other measures affecting imports.
  - 12 MFN applied tariffs for 4 tariff items range from 20 to 60 percent; the average rate is 40 percent. The bound rate is 70 percent (WTO Tariff Download Facility).
  - 13 The workshop was organised on behalf of the Department of Minerals & Energy (DME) in February 2009.
  - 14 A study by the OECD, published in 2006, examines the implications of liberalising trade in renewable energy, focusing on several representative fuels and technologies: charcoal, solar photovoltaic systems and their complements, wind turbines and wind pumps, biodiesel, solar-thermal water heaters and geothermal energy systems. See OECD (2006), in particular Chapter 2.
  - 15 In principle, a range of low-carbon vehicles could be considered climate-related, single-use EGs. For practical reasons, this note focuses on electric cars because they can be linked more easily with existing tariff classifications (they are part of HS 870390). Other low-carbon vehicles are included in the trade analysis to the extent that they are classified as part of this 6-digit HS code. As mentioned in section III, a hybrid vehicle, which has two or more distinct power or fuel sources, may be classified under different HS positions. Where an Internal combustion engine (ICE) provides the essential character of the vehicle's power system, it will normally be assigned to the same HS position as a motor vehicle whose sole power or fuel source is an ICE. If the essential character of the vehicle's power system is not an ICE it may be classified under HS 870390. Full hybrid and plug-in hybrid vehicles could perhaps fall into this category.
  - 16 Not included are: (a) a Japanese proposal to liberalise trade in a very large range of motor vehicles that incorporate specific climate-related technologies, in particular natural-gas vehicles (NGVs), hybrid vehicles, electric vehicles and fuel-cell vehicles (FCVs); and (b) a proposal, also made by Japan, to reduce tariffs on a very large range of household appliances and automatic data processing equipment, based on EE criteria. With regard to (a), Japan's proposal covers practically all categories of motor vehicles that may incorporate the specific low-carbon technologies, i.e. vehicles for the transport of persons (HS 8702 and HS 8703), vehicles for the transport of goods (HS 8704) and even special-purpose vehicles (HS 8705). The value of world exports in all vehicles included in the 6-digit HS items referred to in Japan's proposal was USD 435 billion in 2008, but the vehicles actually incorporating the proposed climate-related technologies most likely accounted for only a very small portion of world vehicles trade. It is very difficult to gain any insights on the value and direction of imports and exports of low-carbon vehicles based on existing tariff classifications and trade databases, including at the national and regional levels.
  - 17 A large part of trade in products included in the HS codes listed in Table A.1 corresponds to components that may be used for in the supply of renewable energy. Since the same components may be used for other purposes the trade figures shown may be heavily overestimated.

- 18 This may, in part, reflect the two substantial assets in favour of developing countries in RE: (a) abundant renewable resources (e.g. solar, wind, geothermal and biomass); and (b) in many cases, lower costs of production of associated equipment and components (Vikhlyaev, 2010). Over the same period, the developing country share in world exports (excluding intra-EU trade) of all manufactured products except minerals (HS 28-HS 97) increased from 40 to 46 percent.
- 19 In the case of single-use EGs defined as “ex-out”, the corresponding 6-digit code (for example, HS 841919) includes other, unrelated products.
- 20 A large increase in bio-ethanol exports from Costa Rica, El Salvador, Jamaica and Trinidad and Tobago was matched by a similarly large increase in imports.
- 21 Trade in PV devices may be affected by some double-counting because of intra-regional and intra-firm trade in components, in particular in Asia (HS 854140 includes both finished products and components). However, intra-regional trade among Asian developing countries has been declining as a portion of total PV exports of Asian developing countries.
- 22 This figure is obtained for CN 854140.90, using the EC Export Helpdesk. It may be affected by possible changes in product mix.
- 23 Certain developing countries have provided incentives to stimulate demand for climate-friendly technologies, including through import-duty exemptions. Part of these may have targeted components (which, in general, are not counted as part of single-use EGs) rather than finalised products.
- 24 Certain possible impacts on trade are not taken into account here. For example, increased imports of RE and EE products by developing countries that are heavily dependent on imports of fossil may actually improve their trade balances by reducing expensive fossil fuel imports.
- 25 A significant portion of companies exporting from developing countries are subsidiaries of transnational corporations or nationally owned companies that operate as contract manufacturers or under licensing agreements with foreign companies.
- 26 The experience of India may have been different. Assembling of imported intermediate goods may have played a relatively important role in the increase of Indian exports of PV panels: in the case of products included in HS 854140, in the period 2006-2008 India imported 80 dollar cents for every dollar exported.
- 27 This may in part be explained by the emergence of a competitive local industry (Dong Wu, 2010).
- 28 Excluding bio-fuels and electric cars (the latter product has been excluded because some developing countries have very high import tariffs for cars). Including these tariffs would distort the comparison of tariff levels among developing countries.
- 29 The MTC is also referred to as Section 48C of the Internal Revenue Code.
- 30 The 183 winning projects of the USD 2.3 billion in credits were announced in January 2010: 60 factories supplying the solar energy industry accounted for nearly a third of the selected projects and 46 percent of the awarded funds (US Solar Energy Industries Association (SEIA), 2010). Another 12 percent was allocated to wind energy. ARRA may provide other incentives. For example, manufacturers of advanced battery systems and vehicle batteries (including, for example, advanced lithium ion batteries and hybrid



