Project report

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An Evaluation of Environmental Goods (EGs) for the WTO EGA:

EGs for Developing Countries

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Summary:
The paper presents the design, analyses and results of a methodological assessment and nomination of goods for the ongoing WTO Environmental Goods Agreement (EGA) negotiations. The purpose of the EGA is to reduce tariffs on identified environmental goods and technologies in order to promote international sustainable production, consumption and development. The methodology presented is based on multi criteria decision making (MCDM) tools and management.

The Norwegian Government's focus on supporting the developing world has guided their international policy over the past years. This study is therefore commissioned by the Norwegian Ministry of Foreign affairs to ensure that goods of particular relevance to developing countries will be discussed in the EGA. Environmental goods specifically relevant to developing countries fall mainly into the categories of sanitation, waste management, water supply and availability, and renewable energy access. 15 development EGs are identified and discussed in the report, and should aid the Norwegian Delegation in promoting EGs relevant to developing countries for nomination in the EGA.

Appendices:
1: Initial List of EGs
2: Development EGs List

Key words: Environmental Goods Agreement, EGA, WTO, environmental goods, multi criteria decision making, MSDM

Executive Summary

The paper presents the design, analyses and results of a methodological assessment and nomination of goods for the ongoing WTO Environmental Goods Agreement (EGA) negotiations. The purpose of the EGA is to reduce tariffs on identified environmental goods and technologies in order to promote international sustainable production, consumption and development. The methodology presented is based on multi criteria decision making (MCDM) tools and management.

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The methodology combines two approaches in its assessment of EGs for nomination to the EGA. Goods and technologies must first be analyzed and assessed for their impact on the environment and climate change mitigation, and second, be designed for practical use and implementation in developing countries through the EGA-system. Using a MCDM approach, criteria to evaluate EGs are identified based on the objectives of the tender and relevant research. When a good benefits the environment, either directly or comparatively, and can be applied to solve issues and meet needs in developing contexts, it fits the general criteria of the study. The report identifies 15 development EGs that make up the core of the study. They are evaluated across the environmental and development criteria, for their positive and negative contributions to each, and described in the text and in a summarizing factsheet. The presentation of development goods includes the Harmonized System (HS) six-digit subheading code and description, a description of content and use, and relevant Norwegian producers, sellers and traders, if applicable. 15 development EGs are identified in the report:

- **Goods for waste management and sanitation:** composting toilets, vacuum toilets, landfill liners and covers, and containers for waste management and sanitation purposes,
- **Goods for drinking water delivery and storage**: hand pumps, RE powered pumps, drinking water taps and valves, and flexible storage tanks for drinking and potable water,
- **Goods for cleaner and renewable energy:** Fresnel reflectors for solar energy, biomass boilers, hydraulic turbines, and
- **Environmentally preferable goods**: solar stoves and cookers, solar and other RE powered lamps, and building and construction products of sustainable natural materials.

The selection and discussion of development EGs should aid the Norwegian Delegation in promoting EGs that help to meet human development needs in the EGA negotiations.

Preface

The Norwegian Ministry of Foreign Affairs commissioned this study on environmental goods for potential nomination to the EGA, with a focus on those goods specifically relevant to developing countries. Our contact at the Ministry was Kaja B. Edrén, and we thank her for her support and guidance throughout the research process. We would also like to thank the others who met with us to give us guidance from the Ministry of Foreign Affairs, Ministry of Climate and Environment, and Miljødirektoratet.

The final report is the product of work conducted at the Norwegian University of Science and Technology (NTNU), Department of Industrial Economics and Technology Management (IØT). The authors would also like to thank Annik Magerholm Fet, Luitzen De Boer, Christofer Skaar, Sigurd Vildåsen, and Michael Myrvold Jenssen for their support in the conceptualization and research of the report.

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1 Introduction

This paper presents the design, analyses and results of a methodological assessment and nomination of goods for the ongoing WTO Environmental Goods Agreement (EGA) negotiations. The purpose of the EGA is to reduce tariff and customs barriers on identified environmental goods and technologies in order to promote international sustainable production, consumption and development. The methodology presented is based on a multi criteria decision making (MCDM) approach, and the Norwegian Government's intention to support developing countries with more effective and environmentally friendly goods and technologies. Environmental goods specifically relevant to developing countries fall into the categories of sanitation, waste management, water supply and availability, food production and cooking, and renewable energy. Increased trade and implementation of such environmental goods and technologies is meant to strengthen public health and capabilities on the household and community levels, based on local and renewable energy sources – empowering development while reducing GHGs.

1.1 Background: Liberalizing trade in environmental goods

Combating climate change and its effects requires a comprehensive and multi-dimensional approach. Seeking to align international trade with the protection of the environment and a reduction in climate gases, trade in environmental goods has been encouraged across the international arena. Although the definition of environmental goods (EGs) is a topic of contention, the environmental goods and services (EGS) industry can generally be understood as, "activities which produce goods and services to measure, prevent, limit, minimize, or correct environmental damage to water, air and soil, as well as problems related to waste, noise and ecosystems" (OECD 2005: 42). The general idea, therefore, is that identifying goods that benefit the environment, and then applying trade mechanisms to these goods, for instance a reduction in tariffs or non-tariff barriers (NTBs), will increase trade in such goods while benefitting the environment and/or combatting climate change along the way.

Supporting this general principle, the World Trade Organization (WTO) recognized the importance of liberalizing trade in EGs, and mandated negotiations on "the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services" (Doha Ministerial Declaration 2001: paragraph 31(iii)). In January 2014, an initiative for negotiations was announced by 14 WTO member-states[1] with the goal of liberalizing trade on a range environmental goods. These negotiations, known as the Environmental Goods Agreement negotiations, began in July 2014.

While the WTO has not yet agreed upon a list of EGs for tariff reduction, the Asia-Pacific Economic Cooperation[2] (APEC) confirmed a list of 54 EGs in 2012. The goal of the APEC list, available in Appendix, is to reduce tariffs on the specified goods to below 5% by the end of

[1] The 14 WTO EGA member states: Australia, Canada, China, Costa Rica, the EU, Hong Kong, Japan, New Zealand, Norway, Singapore, South Korea, Switzerland, Chinese Taipei, and the US

[2] APEC member economies: Australia, Brunei Darussalam, Canada, Chile, China, Hong Kong, Indonesia, Japan, Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, the Philippines, Russia, Singapore, Chinese Taipei, Thailand, the US, and Vietnam

2015. Although criticized in some instances, the APEC list is the only formally implemented list of EGs, and serves as a basis for discussion and expansion in the EGA negotiations. This report, therefore, presents an analysis of specific EGs, not on the APEC list, for the Norwegian Delegation to nominate to the list of environmental goods for trade liberalization in the EGA negotiations.

