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A South Asian Perspective

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Green Growth and Trade in Environmental Goods and Services: A South Asian Perspective

Kshitiz Dahal* and Posh Raj Pandey**

Abstract

Our investigation into the state of Green Growth in South Asia through a rigorous analysis of carbon dioxide emission, energy supply, energy consumption, power generation, and carbon intensity of growth does not find any evidence that South Asia is making the switch to an environmental-friendly growth. The unsustainable modes of production and consumption still fuel the growth in South Asia and carbon emissions are perpetually rising. This environmentally hazardous growth model could be transmuted, inter alia, through extensive trade in Environmental Goods and Services (EGS). By mitigating environmental pollution, enhancing energy efficiency, augmenting the use of renewable energy, and promoting environmental industries and creating green jobs, substantial trade of EGS can reduce environmental degradation as well as promote growth. Thus, the paper complements the preceding analysis on the state of Green Growth by an in-depth analysis of this potential enabler of green growth, with a strong focus on South Asia. Our assessment suggests that trade in Environmental Goods is not at a level to promote the transition to a green economy in South Asia. Although the trade of Environmental Goods exhibits an increasing trend, it is almost exclusively the result of rising imports. Furthermore, assessment of Revealed Comparative Advantage (RCA) suggests a poor state of environmental industries in South Asia, except for India. Moreover, significant barriers to trade of EGS exist indicating that the current level of EGS trade is nowhere near the potential. Against this backdrop of carbon-heavy growth and largely untapped potential in the trade of Environmental Goods and Services, the paper argues for a comprehensive WTO Agreement on Environmental Goods, one that also simplifies the trade of Environmental Services, and pays special attention to the needs of Member States well below the environmental technology frontier, like the ones in South Asia.

JEL Classification: F1, O0, Q2, Q3, Q4

Keywords: Green Growth, green economy, Environmental Goods, Environmental Services, OECD List, APEC List, Friends List, List approach, Integrated Project Approach, Request and Offer , Hybrid Approach, Revealed Comparative Advantage (RCA), Carbon dioxide emission, Total Primary Energy Supply Mix (TPES), Total Energy Consumption Mix, Electricity Generation Mix

JEL Classification: F1, O0, Q2, Q3, Q4

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1. Introduction

Along with unprecedented economic growth resulting in a higher quality of life throughout the world, the 20th century also witnessed a serious degradation of natural resources and the environment as a consequence of this growth. The outcomes of resource depletion and environmental deterioration are becoming increasingly conspicuous in the forms of frequent extreme weather and climate events, contaminated water, soil, and air, loss of biodiversity, reduced agricultural productivity, and scarcity of natural resources[1]. Along with many other pernicious effects, the current trends of natural resources and environment degradation pose a serious threat to the long term prospects of economic growth itself[2]. However, economic growth is as necessary as ever to lift millions out of poverty and to ensure the socio-economic well-being of this growing population. Thus, there is an urgent need to ensure that economic growth can be sustained over time as well as to reverse the devastations to the environment and natural resources along with social injustice caused by the current model of economic growth. Green Growth has been proposed as the means to achieve this seeming paradox – environmental sustainability, social justice, and economic growth.

There are several different definitions of Green Growth or Green Economy[3]. Among multifarious definitions, the essence is an economic paradigm that simultaneously bolsters economic growth, socially-inclusive development, and ecological well-being[4]. These important goals of the Green Growth paradigm are achieved through an inclusive Green Growth Strategy - an infrastructure policy that allows for welfare-improving and productivity-enhancing infrastructure systems; policies such as tax and competition policy that maximize the efficient allocation of resources; policies that include a mix of price-based instrument (for example, carbon taxes) and non-market instruments such as regulations, and voluntary approaches to incentivise efficient use of resources and to promote pollution; and an innovation policy that promotes Green innovation (OECD, 2011; World Bank, 2012). Once the Green Growth paradigm is entrenched in an economy, it can open up new sources of growth through increased productivity, opportunities for innovation, creation of new markets and new jobs by increased demand for green technologies, goods, and services, and through macroeconomic stability and higher investor confidence brought forth by the new paradigm (OECD, 2011). Likewise, Green Growth is also believed to reduce the risks to growth

[1] See, for example, IPCC (2014) for an in-depth account of human influence on the climate system and its subsequent impacts on human and natural systems.

[2] See, for example, influential "Stern Review: The Economics of climate change," which provides estimates of climate-driven reduction in GDP and consequently an increase in incidence of poverty.

[3] Organisation for Economic Co-operation and Development (OECD) defines Green Growth as, "fostering economic growth and development, while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies." (OECD, 2011). United Nations Environment Programme (UNEP) defines green economy as one that results in "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (UNEP, 2011). Likewise, the World Bank defines Green Growth as "growth that is efficient in its use of natural resources, clean in that it minimizes pollution and environmental impacts, and resilient in that it accounts for natural hazards and the role of environmental management and natural capital in preventing physical disasters. And this growth needs to be inclusive" (World Bank, 2012).

arising from imbalances in the natural systems and from bottlenecks resulting from resource scarcity (OECD, 2011). This is why Green Growth is believed to be critical to achieving the transformations envisioned by the Sustainable Development Goals (SDGs)[5].

To achieve the objectives of Green Growth as well as SDGs, international trade of Environmental Goods and Services (EGS) is proposed to be a significant enabler through ensuring worldwide access to affordable goods and services that can expedite the switch into a green economy. By mitigating environmental pollution, enhancing energy efficiency, augmenting the use of renewable energy, and promoting environmental industries and creating green jobs, meaningful trade of EGS can reduce environmental degradation as well as promote economic growth. Realizing the possibilities offered by the trade of EGS to deal with environmental threats, the Doha round of the WTO, which started in 2001, agreed to negotiations to enhance the trade of EGS but no WTO agreement has been reached till this date.

Against this background, we first look at the state of green growth to get an idea about whether South Asia exhibits signs of transition to a green economy. This analysis is then complemented by an in-depth assessment of one of the potential enablers of green growth - the trade of EGS. We assess the trends, patterns, and barriers to the trade of EGS, with a special focus on South Asia. We then examine in detail the issues with WTO negotiations that are preventing a successful agreement regarding the trade of EGS. This will enable us to recommend strategies for expediting the transition to a green economy through seamless trade of EGS.

Our focus on South Asia is important because it is one of the most affected and vulnerable regions to the deleterious impacts of environmental deterioration and climate change. Six out of eight nations in South Asia (Afghanistan, Bangladesh, Bhutan, Maldives, and Nepal) are members of the V20 (Vulnerable Twenty) group, a consortium of countries that are systematically vulnerable to climate change. The fact that the region is home to a significant population below poverty line exacerbates the negative impacts it is currently exposed to as well as the vulnerabilities it faces. Secondly, as a region experiencing strong and dynamic economic growth, it will also result in a large number of new consumers whose affluent lifestyle will be putting additional pressure on the environment. Lastly, since the region houses a large number of people living below the poverty line, the region cannot afford to sacrifice economic growth to achieve other important objectives of sustainable development.

The rest of the paper is organized as follows. Section 2 looks at the state of green growth in Asia, with an emphasis on carbon emission and energy supply and consumption patterns. Section 3 analyzes the patterns and trends of EGs trade in South Asia. Furthermore, important barriers to trade in EGS are discussed. Section 4 discusses in detail one potential instrument for catalyzing the trade of EGS - the WTO Agreement on EGs. Section 5 concludes.

[5] Many of the SDG goals and targets reflect the principle of Green Growth. In particular, SDG's target 8.4 – "Improve progressively, through 2030, global resource efficiency in consumption and production endeavor to decouple economic growth from environmental degradation" – mirrors the central tenet of Green Growth.

2. State of Green Growth in South Asia

Among many ways that the current mode of economic growth degrades the environment, an overwhelming increase in greenhouse gas (GHG) emissions is one of the most prominent. The release of vastly unsustainable levels of GHG into the atmosphere has wreaked havoc on the Earth's atmosphere and has resulted in major adverse effects such as the global warming and the climate change. Since GHG emissions are such critically linked to the environmental prospects of an economy, the trends in GHG emissions could offer valuable insights on whether the economy is making a transition into Green Growth paradigm or whether it is stuck to an environmentally destructive model of growth. Thus, to get a glimpse of the state of Green Economy in South Asia, we first look at the current level of GHG emissions, particularly the anthropogenic carbon dioxide emissions, in the Member States.

2.1 Carbon dioxide emissions in South Asia

The world saw an unprecedented rise in CO2 emissions (as well as other GHG emissions) since the advent of the industrial revolution in the 1800s, and much more rapidly since the 1950s. South Asia is no exception to this unfortunate trend. South Asian CO2 emissions increased steadily over the entire period 1970-2016 covered by the Emission Database for Global Atmospheric Research (EDGAR) (Table 1). All the Member States exhibit this trend of relentlessly rising CO2 emissions indicating that emissions are not yet decoupled from economic growth.

Along with the steady rise of C02 emissions witnessed by all the economies in South Asia, South Asia's emission status is further exacerbated by the fact that it houses India, one of the top emitters of CO2, which shows no signs of reversing its rapidly rising emissions. India's average annual CO2 emissions rose by a staggering 7.5% for the period 2006-2012 and with a share of 7.1% of total global CO2 emissions (in 2016), India is the next largest emitter after China, US, and EU 28 (Janssens-Maenhout et al., 2017). Also worrisome is the fact that India's C02 emission increased by 5% in 2016 when other largest emitters either posted a reduced level of emissions or no increase and global CO2 emissions stagnated for the third year in row[6]. Another concern for South Asia is that the second-largest emitter in South Asia, Pakistan, also emitted 9% more CO2 in 2016 compared to 2015 (Janssens-Maenhout et al., 2017).

Similarly, per capita CO2 emissions are steadily increasing since 2002 (Table 2). Sector-wise CO2 emission data for South Asian economies (in EDGAR database) shows that all the sectors – Power industry, Transport, Other industrial combustion, Non-combustion, and Buildings – have generally posted a significantly increasing CO2 emission over the years, except for a modest increase in the case of Bhutan[7]. This indicates that unsustainable modes of production and consumption haven't slowed down a bit.

[6] According to Janssens-Maenhout et al. (2017), CO2 emissions decreased by 2% in US and Russia, by 1% in Japan, and remained constant for China and EU28.

[7] Buildings in Bhutan posted a lower CO2 emission in 2016 compared to 1990 but the emission levels are rising again since 2000. Nepal's power industry's emissions have been generally declining since 1995 and remains at a modest level. However, Nepal has a low access to electricity and a huge chunk of its electricity is imported from India. Maldives' CO2 emissions from Buildings and Non-combustion activities do not show significant increase and remain at a modest level.

Table 1: Anthropogenic CO2 emission by South Asian Countries (in kton CO2eq/year)

	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2016
Afghanistan	1742.3	1831.1	2368.0	2544.6	2024.9	2283.0	2426.1	3032.8	6328.4	9241.2	9900.0
Bangladesh	3111.2	4917.3	7300.5	8844.6	13475.1	19984.2	26070.3	38285.9	59676.1	71265.9	74476.2
Bhutan	683.3	704.3	612.1	675.2	734.2	742.6	612.5	609.1	1166.2	1584.9	1682.1
India	231290.8	276005.1	321937.2	466133.3	655461.6	869795.3	1064431.2	1262993.9	1843399.1	2419637.2	2533638.1
Maldives	10.0	11.7	19.9	49.0	57.1	161.5	280.3	538.6	817.4	1150.3	1233.0
Nepal	246.8	386.0	579.2	632.9	1026.0	1961.8	3323.7	3313.9	4794.0	7115.4	7833.8
Pakistan	21291.9	27094.7	35406.8	52306.5	63790.6	86448.1	108295.2	131395.5	152100.0	163120.2	178013.8
Sri Lanka	3074.8	2943.6	4122.7	3918.7	4139.5	6107.6	11263.9	14365.6	14321.2	17000.4	18454.7

Source: Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2_FT2016 (C02 emissions in this data come from Transport, Other industrial combustion, Buildings, Non-combustion, Power Industry)

Table 2: CO2 per capita emissions by South Asian countries (in tonCO2/capita/year)

Country Name	**1970**	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2016**
Afghanistan	0.1570	0.1453	0.1794	0.2156	0.1660	0.1335	0.1207	0.1208	0.2197	0.2742	0.2853
Bangladesh	0.0479	0.0690	0.0896	0.0949	0.1271	0.1679	0.1975	0.2677	0.3926	0.4426	0.4569
Bhutan	2.2931	2.0122	1.4965	1.4459	1.3672	1.4419	1.0689	0.9271	1.6019	2.0138	2.1079
India	0.4175	0.4445	0.4619	0.5961	0.7534	0.9060	1.0137	1.1079	1.4987	1.8471	1.9194
Maldives	0.0865	0.0857	0.1262	0.2581	0.2558	0.6358	1.0009	1.6885	2.2395	2.7519	2.8809
Nepal	0.0206	0.0290	0.0389	0.0379	0.0549	0.0917	0.1402	0.1294	0.1776	0.2479	0.2701
Pakistan	0.3665	0.4056	0.4534	0.5673	0.5907	0.7028	0.7791	0.8532	0.8895	0.8631	0.9224
Sri Lanka	0.2460	0.2133	0.2748	0.2419	0.2393	0.3356	0.5991	0.7367	0.7090	0.8213	0.8872

Source: Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2_FT2016

Although some countries (for example Nepal), because of the low level of industrialization, may statistically look to be on the greener side of things, the reality is much more complicated. As the Global Green Growth Institute (2017) points out, while the use of resource is low in absolute terms, their use is quite inefficient as exemplified by the country's staggering electricity losses, low water and labor productivity, and lack of formal waste recycling. Moreover, C02 emissions are steadily rising, making it more and more difficult to decouple economic growth from environmental degradation.

2.2 How green has the economic growth been?

We look at the carbon intensity of economic growth, i.e. CO2 per GDP emissions, to get a sense of whether the economic growth has been greening over the period of last 10 years (Table 3 and Figure 1). For some countries (India, Pakistan, and Sri Lanka) there has been a slight improvement in the carbon intensity of growth whereas for others (Afghanistan, Bangladesh, Bhutan, Maldives, and Nepal) the carbon intensity of growth has increased over the period 2006-2016. Even for countries that have shown improvements in the carbon intensity, the changes have been modest and erratic, without any steady pattern of decrease in carbon intensity. This implies that the economic growth is still strongly associated with carbon emission and hence only shallow greening

might have occurred in these economies. Furthermore, absolute emissions are what matters in terms of environment quality, and absolute emissions indicate that the carbon intensity of growth has not improved to the level where absolute emissions fall in spite of economic growth. A greening of the economy can be considered to have taken place only if absolute emissions continue to decline over the years while GDP growth remains resilient.

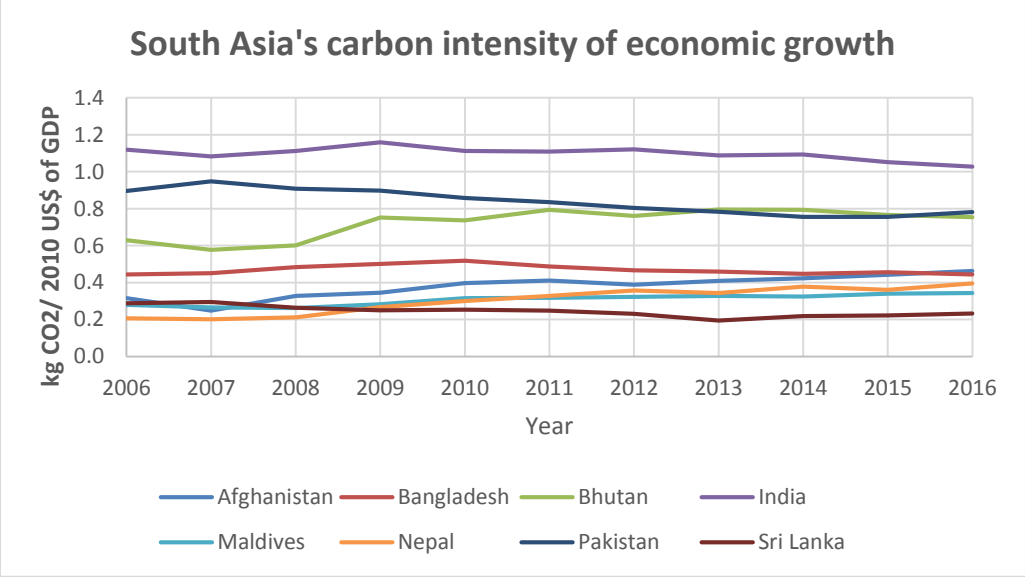
Thus, in light of the evidence offered by carbon intensity of growth and the absolute carbon emissions, we assert that South Asia doesn't show any signs of transitioning into low-carbon growth model embodied by Green Growth, and some improvements in carbon intensity exhibited by some of the economies are merely shallow greening of these economies, without any fundamental change in the growth model.

Table 3: Carbon intensity of growth (in kg CO2/ 2010 US$ of GDP)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Afghanistan	0.316	0.248	0.327	0.345	0.397	0.411	0.388	0.410	0.422	0.442	0.462
Bangladesh	0.443	0.451	0.483	0.500	0.518	0.486	0.466	0.459	0.447	0.455	0.444
Bhutan	0.628	0.577	0.601	0.752	0.736	0.794	0.760	0.795	0.794	0.766	0.753
India	1.119	1.083	1.111	1.159	1.113	1.108	1.120	1.088	1.093	1.051	1.028
Maldives	0.278	0.265	0.261	0.282	0.316	0.317	0.323	0.328	0.324	0.339	0.342
Nepal	0.207	0.201	0.211	0.267	0.300	0.328	0.357	0.344	0.378	0.360	0.395
Pakistan	0.896	0.947	0.907	0.898	0.857	0.835	0.804	0.783	0.754	0.755	0.782
Sri Lanka	0.287	0.295	0.264	0.249	0.252	0.247	0.230	0.193	0.219	0.223	0.232

Source: Authors' computation using emission data from *EDGAR and GDP data from Word Development Indicators (WDI)*

Figure 1*:* Carbon intensity of economic growth in South Asia

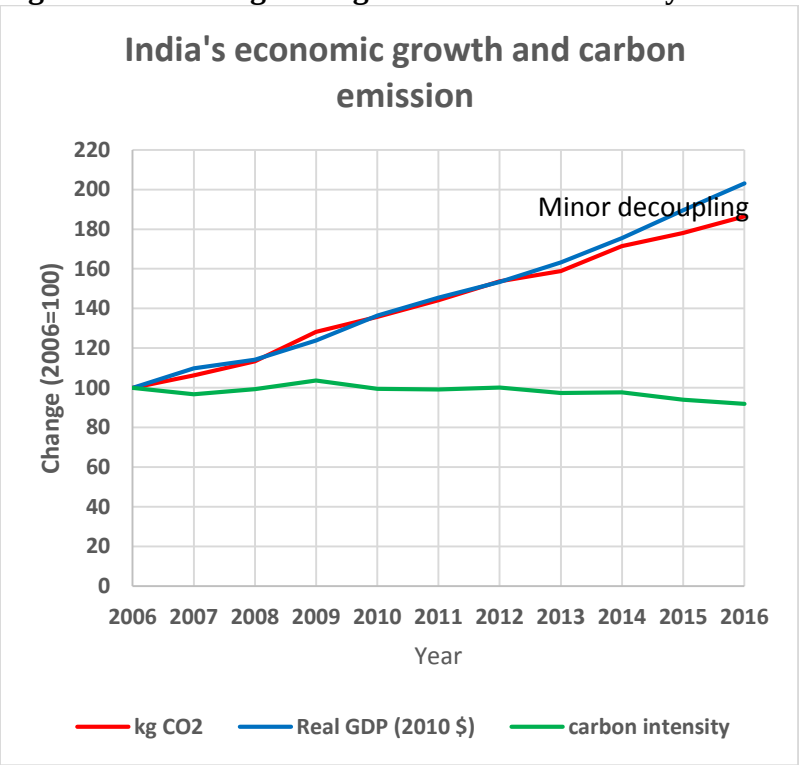


Source: Authors' computations using emission data from EDGAR and GDP data from WDI

To make our argument of shallow greening clearer, we expand upon an example of India's GDP growth and emission patterns. We see in Figure 2 that carbon intensity of growth has generally

declined over the last 10 years. However, although the growth of GDP has surpassed the growth of absolute emissions, the absolute emissions are still on the rise and are growing in tandem with the economic growth. This implies that improvements in the carbon intensity of growth have not been able to reverse the resilient rise of carbon dioxide emissions. What this means is that a significant portion of economic growth still results from the brown modes of production and consumption with only a very minor decoupling, or shallow greening, occurring.