electrical systems) produced in the United States are eligible for grants up to a total of USD 2 billion.

- 31 Wind mills are used for mechanical power and wind pumps for pumping water or drainage.
- 32 Viet Nam accounted for another 13 percent, consisting largely of exports to the United States. However, US import statistics do not show imports under the provisions of HS 850231 from Viet Nam. US imports from Viet Nam appear under HS 730800, which includes wind towers.
- 33 See, for example, Dong Wu (2010).
- 34 In the case of the European Union, this concerns imports from outside the EU27.
- 35 According to the GWEC, a number of other developing countries had cumulative installed capacity by the end of 2008, but without adding new capacity in 2009: Bangladesh, Cape Verde, Colombia, Lebanon, Jordan, Indonesia, Nigeria, Philippines, Thailand, Sri Lanka, Uruguay and some Small Island Developing States in the Caribbean and the Pacific.
- 36 Other key categories of solar power include solar concentrating power (CSP) and solar water heating (SWH).
- 37 The HTSUS has separate 10-digit codes for solar cells (8541406020 for solar cells assembled into modules or made up into panels and 8541406030 for other solar cells), LED and other photosensitive semiconductor devices. In 2007-2009, solar cells accounted for around 45 percent of all US imports under the provisions of HS 854140 and LEDs for 30 percent.
- 38 Some have argued that developing countries may, in some cases, have been overly dependent on the European market. For example, lucrative opportunities in the Spanish and German markets induced Indian PV module manufacturers to increase export-oriented production capacity: in 2008, Indian exports to these countries grew by a factor of five to more than USD 400 million, i.e. more than three-fourths of total Indian PV exports. China and India are now adopting ambitious targets and introducing incentives to strengthen the domestic market for PV cells and modules. India, for example, could “change from a production hub into one of the largest PV markets in the world” (SolarPlaza, 2010).
- 39 To an extent, declining PV prices and incentives are linked. For example, the decline in PV module prices caused the German government to pursue an additional mid-year cut in incentives in 2010 above and beyond what was already scheduled.
- 40 Bio-fuels have the potential to help advance sustainable development by diversifying energy resources, helping to reduce overall GHG emissions associated with transport and promoting rural development and employment. However, the sustainable development benefits of biofuels are neither intrinsic nor automatic but depend on the type, scale and timing of biofuel development and on the support policy and regulations (ICTSD, 2008).
- 41 In the period 2006-2009, almost half of EU imports of undenatured alcohol came from Brazil (at MFN rates of duty). Imports from Pakistan, the second largest import source over the same period, were also subject to MFN rates of duty. Other important suppliers were Guatemala (the second largest supplier in 2009), Peru, Bolivia, Nicaragua, Costa Rica and Egypt. These countries enjoyed duty-free access.
- 42 For a review of initiatives to design sustainability schemes for biofuels see ICTSD (2008).
- 43 The 2009 Renewable Energy Directive (which will come into effect in December 2010) aims to achieve a 20 percent share of energy from renewable sources in the Community’s

gross final consumption of energy and a 10 percent share of energy from renewable sources in each Member State's transport energy consumption by 2020.