1.2 Purpose

The purpose of this report is to investigate potential EGs for the Norwegian Delegation to nominate to the EGA. The basis for investigation is a tender presented for consultancy by the Norwegian Ministry of Foreign Affairs (MFA). The study is structured around the specific concerns and asks of the tender,

(1) Identifying EGs that are *not* on the APEC list;

(2) Identifying EGs that contribute to one or more of the 10 EGA environmental product categories, and/or to the reduction of climate gases;

EGA Environmental Product Categories:

- Air pollution control
- Solid and hazardous waste management
- Wastewater management and Water treatment
- Environmental remediation and clean-up
- Cleaner and renewable energy
- Energy efficiency
- Environmental monitoring, analysis and assessment
- Noise and vibration abatement
- Environmentally preferable products (EPPs)
- Resource efficiency

(3) Identifying EGs specifically relevant to meeting *basic needs in developing countries* such as:

- Energy access
- Sanitation
- Waste management
- Health and safety
- Water: drinking water access and purification, potable water access

(4) Identifying EGs produced by Norway's clean-tech industry.

The project's focus surrounds the search for EGs specifically relevant to developing countries. Keeping such "development EGs" as the core of the report helps to bring the needs of the developing world into the negotiations, and aligns with Norway's commitment to the promotion of international sustainable development. EGs produced in Norway's clean and environmentally friendly technologies industry ("Norwegian EGs") are also listed in the study.

1.3 Research methodology

This study is designed following principles from Multi-Criteria Decision Making (MCDM), where objectives and criteria are used to guide the search for and appraisal of potential EGs.

Objectives are defined according to the tender, as described in section 1.2. From these objectives, a set of criteria are operationalized to assess each potential EG. The search for EGs is done using a needs-based approach, structured according to an activity-framework borrowed from Material Flow Analysis (MFA). Once a list of potential EGs has been compiled, each good is assessed according to each criteria in a qualitative manner.

The presentation of goods includes the Harmonized System (HS) six-digit subheading code and description, a description of content and use, relevant Norwegian producers, sellers and traders, along with the multi criteria assessment.

1.4 Report structure

The remainder of the report explains the use of the multi criteria approach in the search for EGs. Chapter 2 provides a description of relevant theory and concepts, and explains the identification of human development needs applied in the study. Chapter 3 then describes the methodology and conceptualization of the study. Study findings are presented in Chapter 4, the bulk of the report. First, an initial list of EGs in presented (Table 2). Next, those EGs selected for specific developing country relevance are presented in a list of development EGs (Table 3). Each development EG is discussed in detail within the text, and within a summarizing factsheet. A list of EGs produced by Norwegian companies is also included (Table 23).

Chapter 5 then presents additional considerations and points of interest for discussion, and is followed by the conclusion in Chapter 6.

1.4.1 A description of lists included in the study

The report is made up of a number of lists, described below for further clarification:

- **Table 2** (in text): An initial list of EGs for EGA nomination
    - All of the environmental goods discovered while mapping that could be nominated to the EGA and are not on the APEC list. This list is extensive, and includes EGs that may not have specific relevance to development.
    - The list is formatted around HS codes and HS descriptions.

- **Appendix 1**: The same list of goods in Table 2, but with additional information, including potential ex-outs, notes on environmental benefit, and Norwegian producers if applicable.

- **Table 3** (in text): A list of development EGs
    - Those EGs selected from the initial list that have specific relevance to developing countries. These 15 goods contribute to meeting the human development needs of waste management, sanitation, water access and management, health, safety and nourishment, and renewable energy access.
    - The list is formatted to include the name of the development EG, its HS codes, the main EGA product category it meets, additional EGA product categories it meets, and the human development need it satisfies.

- **Appendix 2:** Contains the same list of development EGs presented in Table 3, but with different information. This list specifies each HS code and description that corresponds to the 15 development EGs.

2 Theory and concepts

The following section describes the concepts applied in the development of the study. They concern the definition of environmental goods, and the identification of human needs for development.

2.1 Conceptualizing EGs

There exists no universally agreed upon definition of environmental goods (ICTSD 2009). Avoiding involvement in the complicated debate over such definition was crucial to the expedition of this study, however, and seems to mirror the general approach taken in international negotiations. Varying opinions and interests, across and within nations, make unanimous agreement near impossible, and halt the chance of policy change before it can even begin. This means, however, that disagreement and confusion over specific EGs is more than likely, especially over issues of dual use EGs and EGs with comparative advantage over existing goods. The discussion of such issues is outside the scope of this study, but should be kept in mind in the final examination of EGs for the EGA list.

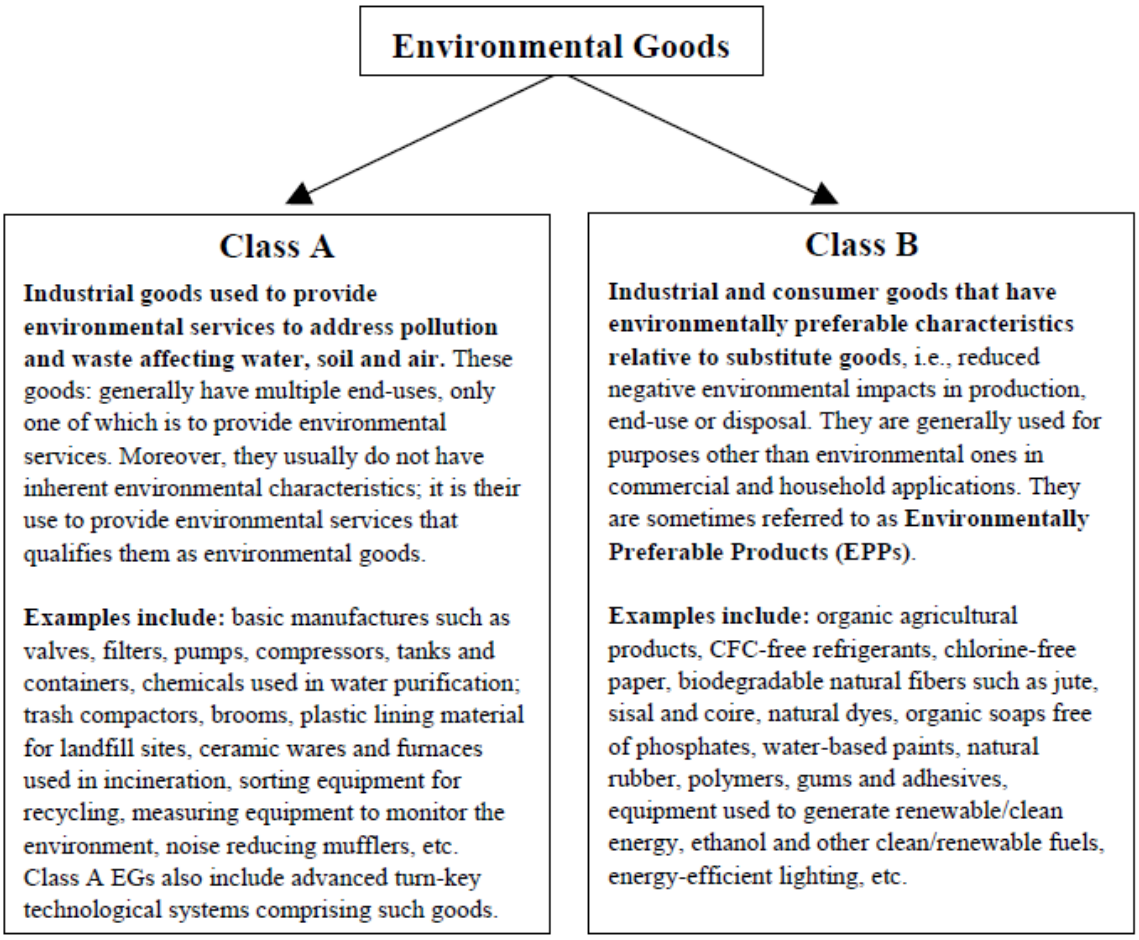


Figure 1: Classes of Environmental Goods (Hamwey 2005: 3)