Figure 2*:* Shallow greening of the Indian economy



Source: Authors' computations using emission data from EDGAR and real GDP data from WDI

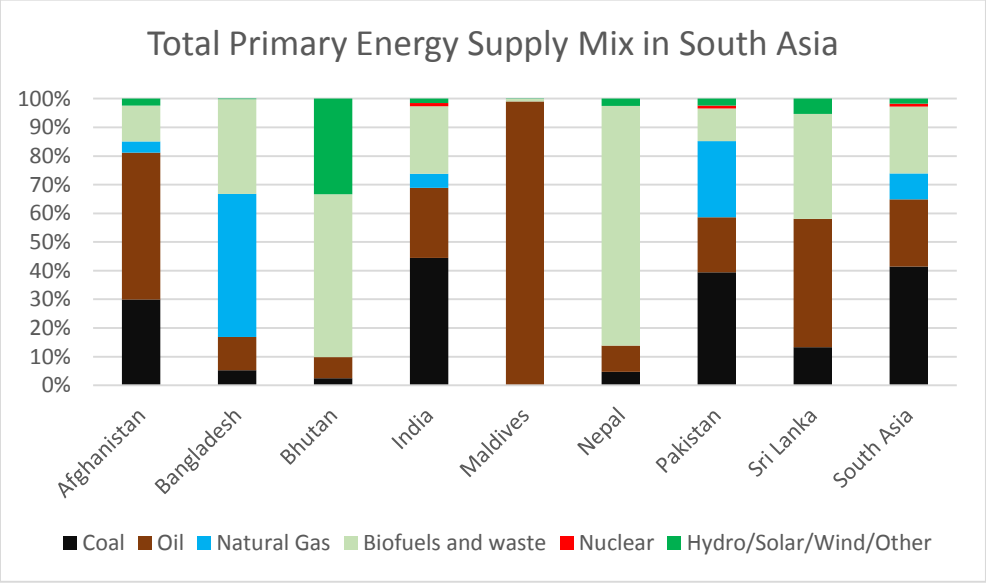
2.3 How unsustainable are the modes of production and consumption in South Asia?

Our assertion that conventional modes of consumption and production fuel the South Asian economies and only shallow greening is occurring in parts of South Asia is further substantiated if we look at the Total Primary Energy Supply (TPES) mix, Final Energy Consumption Mix, and Electricity Generation Mix (Figure 5-7). Coal and oil overwhelmingly dominate the primary energy supply of India and Pakistan, the two biggest economies in South Asia. Hence, it is no surprise that C02 emissions are relentlessly rising in India and Pakistan.

The TPES mix is not rosy for other South Asian economies either. Another fossil fuel – natural gas – dominates Bangladesh's primary energy supply mix, and Sri Lanka's energy mix is also dominated by coal and oil. Overall, South Asia's primary energy supply shows a conspicuously insignificant contribution of clean energy sources, except for Bhutan, where the contribution of fossil fuels is insignificant and hydro contributes little more than 30% to the mix. Although Nepal has low dependence on fossil fuels, the contribution comes almost entirely from biofuels and waste and not from clean energy sources (Figure 3).

The unsustainable modes of production and consumption are also reflected in the Final Energy Consumption Mix (Figure 4) as almost 50% of final energy consumption in South Asia is in the form of coal and oil. Also striking is a low level of electricity consumption in all the South Asian countries. Similarly, Figure 5 shows that electricity generation, one of the significant contributors to GHG emissions, is heavily dominated by fossil fuels in most of the South Asian countries, except for Afghanistan, Bhutan, and Nepal, where hydroelectricity dominates[8]. But even for these countries where hydroelectricity is the dominant form of electricity production, overall energy consumption has a very small contributions from clean energy sources (Figure 4).

Figure 3: Total Primary Energy Supply Mix in South Asia in 2015[9]

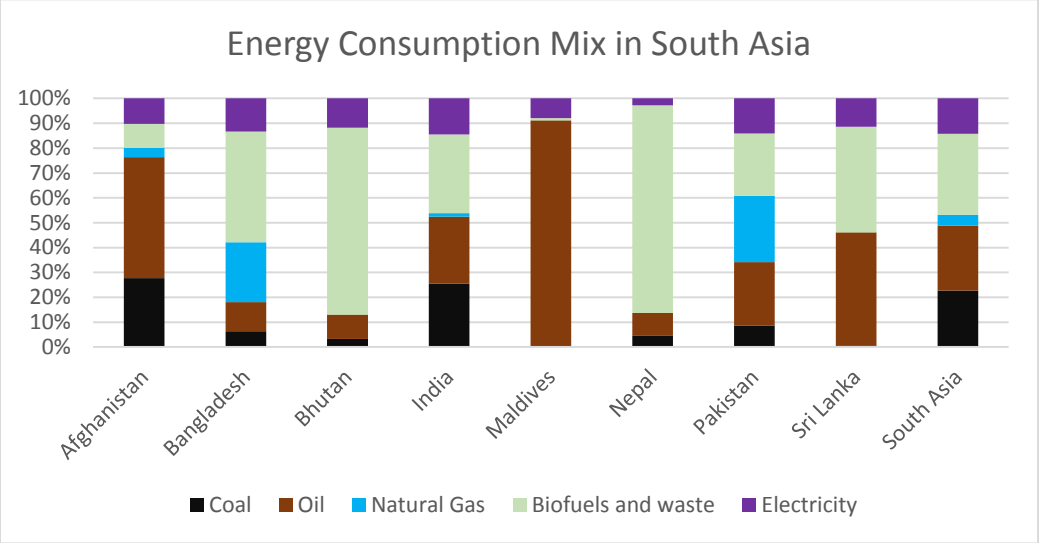


Note: Other includes tide, wave, and ocean sources.
Source: Authors' computations using data from UN (2017a)

Thus, our assessment reveals significant dominance of environmentally destructive modes of production and consumption in South Asia as a result of which carbon dioxide emissions levels are rising relentlessly. The relentless rise of carbon dioxide emissions implies that decoupling of economic growth from environmental degradation has not occurred in South Asia and the transition towards a green economy has not taken off. Furthermore, South Asia economies, owing to their good economic performance in recent years, will also be introducing a large number of new consumers, whose affluent lifestyle will potentially put significant pressure on the environment. Against this background, the next section investigates one of the potential enablers of Green Growth - the trade of EGS.

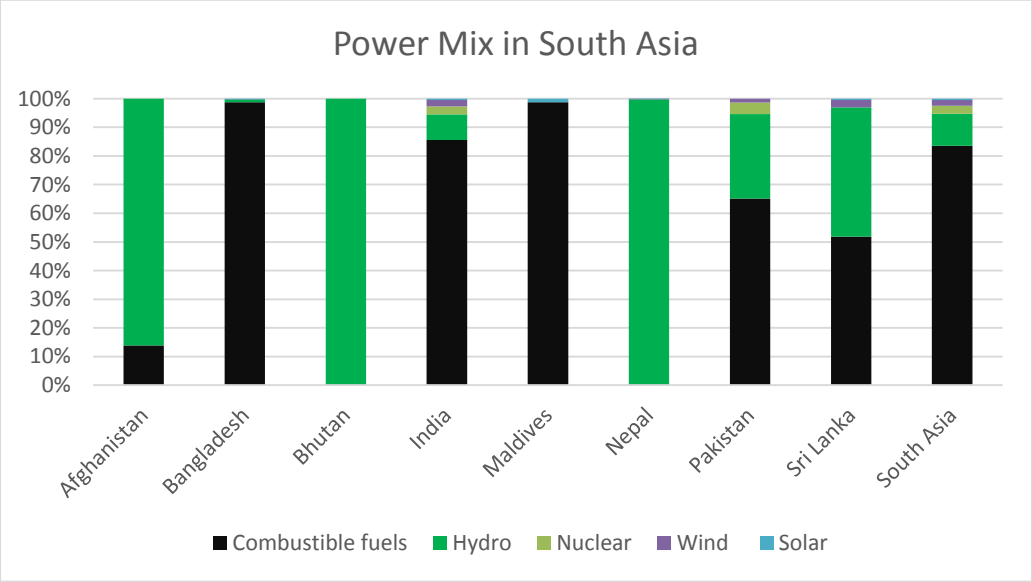
[8] The share of solar energy in electricity generation has been significantly increasing in India since 2015. However, it still doesn't make much difference in energy supply mix and energy consumption mix.
[9] Excludes electricity trade.

Figure 4: Total Energy Consumption Mix in South Asia in 2015



Source: Authors' computations using data from UN (2017a)

Figure 5: Electricity Generation Mix in South Asia in 2015



Source: Authors' computations using data from UN (2017b)

3. Trade of Environmental Goods and Services in South Asia

Trade has a complicated relationship with the environment. On the one hand, export-oriented industries are a major source of GHG emissions (IPCC, 2014). On the other hand, international trade can also play a critical role in mitigation of as well as adaption to environmental degradation and climate change by providing opportunities to source goods from countries with abundance of clean energy and by allowing opportunities for economic diversification thus reducing vulnerabilities to the impacts of environmental degradation and climate change (Teehankee, Jegou, & Rodrigues, 2012).

Diffusion of EGS is another instrument of international trade that can not only contribute to environmental protection but to creating new avenues of economic growth as well. By providing access to EGS, international trade can mitigate environmental pollution, enhance energy efficiency, and augment the use of renewable energy, thus protecting the environment. Similarly, through promoting green industries that produce environmental technologies and services, the EGS trade also contributes to creating jobs and promoting economic growth. Hence, international trade of EGS is believed to be a significant enabler to Green Growth and sustainable development.

With that in the background, we look at the trends in the trade of EGs in South Asian countries[10]. Since there is no single internationally accepted list of EGs, we use three different classifications - the OECD classification of EGs, the APEC list, and the Friends List - to enable comparisons among different lists as well as to ensure that the broad categories of EGs are covered by our analysis. The OECD list helps us gauge the size of the environment industry whereas the APEC list gives us a rough idea about the trade of EGs most recently liberalized. Although none of these lists is a part of the lists proposed at the WTO, these lists have been used as building blocks for current negotiations at the WTO. Finally, we also include the Friends List as it is the most comprehensive among different lists submitted at the WTO.

The OECD list, in our analysis, includes 125 unique products at HS 6-digit[11]. The OECD list is broadly categorized into Pollution management, Cleaner technologies and products, and Resource management group (Steenblik, 2005a; Sugathan, 2013)[12].The APEC list is shorter than the OECD list, composed of 54 goods at HS 6 digit level, primarily consisting of end-of-pipe EGs. The different categories of EGs in the APEC list are Renewable energy, Environmental monitoring, analysis and assessment equipment, Environmental protection (Air pollution control; Management of solid and hazardous waste; and Water treatment and waste-water management), and

[10] Analysis could not be done for Afghanistan because of lack of data.

[11] The original list contains 164 products (132 unique products) at HS 6-digit (HS 6-digit). Our compilations contain only 125 unique products at HS 6-digit level because we use a different HS classification than the original list.

[12] Pollution Management consists of Air pollution control, Wastewater management, Solid waste management, Remediation and clean-up, Noise and vibration abatement, and Environmental monitoring, analysis and assessment; Cleaner technologies and products consists of Cleaner/resource efficient technologies and processes, and Cleaner/resource efficient products; and Resource management group consists of Indoor air pollution, Water supply, Recycled materials, Renewable energy plant, Heat/energy savings and management, Sustainable agriculture and fisheries, Sustainable forestry, Natural risk management, Eco-tourism, and Other.

Environmentally preferable products (Vossenaar, 2013)[13]. The primary difference between the two lists emanate from the fact that the OECD list was intended to map the scope of the environment industry, whereas the AEPC list came forth from the decision to have a list of EGs that could be clearly identified at the customs for tariff reduction purposes[14].

In contrast to the previous two lists, Friends List, jointly submitted by Group of Friends, a group of nine Member States - Canada, Chinese Taipei, European Communities, Japan, Korea, New Zealand, Norway, Switzerland, and the United States - is an officially submitted list at the WTO and hence a component of multilateral negotiations at the WTO. The Friends List is categorized into Air pollution control, Management of solid and hazardous waste and recycling systems, Clean up or remediation of soil and water, Renewable energy plant, Heat and energy management, Waste water management and potable water treatment, environmentally preferable products, Cleaner or more resource efficient technologies and products, Natural risk management, Noise and vibration abatement, and Environmental monitoring, analysis and assessment equipment. Spanning 164 products at HS 6-digit level, the Friends List has been the most expansive list at the WTO (not the largest though) because of its coverage of diverse categories[15].

3.1 A look at the trends and patterns of EG trade in South Asia

Taking into consideration the OECD list of EGs, India has seen a sizeable rise in the export of EGs in the last decade from around $2.3 billion in 2006 to $ 6.57 billion in 2016. Pakistan and Sri Lanka have also seen a fair increase in their export of EGs (Table 4). Pakistan's export of EGs rose from $115.55 million in 2006 to $302.52 million in 2016 and Sri Lanka's export increased from $77.81 million in 2006 to US$ 169.72 million in 2016. However, for these countries, the export of EGs has witnessed a very small increase or has decreased in the later years. The exports of EGs by the South Asian LDCs is very modest. Table 4 shows that the exports of EGs from Bangladesh haven't seen a significant increase and is actually at a level below that in 2007. Similarly, Nepal's exports have fallen dramatically since 2008. Furthermore, Bhutan has a very insignificant size of EG exports and exports of EGs is non-existent for the Maldives.

Table 4: South Asia's export of EGs in US$ Million and export share in total exports (OECD list)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bangladesh	53.8	67.8	77.2	33.6	30.2	33.8	50.8	36.8	46.0*	59.9	48.6#
	0.46%	0.52%	0.50%	0.22%	0.16%	0.14%	0.21%	0.15%	0.13%	0.19%	0.13%
Bhutan	2.1	3.0	2.9	3.2	5.3	6.4	5.2	0.5#	0.8#	9.0#	2.2#
	0.51%	0.44%	0.56%	0.64%	1.29%	1.40%	0.98%	0.31%	0.43%	3.31%	1.57%
India	2310.1	3037.2	4170.7	3717.4	4685.4	5205.3	5427.2	6540.1	6481.5	6495.8	6570.6
	1.91%	2.08%	2.29%	2.10%	2.13%	1.73%	1.87%	1.94%	2.04%	2.46%	2.52%

[13] The only Environmentally Preferable Product in the APEC list is the 'flooring panel made of bamboo (HS 441872).
[14] For a detailed exploration of the APEC and OECD list of environmental goods and their comparison, refer to Steenblik (2005a), Sugathan (2013), and Vossenaar (2013).
[15] Although various literature refers to the Friends List as containing 153 items, our compilation from JOB 09/132 in WTO (2010) produced 164 unique products at HS 6-digit, likely because some items are defined by multiple HS codes.

Maldives	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.002	0.004
	0.00%	0.00%	0.00%	0.00%	0.003%	0.00%	0.00%	0.00%	0.00%	0.001%	0.003%
Nepal	11.1*	41.7*	52.9*	1.2	8.1	8.5	8.6	4.8	0.8	1.0	0.5^
	1.80%	5.39%	5.45%	0.13%	0.92%	0.94%	0.98%	0.55%	0.09%	0.15%	0.07%
Pakistan	115.6	73.0	73.9	116.1	164.1	248.6	187.4	372.9	331.2	322.5	302.5
	0.68%	0.41%	0.36%	0.66%	0.77%	0.98%	0.76%	1.48%	1.34%	1.46%	1.47%
Sri Lanka	77.8	97.8	95.6	90.6	111.5	150.2	153.3	171.3	186.0	170.0	169.7
	1.15%	1.28%	1.17%	1.27%	1.34%	1.50%	1.64%	1.71%	1.65%	1.63%	1.61%

Data Source: Computed using trade data from UNCOMTRADE, ITC Trade Map, TEPC Nepal; OECD list compiled from OECD (1999), WTO (2003); Steenblik (2005a), and Sugathan (2013)
* obtained by using mirror data (sum of all countries' imports from the country of interest)
# obtained from ITC Trade Map; ^ obtained from TEPC Nepal

While India, Pakistan, and Sri Lanka posted decent exports under the OECD classification of EGs, the exports are about the half for India and much less for Pakistan and Sri Lanka if we consider the EGs liberalized by APEC (Table 5). Exports are low for Bangladesh and Nepal, negligible for Bhutan, and mostly non-existent for the Maldives.

The exports of EGs are much bigger for Bangladesh, India and Nepal under the Friends List than under the OECD List, but lower for Pakistan and Sri Lanka (Table 6). Nepal scores remarkably well in the share of exports of EG in total exports in the Friends List, albeit due to the contribution of only couple of products, primarily 'jute sacks and bags' and 'pipe and tube of iron and steel'. India's exports saw a steady rise, albeit marginally in the late years. Furthermore, the exports for Bangladesh, Nepal, and Pakistan saw a decline compared to their peaks (2008 for Pakistan; 2012 for Nepal and Bangladesh). Sri Lanka also saw a decline in its exports from its peak value in 2014. Exports for Bhutan and the Maldives are either negligible or non-existent.

Also noteworthy is that the exports are much higher under Friends List than the APEC List for all the South Asian nations. Thus, South Asia stands to benefit from the multilateral agreement at the WTO much more than the plurilateral agreements like the APEC Agreement.

Table 5: South Asia's export of EGs in US$ million and export share in total exports (APEC list)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bangladesh	5.3	22.0	11.0	9.4	6.3	15.7	13.3	12.0	17.8*	48.8	9.7#
	0.04%	0.17%	0.07%	0.06%	0.03%	0.06%	0.05%	0.05%	0.05%	0.15%	0.03%
Bhutan	0.14	0.01	0.003	0.0	0.0	0.0	0.0	0.1#	0.1#	0.2#	0.004#
	0.03%	0.002%	0.0006%	0.00%	0.00%	0.00%	0.00%	0.04%	0.06%	0.06%	0.003%
India	1372.0	1894.5	3055.5	2756.7	3042.0	2981.2	2767.4	3000.9	3170.6	3127.8	3222.5
	1.13%	1.30%	1.68%	1.56%	1.38%	0.99%	0.96%	0.89%	1.00%	1.18%	1.24%
Maldives	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Nepal	2.46*	5.1*	0.9*	0.7	0.8	1.3	0.8	0.6	0.9	0.9	0.3^
	0.40%	0.65%	0.09%	0.08%	0.09%	0.14%	0.09%	0.07%	0.10%	0.14%	0.05%

Pakistan	16.7	25.3	58.1	30.9	143.5	34.1	16.0	41.2	59.5	35.7	36.9
	0.10%	0.14%	0.29%	0.18%	0.67%	0.13%	0.06%	0.16%	0.24%	0.16%	0.18%
Sri Lanka	30.0	41.2	41.5	30.4	32.0	41.3	62.8	40.3	45.3	52.7	46.6
	0.44%	0.54%	0.51%	0.43%	0.39%	0.41%	0.67%	0.40%	0.40%	0.51%	0.44%

Data Source: Computed using trade data from UNCOMTRADE, ITC Trade Map, and TEPC Nepal; APEC List from APEC (2012)
* obtained by using mirror data
# obtained from ITC Trade Map; ^ obtained from TEPC Nepal

Table 6: South Asia's export of EGs in US$ Million and export share in total exports (Friends List)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bangladesh	271.9	351.6	307.5	304.3	427.8	493.3	493.5	353.3	238.4*	270.4	291.1#
	2.32%	2.67%	1.98%	1.96%	2.22%	2.03%	2.01%	1.44%	0.69%	0.85%	0.77%
Bhutan	0.180	0.150	0.003	0.005	0.006	0.009	0.078	0.009#	0.340#	0.300#	0.580#
	0.04%	0.02%	0.001%	0.001%	0.002%	0.002%	0.015%	0.06%	0.19%	0.11%	0.41%
India	3909.0	5016.0	7123.9	6065.2	6936.7	8328.8	8595.8	9607.9	9760.5	9782.2	10048.4
	3.23%	3.44%	3.92%	3.43%	3.15%	2.76%	2.97%	2.85%	3.07%	3.70%	3.86%
Maldives	0.0003	0.0000	0.0000	0.0000	0.0040	0.0027	0.0000	0.0000	0.0000	0.2840	0.3560
	0.0002%	0.00%	0.00%	0.00%	0.0005%	0.002%	0.00%	0.00%	0.00%	0.20%	0.26%
Nepal	14.7*	36.3*	42.9*	53.7	63.0	61.9	73.0	63.0	62.0	41.2	31.8^
	2.39%	4.69%	4.42%	6.06%	7.20%	6.82%	8.38%	7.30%	6.89%	6.24%	4.58%
Pakistan	54.0	88.6	258.8	132.1	234.1	184.3	224.7	171.4	204.7	158.9	121.5
	0.32%	0.50%	1.28%	0.75%	1.09%	0.73%	0.91%	0.68%	0.83%	0.72%	0.59%
Sri Lanka	38.7	48.0	42.2	32.7	38.5	50.3	52.7	62.4	102.5	89.6	99.2
	0.57%	0.63%	0.52%	0.46%	0.46%	0.50%	0.56%	0.62%	0.91%	0.86%	0.94%

Data Source: Computed using trade data from UNCOMTRADE, ITC Trade Map, and TEPC Nepal; Friends list from WTO JOB (09)/132 in WTO (2010)
* obtained by using mirror data
# obtained from ITC Trade Map; ^ obtained from TEPC Nepal

In all the different lists, South Asian countries generally exhibit an increasing trend when it comes to imports of the EGs, except for Pakistan's dip in EG imports between 2009 and 2012 (Table 7, 8, 9). India also had a fall in EG imports in 2009 (OECD and Friends List). Despite a few instances of decreases in imports, the imports have risen substantially over the last decade in all the lists. Furthermore, in all the lists, imports significantly outnumber the exports, which doesn't bode well for liberalization prospects of the EGs. One caveat in rising imports of EG in South Asia is that the imports of EG as a share of total imports exhibit erratic trends and haven't seen a dramatic rise in most instances. However, the shares of EG imports in total imports have seen a resurrection in the last couple of years in all the South Asian countries except Bhutan.