- 44 The US Farm Bill of 2007 eliminated duty drawback on re-exports of fuels and mixtures that do not contain ethanol, effective 1 October 2008. Previously, exported fuels and mixtures were eligible for duty refund on imported ethyl alcohol or an ethyl alcohol mixture even if the re-exported article upon which a drawback claim was based did not contain ethyl alcohol or a mixture of ethyl alcohol (e.g. jet fuel).
- 45 These countries are granted preferential access to the US market under either the Caribbean Basin Economic Recovery Act (CBERA) or the Central America Free Trade Agreement (CAFTA): up to 7 percent of the US ethanol market may be supplied duty-free by ethanol containing no local feedstock. In this case, hydrous ("wet") ethanol produced in other countries, such as Brazil, can be shipped to a dehydration plant in a CBERA country (or Costa Rica or El Salvador, under CAFTA) for reprocessing. Dehydration plants were operating in all four countries.
- 46 A definition of 'biodiesel' is provided for in the new Note 7 to Chapter 38: "For the purposes of heading 38.26, the term "biodiesel" means mono-alkyl esters of fatty acids of a kind used as a fuel, derived from animal or vegetable fats and oils whether or not used".
- 47 At a global scale it accounted for almost one third of the renewable electric power capacity (REN21, 2009).
- 48 Large hydraulic turbines of a power exceeding 10 MW (HS 841013) are often not considered environment-friendly and have been excluded from proposals on EGs.
- 49 Insulation materials are also included in some proposals tabled in the CTESS, but the product coverage differs.
- 50 Light-emitting diodes (LEDs) are also a highly efficient source of lighting. The corresponding 6-digit HS also includes PV cells and panels (which are far more important from a trade point of view). However, the EC and US tariff schedule have separate subheadings for LEDs. The TERI mapping study includes several products that contribute to energy-savings, such as time-scheduled switches, occupancy sensors and daylight-responsive dimming systems that are also mature and fully proven techniques. It is not possible to know whether these devices may represent a reasonable portion of trade under their respective HS code.
- 51 According to the US ENERGY STAR website, out of 260 CFL manufacturers participating in the programme, eighty are located in China.
- 52 Such as the Efficient Lighting Initiative (ELI) supported by the International Finance Corporation and the Global Environment Facility.
- 53 Heat pumps that incorporate a refrigerating unit and a valve for reversal of the cooling-heating cycle (reversible heat pumps) are classified under HS 841581. Some proposals tabled in the EGS negotiations also include heat pumps under HS 841869, but these heat pumps may represent only a very small portion of trade. In the US Harmonized Tariff Schedule, HS 841869 is broken down into various products, including absorption liquid chilling units (8418.69.01.60). An absorption heat pump is essentially an air-source heat pump driven not by electricity, but by a heat source such as solar-heated water, or geothermal-heated water. There are also absorption coolers available that work on the same principle, but are not reversible and cannot serve as a heat source (Wikipedia).

- 54 As of 2007, HS 841861 accurately indicates trade in heat pumps. Previously, trade in some other products was also reported under HS 841861. Starting in 2007, trade in these products has been reported under HS 841869 (consequently trade values corresponding to HS 841861 became much smaller). Although trade values (at the 6-digit HS level) for HS 841861 and HS 841869 are the same whether the 2002 or 2007 version of the HS is used, the above-mentioned reporting practices seem to follow the changes introduced in the 2007 version of the HS:

Other refrigerating or freezing equipment; heat pumps:

	HS 2002	HS 2007
848161	Compression type units whose condensers are heat exchangers	Heat pumps other than air conditioning machines of heading 8415
848169	Other	Other

- 55 While they have other applications, there is some indication that a significant portion of the thermostats included in HS 903210 is used for HVAC and refrigeration. The HTSUS has specific 10-digit codes for automatic thermostats “for air conditioning, refrigeration or heating”: HTSUS 9032.10.00.30 and 9032.10.00.60. US imports under the provisions of these two HTSUS codes represented more than half (in value terms) of all imports under HS 903210 in the period 2006-2008. Around 85 percent of US imports (in value terms) in the period 2006-2008 came from Mexico and China. Control instruments for air conditioning, refrigeration or heating systems are also imported into the United States under the provisions of HTSUS 9032.89.60.15 and HTSUS 9032.89.60.25. However, these imports represented only a small part of all US imports under HS 903289.
- 56 FCVs may be produced commercially beginning around 2020.
- 57 Full hybrid vehicles combine a fuel-driven power source, such as a conventional ICE with an electric drive train (an electric motor and a battery). When an ICE provides the vehicle’s power system its essential character, a hybrid vehicle is normally assigned to the same HS position as a motor vehicle (with the same ignition type and cylinder capacity) whose sole power or fuel source is an ICE (HS 870321- HS 870333). Electric cars, with an electric motor providing the essential character of the vehicle’s power system, are part of HS 870390. Full hybrid vehicles and plug-in hybrid electric vehicles would also be included in the trade analysis to the extent that they are classified as HS 870390.
- 58 A Japanese proposal on electric vehicles also includes buses (HS 8702, motor vehicles for the transport of ten or more persons). Electric buses are hidden within HS 870290. As in the case of vehicles for the transport of persons, this is a basket item. Nevertheless, trade represents only a very small portion of all trade included in HS 8702.
- 59 Imports and exports may include a range of “other” vehicles, including certain NGVs. The tariff schedule of the Philippines, under various subheadings of 870390 (and 870290), includes duty-free imports of components, parts and/or accessories (including both completely built up completely built up (CBU) and completely knocked down (CKD) for assembly of motor vehicles by participants in the Motor Vehicle Development Program (with a certificate from the Board of Investments (BOI)). The tariff schedule explicitly lists: hybrid (electric/gasoline and electric/diesel), electric, flex-fuel (bioethanol and bio-diesel) and compressed natural gas (CNG) vehicles.