Some criteria for identifying whether a good is environmentally friendly or beneficial are necessary however. As stated in the introduction, the environmental goods and services industry is generally understood as, “activities which produce goods and services to

measure, prevent, limit, minimize, or correct environmental damage to water, air and soil, as well as problems related to waste, noise and ecosystems" (OECD 2005: 42). Such definition closely parallels the ten EGA environmental product categories and therefore guided the search for EGs in the study. Additional conceptualization of EGs followed the distinction between Class A EGs, "industrial goods used to provide environmental services to address pollution and waste affecting water, soil and air," and Class B EGs, "industrial and consumer goods that environmentally preferable characteristics relative to substitute goods," as described in Hamwey (2005: 3) and demonstrated in Figure 1. Existing EGs lists, including the APEC list, contain mostly Class A EGs. The study, therefore, attempts to identify a number of Class B EGs as well.

2.2 Development considerations

As specified in the tender document, "there is a clear need to identify the different environmental goods and technologies *that have a certain and specific interest to developing countries* in the abovementioned [EGA environmental product] categories". Because the majority of the 14 EGA negotiating members are developed nations, it is critical that the voice of developing countries be represented as well in order to achieve internationally beneficial trade liberalization.

2.2.1 Identifying human needs

Before identifying the EGs relevant to developing countries, known generally as "development EGs" in the study, it is important to determine the human development needs to be addressed by such goods and technologies. By first identifying development needs, specific problems and shortcomings are easier to directly address. Some of these needs, such as water, waste management, sanitation, and energy access are specified in the tender.

A needs-based approach

A number of approaches can be applied to the identification of human needs. Recognizing the inputs, outputs, stocks and flows of materials, activities and needs within the natural Earth System, Material Flow Analysis (MFA) strongly supports the goals of this study. Although a complete MFA is not conducted, the concepts of needs and "activities" it defines help to identify EGs specifically relevant to meeting the needs of developing countries. As explained by Brunner and Rechberger (2004), "Regardless of a community's social, cultural, technical or economic development, there is a set of basic human needs such as *to eat, to breath, to reside, to communicate, to transport* and others. The main goal of a sustainable economy is to satisfy these needs best at the least cost" (44). Additionally, the onset of climate change means that needs must be satisfied within the limits of the natural Earth system.

According to MFA, the most important activities – "all relevant processes, flows, and stocks of goods and substances that are necessary to carry out and maintain a certain human need" – can be defined as: to nourish, to clean, to reside and work, and to transport and to communicate (Brunner and Rechberger 2004: 44-48). Table 1 summarizes these activities and the EGs that fall into each category. Recognizing the importance of nourishment (food

and health), cleanliness (sanitation and waste management), places to live and to work (shelter) and reliable transportation and communication helps to clarify the needs that must be met by EGs in developing, and developed, countries.

Paralleling the needs and activities identified in MFA, country-based case studies point to the need for EGs that address the effects and pressures of rapid urbanization in developing nations (Kennett and Steenblik 2005). These needs surround the issues of water availability, access to clean drinking water, energy access, sanitation and waste disposal services.

Reflecting upon the concepts of MFA, relevant case studies in the literature, and the specific asks of the tender, the development needs at the core of the study are therefore:

- Waste management and sanitation, and related health issues
  - EGA product category: Solid and hazardous waste management
  - MFA activity: to clean
- Water and food access and availability, and related health issues
  - EGA product category: Wastewater management and water treatment
  - MFA activity: to nourish, to clean
- Renewable energy access
  - EGA product category: Cleaner and renewable energy
  - MFA activity: to transport and communicate, also relevant for to nourish, to clean, and to reside and work

2.2.2 Identifying contributing factors

When assessing an EG's relevance to meeting development needs, a number of factors must be considered. Outside of a good's benefit, or lack of harm, to the natural environment, and its ability to address a human development need, analysis must include additional contextual considerations. These include aspects of cost, scale of use, technological know-how and relation to local cultural norms. Regarding cost, for example, an EG, such as a solar lamp, may be affordable at initial purchase, but depend on a battery with short-life and high replacement cost. Thinking through an EG's lifespan and application is essential for the identification of valuable EG.

Table 1: MFA activities to meet human development needs (Brunner & Rechberger 2004: 44-48)

Activity	Description	Examples	Type of goods

To nourish	"This activity comprises all processes, goods, and substances used to produce, process, distribute, and consume solid and liquid food. "To nourish" starts with agricultural production, food production, distribution, consumption, and ends with the release of off-gases (breath), feces and urine, and solid wastes to the atmosphere and the waste- and wastewater-treatment systems. These systems already belong to the activity "to clean," as discussed below…" (44).	• Goods: seeds, water, fertilizer
		• Processes: the resulting crop, the harvesting, the distribution, the preparation, the consumption
			• Food
			  ○ Stoves and cookers
			  ○ Kitchen appliances
			• Water
			  ○ Collection
			  ○ Storage
			  ○ Purification

To clean	"In anthropogenic processes, "wanted" materials are often separated from "unwanted" materials. When sugar is produced from sugar cane, sucrose is separated from cellulose and impurities. In dry cleaning, dirt is removed from the surface of clothes by organic solvents such as perchloroethylene. People need to remove dirt and sweat from their body surfaces. Also, they need to remove materials not useful for their metabolism and wastes from their body, such as carbon dioxide in breath, salts in urine, or undigested biomass in feces. Since many of these processes are called "cleaning," the separation of valuable from useless materials has been defined as the activity "to clean." It is an essential activity for human beings, since it is necessary for everybody to keep material input and output in a balance… "To clean" is also a very important activity for public health" (44).	• Individual level: laundry, dishwashing, housecleaning
		• Industrial level: refinery, purification
		• Community level: sewage and waste treatment
			• Sanitation systems
			  ○ Composting
			  ○ Sewage treatment
			• Waste management systems
			  ○ Landfill management
			  ○ Incineration systems
			  ○ Recycling

To reside and work	"This activity comprises all processes that are necessary to build, operate, and maintain residential units and working facilities… The functions and services that are expected from a building are manifold. One is that it should provide an agreeable temperature inside. This can be realized by different heating and cooling systems, different types of wall construction, and the use of different materials for better insulation. But other approaches are also possible to fulfill the service "agreeable body temperature" during the cool season. Besides measures for the outer skin (the wall), a combination of reduced heating and wearing a pullover (insulation of the inner skin) can also fulfill the task. All three approaches (heating, insulation, clothes) result in different materials and energy consumption" (46).	• Building construction and operation and maintenance of buildings
		• Machine construction and operation and maintenance of machinery
		• Manufacture of furniture, household appliances, clothing
		• Consumption
			• Building materials
			  ○ Windows
			  ○ Wood
			  ○ Insulation