Table 7: South Asia's import of EGs in US$ Million and import share in total imports (OECD List)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bangladesh	335.5*	381.3*	414.3	445.3	556.6	797.5	705.1	1083.9	1333.8*	976.4	1406.5#
	2.59%	2.66%	1.70%	1.92%	1.82%	1.93%	1.94%	3.05%	3.28%	2.03%	3.34%
Bhutan	14.6	11.2	14.0	11.8	23.4	29.1	34.9	10.3#	4.7#	11.0#	7.5#
	3.48%	2.25%	2.58%	2.23%	2.74%	2.77%	3.52%	3.81%	1.70%	2.14%	1.64%
India	4976.8	6787.9	8823.3	8448.5	9269.7	13128.3	13774.2	12860.7	13116.3	14492.9	16019.0
	2.79%	3.10%	2.79%	3.17%	2.65%	2.84%	2.82%	2.76%	2.86%	3.71%	4.49%
Maldives	36.2	40.5	43.0	31.9	36.7	46.3	45.2	54.1	69.7	72.5	95.8
	3.91%	3.70%	3.10%	3.30%	3.35%	3.28%	2.91%	3.12%	3.50%	3.82%	4.50%
Nepal	29.6*	44.2*	48.4*	84.2	81.6	91.2	95.9	99.4	133.8	109.6	180.9^
	1.99%	2.11%	1.85%	2.24%	1.59%	1.54%	1.59%	1.54%	1.76%	1.66%	2.03%
Pakistan	702.5*	1173.7*	1581.3	1406.9	1043.3	947.8	1075.5	1264.0	1570.3	1963.6	2325.0
	5.60%	6.07%	3.74%	4.45%	2.78%	2.17%	2.45%	2.89%	3.39%	4.46%	4.95%
Sri Lanka	223.6	240.0	280.7	227.4	295.9	415.1	442.0	444.4	462.6	532.7	588.3
	0.94%	1.10%	0.77%	0.97%	1.04%	1.15%	1.84%	1.27%	1.08%	1.22%	1.40%

Data Source: Computed using trade data from UNCOMTRADE, ITC Trade Map, and TEPC Nepal; OECD list compiled from OECD (1999), WTO (2003); Steenblik (2005a), and Sugathan (2013)
* obtained from UNCOMTRADE by using mirror data (sum of all countries' exports to the country of interest)
# obtained from ITC Trade Map; ^ obtained from TEPC Nepal

Table 8: South Asia's import of EGs in US$ Million and import share in total imports (APEC List)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bangladesh	197.7*	179.4*	302.1	281.6	345.4	786.3	475.3	673.7	827.9*	760.3	898.3#
	1.53%	1.25%	1.24%	1.21%	1.13%	1.91%	1.31%	1.90%	2.03%	1.58%	2.13%
Bhutan	9.4	6.5	9.0	6.6	16.6	20.5	15.3	6.5#	3.8#	16.7#	9.2#
	2.24%	1.30%	1.65%	1.24%	1.95%	1.95%	1.54%	2.39%	1.36%	3.26%	1.99%
India	3736.5	5011.2	6564.8	7237.8	7016.8	9895.6	9753.6	8743.0	8042.2	9560.8	10771.6
	2.10%	2.29%	2.08%	2.72%	2.00%	2.14%	1.99%	1.88%	1.75%	2.45%	3.02%
Maldives	15.2	18.8	15.8	14.2	16.1	25.6	17.2	24.0	30.0	31.3	49.4
	1.64%	1.72%	1.14%	1.47%	1.47%	1.81%	1.11%	1.38%	1.51%	1.65%	2.32%
Nepal	15.8*	22.4*	24.4*	40.3	51.8	65.4	47.6	51.7	93.9	74.4	108.5^
	1.06%	1.07%	0.93%	1.07%	1.01%	1.10%	0.79%	0.80%	1.24%	1.13%	1.22%
Pakistan	203.9*	674.8*	1384.0	1261.8	870.7	741.1	740.2	897.0	1370.2	1918.5	2813.5
	1.63%	3.49%	3.27%	4.00%	2.32%	1.70%	1.69%	2.05%	2.88%	4.36%	5.99%
Sri Lanka	91.6	125.8	105.1	91.4	128.7	225.9	329.8	227.7	208.1	230.9	273.2
	0.94%	1.10%	0.77%	0.97%	1.04%	1.15%	1.84%	1.27%	1.08%	1.22%	1.40%

Data Source: Computed using trade data from UNCOMTRADE, ITC Trade Map, and TEPC Nepal; APEC List from APEC (2012); * obtained by using mirror data; # obtained from ITC Trade Map; ^ obtained from TEPC Nepal

Table 9: South Asia's import of EGs in US$ Million and import share in total imports (Friends List)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Bangladesh	465.8*	473.4*	618.8	604.0	797.2	1437.3	1062.1	1623.7	1912.3*	1680.5	2134.0#
	3.60%	3.31%	2.54%	2.60%	2.61%	3.49%	2.92%	4.57%	4.70%	3.50%	5.07%
Bhutan	20.0	18.4	26.6	11.8	27.5	54.7	71.0	22.7#	9.6#	31.1#	37.1#
	4.77%	3.69%	4.89%	5.20%	6.58%	5.20%	7.16%	8.41%	3.48%	6.06%	8.07%
India	7014.4	10338.3	13415.2	12397.2	17692.3	13128.3	17409.5	15519.0	15181.2	16743.5	18877.4
	3.94%	4.73%	4.25%	4.65%	3.75%	3.83%	3.56%	3.33%	3.30%	4.29%	5.29%
Maldives	61.4	68.8	68.1	49.9	58.3	75.0	67.6	73.6	90.5	101.0	165.2
	6.63%	6.28%	4.91%	5.16%	5.33%	5.31%	4.35%	4.25%	4.54%	5.32%	7.76%
Nepal	34.1*	55.9*	63.2*	118.1	186.1	214.4	187.0	174.6	280.6	239.8	343.8^
	2.30%	2.66%	2.42%	3.15%	3.64%	3.62%	3.11%	2.71%	3.70%	3.63%	3.86%
Pakistan	869.4*	1714.4*	2541.7	2310.0	1830.7	1645.5	1668.5	1872.4	2538.9	3241.4	4570.3
	6.93%	8.87%	6.00%	7.31%	4.88%	3.78%	3.81%	4.28%	5.34%	7.37%	9.72%
Sri Lanka	223.6	240.0	280.7	227.4	295.9	415.1	442.0	444.4	462.6	532.7	588.3
	3.15%	3.08%	2.89%	3.22%	3.14%	3.17%	4.05%	3.44%	3.06%	3.36%	3.79%

Data Source: Computed using trade data from UNCOMTRADE, ITC Trade Map, and TEPC Nepal; Friends list from WTO JOB (09)/132 in WTO (2010)

* obtained by using mirror data

obtained from ITC Trade Map; ^ obtained from TEPC Nepal

3.2 Revealed Comparative Advantage of EGs in South Asia

A quick look at the Revealed Comparative Advantage (RCA)[16] of EGs exported by South Asia portrays a very grim prospect. Except for India, all the South Asian countries have only very few products that have RCA greater than 1, implying low comparative advantage in almost all the EGs (Figure 6). This is indicative of the low level of development of environmental industries in South Asia. This also implies that liberalization of EGs through multilateral negotiations doesn't offer much benefit to South Asian countries (except India) in terms of gains from export. Thus, to stimulate their interest in the EGs negotiations and to jumpstart the development of the environment industry in these countries, financial and technical assistance as well as the provisions of technology transfer seem necessary.

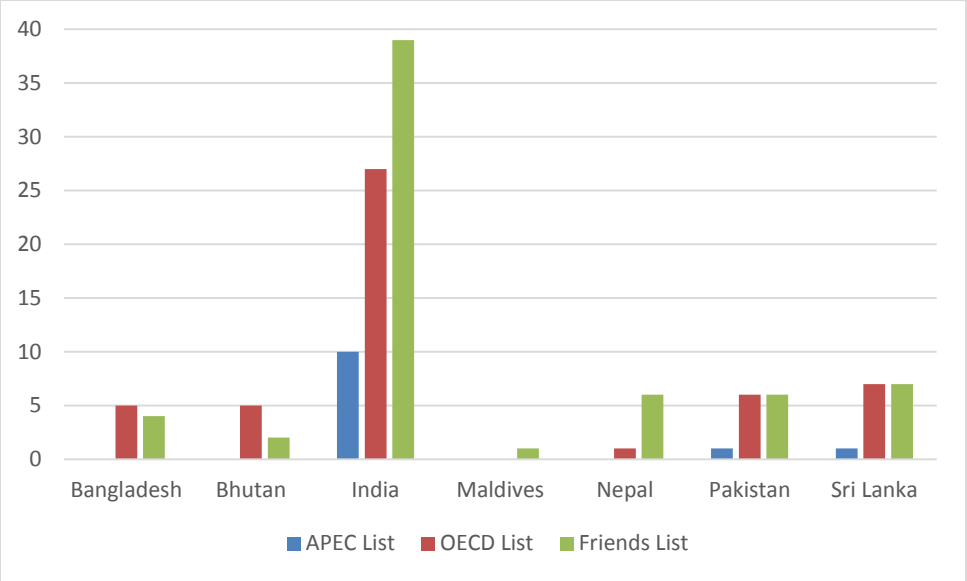
[16] To measure RCA, we use Balassa's RCA index given by

$$RCA_{ij} = (x_{ij}/x_{wj})/(X_i/X_W)$$

Where, x_{ij} = export of commodity j by country i; x_{wj} = world's export of commodity j; X_i = total exports of country i; X_W = total world exports.

A country is said to have a revealed comparative advantage in a product if the RCA index is greater than 1

Figure 6: Number of EGs with RCA>1 in South Asian EG exports in 2016



Source: Authors' computation

3.3 Composition of EG trade in South Asia[17]

For the sake of simplicity, we consider only the "Friends List", given its comprehensive nature, to examine the nature of EG exports from South Asia as well as the imports to South Asia. We see that except for India, EG's exports of other South Asian nations are concentrated among very few products. Bangladesh's EG export almost entirely consists of jute fibres and jute sacks. Similarly, Nepal exports very few EGs, and only a couple of products – jute sacks and pipes/tubes – constitute around 90 per cent of its EG exports. Likewise, Bhutan and the Maldives have only a couple of EGs that they export. Pakistan's EG export is also largely dominated by 10 products. The 'tubes/pipes' comprises more than 4o per cent of its entire EG exports. A similar pattern is seen in the case of Sri Lanka as well where top 10 products constitute more than 80 per cent of its EG exports. Only India exhibits a diverse portfolio of EG exports among South Asian countries as the top 10 exports account for relatively lower share (41per cent). Furthermore, only India, Pakistan, and Sri Lanka have some sophisticated commodities such as machineries and static converters in their export baskets. The import profiles are much more balanced for South Asian countries, except for Bhutan whose top 10 imports account for almost 85 per cent of its total EG imports.

Table 10 shows the category-wise distribution of EG exports of South Asia in 2016. The exports, except somewhat for India and Sri Lanka, are concentrated on a single category.

Table 11 shows the category-wise distribution of EG imports of South Asia. The imports, except for Bhutan, exhibit a significantly more balanced profile than the exports. Furthermore, except for Bhutan, the imports of all the South Asian countries exhibit a bigger share of Renewable Energy. This is a very encouraging prospect as we saw in the preceding section that energy supply and consumption mix as well as the electricity generation mix in South Asia generally have a negligible

[17] The analysis is done for the year 2016

share of clean renewable energy. The fact that 'solar photovoltaic cells' is the leading EG imports of India must have been a significant contributor to India's recent rise in solar power generation to the third place beside China and the United States.

Table 10: Category-wise distribution of EG exports of South Asia in 2016 (in %)

Category	BGD	BTN	IND	MDV	NPL	PAK	LKA
Air Pollution Control (APC)	0.13	1.04	9.11	0.00	0.03	8.84	1.22
Clean Up or Remediation of Soil and Water (R/C)	0.04	8.82	0.72	0.00	0.00	0.02	0.30
Cleaner or more Resource Efficient Technologies and products (CT/P)	0.01	0.69	0.12	99.96	0.00	1.52	0.24
Environmental Monitoring, Analysis and Assessment Equipment (M/A)	0.93	0.00	5.47	0.00	0.07	5.68	31.91
Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)	89.79	0.00	1.20	0.00	64.67	2.57	0.08
Heat and Energy Management (H/EM)	0.11	0.00	3.71	0.00	0.06	0.08	0.05
Management of Solid and Hazardous Waste and Recycling Systems (SHW)	0.15	88.58	10.92	0.00	1.23	5.88	8.65
Natural Resources Protection (NR)	0.62	0.00	0.50	0.00	0.01	0.43	3.34
Natural Risk Management (RM)	0.22	0.00	0.83	0.00	0.00	5.68	0.27
Noise and Vibration Abatement (N/V)	0.43	0.00	8.93	0.00	0.91	0.93	0.63
Renewable Energy (RE)	6.22	0.52	25.23	0.00	0.15	12.81	43.93
Waste Water Management and Potable Water Treatment (WWM)	1.34	0.35	33.25	0.04	32.88	55.56	9.39

Data Source: Authors' computation using trade data from UN COMTRADE, ITC Trade Map, and TEPC Nepal; and Friends list from WTO JOB (09)/132 in WTO (2010)

Table 11: Category-wise distribution of EG imports of South Asia in 2016 (in %)

Category	BGD	BTN	IND	MDV	NPL	PAK	LKA
Air Pollution Control (APC)	11.43	2.10	8.78	5.60	3.81	12.20	7.04
Clean Up or Remediation of Soil and Water (R/C)	0.55	0.77	0.35	12.54	0.53	0.70	0.67
Cleaner or more Resource Efficient Technologies and products (CT/P)	3.00	0.98	0.35	1.52	1.90	0.27	1.97
Environmental Monitoring, Analysis and Assessment Equipment (M/A)	5.32	1.86	14.46	2.71	4.32	3.61	7.98
Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)	0.02	0.95	0.77	0.22	8.79	0.80	0.03
Heat and Energy Management (H/EM)	4.05	0.35	1.20	1.99	2.70	1.24	3.24
Management of Solid and Hazardous Waste and Recycling Systems (SHW)	18.03	77.69	9.96	8.68	14.34	8.22	13.11
Natural Resources Protection (NR)	0.07	0.01	0.04	0.16	0.07	0.11	0.37
Natural Risk Management (RM)	0.89	4.41	0.70	0.24	0.63	0.93	0.40
Noise and Vibration Abatement (N/V)	4.71	0.41	4.49	7.14	1.21	3.65	3.24

Renewable Energy (RE)	30.71	4.03	35.37	21.19	40.99	53.39	29.31
Waste Water Management and Potable Water Treatment (WWM)	21.22	6.44	23.53	38.01	20.73	14.88	32.64

Data Source: Authors' computation using trade data from UN COMTRADE, ITC Trade Map, and TEPC Nepal; and Friends list from WTO JOB (09)/132 in WTO (2010)

3.4 Barriers in the trade of EGs in South Asia

3.4.1 Tariff barriers

To get a rough idea of tariff barriers confronting the trade of EGs in South Asia, we look at average applied MFN tariff rate on these products in South Asia (Table 12, 13, 14). Judging from the Simple Average Tariff (not weighted based on trade value) and Maximum Tariff Rates, particularly in the OECD List and the Friends List, tariff barriers do exist for some of the EGs in South Asia. This finding is in line with Bucher et al. (2014), which finds that South Asia applies the highest tariff on EGs, significantly higher than that of East Asia, North America and the EU.

Bhutan and the Maldives have the highest average tariffs on EGs in South Asia. Also, except for Bhutan and the Maldives, EGs on the APEC list attract a significantly lower average tariff rate than those in the OECD list and the Friends List.

Table 12: Average Applied MFN tariff on EGs in South Asia (OECD List)

	Year	Minimum	Simple Average	Maximum
Bangladesh	2016	0%	7.72%	25%
Bhutan	2015	0%	13.94%	100%
India	2017	0%	9.07%	150%
Maldives	2017	0%	17.46%	50%
Nepal	2016	0%	9.33%	30%
Pakistan	2016	3%	11.53%	90%
Sri Lanka	2017	0%	8.77%	539.13%[18]
South Asia		0%	11.11%	539.13%

Data source: Tariff Data from ITC Market Access Map (http://www.macmap.org)

Table 13: Average Applied MFN tariff on EGs in South Asia (APEC List)

	Year	Minimum	Simple Average	Maximum
Bangladesh	2016	0%	2.59%	25%
Bhutan	2015	0%	10.74%	20%
India	2017	0%	6.65%	10%
Maldives	2017	0%	19.81%	50%
Nepal	2016	0%	5.09%	15%
Pakistan	2016	3%	6.70%	35%
Sri Lanka	2017	0%	1.94%	30%
South Asia		0%	7.65%	50%

Data source: Tariff Data from ITC Market Access Map (http://www.macmap.org)

[18]Undenaturd ethyl alcohol of an alcohol strength by vol of 80% vol/higher (HS 220710) attracted MFN applied rate of Rs 800 per ltr with a Total ad valorem equivalent of 539.13%. The next highest tariff rate is 30%.

Table 14: Average Applied MFN tariff on EGs in South Asia (Friends List)

	Year	Minimum	Simple Average	Maximum
Bangladesh	2016	0%	7.2%	25%
Bhutan	2015	0%	13.41%	30%
India	2017	0%	8.06%	10%
Maldives	2017	0%	21.12%	40%
Nepal	2016	0%	9.7%	30%
Pakistan	2016	3%	10.90%	35%
Sri Lanka	2017	0%	4.6%	30%
South Asia		0%	10.71%	40%

Data source: Tariff Data from ITC Market Access Map (http://www.macmap.org)

3.4.2 Non-tariff barriers

In recent years, non-tariff barriers to trade are believed to be more trade impeding than the tariff barriers. Some of the non-tariff barriers confronting EGs are testing and certification requirements, customs procedures, technical regulations, standards, conformity assessment procedures, labelling schemes, sanitary and phytosanitary (SPS) measures in the case of agricultural EGs, subsidies, government procurement procedures, and intellectual property protection (Fliess & Kim, 2007). Similarly, the lack of uniformity in environmental requirements in different markets also acts as a significant non-tariff barrier (Vikhlyaev, 2004). Likewise, SPS measures in the case of agricultural EGs, eco-labeling, subsidies, and restriction of foreign direct investment (FDI) also act as non-tariff barriers to the trade of EGs (Khatun, 2010).

Regarding South Asia, Steenblik, Drouet, & Stubbs (2005) provides a perspective on non-tariff barriers to EGs trade in India. One of the major obstacles to EG trade according to the study is that the government purchasing process is so lengthy that by the time actual sales take place the environmental technology is often obsolete and the supplier is often accused of selling old technology. The fact that a major share of India's market for environmental technology is through government procurement (around 75% at the time) makes this non-tariff barrier extremely problematic. Likewise, the need for technology to be tested and certified by a local agency (even if accompanied by international approval), which takes months, is another major non-tariff barrier to the trade of EG. It also finds the prevalence of service taxes on services provided by professional service firms as another barrier.

Similarly, Fliess & Kim (2007) finds India as one of the countries where EGs face a variety of non-tariff barriers, according to the EGS exporting firms surveyed in the study. The survey reports overly burdensome terms and conditions related to government bid procedures as a common non-tariff barrier confronting EGs in India, Pakistan, Bangladesh, and Sri Lanka. Similarly, the study also finds that the time and costs associated with setting up letters of credit between banks while exporting to India could be substantial to forego potential sales. India's pre-payment requirements – the requirement that deliveries be made only after exporter receives payment – leading to longer storage times and costs for exporters since payment is made long after the contract is signed in India, was also reported as a hassle for EGs exporters. Similarly, the lack of independent appeals

procedure in India was also cited as an obstacle to the trade of EGs. The study also identifies restrictions on foreign exchange in Bangladesh as an impediment to the trade of EGs.