- 60 Interestingly, the HTSUS, at the 8-digit level, has dedicated tariff lines for batteries “of a kind used as the primary source of electrical power for electrically powered vehicles of subheading 8703.90”, as follows: other lead-acid storage batteries (HTS 8507.20.40); nickel-cadmium storage batteries (HTS 8507.30.40); Nickel-iron storage batteries (HTS 8507.40.40) and other storage batteries (HTS 8507.80.40). These batteries accounted for less than USD 30 million of average annual US imports on average or 1.6 percent of US imports of all products included in the corresponding 6-digit HTS codes in the period 2006-2009).
- 61 Some developing countries apply relatively high import tariffs at the border, but grant significant fiscal incentives, including for imported products (e.g. internal tax reductions or exemptions). In Brazil, for example, there are fiscal incentives for a range of solar and wind-energy products.
- 62 See notes at the end of this table.

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Table A.1: Selected single-use EGs and other sets of (possible) climate-related EGs

HS code	Description	Set of EGs / products				Trade in 2008, USD million			
		S	ICTSD	WTO	WB (43)	World (excl. intra-EU trade)		Developing countries	
						Exports	Imports	Exports	Imports
220710	Undenatured ethyl alcohol	X	X			3603	3425	3372	929
220720	Ethyl alcohol, denatured	X	X			672	833	272	281
380210	Activated carbon		X			330	297	46	67
382450	Non-refractory mortars and concretes		X			330	297	46	67
382490	Chem. preparations (incl. biodiesel)		X			24005	23272	5372	12348
390210	Polypropylene				X	10298	13814	5094	11502
560314	Nonwovens, weighing > 150 g/m <sup>2</sup>				X	870	753	204	339
680610	Slag wool, rock wool	X	X			908	878	268	272
680690	Insulating materials and articles	X	X			822	808	68	344
681091	Prefabricated structural components		X			653	633	200	166
700800	Multiple-walled insulating units	X	X			593	618	213	116
700991	Glass mirrors, unframed		X			521	530	336	172
700992	Glass mirrors, framed		X			599	999	480	133
701931	Mats			X	X	409	493	94	200
701939	Other glass-fibre insulation products	X	X			1213	805	375	241
711590	Other articles of precious metal		X			2156	2616	430	929
730431	Pipes and tubes		X			1228	1035	449	442
730441	Pipes and tubes		X			2381	2010	864	1,009
730451	Pipes and tubes		X			547	494	252	263
730820	Towers and lattice masts		X	X		2380	3048	1647	1491
730900	Reservoirs and similar				X	3235	2378	1297	1142

Table A.1: *Continued*

HS code	Description	Set of EGs / products				Trade in 2008, USD million			
		S	ICTSD	WTO	WB (43)	World (excl. intra-EU trade)		Developing countries	
						Exports	Imports	Exports	Imports
732111	Solar cooking stoves		X		X	2797	3450	1535	750
732183	Wood-pellet burning stoves		X		X	526	658	211	21
732190	Stoves, parts				X	852	898	456	267
732290	Radiators, solar air heaters		X			718	789	151	72
732490	Water-saving showers				X	811	958	553	310
741121	Tubes/pipes, copper-zinc base alloys		X			682	595	424	268
741122	Tubes/pipes, copper-nickel base		X			424	310	240	155
741129	Tubes/pipes, other		X			388	593	196	398
761100	Aluminium reservoirs, tanks		X	X	X	144	73	20	38
761290	Aluminium containers, other			X	X	2176	2076	808	991
830630	Photograph frames, mirrors		X			213	537	162	154
840219	Vapour generating boilers, other				X	517	901	189	703
840290	Steam or other boilers, parts				X	4108	2061	2358	1140
840410	Auxiliary plant for use with boiler			X	X	750	664	560	453
840490	Parts for steam boilers				X	669	634	371	319
840510	Gas generator			X	X	566	995	95	869
840681	Steam turbines > 40 MW		X	X	X	707	579	200	464
840682	Steam turbines < 40 MW		X	X		796	545	164	366
840690	Parts of steam turbines			X		3934	3130	1148	1455