To transport and communicate	"This activity comprises all processes that have been developed to transport energy, materials, persons, and information… Rapid technological progress causes swift changes in processes and goods that are associated with this activity…Hence, there are many ways of transmitting information over longer distances. This can be done by the transport of persons, by the transport of information carriers (printed paper, compact disc, magnetic recording, etc.), or transmission via cable, fiber optics, radio, etc. This activity can be used to decide which way of transmitting information is less resource consuming…" (47).	• Road construction, operation and maintenance of networks and transport vehicles
		• Administration
			• Transportation
			  ○ Roads, railway tracks
			  ○ Cars, trains, planes
			• Communication
			  ○ Radio, cables, satellites, computers

3 Methods

The methodological design of the study supports the objective of the project set out in the tender: *To identify relevant products for environmental challenges in the [EGA product] categories mentioned that are of particular importance to developing countries*. Because a number of factors must be considered in the search and evaluation of each EG, an MCDM approach is qualitatively applied.

3.1 Evaluating EGs with a multi criteria approach

The evaluation of EGs using a multi criteria approach surrounds three basic steps. The first step requires the defining of criteria for each good to meet, based on the asks and requirements of the tender. The second step entails a search for relevant goods (goods that meet the identified criteria), and the third step is the actual assessment of goods according to the criteria. Figure 2 demonstrates the steps of the multi criteria approach.

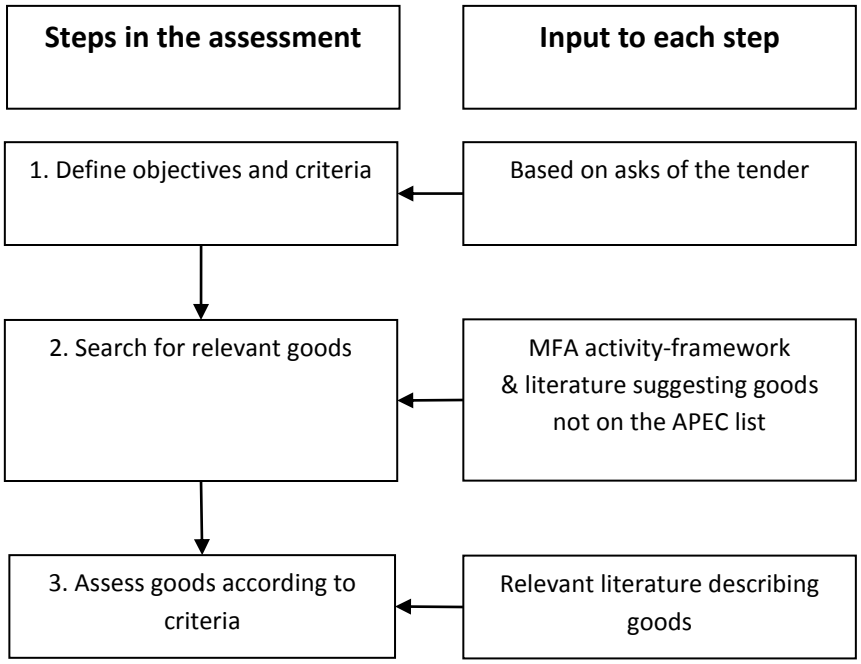


Figure 2: A multi criteria approach to assess and classify goods

3.1.1 Defining objectives and criteria

The objectives for goods nomination and analysis come directly from the tender. They include:

(1) EGs that are *not* on the APEC list;

(2) EGs that contribute to one or more of the 10 *EGA environmental product categories*, and/or to the reduction of climate gases;

(3) EGs specifically relevant to meeting *basic needs in developing countries* in the areas of health, water availability, waste management, sanitation and (renewable) energy access;

(4) If applicable, EGs produced by *Norway's clean-tech industry*.

Based on these objectives, criteria for assessing potential goods is defined. Central to evaluating EGs are their *environmental performance*. This encompasses emissions to air, water and land. A central aspect of this criterion is the impact on climate change, as stated in the tender. A second important criterion included in the analysis is the contribution to *meeting needs in developing countries*. This encompasses social, economic and technical properties of the EGs of interest in the context of developing countries.

3.1.2 The search for relevant goods

After the criteria are identified in step 1, the search for goods that meet such criteria begins. The structure of the search follows the activity-framework presented in Table 1, step 2. Identifying relevant EGs includes the general mapping of environmental goods and technologies based on relevant literature and reports. Previous EG lists, from the World Bank, OECD and past WTO delegations, e.g. the Friends of the Earth "153 List", provide insight into those EGs that have already been identified in international arenas, but are not a part of the APEC list. These EGs are selected for an initial list for potential nomination. Goods and technologies that are unique or expertly produced in Norway are also assessed. Additional considerations while mapping include the EG's environmental impact and EGA product category, whether or not it contributes to development, and in which areas, and its applicable Harmonized System (HS) code.

3.1.3 EG assessment

After potential EGs are identified, and checked against the APEC list, they are put on an initial list and evaluated further. Acknowledging the many factors that make up each EG, including its use, content, effects on the environment, effects on development and effects on health and safety, helps to inform its selection. *When a good benefits the environment, either directly or comparatively, and can be applied to solve issues in developing contexts, it fits the general criteria of the study.*

Acceptable environmental goods are then evaluated across the environmental and development criteria. Those goods that are specifically relevant to developing contexts, considered "development EGs", are investigated more thoroughly for their specific environmental and development implications, and their positive and negative contributions to each. As discussed in section 2.2, relevance to development means the EG assists in the meeting of basic human needs, especially clean water access, waste management and sanitation, energy access and the related health, safety and nourishment aspects of each.

The selected development EGs are placed on a development EG list, and are each presented in an individual factsheet, in addition to a detailed discussion in the text. For demonstrative purposes, the factsheet template is pictured in Figure 3.

Good:			Picture(s)
EGA category:			
HS code and description:			
Potential ex-out:			
Norwegian producers:			
Description:			
Content:			
Use:			
References:			
Evaluation			
	Environment	**Development**	**Other / comments**
+			
–			

Figure 3: Development EG Factsheet Template

The factsheets include the Harmonized System (HS) six-digit subheading code and description, potential ex-out specifications, a picture of the good, a description of its content and use, and relevant Norwegian producers, sellers and traders, if applicable. The second half of the factsheet, labeled “evaluation”, shows the good’s positive and negative contributions to the environment and to development, along with additional remarks important for consideration. It should be noted that the “negative” contributions section of the factsheet table does not discredit the good, but suggests necessary considerations for implementation and application. For example, solar cookers solve the problems of limited access to biofuels for traditional cooking, the negative health effects associated with burning such fuel indoors, and the negative climate gases emitted in the process, making them a clear EG. Local cultural norms, however, may limit the likelihood of cooking outdoors, and the resulting use of the solar cooker. Such is not necessarily a negative, but should be taken into account in the design of the cooker.