While studies providing perspectives on non-tariff barriers to EG trade in South Asian countries other than India as well as recent studies focused on non-tariff barriers confronting EGs entering South Asia, including India, seem scarce, it is fair to assume that a combination of non-tariff barriers discussed in this section are influencing South Asia's EG imports, given that many studies point to rising prominence of non-tariff barriers in the region. Besides these obstacles, lack of stringent environment regulations is possibly one of the most significant non-tariff barriers confronting EGs in South Asia as polluting firms are not compelled to adopt environment protection measures, and hence buy EGs, in many instances[19].

3.5 Trade of Environmental Services in South Asia

No meaningful analysis of trade of Environmental Services (ESs) can be done in the absence of data. However, the issues of public ownership of most of the ESs and difficulty in liberalizing Mode 4 (presence of natural persons) are very pertinent in the case of South Asian economies as well. Thus, it is fair to assume that trade in ESs in South Asia faces significant obstacles.

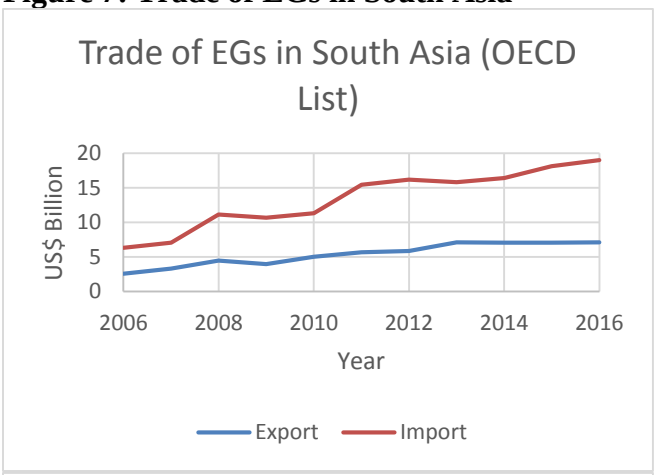
3.6 Summarizing the trends, patterns, and barriers in EGS trade in South Asia

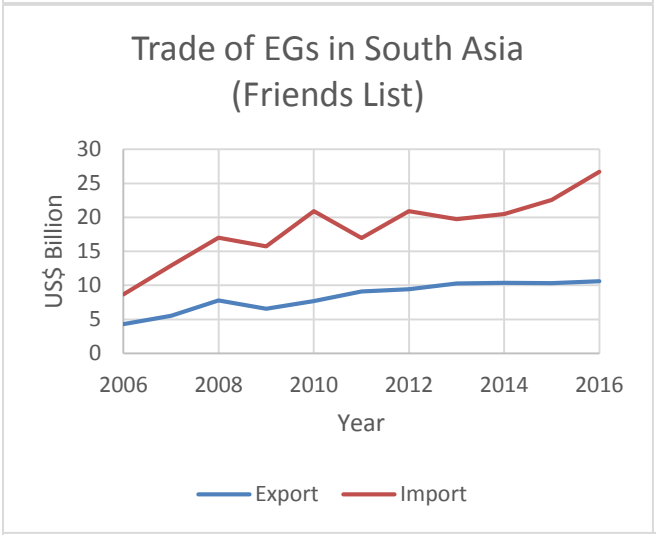
Figure 7 shows an overall trade pattern of EGs in South Asia. The trade in EGs has increased substantially in South Asia over the period of last 10 years. However, overall export has either stagnated or decreased in the later years and hence the increase in trade is almost exclusively the result of rising imports. An assessment of RCA indicates that, except for India, South Asia countries have a comparative advantage in very few EGs, which implies that the environmental industries are not very developed in South Asia. Regarding the composition of exports and imports, except for India, the exports are highly concentrated among a few products whereas the imports generally show a balanced profile. The fact that renewable energy makes a big share of South Asia's EG imports is reassuring given the unsustainable modes of energy fueling the economy. However, barriers to trade of EGs - tariff to some extent but mostly non-tariff barriers - pose a significant challenge and hence the current increase in trade of EGs is still below the potential that could be achieved if these barriers are reduced or eliminated. Regarding ESs trade, although no meaningful analysis could be done due to the lack of data, barriers to Mode 4 of trade in services and public ownership of many ESs imply hindrances to the trade of ESs in South Asia.

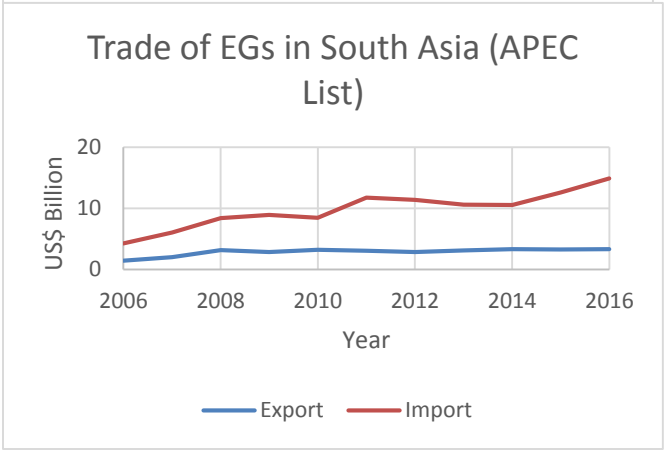
Against the backdrop of significant barriers confronting the trade of EGS in South Asia, we next discuss what could pave the way for extensive trade of EGS - the WTO EGS negotiations.

[19] OECD's Environment Policy Stringency (EPS) Index 2012, which covered OECD and BRIICS, ranked India 28th out of 33 countries considered. Except for Bhutan, environmental policies in South Asian countries are generally considered lax.

Figure 7: Trade of EGs in South Asia







Data Source: Authors' construction using trade data from UNCOMTRADE, ITC Trade Map, and TEPC Nepal; OECD List from OECD (1999), WTO (2003); Steenblik (2005a), and Sugathan (2013); APEC List from APEC (2012); and Friends list from WTO JOB (09)/132 in WTO (2010)

4. The WTO and the Green Economy

Recognizing the role trade can play in the improvement of the environment, the WTO Members agreed to negotiations on "*the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services*[20]" at the Doha Ministerial Conference in 2001. However, several issues, notably the lack of internationally agreed definition of EGs and ESs, have stagnated multilateral negotiations. Furthermore, the structure of the negotiations - negotiations for EGs and ESs taking place in the different committees at the WTO with different modalities - has rendered a comprehensive and integrated approach practically impossible (UNCTAD, 2009). As a result, in nearly twenty years of negotiations, no real progress has occurred, except for a very limited APEC agreement among 21 Asia-Pacific economies that agreed to reduce tariffs on 54 EGs to 5 per cent or less by 2015.

4.1 Issues in Environmental Goods Negotiations

The inability to find a consensus list of EGs has given rise to different lists proposed and even different approaches suggested as alternatives to the List approach, in effect stalling the WTO negotiations on EGs taking place in the WTO Committee on Trade and Environment Special Session (CTESS)[21]. Furthermore, the lack of progress in negotiations has reduced the scope of negotiations to tariff reductions, while leaving out the most important areas - non-tariff barriers and ESs (Melo & Solleder, 2018). The reasons for lack of agreement on which list will best define the EGs or which approach offers the way forward are partly technical and partly political - technical because of the real complexities in defining EGs and identifying them through Harmonized Systems (HS) of classification used at the customs and political because different countries have different preferences based on their needs as well as export capacity. Against this background, we discuss the major approaches proposed in the WTO EGs negotiations so that a clear picture of issues in reaching a WTO agreement could be portrayed.

List Approach: Under this approach, the WTO members propose a list of EGs as candidates for tariff reductions and through negotiations, a consensus list is sought after. However, this approach is fraught with several issues that haven't been resolved yet.

First of all, as Steenblik (2005b) points out, a lack of an internationally agreed definition of an Environmental Good deprives the negotiators with an advantage of moving forward with a rough idea of which products will be covered[22]. For example, it is not clear whether only goods that provide direct environmental services (Class A EGs) are eligible or whether Class B EGs, the Environmentally Preferred Products, are also worthy candidates for tariff reductions[23]. Likewise, there is little clarity on whether the EGs are to be chosen based solely on end-use criteria or also based on process and production based methods (PPMs)[24]. Similarly, it is also not clear whether

[20] Doha WTO Ministerial 2001 Declaration, para 31 (iii).

[21] See, for example Steenblik (2005b) for an in-depth analysis of issues in defining EGs and Howse & Bork (2006); WTO (2011); and Balineau & Melo (2013) for discussion of different approaches proposed in WTO EGs negotiations.

[22] According to Steenblik (2005b), this is a unique problem, as many other sectoral negotiations, such as the Agreement on Agriculture, had a rough idea of products that would be covered.

[23] See, for example, Hamwey (2005), for descriptions of Class A EGs and Class B EGs.

[24] For example, electric cars emit significantly low GHG and thus are strong contenders based on end-use criteria but electricity production is the largest source of GHG emission and hence electric cars may not qualify as EGs if PPMs criteria is used.

only industrial goods are to be considered or whether agricultural products are potential candidates as well.

Secondly, the List approach does not offer an effective solution for products with multiple end uses. Many products such as centrifuges, pumps, filters, incinerators, and chemicals used for environmental protection also have non-environmental industrial applications (Steenblik, 2005b).

Likewise, the HS classification of commodities, the international standard of product classification for cross-border trade, are internationally harmonized only up to 6 digits but 8-digit HS codes are required to isolate EGs from other similar commodities. For example, "water heaters fall under HS code 8419, but a solar water heater would have to be defined (nationally) at the eight-digit level, such as 841919-10 in China" (Jacob & Møller, 2017, p. 2).

Lastly, the List approach is also criticized for its inability to capture the dynamic nature of environmental technology. The EGs chosen through a List today may be outdated technologies in the next 10 years.

Since there are no internationally agreed upon lists of EGs, the countries have an incentive to prioritize EGs based on their needs and export capacity. For example, the developed countries prioritize energy efficiency, renewable energy and reduction of CO_2 emissions whereas developing and least developed countries (LDCs) are likely to place a higher importance to waste and wastewater management (Bucher et al., 2014).

The inherent complexity in defining EGs has thus led to multiple lists under the List approach but not to an Agreement[25]. The inability of the List approach to produce a consensus list of Goods and effectively address the potential issues have led some members to propose alternative approaches.

Integrated-Project Approach: Acknowledging the need to move away from the List approach, India proposed an alternative approach in 2005, the "*Environmental Project Approach*."[26] Under this approach, goods and services used in environmental projects identified by a designated national authority would qualify for specified concessions for the duration of the project.[27] Since the goods and services are valid only for environmental projects and for a limited duration, this approach is believed to mitigate the issue of dual use of EGs present in the List approach. Likewise, according to the proposal, it allows for the projects to employ the latest environmental technologies and hence solves the potential issue of outdated technologies and products being classified as EGs in the List approach. Furthermore, it is believed to strengthen positive measures like capacity building, technology transfer, and technical assistance as the designated national authority are likely to factor in these possibilities while designating environmental projects.

Following India's proposal, Argentina made a subsequent proposal in 2005 to integrate elements of both the list based approach and the project approach, also known as the *integrated approach*[28].

[25] See, for example, Balineau & Melo (2013) for discussions on different lists proposed at the WTO.
[26] See WTO (2005a) and WTO (2005b) for details
[27] Environmental projects could include those aimed at meeting national environmental objectives as well as the objectives stipulated in bilateral and multilateral environment agreement
[28] See WTO (2005d) for details

Under this approach, the CTESS would identify the categories of environmental projects (for example: air pollution control, water and waste water management, etc.) and then include in each category the list of EGs (not ESs present in India's proposal) that would qualify for the reduction/elimination of tariff and non-tariff barriers.

Amalgamating the important aspects of the Project Approach and the Integrated Approach, India and Argentina submitted a modified integrated approach in 2007 under which WTO Members would identify and agree upon the categories of environmental projects, with broad categories identified by the CTESS as the reference. Then, a list of private and public entities carrying out these projects are identified who will be eligible for specified concessions during the duration of the project.

Request and Offer: Under this approach proposed by Brazil in 2007, WTO Members produce a list of EGs that they wish to liberalize, request concessions on these products with each other, and extend the concessions achieved to all the WTO Members[29]. This approach is believed to take account of each country's contexts and needs and remedy the 'one list fits all' approach inherent in the List method.

Hybrid Approach[30]: This approach, proposed by Australia, Colombia, Hong Kong, China, Norway, and Singapore in 2011, combines various elements of different proposals. It consists of the following components: (i) an agreed core list of EGs on which all the Members would take commitments; (ii) a complementary self-selected list: developed countries are obliged to individually select a number of EGs for tariff elimination and developing countries are encouraged to participate; (iii) request and offer approach to complement the common core list and complementary list, the outcome of which will be extended to all WTO Members; and (iv) environmental projects could be used to identify lines in all of the different components: core list, complementary list, and request and offer process (WTO, 2011).

Combined Approach[31]: Similar to the hybrid approach, this approach proposed by Mexico and Chile in 2011, combines List approach with request and offer process. Contrary to an agreed core list of EGs in the hybrid approach, all the Members self-select goods from a reference list under this approach. This self-selection is subject to the condition that the agreed minimum number of tariff lines would be greater for a developed country than for a developing country. The products in the self-selected list of individual Members that fail to be liberalized through the preceding step could then be put up for concessions through a voluntary *request and offer* process.

The lack of consensus on what to liberalize and how to liberalize has stalled the multilateral negotiations at the WTO. The WTO abandoned multilateral negotiations over EGs in 2014, instead opting for a plurilateral agreement. However, the plurilateral negotiations involving 18 participants (46 WTO Members), the Environmental Goods Agreement (EGA) is also currently stalled over the same issue of what products to liberalize.

[29] See WTO (2011) for elaboration and sample modality
[30] See WTO (2011) for elaboration
[31] See WTO (2011) for elaboration

In addition to what we have discussed above, the fact that most of the least developed and developing nations are net importers of the EGs has also been an impediment in the negotiation process as the direct consequence of liberalization would be the bombardment of imports for these nations. That is why a clear divide is seen among developed countries and developing countries. The developed countries actively participated in the negotiations through lists whereas developing countries refrained from submitting lists (except for the Philippines) and few developing countries that participated proposed alternative approaches. This reservation in the part of LDCs and developing countries does not bode well for the prospects of actualizing the aspirations of para 31(iii) of the Doha round.

4.2 Issues in Environmental Services Negotiations

ESs are part of the latest round of services negotiations under the General Agreement on Trade in Services (GATS) that has been taking place since 2000. More particularly, the negotiations on ESs are taking place in the Special Sessions of the Committee for trade in Services (CTS). However, no notable liberalization of ESs (services in general) has been achieved at the multilateral level. Furthermore, negotiations of trade in EGs have overshadowed the negotiations of trade in ESs. "The different modes whereby goods and services are traded and the complexity in identifying barriers to environmental services trade, has led to a clear separation of the two parts in international negotiations, with a resulting lack of attention to services" (Bucher et al., 2014, p. 7). Moreover, the structure of the negotiations - negotiations for EGs and ESs taking place in the different committees at the WTO with different modalities - has rendered a comprehensive and integrated approach practically impossible (UNCTAD, 2009).

One of the major impediments to liberalizing trade of ESs is the complexities arising from the way they are traded. The common method of trading ESs is through commercial presence (Mode 3) and presence of natural persons (Mode 4) given that these services are rendered through highly specialized professionals (Vikhlyaev, 2004). However, Mode 4 remains the least liberalized mode of service trade. Furthermore, since public entities are predominantly involved in providing many ESs such as sewage, sanitation, waste management, etc., these sectors are very likely to have restrictions on commercial presence as well. Hence, the level of ESs commitments bound under the General Agreement on Trade in Services (GATS) are not up to the ones committed in other sectors such as tourism, financial services or telecommunications[32]. Similarly, the lack of an internationally agreed list of ESs arising from the definitional problem has also been a major hindrance. The WTO uses a 1991 Services Sectoral Classification List (MTN.GNS/W/120), which focuses on only three categories: Sewage, Refuse, and Sanitation, with "Other" being the fourth one[33]. Many WTO members criticized the classification as being too narrow and not reflective of the current structure and state of the industry (Vikhlyaev, 2004). Particularly, the W/120 focuses only on the traditional infrastructure ESs while ignoring other important non-infrastructure ESs (relegating them to 'other' category). However, recent developments in regulatory requirements,

[32]https://www.wto.org/english/tratop_e/serv_e/environment_e/environment_e.htm

[33] While 'Other' is presumed to include other components of Central Product Classification (CPC) environmental services category: Cleaning services of exhaust gases, Noise abatement services, Nature and landscape protection services and even other possible additions, the W/120 does not expand on what "other" constitutes and having a large number of services under "Other" still implies that the focus is on the first three categories.

steadily increasing public sensitivity to environmental problems, and trends in private participation have necessitated a need to move beyond the traditional 'infrastructure' services to other 'non-infrastructure' ESs like air pollution control and environment-related support services like environmental consulting (Grosso, 2004). As a result, several proposals to update W/120 have emerged, most notable of which is the one tabled by the European Union[34]. However, no consensus list that would update the W/120 has emerged so far.

4.3 Negotiations disrupting the synergies between Environmental Goods and Environmental Services

The lack of attention to the liberalization of ESs in the multilateral and plurilateral negotiations is unfortunate because EGs and ESs have strong linkages as one is usually an indispensable component of the other. Thus, obstacles to trade in ESs impede the trade of many EGs as well. Steenblik et al. (2015) illustrates with several real-world examples that the growth in the EGs markets is being driven by ESs. A survey of 136 exporting environmental firms also indicated a clear preference for simultaneous liberalization of trade in EGs and ESs as environmental products, technology and services are often supplied on an integrated basis (Fliess & Kim, 2007). Thus, the multilateral and plurilateral negotiations that are only focusing on EGs must broaden their scope to include ESs to enhance the volume of EGS trade to a level that facilitates the transition to Green Growth.

4.4 Trade of Environmental Goods and Services and the Green Growth in South Asia: How the WTO can help

Since the tariff and most importantly non-tariff barriers confronting EGs loom large in South Asia, the WTO Agreement is more necessary than ever to increase EG trade to a level conducive to Green Growth. However, a sole focus on tariff reductions, a feature of the negotiations so far, is not going to yield much benefit given that tariffs are already low in many of the EGs. To really catalyze the trade of EGs, the negotiations must also address the areas that could result in an explosion of cross-border trade of these products: (i) trade of ESs and (ii) non-tariff barriers.

Given the strong complementarities between the trade of EGs and the trade of ESs, the importance of trade of ESs in catalyzing the trade of EGs cannot be ignored. Hence, the WTO Agreement that aims to enhance the trade of EGs to the level conducive to green growth must also have provisions to streamline the trade of ESs.

Similarly, non-tariff barriers have been found to be more disruptive to the trade of EGs than are the tariff barriers. Thus, to really enhance the trade of EGs, the real crux of the WTO Agreement must be to eliminate various forms of trade-impeding non-tariff barriers confronting these products.

Besides these important components, a successful WTO Agreement is also mindful to the needs of LDCs and developing countries. There is a concern among LDCs and developing countries with

[34] The proposed classification by the European Union includes (i) Water for Human Use & Wastewater Management, (ii) Solid/Hazardous Waste Management, (iii) Protection of Ambient Air and Climate, (iv) Remediation and Cleanup of Soil & Water, (v) Noise & Vibration Abatement, (vi) Protection of Biodiversity and Landscape; and (vii) Other Environmental & Ancillary Service.

infantile environmental industries that the primary consequence of an agreement for them would be a bombardment of imports without other major benefits. The fact that increase in South Asia's trade of EGs is predominantly driven by imports and that the countries (except India) have almost no EGs that they have a comparative advantage in exporting substantiates this concern. This apprehension has to be allayed through capacity building, technical assistance, and preferential treatment so that they will be well poised to increase their production and exports. Moreover, since environmental technologies are usually protected by intellectual property rules, extra efforts are required to ensure that effective technology transfer takes place in practice. Furthermore, including Environmentally Preferable Products (EPP) in the WTO Agreement might also motivate the LDCs and developing countries to actively participate in the negotiations as they have comparative advantage in several of these products.