Table A.1: *Continued*

HS code	Description	Set of EGs / products				Trade in 2008, USD million			
		S	ICTSD	WTO	WB (43)	World (excl. intra-EU trade)		Developing countries	
						Exports	Imports	Exports	Imports
841011	Hydraulic turbines, micro (<1 MW)	X	X	X	X	50	46	8	27
841012	Hydraulic turbines, small (1-10 MW)	X	X	X		58	62	27	46
841013	Hydraulic turbines, large (> MW)		X			99	275	28	252
841090	Parts for hydraulic turbines		X	X	X	942	710	377	472
841181	Gas turbines, of a power < 5,000 kW		X	X	X	1332	1124	58	303
841182	Gas turbines, of a power > 5,000 kW		X	X	X	7032	4186	408	2521
841280	Other engines and motors		X			561	459	114	295
841290	Other engines/ motors (blades)		X			3110	4494	656	898
841581	Air conditioner with heat pump			X	X	1655	2790	731	729
841620	Other furnace burners		X			751	988	104	709
841861	Heat pumps	X	X	X	X	1916	1531	358	716
841869	Absorption chillers/heat pumps		X	X	X	4382	4710	2046	2527
841919	Solar water heater		X	X	X	969	1013	504	224
841931	Dryers, for agricultural products		X			378	382	68	154
841940	Distilling or rectifying plant		X	X	X	1780	2127	275	1479
841950	Heat exchange units		X	X	X	6889	6450	1845	3119
841989	Machinery, other		X	X	X	6545	7005	1984	4746

Table A.1: *Continued*

HS code	Description	Set of EGs / products				Trade in 2008, USD million			
		S	ICTSD	WTO	WB (43)	World (excl. intra-EU trade)		Developing countries	
						Exports	Imports	Exports	Imports
841990	Parts of machinery, plant, equipment		X	X	X	5198	4443	1494	2050
847920	Machinery extraction veg. fats/oils		X			580	437	239	216
848210	Ball bearings		X			7129	8110	2946	4471
848220	Tapered roller bearings		X			2519	2578	741	1150
848230	Spherical roller bearings		X			1562	1581	507	1036
848240	Needle roller bearings		X			653	676	166	394
848250	Other cylindrical roller bearings		X			1536	1955	370	1085
848280	Other ball or roller bearings		X			989	1562	468	1045
848340	Gears		X	X	X	10266	10621	1993	5150
848360	Clutches				X	1643	1988	273	1032
850161	AC generators <75kVA		X	X	X	634	769	275	301
850162	AC generators 75 - 375kVA		X	X	X	434	411	159	215
850163	AC generators 375 - 750 kVA		X	X	X	306	269	152	131
850164	AC generators 750 kVA		X	X	X	3099	2511	496	1011
850231	Wind-powered generation sets	X	X	X	X	3335	4753	1010	941
850239	Other generation sets		X	X		3290	5407	392	3236
850300	Parts of motors, generators		X	X		13154	10942	4291	5479
850421	Liquid dielectric transformers		X			1317	1070	597	556
850422	Liquid dielectric transformers		X			1222	1032	567	444
850423	Liquid dielectric transformers		X			5612	3701	3172	1614

Table A.1: *Continued*

HS code	Description	Set of EGs / products				Trade in 2008, USD million			
		S	ICTSD	WTO	WB (43)	World (excl. intra-EU trade)		Developing countries	
						Exports	Imports	Exports	Imports
850431	Electric transformers		X			3235	4185	2234	2350
850432	Electric transformers		X			429	671	197	349
850433	Electric transformers		X			934	1203	476	630
850434	Electric transformers		X			1507	1726	529	1047
850440	Static converters		X	X		25541	32037	15901	14701
850680	Primary cells			X	X	449	966	237	657
850720	Lead acid accumulators	X		X	X	3751	3420	2420	1306
850740	Nickel-iron storage batteries			X		21	75	2	49
850780	Other accumulators		X	X		11274	11888	7068	7642
853710	Control boards			X	X	20155	21624	7316	9836
853931	Fluorescent, hot cathode lamps	X	X			3625	3822	3091	1216
854140	PV semiconductor devices	X	X	X	X	30513	33135	19460	11064
854449	Other electric conductors		X			462	1230	456	1042
854460	Other electric conductors		X			5734	4714	2370	2671
870390	Other (including electric) cars	X	X	X		1138	1033	71	626
900190	Mirrors (for solar energy)		X	X	X	5509	6961	1757	4936
900290	Glass mirrors (for solar energy)		X	X	X	1103	1167	516	688
902830	Electricity meters			X		1242	1240	753	517
903020	Cathode-ray oscilloscopes		X			437	623	244	247
903031	Multi-meters		X			326	377	148	138
903210	Thermostats	X	X	X	X	1528	2125	721	845
903220	Manostats		X	X	X	655	402	89	140