4 Findings

The following sections detail the findings of the study. Adhering to the methods introduced in chapter 3, section 4.1 presents a list of EGs for possible nomination. This initial list contains EGs that are not on the APEC list and that contribute to the EGA product categories and/or to the reduction of climate gases.

Section 4.2 describes the results of the analysis of the initial EG list. 15 EGs with specific relevance to developing countries were selected from the initial list and placed on a list of development EGs. This list makes up the core of the study.

Next, section 4.3 presents a description of each of the identified development EGs. This discussion explains the environmental and development contribution of each good, and makes the case for its EGA nomination. Along with the description in the text, the factsheet for each development EG is presented.

Finally, section 4.4 outlines the contributions of the Norwegian clean-tech industry to the production of EGs.

4.1 An initial list of EGs

After mapping EGs across industries, the EGA environmental product categories and existing EG lists, an initial list of EGs for potential nomination to the EGA was compiled. This initial list is available in Table 2, and contains the HS code and HS description for the EGs that meet one or more of the EGA product categories and/or contribute to the reduction of climate gases, and that are not on the APEC list.

For cohesiveness, EGs are organized by EGA product category. Appendix 1 presents this same list, but in more detail, including potential ex-outs, environmental and development considerations, and Norwegian producers, if applicable.

As Table 2 demonstrates, the initial list is made up mostly of Class A industrial EGs. This is due to the ease of defining industrial goods and their corresponding parts, along with the clarity of their HS codes. Many of such goods can be applied to developing contexts, however, and are essential to the expansion of the renewable energy sector, and to the widespread meeting of human needs in developing countries.

Table 2: Initial list of EGs for EGA nomination

HS Code	HS Code Description
AIR POLLUTION CONTROL	
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
841410*	Vacuum pumps
841430	Compressors of a kind used in refrigerating equipment
841440	Air compressors mounted on a wheeled chassis for towing
841459	Fans other than table, floor, wall, window, ceiling or roof fans, with a self-contained electric motor of an output not exceeding 125W
841480	Air pumps, other than compressors and fans; ventilating/recycling hoods incorporating a fan, whether or not fitted with filters
SOLID AND HAZARDOUS WASTE MANAGEMENT	
392010	Other plates, sheets, film, foil and strip, of plastics, non-cellular and not reinforced, laminated, supported or similarly combined with other materials: of polymers of ethylene
392020	Other plates, sheets, film, foil and strip, of plastics, non-cellular and not reinforced, laminated, supported or similarly combined with other materials: of polymers of propylene
392220	Lavatory seats and covers, of plastics
392290	Bidets, lavatory pans, flushing cisterns and similar sanitary ware, of plastics
392690	Other articles of plastics and articles of other materials of headings 39.01 to 39.14: other
442190	Other articles of wood: other
560290	Felt, whether or not impregnated, coated, covered or laminated: other
560314*	Nonwovens, whether or not impregnated, coated, covered or laminated, Weighing more than 150 g/m²
680620	Exfoliated vermiculite, expanded clays, foamed slag and similar expanded mineral materials (including intermixtures thereof) [Filtralite]
681099	Other articles of cement, of concrete
681599	Articles of stone or of other mineral substances (including carbon fibres, articles of carbon fibres and articles of peat), not elsewhere specified or included: other
691010*	Ceramic sinks, wash basins, wash basin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures of *porcelain or china*
700100	Cullet and other waste and scrap of glass; glass in the mass [Glasopor]
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
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 : Greater than 50l
731021*	Tanks, casks, drums, cans, boxes and similar containers, of a capacity not exceeding 300 l: To be closed by soldering or crimping
731029*	Tanks, casks, drums, cans, boxes and similar containers, of a capacity not exceeding 300 l: Other
732429*	Sanitary ware and parts thereof of *iron or steel:* other, including parts
761290*	Aluminium casks, drums, cans, boxes and similar 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: other
761529*	Sanitary ware and parts therefore, of *aluminum*
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: Other vapour generating boilers, including hybrid boilers
841320*	Hand pumps, other than those of subheading 841311 or 841319
841410*	Vacuum pumps
842220	Machinery for cleaning or drying bottles or other containers
842290	Parts for 842220

WASTEWATER MANAGEMENT AND WATER TREATMENT	
391400	Ionexchangers based on polymers of headings 39.01 to 39.13, in primary forms.
392510	Reservoirs, tanks, vats and similar containers, of a capacity exceeding 300 l
560314*	Nonwovens, whether or not impregnated, coated, covered or laminated, Weighing more than 150 g/m²
591190	Textile products and articles, for technical uses, specified in Note 7 to this Chapter: Filter bags and similar for use in purifying plants
680620*	Exfoliated vermiculite, expanded clays, foamed slag and similar expanded mineral materials (including intermixtures thereof)
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
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 : Greater than 50l
731021*	Tanks, casks, drums, cans, boxes and similar containers, of a capacity not exceeding 300 l: To be closed by soldering or crimping
731029*	Tanks, casks, drums, cans, boxes and similar containers, of a capacity not exceeding 300 l: Other
761290*	Aluminium casks, drums, cans, boxes and similar 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: other
820750	Interchangeable tools for hand tools, whether or not power-operated, or for machine-tools (for example, for pressing, stamping, punching, tapping, threading, drilling, boring, broaching, milling, turning or screw driving): Tools for drilling, other than rock drilling
820760	Interchangeable tools for hand tools, whether or not power-operated, or for machine-tools (for example, for pressing, stamping, punching, tapping, threading, drilling, boring, broaching, milling, turning or screw driving): Tools for boring or broaching
841320*	Hand pumps, other than those of subheading 841311 or 841319
841381	Pumps
848180	Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, including pressure-reducing valves and thermostatically controlled valves: Other appliances
854370	Other electrical machines and apparatus having individual functions (not specified elsewhere in chapter 85)
ENVIRONMENTAL REMEDIATION AND CLEAN-UP	
842119	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases: Other
842191	Parts for 842119
CLEANER AND RENEWABLE ENERGY	
730820	Towers and lattice masts
732111*	Stoves, ranges, grates, cookers, barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel: for gas fuel or for both gas and other fuels
732190*	Parts for 732111
840211	Watertube boilers with a steam production exceeding 45 t per hour
840212	Watertube boilers with a steam production not exceeding 45 t per hour
840219*	Other vapour generating boilers, including hybrid boilers
840220	Superheated water boilers
840310	Central heating water boilers other than those of heading 84.02
840390	Parts for 840211, 840212, 840219, 840220, 840310
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
840590	Parts for 840510
840681	Steam and other vapor turbines of an output exceeding 40 MW
840682	Steam and other vapor turbines of an output not exceeding 40 MW
841011	Hydraulic turbines, water wheels, and regulators therefor, Of a power *not exceeding 1,000 Kw*
841012	Hydraulic turbines, water wheels, and regulators therefor, Of a power *exceeding 1,000 kW but not*