The List based approach seems inadequate to address the real barriers confronting the trade of EGS. Thus, one way to move forward and make a meaningful contribution to the trade of EGs is by adopting a holistic approach, something akin to the integrated-project approach. As pointed out by Jacob & Møller (2017), even though the specific EGs face very low tariffs, many goods required for environmental projects still face high tariffs, particularly in LDCs. This is a major disincentive for firms in the LDCs to make the transition to green modes of production and consumption, as the current levels of tariffs do not enable them to compete with the brown firms. By providing green projects with concessional access to goods and services they need, we will be enabling the green firms to compete and incentivizing the prospective firms to adopt environment-friendly approaches to production, and hence the current level of shallow greening we observed in South Asia in our study could be transformed into meaningful greening of the economies. Besides, the holistic approach, to a certain extent, also encourages measures like capacity building and technology transfer, which are crucial to the needs of LDCs and developing countries.

The reduction in tariff and non-tariff barriers and the concurrent liberalization of ESs will result in lower prices of EGS, will lead to greater availability of environmental technologies at affordable prices, spur innovation, and consequently stimulate the growth of green industries. However, judging from what has transpired in nearly twenty years of negotiations, our recommendations seem overly optimistic. Thus, any agreement, even if it is just the tariff reductions, is much better than current stalemate. The best course in today's context would thus be the reconvening of currently stalled EGA. The tariff reductions thus achieved could still reduce the prices of EGs and thus increase its use and spur innovation, albeit to a lesser extent. But, most importantly, the debates will go beyond its current focus on tariff reductions to the real barriers confronting the trade of EGS- a hindrance to the trade of ESs and non-tariff barriers confronting EGs. Furthermore, the attention can then also shift to how best to address the needs of LDCs and developing countries so that a comprehensive agreement could be achieved at the multilateral level.

5. Summing up: Trade of Environmental Goods and Services and the road from brown to a green economy

On the one hand, South Asia has seen a significant rise in the trade of EGs over the last 10 year, but on the other hand, GHG emission continues to rise and unsustainable forms of energy use fuel the economic engine. Since any small step taken for environmental improvement is praiseworthy, the increased trade of EGs in South Asia should be taken in a positive light. However, since the trade of EGS still faces significant barriers in South Asia, the potential trade of EGS is probably much larger than the current level. Thus, it is our assertion that while the trade of EGs has definitely resulted in some positive impacts to the environment, the effect has been limited and hence only a shallow greening has occurred in South Asia. The current volume of trade of EGs seems grossly insignificant for making a leap to a green economy.

Enhancing the trade of EGS will require reducing or eliminating the barriers impeding the trade of EGs, particularly the non-tariff barriers and lack of progress in the liberalization of ESs. This is what the Doha round envisaged through its popular para 31(iii) but so far the negotiations have not produced any real progress. Against this background, we propose a speedy conclusion to EGA and continuing this progress in tariff reductions to move the debate towards addressing non-tariff barriers and liberalizing trade of ESs and also towards addressing the needs of developing countries so that a meaningful multilateral agreement could take place. Before the multilateral agreement is finalized under WTO, South Asian countries can also opt for selective liberalization in EGS and /or liberalize at the regional level through South Asia's free trade agreement - the South Asian Free Trade Area (SAFTA) - and South Asia's agreement on trade of services - the Saarc Agreement on Trade in Services (SATIS). However, as argued before, these liberalizations must go beyond the scope of tariff reductions to reduce trade obstructing non-tariff barriers and truly facilitate the trade of ESs. How to induce SAFTA and SATIS to liberalize the trade of EGS given the very limited liberalization achieved through SAFTA and lack of progress in SATIS, and what would be the extent of the potential increase in trade of EGS could be an interesting area of research.

Needless to say, while trade of EGS can play an important role in leading the South Asian economies towards Green Growth model, a strong commitment to green economy through legislations, policy, institutional settings, etc. as well as behavioral changes are also needed.

References

APEC. (2012). Annex C – APEC List of Environmental Goods. Retrieved from https://www.apec.org/Meeting-Papers/Leaders-Declarations/2012/2012_aelm/2012_aelm_annexC.aspx

Balineau, G., & Melo, J.D. (2013). Removing Barriers to Trade on Environmental Goods: An Appraisal. *World Trade Review* 12(4): 693-718.

Bucher, H., Drake-Brockman, J., Kasterine, A., &Sugathan, M. (2014). Trade in Environmental Goods and Services: Opportunities and Challenges (ITC Technical Paper No. DMD-14-255.e). Geneva: ITC.

European Commission (EC-JRC)/Netherlands Environmental Assessment Agency (PBL). (2017). Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2 (1970 - 2012). Retrieved from http://edgar.jrc.ec.europa.eu/overview.php?v=booklet2017&dst=GHGemi

European Commission Joint Research Centre (EC-JRC)/Netherlands Environmental Assessment Agency (PBL). (2017). Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2_FT2016 (1970 - 2016). Retrieved from http://edgar.jrc.ec.europa.eu/overview.php?v=booklet2017&dst=CO2pc

Fliess, B., & Kim, J. (2007). Business Perceptions of Non-Tariff Barriers (NTBs) Facing Trade in Selected Environmental Goods and Associated Services: Survey Results (OECD Trade and Environment Working Paper 2007-02 Part I). Paris: OECD.

Global Green Growth Institute. (2017). Green Growth Potential Assessment: Nepal Country Report. Seoul: Global Green Growth Institute.

Grosso, M.G. (2004). Managing Request-Offer Negotiations under the GATS: The Case of Environmental Services (OECD Trade Policy Working Paper No. 11). Paris: OECD.

Hamwey, R.M. (2005). Environmental Goods: Where Do the Dynamic Trade Opportunities for Developing Countries Lie? International Centre for Trade and Sustainable Development.

Howse, R. & Bork, P.B.V. (2006). Options for Liberalising Trade in Environment Goods in the Doha Round (ICTSD Issue Paper No. 2). Geneva: International Centre for Trade and Sustainable Development (ICTSD).

IPCC. (2014). *Climate Change 2014: Mitigation of Climate Change.* Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., Pichs-Madruga, R., Sokona, Y., Farahani, E., Kadner, S.,Seyboth, K., Adler, A., Baum, I., Brunner, S., Eickemeier, P., Kriemann, B., Savolainen, J., Schlömer, S., Stechow, C.v., Zwickel, T., & Minx, J.C. (eds)]. Cambridge and New York: Cambridge University Press.

Jacob, A. &Møller, A.K. (2017). Policy landscape of trade in environmental goods and services (ARTNeT Working Paper No. 166). Bangkok: ESCAP.

Janssens-Maenhout, G., Crippa, M., Guizzardi, D., Muntean, M., Schaaf, E., Olivier, J.G.J., Peters, J.A.H.W., &Schure, K.M. (2017). Fossil CO_2 and GHG emissions of all world countries. Luxembourg: Publications Office of the European Union.

Khatun, F. (2010). Trade Negotiations on Environmental Goods and Services in the LDC context (Discussion Paper). New York: United Nations Development Programme (UNDP).

Melo, J. D., & Solleder, J. 2018. Barriers to Trade in Environmental Goods: How Important they are and what should developing countries expect from their removal (FERDI Working Paper No. 235). Foundation for International Development and Research (FERDI).

OECD. (1999). *The Environmental Goods & Services Industry: Manual for Data Collection and Analysis*. Paris: OECD.

OECD. (2011). *Towards Green Growth*. Paris: OECD.

Steenblik, R. (2005a). Environmental Goods: A Comparison of the APEC and OECD Lists (OECD Trade and Environment Working Paper No. 2005-04). Paris: OECD Publications.

Steenblik, R. (2005b). Liberalising Trade in "Environmental Goods": Some Practical Considerations (OECD Trade and Environment Working Paper No. 2005-05). Paris: OECD.

Steenblik, R. Drouet, D. & Stubbs, G. (2005). Synergies between trade in environmental services and trade in environmental goods (OECD Trade and Environment Working Paper No., 2005-01). Paris: OECD.

Sugathan, M. (2013). Lists of Environmental Goods: An Overview (Environmental Goods and Services Series). Geneva: International Centre for Trade and Sustainable Development.

Teehankee, M.A.J., Jegou, I. & Rodrigues, R. J. (2012). Multilateral Negotiations at the Intersection of Trade and Climate Change (Issue Paper No. 2). Geneva: International Centre for Trade and Sustainable Development (ICTSD).

UN. (2017a). *2015 Energy Balances*. New York: United Nations. Retrieved from https://unstats.un.org/unsd/energy/balance/default.htm

UN. (2017b). *2015 Energy Statistics Yearbook.* New York: United Nations. Retrieved from https://unstats.un.org/unsd/energy/yearbook/default.htm

UNCTAD. 2009. WTO Negotiations on Environmental Goods and Services: A Potential Contribution to the Millennium Development Goals (UNCTAD/DITC/TED/2008/4). New York and Geneva: United Nations Conference on Trade and Development (UNCTAD).

UNEP. (2011). *Toward a Green Economy: Pathways to Sustainable Development and Poverty Eradication*. Nairobi: United Nations Environment Programme (UNEP).

Vikhlyaev, A. (2004). Environmental Goods and Services: Defining Negotiations or Negotiating Definitions?. *UNCTAD Trade and Environment Review 2003* (UNCTAD/DITC/TED/2003/4). New York and Geneva: UNCTAD.

Vossenaar, R. (2013). The APEC List of Environmental Goods: An Analysis of the Outcome & Expected Impact (Environmental Goods and Services Series). Geneva: International Centre for Trade and Sustainable Development.

World Bank. 2012. *Inclusive Green Growth: The Pathway to Sustainable Development*. Washington DC: The World Bank.

WTO. (1991). Services Sectoral Classification List (MTN.GTS/W/120). Retrieved from http://i-tip.wto.org/services/

WTO. (2001). Ministerial Declaration. Retrieved from WTO website: https://www.wto.org/english/thewto_e/minist_e/min01_e/mindecl_e.pdf

WTO. (2003). WTO Committee on Trade and Environment Special Session, OECD Joint Working Party on Trade and Environment: Environmental Goods: A Comparison of the APEC and OECD Lists (WTO TN/TE/W/33). Retrieved from WTO website: https://docs.wto.org/

WTO. (2005a). An Alternative Approach for Negotiations under Paragraph 31(iii), Submission by India, Committee on Trade and Environment Special Session, TN/TE/W/51 (3 June 2005). Retrieved from WTO website: https://docs.wto.org/

WTO. (2005b). Structural Dimensions of the Environmental Project Approach, Submission by India, Committee on Trade and Environment Special Session, TN/TE/W/54 (8 July 2005). Retrieved from WTO website: https://docs.wto.org/

WTO. (2005c). Environmental Goods For Development, Submission by Brazil, Committee on Trade and Environment Special Session, TN/TE/W/59 (8 July 2005). Retrieved from WTO website: https://docs.wto.org/

WTO. (2005d). Integrated Proposal on Environmental Goods for Development, Submission by Argentina, Committee on Trade and Environment Special Session, TN/TE/W/62 (14 October 2005). Retrieved from WTO website: https://docs.wto.org/

WTO. (2010). Report by the Chairman, Ambassador Manuel A.J. Teehankee, to the Trade Negotiations Committee for the purpose of the TNC stocktaking exercise, Committee on Trade and Environment Special Session (TN/TE/19). Retrieved from WTO website: https://docs.wto.org/

WTO. (2011). Report by the Chairman, Ambassador Manuel A.J. Teehankee, to the Trade Negotiations Committee, Committee on Trade and Environment Special Session (TN/TE/20). Retrieved from WTO website: https://docs.wto.org/

Annex

Annex 1: List of Environmental Goods

Table A.1.1: APEC List of Environmental Goods

S.N.	HS 2012	Description	Category
1	441872	Other Assembled Flooring Panels, Multilayer, of Bamboo (44187210)	Environmentally Preferable Products
2	840290	Super-heated water boilers and parts of steam generating boilers	Management of Solid and Hazardous Waste and Recycling Systems
3	840410	Auxiliary plant for steam, water and central boiler	Management of Solid and Hazardous Waste and Recycling Systems
4	840420	Auxiliary plant for use with boilers of heading 84.02 or 84.03 (for example, economisers, super-heaters, soot removers, gas recovers'); condensers for steam or other vapour power units.	Air Pollution Control
5	840490	Auxiliary plant for use with boilers of heading 8402 or 8403 (for example, economizers, super-heaters, soot removers, gas recovers'); condensers for steam or other vapour power units; Part	Air Pollution Control
6	840690	Parts for steam and other vapour turbines.	Renewable Energy Plant
7	841182	Gas turbines, except turbo-jets and turbo-propellers, of a power exceeding 5,000 kW	Renewable Energy Plant
8	841199	Parts of gas turbines	Renewable Energy Plant
9	841290	Parts of the engines & motors of 8412.10-8412.80	Renewable Energy Plant
10	841780	Other industrial or laboratory furnaces and ovens, including incinerators, non-electric	Management of Solid and Hazardous Waste and Recycling Systems
11	841790	Industrial or laboratory furnaces and ovens, including incinerators, nonelectric, and parts thereof: Parts	Management of Solid and Hazardous Waste and Recycling Systems
12	841919	Instantaneous or storage water heaters, non-electric (Solar water heaters)	Renewable Energy Plant
13	841939	Dryers, other (Sludge driers)	Waste Water Management and Potable Water Treatment
14	841960	Machinery for liquefying air or other gases.	Air Pollution Control

15	841989	Industrial machinery, plant or equipment for the treatment of materials, by process involving a change in temperature, nesoi	Air Pollution Control
16	841990	Parts of machinery, plant or laboratory equipment of heading 84.19	Renewable Energy Plant
17	842121	Filtering or purifying machinery and apparatus for liquids: for filtering or purifying water	Waste Water Management and Potable Water Treatment
18	842129	Filtering or purifying machinery and apparatus for liquids: other.	Waste Water Management and Potable Water Treatment
19	842139	Filtering or purifying machinery and apparatus for gas (other than intake air filters for internal combustion engines).	Air Pollution Control
20	842199	Parts Of Household Filtering and Purifying Machines For Gases	Waste Water Management and Potable Water Treatment
21	847420	Crushing/grinding machines for earth/stone/ores/other mineral substance, in solid (incl. powder/paste) form	Management of Solid and Hazardous Waste and Recycling Systems
22	847982	Mixing, kneading, crushing, grinding, screening, sifting, homogenising, emulsifying or stirring machines not elsewhere specified in Chapter 84	Management of Solid and Hazardous Waste and Recycling Systems
23	847989	Machines and mechanical appliances having individual functions, not specified or included elsewhere in this Chapter: Other (E.g. Air Humidifiers or Dehumidifiers; Machines For Squeezing Radioactive Waste)	Management of Solid and Hazardous Waste and Recycling Systems
24	847990	Parts of Machines & mechanical appliances having individual functions, not specified/incld. elsewhere in this Ch. (E.g. Parts of Air Humidifiers or Dehumidifiers)	Management of Solid and Hazardous Waste and Recycling Systems
25	850164	AC generators (alternator), of an output exceeding 750 kVA	Renewable Energy Plant
26	850231	Wind-powered electric generating sets	Renewable Energy Plant
27	850239	Electric generating sets and rotary convertors: other.	Renewable Energy Plant
28	850300	Parts suitable for use solely or principally with the machines of heading 8501 or 8502 (e.g. nacelles and blades for wind turbines)	Renewable Energy Plant
29	850490	Parts for electrical transformers, static converters and inductors	Renewable Energy Plant

30	851410	Resistance heated furnaces and ovens	Management of Solid and Hazardous Waste and Recycling Systems
31	851420	Furnaces and ovens; functioning by induction or dielectric loss.	Management of Solid and Hazardous Waste and Recycling Systems
32	851430	Industrial or laboratory electric furnaces and ovens, nesoi.	Management of Solid and Hazardous Waste and Recycling Systems
33	851490	Parts for industrial or laboratory electric furnaces and ovens (including those functioning by induction or dielectric loss); parts for other industrial or laboratory equipment for the heat treatment of materials by induction or dielectric loss.	Management of Solid and Hazardous Waste and Recycling Systems
34	854140	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes (Solar Cells)	Renewable Energy Plant
35	854390	Parts of the machines and apparatus of 85.43	Waste Water Management and Potable Water Treatment
36	901380	Optical devices, appliances and instruments, nesoi (Solar heliostats)	Renewable Energy Plant
37	901390	parts and accessories for optical devices, appliances and instruments, nesoi (Parts for solar heliostats)	Renewable Energy Plant
38	901580	Surveying instruments and appliances, hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances nesoi	Natural Risk Management
39	902610	Instruments and apparatus for measuring or checking the flow or level of liquids.	Environmental Monitoring, Analysis and Assessment Equipment
40	902620	Instruments and apparatus for measuring or checking pressure of liquids or gases, nesoi.	Environmental Monitoring, Analysis and Assessment Equipment
41	902680	Instruments and apparatus for measuring or checking other variables of liquids or gases, nesoi (E.g. heat meters)	Environmental Monitoring, Analysis and Assessment Equipment
42	902690	Parts and accessories for instruments and apparatus for measuring or checking the flow, level, pressure or other variables of liquids or gases, nesoi.	Environmental Monitoring, Analysis and Assessment Equipment

43	902710	Gas or smoke analysis apparatus (Automatic NOX and NO2 sampler and measuring apparatus; Automatic SO2 sampler and measuring apparatus)	Environmental Monitoring, Analysis and Assessment Equipment
44	902720	Chromatographs and electrophoresis instruments	Environmental Monitoring, Analysis and Assessment Equipment
45	902730	Spectrometers, spectrophotometers and spectrographs using optical radiations (ultraviolet, visible, infrared)	Environmental Monitoring, Analysis and Assessment Equipment
46	902750	Instruments and apparatus for physical and chemical analysis using optical radiations (ultraviolet, visible, infrared), nesoi (E.g. automatic infrared oil content analyzer)	Environmental Monitoring, Analysis and Assessment Equipment
47	902780	Instruments and apparatus for physical and chemical analysis, nesoi (magnetic resonance instruments, mass spectrometers, etc.)	Environmental Monitoring, Analysis and Assessment Equipment
48	902790	Microtomes; parts and accessories for instruments and apparatus for physical or chemical analysis (E.g. polarimeters, refractometers)	Environmental Monitoring, Analysis and Assessment Equipment
49	903149	Measuring or checking instruments, appliances and machines, nesoi (E.g. profile projectors)	Environmental Monitoring, Analysis and Assessment Equipment
50	903180	Other instruments, appliances and machines, not elsewhere specified in heading 90.31	Environmental Monitoring, Analysis and Assessment Equipment
51	903190	Parts and accessories for measuring or checking instruments, appliances and machines, nesoi; parts and accessories for profile projectors.	Environmental Monitoring, Analysis and Assessment Equipment
52	903289	Automatic regulating or controlling instruments and apparatus (excluding thermostats, manostats and hydraulic types), nesoi.	Renewable Energy Plant
53	903290	Parts and accessories of automatic regulating or controlling instruments and apparatus.	Environmental Monitoring, Analysis and Assessment Equipment
54	903300	Parts and accessories (not specified or included elsewhere in this Chapter) for machines, appliances, instruments or apparatus of Chapter 90.	Environmental Monitoring, Analysis and Assessment Equipment

Source: APEC (2012) for the list and WTO (2010) for categorization

Table A.1.2: OECD List of Environmental Goods

HS 2012	Description	Category
220110[#]	Mineral waters and aerated waters	Resources Management Group
220190[#]	Waters, including natural or artificial mineral waters; other	Resources Management Group
220710	Ethanol	Resources Management Group
252100	Limestone flux	Pollution Management
252220	Slaked (hydrated) lime	Pollution Management
280110	Chlorine	Pollution Management
281410	Anhydrous ammonia	Pollution Management
281511	Sodium hydroxide solid	Pollution Management
281512	Sodium hydroxide in aqueous solution	Pollution Management
281610	Magnesium hydroxide and peroxide	Pollution Management
281830	Aluminium hydroxide	Pollution Management
282010	Manganese dioxide	Pollution Management
282090	Manganese oxides (other)	Pollution Management
282410	Lead monoxide	Pollution Management
283210	Sodium sulphites	Pollution Management
283220	Other sulphites	Pollution Management
283510	Phosphinates and phosphonates	Pollution Management
283521[$]	Phosphates of triammonium	Pollution Management
283522	Phosphates of monosodium or disodium	Pollution Management
283523[$]	Phosphates of trisodium	Pollution Management
283524	Phosphates of potassium	Pollution Management
283525	Calcium hydrogenorthophosphate	Pollution Management
283526	Other phosphates of calcium	Pollution Management
283529	Other phosphates (excl. polyphosphates)	Pollution Management
284700	Hydrogen peroxide	Cleaner Technologies and Products
285300[1]	Distilled and conductivity water	Resources Management Group
290511	Methanol	Resources Management Group
320910	Paints and varnishes, in aqueous medium, acrylic or vinyl	Cleaner Technologies and Products
320990	Other paints and varnishes, in aqueous medium	Cleaner Technologies and Products
380210	Activated carbon	Pollution Management
381511[&]	Catalysts with nickel compounds as the active substance	Resources Management Group
381512[&]	Catalysts with precious metal or precious metal compounds as the active substance	Resources Management Group
381519[&]	Catalysts; other	Resources Management Group
381590[&]	Reaction initiators, reaction accelerators and catalytic preparations; other	Resources Management Group
391400	Ion exchangers (polymer)	Resources Management Group
392020	Polypropylene sheeting, etc.	Pollution Management
392490	Household & toilet articles of plastic	Pollution Management
392690	Other articles of plastics and articles of other materials of HS3901 to 3914; other	Pollution Management
580190	Woven pile & chenille fabrics of other textile materials	Pollution Management
681099	Other articles of cement, concrete	Pollution Management
700800	Multiple-walled insulating units of glass	Resources Management Group
701990	Other glass fibre products	Pollution Management
730900	Tanks, vats, etc., > 300 litres	Pollution Management
731010	Tanks, drums, etc., >50 litres <300 litres	Pollution Management