Table A.1: *Continued*

HS code	Description	Set of EGs / products				Trade in 2008, USD million			
		S	ICTSD	WTO	WB (43)	World (excl. intra-EU trade)		Developing countries	
						Exports	Imports	Exports	Imports
903289	Other control instruments			X		10573	13736	3263	6869
Total						312599	332010	130438	161986

S: Single-use EGs selected for analysis in this note

ICTSD: ICTSD studies on the renewable energy; residential and commercial buildings; and transport sectors (includes a large number of multiple-use products that may be used as components in any of these sectors)

WB: 43 climate-related EGs identified by the WB

WTO: based on proposals listed in TN/TE/19, 22 March 2010, excluding vehicles (other than HS 870390) and goods proposed on the basis of energy-efficiency criteria only (see footnote 14).

Source: based on COMTRADE (using WITS, May 2010)

Table A.2: Top exporters of single-use EGs and other product groups, 2008 (Excluding intra-EU trade)

	Single-use EGs		Climate-friendly products and components (ICTSD studies)		43 climate-friendly EG (World Bank)		All manufactured products, non-mineral (HS 28-97)	
	USDm	%	USDm	%	USDm	%	USDm	%
All	50986	100	236792	100	153354	100	7518538	100
China	16204	31.8	59960	25.3	40734	26.6	1629069	21.7
Japan	7923	15.5	48851	20.6	26954	17.6	1353673	18.0
EU27	7043	13.8	31053	13.1	19739	12.9	935450	12.4
United States	4234	8.3	27303	11.5	19649	12.8	720500	9.6
Taiwan	4038	7.9	9827	4.2	7232	4.7	378667	5.0
Brazil	2449	4.8	7396	3.1	6254	4.1	247088	3.3
India	1256	2.5	5633	2.4	5008	3.3	243685	3.2
Mexico	1152	2.3	5013	2.1	3262	2.1	221450	2.9
Korea, Rep.	902	1.8	4756	2.0	3133	2.0	211702	2.8
Malaysia	888	1.7	4635	2.0	2897	1.9	187462	2.5
Singapore	793	1.6	4261	1.8	2759	1.8	139693	1.9
Canada	560	1.1	3872	1.6	2617	1.7	138893	1.8
Norway	390	0.8	3292	1.4	2225	1.5	120589	1.6
Thailand	357	0.7	3011	1.3	1261	0.8	109306	1.5
South Africa	315	0.6	2571	1.1	1213	0.8	109150	1.5
Pakistan	226	0.4	2101	0.9	1129	0.7	97661	1.3
					Developing countries			
	29861	58.6	99778	42.1	62433	40.7		45.5

Source: COMTRADE using WITS (March 2010)

Table A.3: Top importers of single-use EGs and other product groups, 2008 (Excluding intra-EU trade)

	Single-use EGs		Climate-friendly products and components (ICTSD studies)		43 climate-friendly EG (World Bank)		All manufactured products, non-mineral (HS 28-97)	
	USDm	%	USDm	%	USDm	%	USDm	%
All	54916	100	248651	100	160779	100	8060124	18.7
EU27	20345	37.0	49418	19.9	EU27	19.9	1504068	18.5
United States	9465	17.2	41065	16.5	United States	15.7	1488691	9.0
China	4539	8.3	28177	11.3	China	12.8	724045	4.8
Korea, Rep.	2627	4.8	11267	4.5	Korea, Rep.	4.0	383841	4.5
Hong Kong, China	2365	4.3	11148	4.5	Canada	3.5	363664	3.9
Japan	2302	4.2	10468	4.2	Japan	3.5	316826	3.2
Canada	2059	3.7	8241	3.3	Hong Kong, China	3.0	260402	3.1
Mexico	941	1.7	6778	2.7	Mexico	2.9	250166	2.6
Taiwan	901	1.6	6491	2.6	Turkey	2.6	212900	2.6
Singapore	717	1.3	6315	2.5	Taiwan	2.3	212108	2.2
India	653	1.2	5844	2.4	India	2.1	180448	1.9
Turkey	640	1.2	5022	2.0	Singapore	2.0	156332	1.9
Switzerland	630	1.1	4130	1.7	Switzerland	1.9	155432	1.8
Australia	588	1.1	3871	1.6	Thailand	1.7	148063	1.8
Malaysia	450	0.8	3858	1.6	Australia	1.6	142598	1.7
Brazil	431	0.8	3753	1.5	United Arab Emirates	1.6	140114	1.6
Russian Federation	407	0.7	3574	1.4	Brazil	1.6	129955	1.6
South Africa	330	0.6	3333	1.3	Malaysia	1.4	127767	1.6
Philippines	316	0.6	3112	1.3	Vietnam	1.3	125550	1.0
Norway	309	0.6	2506	1.0	Norway	1.0	80776	0.8
Thailand	303	0.6	2306	0.9	South Africa	1.0	61849	0.7
Ukraine	262	0.5	2150	0.9	Qatar	0.9	55900	18.7
					Developing countries			
	17909	32.6		47.5	77859	48.4	3556620	44.1