	exceeding 10,000 kW
841013	Hydraulic turbines, water wheels, and regulators therefor, Of a power *exceeding 10,000 kW*
841090	Parts for 841011, 841012, 841013
841280	Other engines and motors: Other
848610	Machines and apparatus for the manufacture of boules or wafers
850161	AC generators of an output not exceeding 75 kVA
850162	AC generators of an output exceeding 75 kVA but not exceeding 375 kVA
850163	AC generators of an output exceeding 375 kVA but not exceeding 750 kVA
850300	Parts suitable for use solely or principally with the machines of heading 85.01 or 85.02
850440	Static converters
854190	Parts for 854140 – photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes
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
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
ENERGY EFFICIENCY	
680610	Slag wool, rock wool and similar mineral wools (including intermixtures thereof), in bulk, sheets or rolls
700800	Multiplewalled insulating units of glass
730830	Structures and parts of structure: Doors, windows and their frames and thresholds for doors
841861	Compression type units whose condensers are heat exchangers
841950	Heat exchange units
841990	Parts for 841950
850240	Electric rotary converters
853931*	Electric filament or discharge lamps: Fluorescent, hot cathode
NOISE AND VIBRATION ABATEMENT	
450410	Blocks, plates, sheets and strip; tiles of any shape; solid cylinders, including discs of agglomerated cork with or without binding substance
840991	Parts suitable for use solely or principally with spark-ignition internal combustion piston engines
840999	Parts suitable for use solely or principally with other engines (not spark-ignition internal combustion piston engines or aircraft engines)
ENVIRONMENTALLY PREFERABLE PRODUCTS	
440921	Wood (including strips and friezes for parquet flooring, not assembled) continuously shaped (tongued, grooved, rebated, chamfered, V-jointed, beaded, moulded, rounded or the like) along any of its edges, ends or faces, whether or not planed, sanded or end: of bamboo
441210	Plywood, veneered panels and similar laminated wood: of bamboo
460121	Mats, matting and screen of bamboo
460129	Mats, matting and screens of vegetable materials: Other
482361	Trays, dishes, plates, cups and the like, of paper or paperboard: of bamboo
530310	Jute and other textile bast fibers, raw or processed, but not spun, excluding flax, true hemp and ramie: raw or retted
530110	Flax, raw or processed but not spun: raw or retted
530121	Flax, raw or processed but not spun: broken or scotched
530129	Flax, raw or processed but not spun: other
530390	Jute and other textile bast fibers, raw or processed, but not spun, excluding flax, true hemp and ramie: other
530500	Coconut, abaca (Manila hemp or Musa textilis Nee), ramie and other vegetable textile fibres, not elsewhere specified or included, raw or processed but not spun; tow, noils and waste of these fibres (including yarn waste and garnetted stock), raw of processed but not spun
530610	Flax yarn: single
530620	Flax yarn: multiple (folded) or cabled
530710	Yarn of jute or other textile bast fibers of heading 53.03: single
530720	Yarn of jute or other textile bast fibers of heading 53.03: multiple (folded) or cabled
530911	Woven fabrics of flax, containing 85% or more by weight of flax: unbleached or bleached

530919	Woven fabrics of flax, containing 85% or more by weight of flax: other
530921	Woven fabrics of flax, containing less than 85% by weight of flax: unbleached or bleached
530929	Woven fabrics of flax, containing less than 85% by weight of flax: other
531010	Woven fabrics of jute or of other textile bast fibers: unbleached
531090	Woven fabrics of jute or of other textile bast fibers: other
560710	Twine, cordage, ropes and cables, whether or not plaited or braided; whether or not impregnated, coated, covered or sheathed with rubber or plastics, of jute or other textile based fibers (of heading 53.03)
560721	Twine, cordage, ropes and cables, whether or not plaited or braided; whether or not impregnated, coated, covered or sheathed with rubber or plastics, of sisal or other textiles fibers of the genus Agave: binder or baler twine
560729	Twine, cordage, ropes and cables, whether or not plaited or braided; whether or not impregnated, coated, covered or sheathed with rubber or plastics, of sisal or other textiles fibers of the genus Agave: other
560900	Articles of yarn, strip or the like of heading 54.04 or 54.05, twine, cordage, rope or cables, not elsewhere specified or included
630510	Sacks and bags, of a kind used for the packing of goods of jute or other textile based fibers (of heading 53.03)
680800	Panels, boards, tiles, blocks and similar articles of vegetable fibre, of straw or of shavings, chips
732111*	Stoves, ranges, grates, cookers, barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel: for gas fuel or for both gas and other fuels
732190*	Parts for 732111
851310	Portable electric lamps designed to function by their own source of energy (for example, dry batteries, accumulators, magnetos), other than lighting equipment of heading 85.12.
853931*	Electric filament or discharge lamps: Fluorescent, hot cathode
940151	Furniture, seats: of bamboo or rattan
940381	Other furniture and parts thereof: of bamboo or rattan
940540	Other electric lamps and lighting fittings
940550	Non-electric lamps
RESOURCE EFFICIENCY	
691010*	Ceramic sinks, wash basins, wash basin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures of *porcelain or china*
732490*	Sanitary ware and parts thereof, or iron or steel
841410*	Vacuum pumps

*Good listed more than once in table

4.2 A list of development EGs

After the initial list of EGs was completed, EGs that could contribute to meeting basic needs in developing countries were selected from the list and investigated more thoroughly. These developmentally relevant EGs were then placed the next list, the Development EG List, presented in Table 3. This Development EG list contains 15 EGs from the initial list that clearly contribute to improving livelihoods and living conditions in the basic needs areas of water access and availability, waste management and sanitation, health and safety, and renewable energy access in developing countries.

The 15 EGs on the Development EG list are the core of the study. Not only do they help to reduce climate gases and/or fit one or more of the EGA product categories, but also support the meeting of development needs – the goal of this research. They are the EGs the study suggests the Norwegian delegation nominate in the EGA negotiations. Some development EGs can be classified under multiple HS codes, or do not have a specific HS code and are instead made up of coded parts. Table 3, therefore, includes all relevant HS codes for each

development EG. The codes will be clarified further in the discussion of each good. Appendix 2 presents the same list, but with more emphasis on HS codes and descriptions.