731021	Cans < 50 litres, closed by soldering or crimping	Pollution Management
731029	Other cans < 50 litres	Pollution Management
732510	Articles of cast iron	Pollution Management
780600	Other articles of lead	Pollution Management
840991	Parts suitable for use solely or principally with the engines of HS 8407 or 8408; suitable for use solely or principally with spark-ignition internal combustion piston engines	Pollution Management
840999	Parts for diesel or semi-diesel engines	Pollution Management
841011	Hydraulic turbines 11	Pollution Management
841012	Hydraulic turbines 12	Pollution Management
841013	Hydraulic turbines 13	Pollution Management
841090	Parts for hydraulic turbines	Pollution Management
841320	Root-control equipment	Pollution Management
841350	Positive displacement pumps, hand-operated [centrifugal pumps]	Pollution Management
841360	Pumps for liquids, whether or not fitted with a measuring device; other rotary positive displacement pumps	Pollution Management
841370	Pumps for liquids, whether or not fitted with a measuring device; other centrifugal pumps	Pollution Management
841381	Other pumps	Pollution Management
841410	Vacuum pumps	Pollution Management
841430	Compressors of a kind used in refrigerating equipment	Pollution Management
841440	Air compressors mounted on a wheeled chassis for towing	Pollution Management
841480	Other air or gas compressors or hoods	Pollution Management
841490	Parts for air or gas compressors, fans or hoods	Pollution Management
841780	Industrial or laboratory furnaces and ovens, including incinerators, non-electric; other than bakery ovens and furnaces for treatment of ores	Pollution Management
841790	Parts of Industrial or laboratory furnaces and ovens, including incinerators, non-electric	Pollution Management
841911	Instantaneous gas water heaters	Resources Management Group
841919	Other instantaneous or storage water heaters, nonelectric	Resources Management Group
841950	Heat exchange units	Resources Management Group
841960	Machinery for liquefying air or other gases	Pollution Management
841989	Other machinery for treatment of materials by change of temperature	Pollution Management
841990	Parts for heat exchange equipment	Resources Management Group
842119	Other centrifuges	Pollution Management
842121	Filtering or purifying machinery and apparatus for liquids: for filtering or purifying water	Pollution Management
842129	Filtering or purifying machinery and apparatus for liquids; other	Pollution Management
842139	Filtering or purifying machinery and apparatus for gases	Pollution Management
842191	Parts of centrifuges	Pollution Management
842199	Parts for filtering or purifying machinery	Pollution Management
842220	Machinery for cleaning or drying bottles or other containers	Pollution Management
842381	Weighing machines capacity <30 kg	Pollution Management
842382	Weighing machines capacity >30 kg <500 kg	Pollution Management
842389	Weighing machines	Pollution Management
842490	Parts for sprayers for powders or liquids	Pollution Management

847439	Other mixing or kneading machines for earth, stone, sand, etc.	Pollution Management
847982	Mixing, kneading, crushing, grinding, screening, sifting, homogenising emulsifying or stirring machines	Pollution Management
847989	Machines and mechanical appliances having individual functions, not elsewhere specified or included in this chapter, other	Pollution Management
848110	Valves, pressure-reducing	Pollution Management
848130	Valves, check	Pollution Management
848140	Valves, safety	Pollution Management
848180	Other taps, cocks, valves, etc.	Pollution Management
851410	Industrial or laboratory furnaces and ovens; electric, resistance heated	Pollution Management
851420	Industrial or laboratory induction or dielectric furnaces	Pollution Management
851430	Industrial or laboratory furnaces and ovens, electric, other	Pollution Management
851490	Parts of industrial or laboratory electric furnaces and ovens or other laboratory induction or dielectric heating equipment	Pollution Management
851629	Other electric space heating and soil heating apparatus	Pollution Management
853931	Fluorescent lamps, hot cathode	Resources Management Group
854140	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light-emitting diodes	Resources Management Group
854370[2]	Other electrical machines and apparatus with one function	Pollution Management
870892	Silencers and exhaust pipes, motor vehicles	Pollution Management
901320	Lasers	Pollution Management
902511	Thermometers and pyrometers, not combined with other instruments: liquid-filled, for direct reading	Pollution Management
902519	Thermometers and pyrometers, not combined with other instruments: other than liquid-filled, for direct reading	Pollution Management
902580	Hydrometers and similar floating instruments, thermometers, pyrometers, barometers, hygrometers and psychrometers, recording or not, and any combination of these instruments	Pollution Management
902610	Instruments for measuring the flow or level of liquids	Pollution Management
902620	Instruments for measuring or checking pressure	Pollution Management
902680	Other instruments and apparatus	Pollution Management
902690	Parts and accessories for articles of HS 9026	Pollution Management
902710	Gas or smoke analysis apparatus	Pollution Management
902720	Chromatographs and electrophoresis instruments	Pollution Management
902730	Spectrometers, spectrophotometers and spectrographs using optical radiations (ultraviolet, visible, infrared)	Pollution Management
902780[3]	Exposure meters [including sound-level meters]	Pollution Management
902750	Other instruments and apparatus using optical radiations (ultraviolet, visible, infrared)	Pollution Management
902790	Microtomes; parts and accessories	Pollution Management
902810	Gas supply, production and calibrating metres	Resources Management Group
902820	Liquid supply, production and calibrating metres	Resources Management Group
903010	Instruments and apparatus for measuring or detecting ionising radiations	Pollution Management
903149	Other optical instruments	Pollution Management
903180	Other measuring or checking instruments, appliances and machines, not elsewhere specified in this chapter	Pollution Management

903210	Thermostats	Pollution Management
903220	Manostats	Pollution Management
903281	Hydraulic and pneumatic instruments and apparatus	Pollution Management
903289	Automatic regulating or controlling instruments, other	Pollution Management
960310	Brooms, hand	Pollution Management
960350	Brushes as parts of machines, appliances	Pollution Management
960390	Mechanical floor sweepers	Pollution Management

 # Listed as HS 220100 in available lists as per previous HS classification
& Listed as HS 381500 in available lists as per previous HS classification
$ HS 283521 and HS 283523 not described in HS 2012
1 Listed as HS 285100 in available lists as per previous HS classification
2 Listed as HS 854389 in available lists as per previous HS classification
3 Listed as HS 902740 in available lists as per previous HS classification

Source: Authors' updates in OECD (1996); WTO (2003); Steenblik (2005); and Sugathan (2013)

Table A.1.3: Friends' List of Environmental Goods

HS 2002	Description	Category
840420	Condensers for steam or other vapour power units	Air Pollution Control (APC)
840490	Parts for auxiliary plant for boilers, condensers for steam, vapour power unit.	Air Pollution Control (APC)
840510	Producer gas or water gas generators, with or without their purifiers; acetylene gas generators and similar water process gas generators, with or without their purifiers.	Air Pollution Control (APC)
841410	Vacuum pumps.	Air Pollution Control (APC)
841430	Compressors of a kind used in refrigerating equipment	Air Pollution Control (APC)
841440	Air compressors mounted on a wheeled chassis for towing.	Air Pollution Control (APC)
841459	Fans other than table, floor, wall, window, ceiling or roof fans, with a self-contained electric motor of an output not exceeding 125 W.	Air Pollution Control (APC)
841480	Air Pumps, air/oth. gas compressors and fans (excl. of 8414.10-8414.59); ventilating/recycling hoods incorp. a fan, whether or not fitted with filters (excl. of 8414.60).	Air Pollution Control (APC)
841490	Air or vacuum pumps, air or other gas compressors and fans; ventilating or recycling hoods incorporating a fan, whether or not fitted with filters: Parts.	Air Pollution Control (APC)
841960	Machinery for liquefying air or other gases.	Air Pollution Control (APC)
841989	Machinery, plant or laboratory equipment, whether or not electrically heated (excluding furnaces, ovens and other equipment of heading 85.14), for the treatment of materials by a process involving a change of temperature such as heating, cooking, roasting, distilling, rectifying, sterilising, pasteurising, steaming, drying, evaporating, vaporising, condensing or cooling, other than machinery or plant of a kind used for domestic purposes; instantaneous or storage water heaters, non-electric.	Air Pollution Control (APC)
842139	Filtering or purifying machinery and apparatus for gas (other than intake air filters for internal combustion engines).	Air Pollution Control (APC)

902610	Instruments for measuring or checking the flow, level, pressure or other variables of liquids or gases.	Air Pollution Control (APC)
730820	Towers and lattice masts.	Renewable Energy (RE)
761100	Aluminium reservoirs, tanks, vats and similar containers, for any material (other than compressed or liquefied gas), of a capacity exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment: tanks etc., over 300 litres capacity, aluminium.	Renewable Energy (RE)
840681	Steam and other vapour turbines (other than turbines for marine propulsion): Of an output exceeding 40 MW.	Renewable Energy (RE)
840682	Steam turbines and other vapour turbines (other than for marine propulsion) of an output not exceeding 40 MW.	Renewable Energy (RE)
840690	Parts for steam and other vapour turbines.	Renewable Energy (RE)
841011	Hydraulic turbines and water wheels of a power not exceeding 1,000 kW.	Renewable Energy (RE)
841090	Hydraulic turbines, water wheels, and regulators; parts, including regulators.	Renewable Energy (RE)
841181	Other gas turbines of a power not exceeding 5,000 kW.	Renewable Energy (RE)
841182	Other gas turbines of a power exceeding 5,000 kW	Renewable Energy (RE)
841861	Compression-type refrigerating, freezing equipment whose condensers are heat exchangers; Refrigerating, freezing equipment not elsewhere specified in 84.18; heat pumps and Air-conditioning machines incorporating a refrigerating unit and a valve for reversal of the cooling/heat cycle (reversible heat pumps)	Renewable Energy (RE)
841869	Compression-type refrigerating, freezing equipment whose condensers are heat exchangers; Refrigerating, freezing equipment not elsewhere specified in 84.18; heat pumps and Air-conditioning machines incorporating a refrigerating unit and a valve for reversal of the cooling/heat cycle (reversible heat pumps)	Renewable Energy (RE)
841581	Compression-type refrigerating, freezing equipment whose condensers are heat exchangers; Refrigerating, freezing equipment not elsewhere specified in 84.18; heat pumps and Air-conditioning machines incorporating a refrigerating unit and a valve for reversal of the cooling/heat cycle (reversible heat pumps)	Renewable Energy (RE)
841919	Instantaneous or storage water heaters, non-electric (other than instantaneous gas water heaters).	Renewable Energy (RE)
841990	Parts of machinery, plant and equipment of heading No 84.19	Renewable Energy (RE)
848340	Gears and gearing, other than toothed wheels, chain sprockets and other transmission elements presented separately; ball or roller screws; gear boxes and other speed changers, including torque converters	Renewable Energy (RE)
848360	Clutches and shaft couplings (including universal joints).	Renewable Energy (RE)
850161	AC generators (alternators), of an output not exceeding 75 kVA	Renewable Energy (RE)

850162	AC generators (alternator), of an output exceeding 75 kVA but not exceeding 375 kVA	Renewable Energy (RE)
850163	AC generators (alternator), of an output exceeding 375 kVA but not exceeding 750 kVA	Renewable Energy (RE)
850164	AC generators (alternator), of an output exceeding 750 kVA	Renewable Energy (RE)
850231	Other electric generating sets: Wind-powered.	Renewable Energy (RE)
850239	Electric generating sets and rotary convertors: other	Renewable Energy (RE)
850300	Parts suitable for use solely or principally with the machines of heading 85.01 or 85.02.	Renewable Energy (RE)
850440	Static converters	Renewable Energy (RE)
850720	Electric accumulators, including separators thereof, whether or not rect. (incl. square), lead-acid (exclusive of 8507.10)	Renewable Energy (RE)
853710	Boards, panels, consoles, desks, cabinets and other bases, equipped with 2 or more app. of 85.35/85.36, for electrical control..., for a voltage not exceeding 1000V	Renewable Energy (RE)
854140	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes.	Renewable Energy (RE)
900190	Optical fibres and optical fibre bundles; optical fibre cables other than those of heading 85.44; sheets and plates of polarising material; lenses (including contact lenses), prisms, mirrors and other optical elements, of any material, unmounted, other than such elements of glass not optically worked: Other: Lenses prisms mirrors optical element not optically worked	Renewable Energy (RE)
900290	Lenses, prisms, mirrors and other optical elements, of any material, mounted, being parts of or fittings for instruments or apparatus, other than such elements of glass not optically worked: Other: Prism, mirrors, mounted and parts and accessories, not elsewhere specified or included	Renewable Energy (RE)
903289	Automatic regulating or controlling instruments, other	Renewable Energy (RE)
842119	Centrifuges, including centrifugal dryers, other than cream separators and clothes-dryers.	Clean Up or Remediation of Soil and Water (R/C)
842191	Parts of centrifuges, including centrifugal dryers	Clean Up or Remediation of Soil and Water (R/C)
851629	Electric space heating apparatus and electric soil heating apparatus; other.	Clean Up or Remediation of Soil and Water (R/C)
890790	Other floating structures (for example, rafts, tanks, coffer-dams, landing-stages, buoys and beacons): Other (other than inflatable rafts).	Clean Up or Remediation of Soil and Water (R/C)

392010	Other plates, sheets, film, foil and strip, of polymers of ethylene, non-cellular and not reinforced, laminated, supported or similarly combined with other materials: Plates, sheets, film, foil and strip of plastics, not self-adhesive, non-cellular, not reinforced or laminated etc., of polymers of ethylene.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
761290	Aluminium casks, drums, cans, boxes and similar containers (including rigid or collapsible tubular containers), for any material (other than compressed or liquefied gas), of a capacity not exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
840219	Steam or other vapour generating boilers (other than central heating hot water boilers capable also of producing low pressure steam); super-heated water boilers: and part of the boilers of 840211 - 840220	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
840290	Steam or other vapour generating boilers (other than central heating hot water boilers capable also of producing low pressure steam); super-heated water boilers.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
840410	Auxiliary plant for use with boilers of heading 84.02 or 84.03 (for example, economisers, super-heaters, soot removers, gas recoverers); condensers for steam or other vapour power units.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
841780	Other industrial or laboratory furnaces and ovens, including incinerators, non-electric	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
841790	Industrial or laboratory furnaces and ovens, including incinerators, non-electric: Parts.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
841940	Distilling or rectifying plant.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
842220	Machinery for cleaning or drying bottles or other containers	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
842290	Machinery for cleaning or drying bottles or other containers: Parts.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
842940	Tamping machines and road rollers.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
846291	Hydraulic presses for working metal.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
846596	Splitting, slicing or paring machines.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)

846599	Other machine tools not elsewhere specified or included	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
846694	Parts and accessories suit. for use solely/princ. with the machines of 84.62/84.63.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
847420	Crushing or grinding machines.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
847982	Mixing, kneading, crushing, grinding, screening, sifting, homogenising, emulsifying or stirring machines not elsewhere specified in Chapter 84	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
847989	Machines and mechanical appliances having individual functions, not specified or included elsewhere in this Chapter: Other.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
847990	Parts of the mach. and mech. appls. of 84.79	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
850590	Other, including parts	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
851410	Resistance heated furnaces and ovens.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
851420	Furnaces and ovens; functioning by induction or dielectric loss.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
851430	Other furnaces and ovens.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
851490	Parts of industrial or laboratory electric furnaces and ovens; other laboratory induction or dielectric heating equipment.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)
560314	Non wovens, whether or not impregnated, coated, covered or laminated: Of man-made filaments: Weighing more than 150 g/m2.	Waste Water Management and Potable Water Treatment (WWM)
691010	Ceramic sinks, wash basins, wash basin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures: Of porcelain or china.	Waste Water Management and Potable Water Treatment (WWM)
730300	Tubes, pipes and hollow profiles, of cast iron:	Waste Water Management and Potable Water Treatment (WWM)
730431	Tubes, pipes and hollow profiles, seamless, of iron (other than cast iron) or steel: Other than Line pipe of a kind used for oil or gas pipelines.	Waste Water Management and Potable Water Treatment (WWM)

730439	Tubes, pipes and hollow profiles, seamless, of iron (other than cast iron) or steel: Other than Line pipe of a kind used for oil or gas pipelines.	Waste Water Management and Potable Water Treatment (WWM)
730441	Tubes, pipes and hollow profiles, seamless, of iron (other than cast iron) or steel: Other than Line pipe of a kind used for oil or gas pipelines.	Waste Water Management and Potable Water Treatment (WWM)
730449	Tubes, pipes and hollow profiles, seamless, of iron (other than cast iron) or steel: Other than Line pipe of a kind used for oil or gas pipelines.	Waste Water Management and Potable Water Treatment (WWM)
730451	Tubes, pipes and hollow profiles, seamless, of iron (other than cast iron) or steel: Other than Line pipe of a kind used for oil or gas pipelines.	Waste Water Management and Potable Water Treatment (WWM)
730459	Tubes, pipes and hollow profiles, seamless, of iron (other than cast iron) or steel: Other than Line pipe of a kind used for oil or gas pipelines.	Waste Water Management and Potable Water Treatment (WWM)
730490	Tubes, pipes and hollow profiles, seamless, of iron (other than cast iron) or steel: Other than Line pipe of a kind used for oil or gas pipelines.	Waste Water Management and Potable Water Treatment (WWM)
730630	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel: Other:	Waste Water Management and Potable Water Treatment (WWM)
730640	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel: Other:	Waste Water Management and Potable Water Treatment (WWM)
730650	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel: Other:	Waste Water Management and Potable Water Treatment (WWM)
730660	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel: Other:	Waste Water Management and Potable Water Treatment (WWM)
730690	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel: Other:	Waste Water Management and Potable Water Treatment (WWM)
730900	Reservoirs, tanks, vats and similar containers for any material (other than compressed or liquefied gas), of iron or steel, of a capacity exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment; Tanks etc., over 300 litres capacity, iron or steel; Reservoirs, tanks, vats and similar containers, capacity >300L, iron or steel (ex liq/compr gas type); Reservoirs, tanks, vats and similar containers, of iron or steel, > 300 litres	Waste Water Management and Potable Water Treatment (WWM)

731010	Tanks, casks, drums, cans, boxes and similar containers, for any material (other than compressed or liquefied gas), of iron or steel, of a capacity not exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment: Of a capacity of 50 l or more: Composting systems of organic matter.	Waste Water Management and Potable Water Treatment (WWM)
731029	Tanks, casks, drums, cans, boxes and similar containers, for any material (other than compressed or liquefied gas), of iron or steel, of a capacity not exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment: Of a capacity of less than 50 l: Other (excluding containers fitted with mechanical or thermal equipment, and cans); Other cans which are to be closed by soldering or crimping, capacity less 50L	Waste Water Management and Potable Water Treatment (WWM)
732490	Sanitary ware and parts thereof, of iron or steel: Exclusive of 732410 - 732429.	Waste Water Management and Potable Water Treatment (WWM)
732510	Other cast articles of iron or steel; of non-malleable cast iron	Waste Water Management and Potable Water Treatment (WWM)
732690	Other articles of iron or steel: Other	Waste Water Management and Potable Water Treatment (WWM)
841320	Hand pumps, other than those of subheading 8413.11 or 8413.19	Waste Water Management and Potable Water Treatment (WWM)
841350	Other reciprocating positive displacement pumps	Waste Water Management and Potable Water Treatment (WWM)
841360	Other rotary positive displacement pumps	Waste Water Management and Potable Water Treatment (WWM)
841370	Other centrifugal pumps	Waste Water Management and Potable Water Treatment (WWM)
841381	Pumps for liquids, whether or not fitted with a measuring device; other pumps	Waste Water Management and Potable Water Treatment (WWM)
841939	Dryers, other:	Waste Water Management and Potable Water Treatment (WWM)
842121	Filtering or purifying machinery and apparatus for liquids: for filtering or purifying water	Waste Water Management and Potable Water Treatment (WWM)
842129	Filtering or purifying machinery and apparatus for liquids: other.	Waste Water Management and Potable Water Treatment (WWM)