Source: COMTRADE using WITS (March 2010)

**Table A.4: Top 10 exporters and importers of selected single-use EGs, 2008<sup>62</sup>**  
**Ethyl alcohol (HS 2207)**

Exporters	USD m	%	Importers	USD m	%
All reporters	4347	100	All reporters	4315	100
Brazil	2390	55.0	United States	1363	31.6
United States	410	9.4	EU27	975	22.6
Pakistan	220	5.1	Canada	354	8.2
El Salvador	195	4.5	Japan	253	5.9
Jamaica	152	3.5	El Salvador	216	5.0
Trinidad and Tobago	113	2.6	Trinidad and Tobago	162	3.8
South Africa	110	2.5	Korea, Rep.	159	3.7
Guatemala	86	2.0	Jamaica	140	3.2
EU27	82	1.9	India	58	1.4
Costa Rica	75	1.7	Aruba	56	1.3
Top 10	3833	88.2	Top 10	3883	90.0
Developing countries	3716	85.5	Developing countries	1267	29.4

**Buildings insulation materials (HS 680610; HS 680690; HS 700800 and HS 701939)**

Exporters	USD m	%	Importers	USD m	%
All reporters	3536	100	All exporters	3109	100.0
EU27	1284	36.3	United States	476	15.3
United States	665	18.8	EU27	420	13.5
China	626	17.7	Canada	334	10.7
Japan	205	5.8	Russian Federation	182	5.9
Canada	179	5.1	Ukraine	167	5.4
Mexico	85	2.4	Switzerland	143	4.6
Turkey	78	2.2	Norway	116	3.7
Russian Federation	72	2.0	Mexico	85	2.7
Croatia	36	1.0	Japan	82	2.6
Malaysia	26	0.7	Korea, Rep.	80	2.6
Top 10	3255	92.1	Top 10	2084	67.0
Developing countries	925	26.1	Developing countries	974	31.3

**Hydraulic turbines (HS 841011 and HS 841012)**

Exporters	USD m	%	Importers	USD m	%
All reporters	109	100.0	All reporters	108	100.0
EU27	55	50.6	Turkey	17	15.5
China	29	26.6	EU27	13	11.6
Switzerland	5	4.8	Vietnam	11	10.2
Japan	3	2.5	Norway	10	9.1
Singapore	2	1.7	United Arab Emirates	9	8.2
Brazil	2	1.4	Qatar	7	6.3
Australia	1	0.9	Algeria	4	3.6
India	1	0.8	Morocco	4	3.6
Malaysia	1	0.6	India	3	2.7
Russian Federation	..	0.4	Panama	2	2.1
Top 10	98	90.3	Top 10	62	72.8
Developing countries	36	33.0	Developing countries	73	67.4

**Heat pumps (HS 841861)**

Exporters	USD m	%	Importers	USD m	%
All reporters	1916	100.0	All reporters	1532	100.0
Japan	741	38.7	China	339	22.1
EU27	675	35.2	Canada	201	13.1
China	235	12.3	EU27	155	10.2
United States	76	4.0	Japan	140	9.1
Mexico	65	3.4	Switzerland	127	8.3
Malaysia	24	1.2	Yemen	83	5.4
Switzerland	21	1.1	United States	52	3.4
Ukraine	18	0.9	Norway	50	3.2
Canada	17	0.9	South Africa	38	2.5
India	6	0.3	Mexico	35	2.3
Top 10	1878	98.0	Top 10	1249	81.5
Developing countries	358	18.7	Developing countries	717	46.8



**Non-electrical water heaters, including SWH equipment (HS 841919)**

Exporters	USD m	%	Importers	USD m	%
All reporters	969	100	All reporters	1013	100.0
Mexico	315	32.5	United States	387	38.2
EU27	245	25.3	EU27	167	16.5
China	133	13.7	Canada	90	8.9
United States	115	11.8	Qatar	53	5.2
Israel	42	4.3	Russian Federation	50	4.9
Switzerland	37	3.8	Mexico	24	2.3
Turkey	21	2.1	Thailand	20	1.9
Malaysia	16	1.7	United Arab Emirates	12	1.2
Japan	13	1.3	Croatia	9	0.9
Canada	10	1.1	Turkey	8	0.8
Top 10	947	97.7	Top 10	820	81.0
Developing countries	504	52.1	Developing countries	224	22.1