Table 3: Development EG List

Development EG	HS code(s)	Main EGA product category	Additional EGA product categories	Human development need met
1) Composting toilets	392220, 392290, 442190, 691010, 732429, 761529	Solid and hazardous waste management	Wastewater management and water treatment, Resource efficiency	Sanitation
2) Vacuum toilets	392220, 392290, 691010, 732429, 761529, 841410	Solid and hazardous waste management	Wastewater management and water treatment, Resource efficiency	Sanitation
3) Landfill liners and covers	392010, 392020, 392112, 560314, 392690, 560290, 680620, 681599	Solid and hazardous waste management	Wastewater management and water treatment	Sanitation and waste management
4) Containers for waste management and sanitation purposes	730900, 731010, 731021, 731029, 761290	Solid and hazardous waste management	Wastewater management and water treatment	Sanitation and waste management
5) Hand and foot pumps	841320	Wastewater management and water treatment	Solid and hazardous waste management	Access to clean drinking water
6) Renewable energy powered pumps (wind & solar)	841381	Wastewater management and water treatment	Cleaner and renewable energy, Environmentally preferable products	Access to clean drinking water and potable water
7) Drinking water taps, valves and distribution kits	848180	Wastewater management and water treatment		Access to clean drinking water
8) Drinking and potable water storage tanks	392510	Wastewater management and water treatment		Access to clean drinking water and potable water
9) Fresnel mirrors and reflectors	900190, 900290	Cleaner and renewable energy	Reduces climate gases	Energy access
10) Hydraulic turbines	841011, 841012, 841013, 841090	Cleaner and renewable energy	Reduces climate gases	Energy access
11) Biomass boilers	840219	Cleaner and renewable energy	Solid and hazardous waste management	Energy access and waste management
12) Solar stoves and cookers	732111, 732190	Environmentally preferable products	Cleaner and renewable energy, Resource efficiency, Air pollution control	Energy access, food availability, improved health and livelihoods
13) Solar powered lamps	851310, 940540, 940550	Environmentally preferable products	Cleaner and renewable energy, Resource efficiency	Energy access and improved livelihoods
14) Other renewable energy powered lamps	851310	Environmentally preferable products	Cleaner and renewable energy, Resource efficiency	Energy access and improved livelihoods
15) Building materials of sustainable natural materials	440921, 441210, 460121, 460129, 680800	Environmentally preferable products		Infrastructural and shelter improvements for development

4.3 A discussion of development EGs

Beyond simply identifying EGs relevant for developing countries, an understanding of their environmental and development implications helps to inform their selection for EGA nomination. A brief discussion of each development EG presented on the Development EG List therefore follows below. Each description includes the EG's HS code(s), its content and use, and the development and/or environmental problem it is solving. Additionally, a factsheet for each EG summarizes the information in the text.

The presentation of goods is arranged by EGA product category. The development EGs that fit into multiple categories are clearly noted, but are only described once in the text.

4.3.1 Solid and hazardous waste management

There is a growing need for thorough waste management systems in developing countries. Expanding populations and rapid urbanization mean that waste is being generated in larger quantities and accumulating faster, all while resources are being stretched (Guerrero, Mass and Hogland 2012; Kennett and Steenblik 2005). Various technologies and disposal options must be considered for their efficiency and environmental impact, along with their likelihood of implementation within local conditions and means.

In terms of environmental goods specifically relevant to developing countries in the category of waste management, a few have been identified in the study and are presented below. Such goods include composting, and other resource efficient toilets and sanitary fixtures, landfill liners and covers, and storage containers for waste.

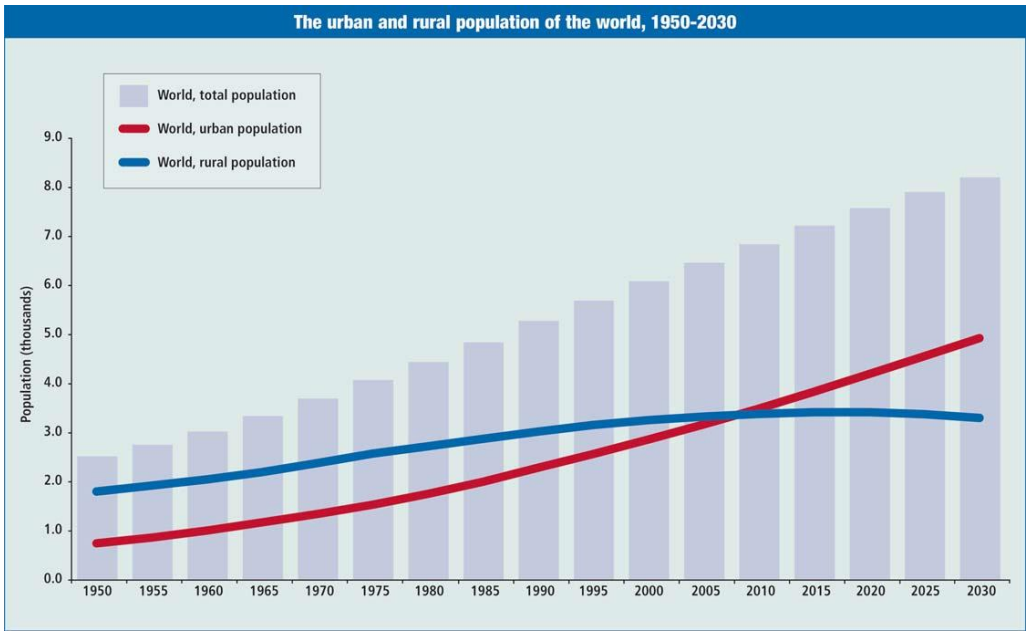


Figure 4: Urban and rural populations (1950-2030)
(http://www.un.org/esa/population/publications/WUP2005/2005wup.htm)

Sanitation

Sanitation and sewage management are two essential areas of improvement for development. Meeting the basic need of sanitation is often taken for granted in the developed world, but 2.5 billion people still practice open defecation and/or lack adequate sanitation in the developing world (Gates Foundation). As a result, there are an estimated 700,000 child deaths from diarrhea each year (Ibid.).

A number of sanitation technologies for developing countries exist. Limited access to a reliable water supply and a lack of municipally organized waste management systems make the practical and financial implementation of these technologies difficult.

Composting toilets

Composting toilets (HS Codes 392220, 392290, 691010, 732429, 761529) are an EG that do not require a water supply and help in the proper disposal of human waste. There are many different designs, but they consist mainly of a hole, which may or may not be covered or contain a seat, placed over a contained collection unit for defecation. Because composting toilets are made up of a number of non-specific parts, there is no specific HS code for composting toilets as a whole. Instead, relevant parts can be identified by HS code and then applied, or "exed-out", for resource efficient settings.

Composting toilets require no water, and therefore do not rely on large sanitation infrastructure such as sewer systems or septic tanks. They fit into three EGA product categories:

(1) **Solid and hazardous waste management:** for their treatment and collection of human waste,

(2) **Wastewater management and water treatment:** for their waterless construction, and protection of ground water sources previously contaminated by open defecation, and

(3) **Resource efficiency:** because other toilet designs require some amount of water for flushing.

The contents of the collection unit are then managed, through aeration and the addition of other biological materials (e.g. ash, sawdust, wood shavings), to enable anaerobic processing into fertilizer. When properly managed, the compost can be used for agricultural purposes, and is no longer left exposed and untreated to pollute soil and ground water sources. The information on composting toilets is summarized in their factsheet in Table 4.

Figure 5: A composting toilet with wood shavings to assist in composition
(http://www.homesteadnotes.com/a-composting-toilet-on-your-homestead/2/)

Vacuum toilets

Vacuum toilets are another EG for sanitation that are applicable for developing country contexts. Similar looking to traditional flush-toilets, vacuum toilets use a vacuum pump to generate air pressure for the transport of sewage, rather than the water used in traditional systems. As with composting toilets, there is no specific HS code for vacuum toilet systems, and the toilet unit (HS codes 392220, 392290, 691010, 732429, 761529) and vacuum pump (HS code 841410) must be coded separately. This may present some difficulty for tracking trade statistics.