842199	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases: Parts (other than of centrifuges and centrifugal dryers):Filtering or purifying machinery and apparatus for water and parts thereof	Waste Water Management and Potable Water Treatment (WWM)
842833	Other continuous-action elevators and conveyors, for goods or materials: Other, belt type	Waste Water Management and Potable Water Treatment (WWM)
848110	Pressure-reducing valves	Waste Water Management and Potable Water Treatment (WWM)
841120	Valves for oleohydraulic or pneumatic transmissions	Waste Water Management and Potable Water Treatment (WWM)
848130	Check (non-return) valves	Waste Water Management and Potable Water Treatment (WWM)
848140	Safety or relief valves	Waste Water Management and Potable Water Treatment (WWM)
848180	Other appliances for pipes, boiler shells, tanks, vats or the like	Waste Water Management and Potable Water Treatment (WWM)
848190	Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, including pressure-reducing valves and thermostatically controlled valves: Parts.	Waste Water Management and Potable Water Treatment (WWM)
854389	Other electrical machines and apparatus having individual functions, not elsewhere specified in chapter 85	Waste Water Management and Potable Water Treatment (WWM)
854390	Parts of the machines and apparatus of 85.43	Waste Water Management and Potable Water Treatment (WWM)
732111	Cooking appliances and plate warmers: For gas fuel or for both gas and other fuels	Cleaner or more Resource Efficient Technologies and products (CT/P)
732190	Stoves, ranges, grates, cookers (including those with subsidiary boilers for central heating), barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel: Parts.	Cleaner or more Resource Efficient Technologies and products (CT/P)
850680	Other primary cells and primary batteries	Cleaner or more Resource Efficient Technologies and products (CT/P)
850980	Electro-mechanical domestic appliances, with self-contained electric motor: Other.	Cleaner or more Resource Efficient Technologies and products (CT/P)

901530	Levels: Hydrological, oceanographic, meteorological instruments and appliances. Exclusive of 90.31	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
902610	Instruments and apparatus for measuring or checking the flow or level of liquid	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
902620	Instruments and apparatus for measuring or checking pressure	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
902680	Other instruments and apparatus	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
902690	Parts and accessories for articles of subheading 9026	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
902710	Gas or smoke analysis apparatus	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
902720	Chromatographs and electrophoresis instruments	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
902730	Spectrometers, spectrophotometers and spectrographs using optical radiations (UV, visible, IR)	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
902740	Exposure meters	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
902750	Other instruments and apparatus using optical radiations (UV, visible, IR)	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
902780	Instruments and apparatus for physical or chemical analysis not elsewhere specified in 90.27.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
902790	Microtomes; parts and accessories of instruments and appliances of 90.27.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903010	Instruments and apparatus for measuring or detecting ionising radiations.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903020	Cathode-ray oscilloscopes and cathode-ray oscillographs.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903031	Multimeters.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)

903039	Other instruments and apparatus, for measuring or checking voltage, current, resistance or power, without a recording device.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903083	Other instruments and apparatus for measuring or checking electrical quantities, with a recording device.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903089	Other instruments and apparatus for measuring or checking electrical quantities.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903090	Parts and accessories of Heading 90.30.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903120	Test benches.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903130	Profile projectors.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903149	Other measuring and checking instruments, appliances and machines, not specified or included elsewhere in this chapter: Other optical instruments, appliances and machines elsewhere specified for measuring or checking.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903180	Other instruments, appliances and machines.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903190	Parts and accessories of the instruments and appliances and machines of 90.31.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903210	Thermostats.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903220	Manostats	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903281	Hydraulic and pneumatic instruments and apparatus.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903290	Parts and accessories for nominated articles of subheading 9032.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)
903300	Parts and accessories (not specified or included elsewhere in this Chapter) for machines, appliances, instruments or apparatus of Chapter 90.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)

701931	Glass fibres (including glass wool) and articles thereof (for example, yarn, woven fabrics): Mats	Heat and Energy Management (H/EM)
841950	Heat exchange units, whether or not electrically heated	Heat and Energy Management (H/EM)
902810	Gas meters -including calibrating meters thereof	Heat and Energy Management (H/EM)
902820	Liquid meters including calibrating meters thereof	Heat and Energy Management (H/EM)
902830	Electricity meters	Heat and Energy Management (H/EM)
902890	Parts and accessories for articles of subheading 9028:	Heat and Energy Management (H/EM)
901540	Photogrammeterical surveying instruments and appliances	Natural Risk Management (RM)
901580	Other surveying, hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances, excluding compasses, not elsewhere specified in 90.15	Natural Risk Management (RM)
901590	Parts and accessories of the instruments and appliances of 90.15	Natural Risk Management (RM)
450410	Agglomerated cork (with or without a binding substance) and articles of agglomerated cork: Panels, boards, tiles, blocks and similar articles of agglomerated cork	Noise and Vibration Abatement (N/V)
840991	Parts suitable for use solely or principally with the engines of heading No. 84.07 or 84.08: Other: Suitable for use solely or principally with spark-ignition internal combustion piston engines.	Noise and Vibration Abatement (N/V)
840999	Parts suitable for use solely or principally with the engines of heading No. 84.07 or 84.08: Other.	Noise and Vibration Abatement (N/V)
903110	Machines for balancing mechanical parts.	Noise and Vibration Abatement (N/V)
530310	Jute and other textile bast fibres (excluding flax, true hemp and ramie), raw or processed but not spun; tow and waste of these fibres (including yarn waste and garnetted stock).	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)
530410	Sisal other textile fibres of the genus *Agave* raw	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)
530490	Sisal and other textile fibres of the genus Agave, processed but not spun; tow and waste of these fibres (including yarn waste and garnetted stock).	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)

560710	Twine, cordage, ropes and cables, whether or not plaited or braided and whether or not impregnated, coated, covered or sheathed with rubber or plastics: Of jute or other textile bast fibres of heading 53.03.	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)
560721	Twine, cordage, ropes and cables whether or not plaited or braided and whether or not impregnated, coated, covered or sheathed with rubber or plastics: Of sisal or other textile fibres of the genus Agave: Binder or baler twine	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)
630510	Sacks and bags, of a kind used for the packing of goods: Of jute or of other textile bast fibres of heading 53.03.	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)
560811	Made-up fishing nets of man-made textile materials	Natural Resources Protection (NR)
560890	Knotted netting of twine, cordage or rope; made up fishing nets and other made up nets, of textile materials; Other than made-up fishing nets of manmade textile materials: Knot net of twine made-up fish net textile materials not elsewhere specified or included.	Natural Resources Protection (NR)
950720	Fish-hooks, whether or not snelled.	Natural Resources Protection (NR)

Source: WTO JOB (09)/132 in WTO TN/TE/19

Annex 2: Top EGs exports of South Asian Countries (Friends List)

Table A.2.1: Top 10 EGs exports of Bangladesh in 2016 (in US$ Million)

SN	HS 2012	Description	Category	Export (in US$ Million)	Share in total EG exports (%)
1	530310	Jute and other textile bast fibres (excluding flax, true hemp and ramie), raw or processed but not spun; tow and waste of these fibres (including yarn waste and garnetted stock).	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)	171.09	58.78
2	630510	Sacks and bags, of a kind used for the packing of goods: Of jute or of other textile bast fibres of heading 53.03.	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)	87.67	30.12

3	900190	Optical fibres and optical fibre bundles; optical fibre cables other than those of heading 85.44; sheets and plates of polarising material; lenses (including contact lenses), prisms, mirrors and other optical elements, of any material, unmounted, other than such elements of glass not optically worked: Other: Lenses prisms mirrors optical element not optically worked	Renewable Energy (RE)	9.56	3.28
4	900290	Lenses, prisms, mirrors and other optical elements, of any material, mounted, being parts of or fittings for instruments or apparatus, other than such elements of glass not optically worked: Other: Prism, mirrors, mounted and parts and accessories, not elsewhere specified or included	Renewable Energy (RE)	4.60	1.58
5	560721	Twine, cordage, ropes and cables whether or not plaited or braided and whether or not impregnated, coated, covered or sheathed with rubber or plastics: Of sisal or other textile fibres of the genus Agave: Binder or baler twine	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)	2.57	0.88
6	732690	Other articles of iron or steel: Other	Waste Water Management and Potable Water Treatment (WWM)	2.54	0.87
7	854140	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes.	Renewable Energy (RE)	2.06	0.71
8	560811	Made-up fishing nets of man-made textile materials	Natural Resources Protection (NR)	1.66	0.57
9	903190	Parts and accessories of the instruments and appliances and machines of 90.31.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)	1.29	0.44
10	840999	Parts suitable for use solely or principally with the engines of heading No. 84.07 or 84.08: Other.	Noise and Vibration Abatement (N/V)	1.16	0.40
				Total	97.64

Data Source: Authors' computation using trade data from ITC Trade Map; and Friends list from WTO JOB (09)/132

Table A.2.2: EGs exports of Bhutan in 2016 (in US$ Million)

SN	HS 2012	Description	Category	Export (in US$ Million)	Share in total EG exports (%)
1	392010	Other plates, sheets, film, foil and strip, of polymers of ethylene, non-cellular and not reinforced, laminated, supported or similarly combined with other materials: Plates, sheets, film, foil and strip of plastics, not self-adhesive, non-cellular, not reinforced or laminated etc., of polymers of ethylene.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	0.51	88.58
2	890790	Other floating structures (for example, rafts, tanks, coffer-dams, landing-stages, buoys and beacons): Other (other than inflatable rafts).	Clean Up or Remediation of Soil and Water (R/C)	0.05	8.82
3	841480	Air Pumps, air/oth. gas compressors and fans (excl. of 8414.10-8414.59); ventilating/recycling hoods incorp. a fan, whether or not fitted with filters (excl. of 8414.60).	Air Pollution Control (APC)	0.01	1.04
4	850440	Static converters	Renewable Energy (RE)	0.00	0.52
5	902610	Instruments and apparatus for measuring or checking the flow or level of liquid	Environmental Monitoring, Analysis and Assessment Equipment (M/A)	0.00	0.52
6	841381	Pumps for liquids, whether or not fitted with a measuring device; other pumps	Waste Water Management and Potable Water Treatment (WWM)	0.00	0.35
7	902620	Instruments and apparatus for measuring or checking pressure	Environmental Monitoring, Analysis and Assessment Equipment (M/A)	0.00	0.17
				Total	100

Data Source: Authors' computation using trade data from ITC Trade Map; and Friends list from WTO JOB (09)/132

Table A.2.3: Top 10 EGs exports of India in 2016 (in US$ Million)

SN	HS 2012	Description	Category	Export (in US$ Million)	Share in total EG exports (%)
1	848180	Other appliances for pipes, boiler shells, tanks, vats or the like	Waste Water Management and Potable Water Treatment (WWM)	707.11	7.04
2	840999	Parts suitable for use solely or principally with the engines of heading No. 84.07 or 84.08: Other.	Noise and Vibration Abatement (N/V)	671.84	6.69
3	732690	Other articles of iron or steel: Other	Waste Water Management and Potable Water Treatment (WWM)	619.84	6.17

4	850440	Static converters	Renewable Energy (RE)	526.61	5.24
5	853710	Boards, panels, consoles, desks, cabinets and other bases, equipped with 2 or more app. of 85.35/85.36, for electrical control..., for a voltage not exceeding 1000V	Renewable Energy (RE)	352.05	3.50
6	847989	Machines and mechanical appliances having individual functions, not specified or included elsewhere in this Chapter: Other.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	284.68	2.83
7	848190	Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, including pressure-reducing valves and thermostatically controlled valves: Parts:.	Waste Water Management and Potable Water Treatment (WWM)	268.97	2.68
8	841490	Air or vacuum pumps, air or other gas compressors and fans; ventilating or recycling hoods incorporating a fan, whether or not fitted with filters: Parts.	Air Pollution Control (APC)	253.37	2.52
9	730820	Towers and lattice masts.	Renewable Energy (RE)	247.50	2.46
10	841480	Air Pumps, air/oth. gas compressors and fans (excl. of 8414.10-8414.59); ventilating/recycling hoods incorp. a fan, whether or not fitted with filters (excl. of 8414.60).	Air Pollution Control (APC)	244.21	2.43
				Total	41.56

Data Source: Authors' computation using trade data from UN COMTRADE; and Friends list from WTO JOB (09)/132

Table A.2.4: EGs exports of Maldives in 2016 (in US$ Million)

SN	HS 2012	Description	Category	Export (in US$ Million)	Share in total EG exports (%)
1	850680	Other primary cells and primary batteries	Cleaner or more Resource Efficient Technologies and products (CT/P)	0.36	99.96
2	732690	Other articles of iron or steel: Other	Waste Water Management and Potable Water Treatment (WWM)	0.00	0.04
				Total	100.00

Data Source: Authors' computation using trade data from UN COMTRADE; and Friends list from WTO JOB (09)/132

Table A.2.5: Top 10 EGs exports of Nepal in 2016 (in US$ Million)

SN	HS 2012	Description	Category	Export (in US$ Million)	Share in total EG exports (%)
1	630510	Sacks and bags, of a kind used for the packing of goods: Of jute or of other textile bast fibres of heading 53.03.	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)	17.63	55.48
2	730630	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel: Other:	Waste Water Management and Potable Water Treatment (WWM)	7.19	22.62
3	730690	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel: Other:	Waste Water Management and Potable Water Treatment (WWM)	3.15	9.91
4	560721	Twine, cordage, ropes and cables whether or not plaited or braided and whether or not impregnated, coated, covered or sheathed with rubber or plastics: Of sisal or other textile fibres of the genus Agave: Binder or baler twine	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)	2.44	7.67
5	530310	Jute and other textile bast fibres (excluding flax, true hemp and ramie), raw or processed but not spun; tow and waste of these fibres (including yarn waste and garnetted stock).	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)	0.48	1.53
6	392010	Other plates, sheets, film, foil and strip, of polymers of ethylene, non-cellular and not reinforced, laminated, supported or similarly combined with other materials: Plates, sheets, film, foil and strip of plastics, not self-adhesive, non-cellular, not reinforced or laminated etc., of polymers of ethylene.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	0.36	1.14
7	903110	Machines for balancing mechanical parts.	Noise and Vibration Abatement (N/V)	0.29	0.91
8	732690	Other articles of iron or steel: Other	Waste Water Management and Potable Water Treatment (WWM)	0.10	0.32
9	841090	Hydraulic turbines, water wheels, and regulators; parts, including regulators.	Renewable Energy (RE)	0.04	0.14
10	847982	Mixing, kneading, crushing, grinding, screening, sifting, homogenising, emulsifying or stirring machines not elsewhere specified in Chapter 84	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	0.02	0.06
				Total	99.77

Data Source: Authors' computation using trade data from TEPC Nepal; and Friends list from WTO JOB (09)/132

Table A.2.6: Top 10 EGs exports of Pakistan in 2016 (in US$ Million)

SN	HS 2012	Description	Category	Export (in US$ Million)	Share in total EG exports (%)
1	730690	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel: Other:	Waste Water Management and Potable Water Treatment (WWM)	53.25	43.82
2	841490	Air or vacuum pumps, air or other gas compressors and fans; ventilating or recycling hoods incorporating a fan, whether or not fitted with filters: Parts.	Air Pollution Control (APC)	9.41	7.74
3	841182	Other gas turbines of a power exceeding 5,000 kW	Renewable Energy (RE)	6.31	5.20
4	901580	Other surveying, hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances, excluding compasses, not elsewhere specified in 90.15	Natural Risk Management (RM)	5.40	4.44
5	731029	Tanks, casks, drums, cans, boxes and similar containers, for any material (other than compressed or liquefied gas), of iron or steel, of a capacity not exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment: Of a capacity of less than 50 l: Other (excluding containers fitted with mechanical or thermal equipment, and cans); Other cans which are to be closed by soldering or crimping, capacity less 50L	Waste Water Management and Potable Water Treatment (WWM)	5.21	4.28
6	732690	Other articles of iron or steel: Other	Waste Water Management and Potable Water Treatment (WWM)	4.06	3.34
7	630510	Sacks and bags, of a kind used for the packing of goods: Of jute or of other textile bast fibres of heading 53.03.	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)	3.12	2.57

8	392010	Other plates, sheets, film, foil and strip, of polymers of ethylene, non-cellular and not reinforced, laminated, supported or similarly combined with other materials: Plates, sheets, film, foil and strip of plastics, not self-adhesive, non-cellular, not reinforced or laminated etc., of polymers of ethylene.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	2.95	2.43
9	850239	Electric generating sets and rotary convertors: other	Renewable Energy (RE)	2.47	2.03
10	903180	Other instruments, appliances and machines.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)	2.19	1.80
				Total	77.65

Data Source: Authors' computation using trade data from UN COMTRADE; and Friends list from WTO JOB (09)/132

Table A.2.7: Top 10 EGs exports of Sri Lanka in 2016 (in US$ Million)

SN	HS 2012	Description	Category	Export (in US$ Million)	Share in total EG exports (%)
1	903180	Other instruments, appliances and machines.	Environmental Monitoring, Analysis and Assessment Equipment (M/A)	29.08	29.32
2	853710	Boards, panels, consoles, desks, cabinets and other bases, equipped with 2 or more app. of 85.35/85.36, for electrical control..., for a voltage not exceeding 1000V	Renewable Energy (RE)	25.03	25.24
3	761290	Aluminium casks, drums, cans, boxes and similar containers (including rigid or collapsible tubular containers), for any material (other than compressed or liquefied gas), of a capacity not exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	6.84	6.90
4	732690	Other articles of iron or steel: Other	Waste Water Management and Potable Water Treatment (WWM)	4.90	4.94
5	850440	Static converters	Renewable Energy (RE)	4.37	4.40
6	730820	Towers and lattice masts.	Renewable Energy (RE)	4.12	4.15
7	850300	Parts suitable for use solely or principally with the machines of heading 85.01 or 85.02.	Renewable Energy (RE)	2.84	2.86
8	850720	Electric accumulators, including separators thereof, whether or not rect. (incl. square), lead-acid (exclusive of 8507.10)	Renewable Energy (RE)	2.81	2.83

9	950720	Fish-hooks, whether or not snelled.	Natural Resources Protection (NR)	2.64	2.67
10	850231	Other electric generating sets: Wind-powered.	Renewable Energy (RE)	1.43	1.45
				Total	84.76

Data Source: Authors' computation using trade data from UN COMTRADE; and Friends list from WTO JOB (09)/132

Annex 3: Top EGs imports of South Asian Countries (Friends List)

Table A.3.1: Top 10 EGs imports of Bangladesh in 2016 (in US$ Million)

SN	HS 2012	Description	Category	Import (in US$ Million)	Share in total EG imports (%)
1	850440	Static converters	Renewable Energy (RE)	112.78	5.28
2	847989	Machines and mechanical appliances having individual functions, not specified or included elsewhere in this Chapter: Other.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	111.00	5.20
3	850720	Electric accumulators, including separators thereof, whether or not rect. (incl. square), lead-acid (exclusive of 8507.10)	Renewable Energy (RE)	93.97	4.40
4	841370	Other centrifugal pumps	Waste Water Management and Potable Water Treatment (WWM)	93.24	4.37
5	840999	Parts suitable for use solely or principally with the engines of heading No. 84.07 or 84.08: Other.	Noise and Vibration Abatement (N/V)	74.88	3.51
6	841430	Compressors of a kind used in refrigerating equipment	Air Pollution Control (APC)	72.74	3.41
7	841182	Other gas turbines of a power exceeding 5,000 kW	Renewable Energy (RE)	71.00	3.33
8	853710	Boards, panels, consoles, desks, cabinets and other bases, equipped with 2 or more app. of 85.35/85.36, for electrical control..., for a voltage not exceeding 1000V	Renewable Energy (RE)	68.09	3.19
9	841480	Air Pumps, air/oth. gas compressors and fans (excl. of 8414.10-8414.59); ventilating/recycling hoods incorp. a fan, whether or not fitted with filters (excl. of 8414.60).	Air Pollution Control (APC)	67.38	3.16

Data Source: Authors' computation using trade data from ITC Trade Map; and Friends list from WTO JOB (09)/132

10	848180	Other appliances for pipes, boiler shells, tanks, vats or the like	Waste Water Management and Potable Water Treatment (WWM)	65.43	3.07
				Total	38.92

Table A.3.2: Top 10 EGs imports of Bhutan in 2016 (in US$ Million)