**Wind-powered generating sets (HS 850231)**

Exporters	USD m	%	Importers	USD m	%
All reporters	3335	100.0	All reporters	4753	0.0
EU27	1810	54.3	United States	2679	56.4
India	651	19.5	Canada	545	11.5
Japan	469	14.1	Turkey	285	6.0
China	211	6.3	Australia	221	4.6
Vietnam	126	3.8	China	189	4.0
United States	22	0.7	Japan	174	3.7
Australia	20	0.6	Brazil	122	2.6
Brazil	14	0.4	EU27	106	2.2
Korea, Rep.	3	0.1	Korea, Rep.	102	2.1
Canada	3	0.1	Taiwan	91	1.9
Top 10	3329	99.8	Top 10	4514	95.0
Developing countries	1010	30.3	Developing countries	941	19.8

**Compact fluorescent lamps (HS 853931)**

Exporters	USD m	%	Importers	USD m	%
All reporters	3625	100	All reporters	3824	100
China	2887	79.6	United States	1029	26.9
EU27	310	8.6	EU27	943	24.7
Canada	89	2.5	Japan	192	5.0
United States	81	2.2	Brazil	136	3.6
Thailand	58	1.6	Canada	135	3.5
Japan	37	1.0	Hong Kong, China	121	3.2
India	29	0.8	Turkey	110	2.9
Mexico	21	0.6	Russian Federation	84	2.2
Korea, Rep.	20	0.6	Korea, Rep.	79	2.1
Brazil	15	0.4	Argentina	63	1.6
Top 10	3547	97.9	Top 10	2892	75.6
Developing countries	3091	85.3	Developing countries	1218	31.9

**Photovoltaic (PV) cells, modules and panels (including light-emitting diodes, LEDs) (HS 854140)**

Exporters	USD m	%	Importers	USD m	%
All reporters	30513	100.0	All reporters	33138	100.0
China	11745	38.5	EU27	17075	51.5
Japan	6190	20.3	China	3744	11.3
Taiwan, China	4002	13.1	United States	2760	8.3
EU27	2027	6.6	Korea, Rep.	2144	6.5
United States	1976	6.5	Hong Kong, China	1984	6.0
Korea, Rep.	805	2.6	Japan	1412	4.3
Malaysia	749	2.5	Taiwan, China	660	2.0
Singapore	737	2.4	Singapore	559	1.7
India	529	1.7	Mexico	488	1.5
Mexico	398	1.3	India	420	1.3
Top 10	29159	95.6	Top 10	30826	93.0
Developing countries	19460	63.8	Developing countries	11068	33.4

**“Other” vehicles, including electric cars (HS 870390)**

Exporters	USD m	%	Importers	USD m	%
All reporters	1138	100.0	All reporters	1033	100.0
United States	770	67.7	Philippines	238	23.1
Japan	163	14.4	United States	179	17.4
EU27	112	9.9	Yemen	100	9.7
South Africa	17	1.5	EU27	99	9.6
China	16	1.4	Israel	80	7.7
India	11	1.0	India	73	7.1
Canada	10	0.9	Qatar	44	4.3
Singapore	8	0.7	Australia	23	2.2
Pakistan	6	0.5	Singapore	21	2.1
Australia	4	0.4	Tunisia	21	2.1
Top 10	1118	98.3	Top 10	879	85.1
Developing countries	71	6.2	Developing countries	626	60.6

**Thermostats (HS 903210)**

Exporters	USD m	%	Importers	USD m	%
All reporters	1528	100.0	All reporters	2125	100.0
EU27	442	28.9	United States	538	25.3
Mexico	259	17.0	EU27	392	18.4
China	256	16.8	Hong Kong, China	182	8.5
United States	112	7.3	China	138	6.5
Japan	100	6.6	Mexico	130	6.1
Hungary	76	5.0	Canada	116	5.4
Switzerland	69	4.5	Turkey	60	2.8
Malaysia	60	3.9	Korea, Rep.	48	2.3
Canada	40	2.6	Japan	46	2.2
Korea, Rep.	39	2.6	Switzerland	41	1.9
Top 10	1454	95.1	Top 10	1690	79.5
Developing countries	721	47.2	Developing countries	392	18.4

Notes:

Source: COMTRADE (Using WITS, May 2010)

Figures for “all reporters” and EU27 exclude intra-EU trade

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