SN	HS 2012	Description	Category	Import (in US$ Million)	Share in total EG imports (%)
1	846694	Parts and accessories suit. for use solely/princ. with the machines of 84.62/84.63.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	22.38	60.29
2	847990	Parts of the mach. and mech. appls. of 84.79	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	3.02	8.14
3	847989	Machines and mechanical appliances having individual functions, not specified or included elsewhere in this Chapter: Other.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	1.62	4.37
4	842290	Machinery for cleaning or drying bottles or other containers: Parts.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	1.01	2.71
5	901580	Other surveying, hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances, excluding compasses, not elsewhere specified in 90.15	Natural Risk Management (RM)	0.86	2.31
6	901590	Parts and accessories of the instruments and appliances of 90.15	Natural Risk Management (RM)	0.78	2.10
7	847420	Crushing or grinding machines.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	0.53	1.44
8	848180	Other appliances for pipes, boiler shells, tanks, vats or the like	Waste Water Management and Potable Water Treatment (WWM)	0.41	1.10
9	630510	Sacks and bags, of a kind used for the packing of goods: Of jute or of other textile bast fibres of heading 53.03.	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)	0.35	0.95
10	853710	Boards, panels, consoles, desks, cabinets and other bases, equipped with 2 or more app. of 85.35/85.36, for electrical control..., for a voltage not exceeding 1000V	Renewable Energy (RE)	0.34	0.92

				Total	84.32

Data Source: Authors' computation using trade data from ITC Trade Map; and Friends list from WTO JOB (09)/132

Table A.3.3: Top 10 EG imports of India in 2016 (in US$ Million)

SN	HS 2012	Description		Category	Impor (in US Million
1	854140	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes.		Renewable Energy (RE)	3157.2
2	848180	Other appliances for pipes, boiler shells, tanks, vats or the like		Waste Water Management and Potable Water Treatment (WWM)	1772.6
3	850440	Static converters		Renewable Energy (RE)	888.4
4	847989	Machines and mechanical appliances having individual functions, not specified or included elsewhere in this Chapter: Other.		Management of Solid and Hazardous Waste and Recycling Systems (SHW)	748.0
5	850300	Parts suitable for use solely or principally with the machines of heading 85.01 or 85.02.		Renewable Energy (RE)	648.4
6	903180	Other instruments, appliances and machines.		Environmental Monitoring, Analysis and Assessment Equipment (M/A)	549.8
7	840999	Parts suitable for use solely or principally with the engines of heading No. 84.07 or 84.08: Other.		Noise and Vibration Abatement (N/V)	537.2
8	732690	Other articles of iron or steel: Other		Waste Water Management and Potable Water Treatment (WWM)	523.4
9	841480	Air Pumps, air/oth. gas compressors and fans (excl. of 8414.10-8414.59); ventilating/recycling hoods incorp. a fan, whether or not fitted with filters (excl. of 8414.60).		Air Pollution Control (APC)	517.5
10	903289	Automatic regulating or controlling instruments, other		Renewable Energy (RE)	477.4

Data Source: Authors' computation using trade data from UN COMTRADE; and Friends list from WTO JOB (09)/132

Table A.3.4: Top 10 EG imports of Maldives in 2016 (in US$ Million)

SN	HS 2012	Description	Category	Import (in US$ Million)	Share in total EG imports (%)
1	890790	Other floating structures (for example, rafts, tanks, coffer-dams, landing-stages, buoys and beacons): Other (other than inflatable rafts).	Clean Up or Remediation of Soil and Water (R/C)	20.63	12.48
2	732690	Other articles of iron or steel: Other	Waste Water Management and Potable Water Treatment (WWM)	15.94	9.65
3	842121	Filtering or purifying machinery and apparatus for liquids: for filtering or purifying water	Waste Water Management and Potable Water Treatment (WWM)	10.28	6.22
4	840999	Parts suitable for use solely or principally with the engines of heading No. 84.07 or 84.08: Other.	Noise and Vibration Abatement (N/V)	10.03	6.07
5	848180	Other appliances for pipes, boiler shells, tanks, vats or the like	Waste Water Management and Potable Water Treatment (WWM)	8.55	5.17
6	847989	Machines and mechanical appliances having individual functions, not specified or included elsewhere in this Chapter: Other.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	7.97	4.83
7	841381	Pumps for liquids, whether or not fitted with a measuring device; other pumps	Waste Water Management and Potable Water Treatment (WWM)	6.56	3.97
8	850239	Electric generating sets and rotary convertors: other	Renewable Energy (RE)	5.43	3.29
9	841869	Compression-type refrigerating, freezing equipment whose condensers are heat exchangers; Refrigerating, freezing equipment not elsewhere specified in 84.18; heat pumps and Air-conditioning machines incorporating a refrigerating unit and a valve for reversal of the cooling/heat cycle (reversible heat pumps)	Renewable Energy (RE)	5.25	3.18
10	730690	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel: Other:	Waste Water Management and Potable Water Treatment (WWM)	4.65	2.81
				Total	57.67

Data Source: Authors' computation using trade data from UN COMTRADE; and Friends list from WTO JOB (09)/132

Table A.3.5: Top 10 EG imports of Nepal in 2016 (in US$ Million)

SN	HS 2012	Description	Category	Import (in US$ Million)	Share in total EG imports (%)
1	850720	Electric accumulators, including separators thereof, whether or not rect. (incl. square), lead-acid (exclusive of 8507.10)	Renewable Energy (RE)	41.95	12.20
2	530310	Jute and other textile bast fibres (excluding flax, true hemp and ramie), raw or processed but not spun; tow and waste of these fibres (including yarn waste and garnetted stock).	Environmentally Preferable Products Based on End-Use or Disposal Characteristics(EPP)	30.06	8.74
3	854140	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes.	Renewable Energy (RE)	23.61	6.87
4	847420	Crushing or grinding machines.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	20.58	5.98
5	850440	Static converters	Renewable Energy (RE)	13.37	3.89
6	841090	Hydraulic turbines, water wheels, and regulators ; parts, including regulators.	Renewable Energy (RE)	12.34	3.59
7	848180	Other appliances for pipes, boiler shells, tanks, vats or the like	Waste Water Management and Potable Water Treatment (WWM)	11.12	3.24
8	841370	Other centrifugal pumps	Waste Water Management and Potable Water Treatment (WWM)	10.15	2.95
9	730820	Towers and lattice masts.	Renewable Energy (RE)	9.37	2.73
10	730690	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel: Other:	Waste Water Management and Potable Water Treatment (WWM)	8.66	2.52
				Total	52.71

Data Source: Authors' computation using trade data from TEPC Nepal; and Friends list from WTO JOB (09)/132

Table A.3.6: Top 10 EG imports of Pakistan in 2016 (in US$ Million)

SN	HS 2012	Description	Category	Import (in US$ Million)	Share in total EG imports (%)
1	854140	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes.	Renewable Energy (RE)	493.70	10.80
2	850231	Other electric generating sets: Wind-powered.	Renewable Energy (RE)	380.43	8.32
3	850239	Electric generating sets and rotary convertors: other	Renewable Energy (RE)	329.86	7.22
4	841182	Other gas turbines of a power exceeding 5,000 kW	Renewable Energy (RE)	317.98	6.96
5	841430	Compressors of a kind used in refrigerating equipment	Air Pollution Control (APC)	173.81	3.80
6	840682	Steam turbines and other vapour turbines (other than for marine propulsion) of an output not exceeding 40 MW.	Renewable Energy (RE)	130.87	2.86
7	850300	Parts suitable for use solely or principally with the machines of heading 85.01 or 85.02.	Renewable Energy (RE)	118.16	2.59
8	848180	Other appliances for pipes, boiler shells, tanks, vats or the like	Waste Water Management and Potable Water Treatment (WWM)	117.81	2.58
9	841989	Machinery, plant or laboratory equipment, whether or not electrically heated (excluding furnaces, ovens and other equipment of heading 85.14), for the treatment of materials by a process involving a change of temperature such as heating, cooking, roasting, distilling, rectifying, sterilising, pasteurising, steaming, drying, evaporating, vaporising, condensing or cooling, other than machinery or plant of a kind used for domestic purposes; instantaneous or storage water heaters, non-electric.	Air Pollution Control (APC)	115.85	2.53
10	840690	Parts for steam and other vapour turbines.	Renewable Energy (RE)	105.58	2.31
				Total	49.98

Data Source: Authors' computation using trade data from UN COMTRADE; and Friends list from WTO JOB (09)/132

Table A.3.7: Top 10 EG imports of Sri Lanka in 2016 (in US$ Million)

SN	HS 2012	Description	Category	Import (in US$ Million)	Share in total EG imports (%)
1	848180	Other appliances for pipes, boiler shells, tanks, vats or the like	Waste Water Management and Potable Water Treatment (WWM)	46.27	6.25
2	850440	Static converters	Renewable Energy (RE)	38.18	5.16
3	847989	Machines and mechanical appliances having individual functions, not specified or included elsewhere in this Chapter: Other.	Management of Solid and Hazardous Waste and Recycling Systems (SHW)	28.54	3.86
4	732690	Other articles of iron or steel: Other	Waste Water Management and Potable Water Treatment (WWM)	26.86	3.63
5	850300	Parts suitable for use solely or principally with the machines of heading 85.01 or 85.02.	Renewable Energy (RE)	25.64	3.46
6	730630	Other tubes, pipes and hollow profiles (for example, open seam or welded, riveted or similarly closed), of iron or steel: Other:	Waste Water Management and Potable Water Treatment (WWM)	22.67	3.06
7	853710	Boards, panels, consoles, desks, cabinets and other bases, equipped with 2 or more app. of 85.35/85.36, for electrical control..., for a voltage not exceeding 1000V	Renewable Energy (RE)	22.01	2.97
8	841370	Other centrifugal pumps	Waste Water Management and Potable Water Treatment (WWM)	20.59	2.78
9	903289	Automatic regulating or controlling instruments, other	Renewable Energy (RE)	19.87	2.69
10	731029	Tanks, casks, drums, cans, boxes and similar containers, for any material (other than compressed or liquefied gas), of iron or steel, of a capacity not exceeding 300 l, whether or not lined or heat-insulated, but not fitted with mechanical or thermal equipment: Of a capacity of less than 50 l: Other (excluding containers fitted with mechanical or thermal equipment, and cans); Other cans which are to be closed by soldering or crimping, capacity less 50L	Waste Water Management and Potable Water Treatment (WWM)	19.83	2.68
				Total	36.55

Data Source: Authors' computation using trade data from UN COMTRADE; and Friends list from WTO JOB (09)/132

Annex 4: Brief Description of Greenhouse Gases

Greenhouse Gases: what are they and where do they come from

The most worrisome GHGs that have significant anthropogenic causes of emission include Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_20), and Fluorinated gases (F-gases): Hydrofluorocarbons (SFCs), Petrofluorocarbons (PFCs), and Sulphur hexafluoride (SF_6). These six greenhouse gases were also the subject of Kyoto Protocol, 1998.

Carbon dioxide ($C0_2$) accounts for around 72% of total anthropogenic GHG emissions. It predominantly comes from fossil fuels and land use change (deforestation).

Methane (CH_4) accounts for around 19% of total anthropogenic GHG emissions. Anthropogenic CH_4 emissions are mostly the results of agriculture (primarily through enteric fermentation from livestock; manure; and secondarily through rice farming), waste (chiefly through organic waste decomposition at landfills; secondarily from wastewater), biomass burning, and fossil fuel production.

Nitrous oxide (N_20) accounts for around 6% of total anthropogenic GHG emissions. Anthropogenic N_20 emissions arise chiefly from agricultural activities (primarily the use of chemical fertilizers), fossil fuel burning, and industrial processes (Nitric acid production, Nylon production, etc.).

Fluorinated Gases (F-gases) account for around 3% of total anthropogenic GHG emissions. F-gases are the synthetic gases primarily emitted through industrial processes, refrigeration, and consumer products.

The emission data are derived from "Trends in global CO_2 and total greenhouse gas emissions: 2017 Report" and is based on the year 2016.

Annex 5: GHG emission trends in South Asian countries

Table A. 5. 1: Anthropogenic CH4 emission by South Asian Countries (in kton CO2eq / year)

Country	1970	1975	1980	1985	1990	1995	2000	2005	2010	2012
Afghanistan	12800	12800	12500	9570	7750	8940	10900	12200	16100	15800
Bangladesh	106000	105000	100000	99600	99400	96700	99700	105000	118000	120000
Bhutan	520	564	666	752	736	815	688	868	838	857
India	478000	506000	536000	579000	617000	650000	673000	717000	794000	815000
Maldives	12.5	15	18.1	23.5	28.1	36.3	34.8	40.6	48	51
Nepal	20500	21900	23200	23900	24300	25000	25600	27000	28700	29700
Pakistan	71000	75800	87400	94200	104000	114000	131000	147000	167000	180000
Sri Lanka	13400	12000	13900	14300	13500	13100	10900	11600	12900	12500

Source: Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2

Table A.5. 2: Anthropogenic N20 emission by South Asian Countries (in kton CO2eq / year)

Country	1970	1975	1980	1985	1990	1995	2000	2005	2010	2012
Afghanistan	2670	2720	2750	2330	2170	2170	2690	2980	3610	3610
Bangladesh	8240	8890	9800	11200	13700	17000	18200	20400	22300	21700
Bhutan	71.8	79.1	102	118	132	154	158	166	156	159

India	73900	84200	101000	125000	146000	170000	182000	200000	238000	251000
Maldives	2.35	2.88	3.41	5.38	5.4	9.3	10.7	15.8	22.2	24.2
Nepal	1940	2240	2640	2920	3300	3700	3920	3990	4440	4650
Pakistan	11300	13800	17500	20800	17300	20000	22800	40200	44800	44500
Sri Lanka	1190	1190	1560	1740	1730	1860	2090	2150	2600	2550

Source: Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2

Table A.5.3: GHG per GDP emission by South Asian countries (in ton CO2eq/1000USD GDP/year)

Country	1970	1975	1980	1985	1990	1995	2000	2005	2010	2012
Afghanistan	0.0000	0.0000	0.0000	0.0000	0.7141	0.7298	0.7376	0.6425	0.5618	0.4780
Bangladesh	1.3760	1.5794	1.2172	1.0419	0.9308	0.7899	0.6716	0.5961	0.5416	0.4840
Bhutan	3.6107	3.5620	2.7290	2.0509	1.2847	1.1498	0.7205	0.5547	0.4633	0.4506
India	0.9989	0.9739	1.0686	1.0145	0.9231	0.8591	0.7247	0.5948	0.5334	0.5184
Maldives	0.0989	0.1134	0.0935	0.1231	0.0772	0.1500	0.1650	0.2323	0.2302	0.2338
Nepal	1.9730	1.9211	1.7461	1.5531	1.2778	1.0636	0.9009	0.7956	0.7079	0.6972
Pakistan	0.9060	0.8051	0.7579	0.6638	0.5612	0.5327	0.5408	0.5200	0.5020	0.4884
Sri Lanka	0.3948	0.3062	0.4740	0.3738	0.3110	0.2603	0.2343	0.2234	0.1765	0.1513

Source: Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2

Table A.5. 4: GHG per capita emissions by South Asian Countries (in ton CO2eq / capita / year)

Country	1970	1975	1980	1985	1990	1995	2000	2005	2010	2012
Afghanistan	1.5577	1.3836	1.3382	1.2351	0.9808	0.7858	0.7993	0.7285	0.9061	0.8806
Bangladesh	1.8085	1.6694	1.4427	1.2892	1.1991	1.1352	1.1030	1.1535	1.3244	1.3112
Bhutan	4.2825	3.8555	3.3778	3.3134	2.9873	3.3312	2.5500	2.5080	2.9742	3.1683
India	1.4175	1.3986	1.3823	1.5033	1.6381	1.7682	1.8316	1.9152	2.3463	2.5024
Maldives	0.2172	0.2194	0.2640	0.4131	0.4079	0.8173	1.1642	1.8686	2.4372	2.6036
Nepal	1.8930	1.8456	1.7755	1.6421	1.5280	1.4367	1.3893	1.3415	1.4042	1.4671
Pakistan	1.7487	1.6990	1.7259	1.7353	1.7130	1.7875	1.8899	2.0834	2.1515	2.1348
Sri Lanka	1.4181	1.1768	1.3114	1.2431	1.1230	1.1625	1.3004	1.4479	1.5065	1.5089

Source: Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2

Annex 6: Sector-wise CO2 emission in South Asian countries

Table A.6.1: Afghanistan's sector-wise CO2 emission (in kton CO2 / year)

Sector	1990	1995	2000	2005	2010	2016
Transport	824.34	1321.09	1448.16	1991.45	4831.78	7607.11
Other industrial combustion	335.11	432.05	615.53	687.25	1024.13	1617.59
Buildings	438.67	319.75	157.44	153.30	317.55	446.52
Non-combustion	251.05	156.35	157.70	127.37	97.36	147.09
Power Industry	175.77	53.80	47.25	73.42	57.57	81.71

Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2_FT2016

Table A.6.2: Bangladesh's sector-wise CO2 emission (in kton CO2 / year)

Sector	1990	1995	2000	2005	2010	2016
Power Industry	4310.40	6532.89	8813.63	14718.50	25331.30	31049.57
Buildings	2995.61	3773.42	4913.68	7663.42	8448.68	10733.59
Other industrial combustion	2445.39	3503.46	4209.17	4880.00	9387.30	13005.06
Non-combustion	2055.86	3505.03	5100.85	6328.48	8365.10	9261.31
Transport	1667.82	2669.39	3032.94	4695.51	8143.71	10426.70

Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2_FT2016

Table A.6.3: Bhutan's sector-wise CO2 emission (in kton CO2 / year)

Sector	1990	1995	2000	2005	2010	2016
Buildings	543.38	434.39	216.33	187.84	374.69	526.85
Non-combustion	61.02	120.62	130.17	153.11	432.07	607.88
Transport	84.52	106.33	147.46	125.44	182.38	273.98
Other industrial combustion	33.57	54.15	88.99	96.11	138.00	217.97
Power Industry	11.68	27.10	29.50	46.61	39.05	55.43

Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2_FT2016

Table A.6.4: India's sector-wise CO2 emission (in kton CO2 / year)

Sector	1990	1995	2000	2005	2010	2016
Power Industry	244229.00	392399.00	534087.00	665477.00	934763.00	1310394.00
Other industrial combustion	177919.00	185474.00	230126.00	239293.00	425839.00	556493.50
Transport	84285.50	108185.20	95258.25	102668.30	163154.80	270619.90
Non-combustion	70506.42	92411.85	105921.70	139636.60	163786.30	206042.20
Buildings	78521.70	91325.20	99038.20	115919.00	155856.00	190088.50

Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2_FT2016

Table A.6.5: Maldives' sector-wise CO2 emission (in kton CO2 / year)

Sector	1990	1995	2000	2005	2010	2016
Other industrial combustion	12.24	51.91	136.67	241.85	420.50	664.18
Power Industry	14.57	39.05	61.18	234.39	288.01	408.77
Transport	21.79	53.65	81.44	61.59	107.25	157.93
Buildings	8.30	16.71	0.74	0.56	1.41	1.98
Non-combustion	0.15	0.18	0.24	0.23	0.26	0.16

Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2_FT2016

Table A.6.6: Nepal's sector-wise CO2 emission (in kton CO2 / year)

Sector	1990	1995	2000	2005	2010	2016
Transport	338.57	622.89	825.64	836.80	1906.61	3027.98
Buildings	352.73	758.27	1138.17	1200.17	972.87	1423.82
Other industrial combustion	203.78	351.09	1115.73	1092.72	1276.13	2487.29
Non-combustion	130.89	198.66	223.55	167.00	634.95	889.92
Power Industry	0.00	30.88	20.59	17.18	3.41	4.78

Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2_FT2016

Table A.6.7: Pakistan's sector-wise CO2 emission (in kton CO2 / year)

Sector	1990	1995	2000	2005	2010	2016
Other industrial combustion	17209.60	23665.80	23671.80	38453.50	39439.30	43423.52
Power Industry	15475.10	23262.90	32944.10	35927.90	40462.00	46621.77
Transport	13770.38	20236.86	27164.35	28982.30	35111.53	45492.65
Non-combustion	7837.12	8933.19	12331.24	14629.39	20687.13	21342.18
Buildings	9498.44	10349.40	12183.70	13402.40	16400.00	21133.70

Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2_FT2016

Table A.6.8: Sri Lanka's sector-wise CO2 emission (in kton CO2 / year)

Sector	1990	1995	2000	2005	2010	2016
Transport	2495.79	3696.35	5156.41	6315.36	6837.87	8691.33
Power Industry	6.19	246.15	3167.84	4486.16	4121.39	5374.74
Buildings	627.41	916.26	1240.88	1235.25	1050.49	1327.60
Other industrial combustion	546.80	595.65	957.58	1356.26	1062.65	1425.95
Non-combustion	463.34	653.22	741.21	972.57	1248.81	1635.08

Emissions Database for Global Atmospheric Research (EDGAR), release EDGARv4.3.2_FT2016