Using less than one liter of water per flush, compared to 6-20 liters in traditional flush-toilets, vacuum toilets greatly reduce water usage and can provide large scale sewage management in contexts with limited water supply. Additionally, without the added flush water, less sewage is generated per flush. The reduced water requirement and generation of less sewage make vacuum toilets attractive to developing countries, which may have a limited water supply and unreliable or undeveloped sewage systems. Vacuum toilets therefore fit into three EGA categories:

(1) **Solid and hazardous waste management:** for their treatment and collection of human waste,

(2) **Wastewater management and water treatment:** for their reliance on little water and production of less sewage,

(3) **Resource efficiency:** for their reduced water consumption.

When considering the application of vacuum toilet systems, a few issues must be evaluated. First, in order to generate suction, the vacuum pump relies on electricity, and must remain connected to an electricity source. This means they are not suitable for off-grid usage and may not be applicable in other contexts where electricity in limited or unreliable. Second, the expert design of vacuum toilets makes them expensive for initial purchase. Once

installed, however, the costs are less than those of a traditional flush toilet. Such factors mean that vacuum toilet systems are not a likely choice for individual households in developing countries, especially in rural off-grid communities. A better application is in rapidly urbanizing cities, in city buildings, railway stations, hotels, airports and stadiums, where large quantities of human waste must be managed, and where water supply needs to be conserved. Additionally, because less sewage is produced, existing sewage systems are more likely to be able to be utilized. The factsheet for vacuum toilets is presented in Table 5.

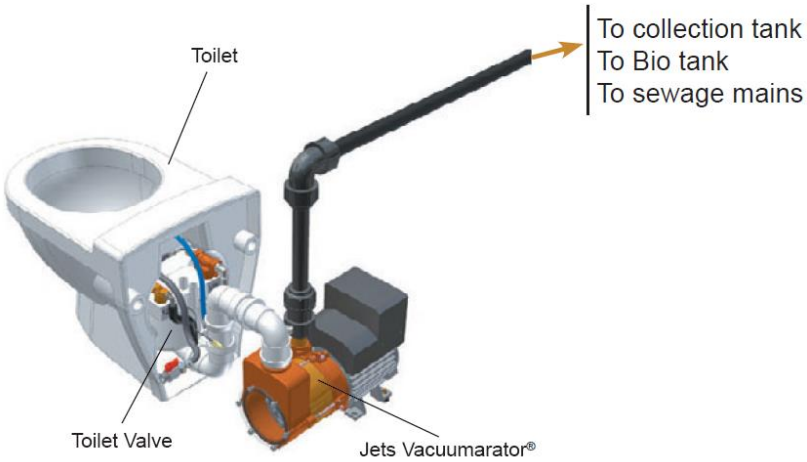


Figure 6: A vacuum toilet
(http://www.sswm.info/content/vacuum-toilet)

Table 4: Composting toilets Factsheet

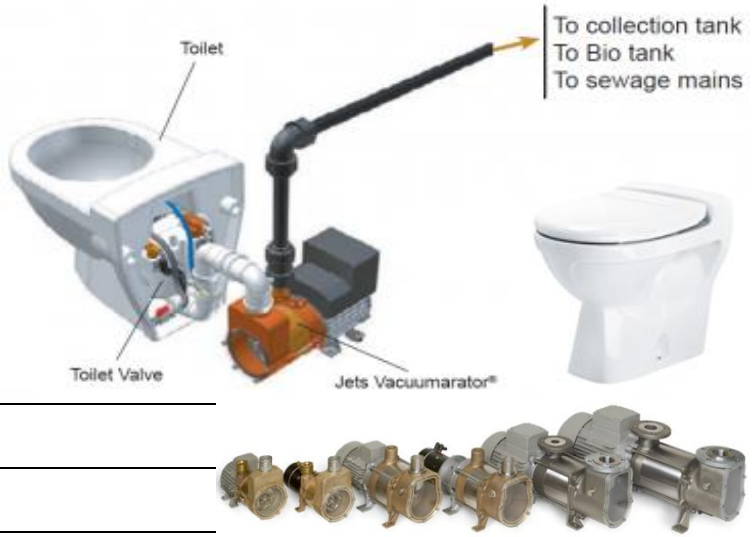
Good:	Composting Toilets	 
EGA category:	Solid and Hazardous Waste Management, Wastewater management and water treatment, Resource efficiency	
HS code and description:	(1) 392220	Lavatory seats and covers, *of plastics*;
	(2) 392290	Bidets, lavatory pans, flushing cisterns and similar sanitary ware, *of plastics*;
	(3) 442190	Other articles of wood: Other;
	(4) 691010	Ceramic, sinks, wash basins, wash basin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures of *porcelain or china*
	(5) 732429	Sanitary ware and parts thereof, *of iron or steel*: other, including parts
	(6) 761529	Sanitary ware and parts thereof, *of aluminum*
Potential ex-out:	Sanitary ware for resource efficient toilets and other sanitary fixtures	
Norwegian producers:	Danfo (Pacto toilet); Vera; Snurredassen; MullToa	
Description:	Contained and managed unit for defecation in which human waste in kept out of soil and water sources and can be transformed into agricultural fertilizer	
Content:	Many different designs, but consist mostly of a hole (with or without seat) over a collection unit for defecation – the contents of the collection unit are managed and additional materials, such as ash, sawdust or wood shavings, are added to aid in the anaerobic processing of the waste into fertilizer	
Use:	Used to treat human waste in areas where local sewage or water supply systems are unavailable	
References:	UNEP, 2005; WaterAid.org; http://www.gatesfoundation.org/What-We-Do/Global-Development/Water-Sanitation-and-Hygiene; Images: http://www.wateraid.org/us/the-water-story/our-approach/delivering-services	

Evaluation

	Environment	**Development**	**Other / comments**
+	• Human waste no longer untreated and out in the open to pollute ground and drinking water sources and soil	• Waste is no longer left open and untreated to cause diseases that are often fatal such as cholera and diarrhea (700,000 yearly child deaths from diarrhea) • Safety is increased for those who previously had to search, alone or at night, for an open defecation spot • Human waste composted can be used for agricultural fertilizer (no money spent on chemical fertilizers), or even as an energy source	• Norway's "hytte" industry specializes in composting and other dry toilets
–		• Improper management may mean that final compost still contains pathogens cannot be used	• May be made of locally available materials or recycled objects and not be internationally traded

Table 5: Vacuum toilets Factsheet

Good:	Vacuum toilets and urinals	
EGA category:	Solid and Hazardous Waste Management, Wastewater management and water treatment, Resource efficiency	
HS code and description:	(1) 392220	Lavatory seats and covers, *of plastics*;
	(2) 392290	Bidets, lavatory pans, flushing cisterns and similar sanitary ware, *of plastics*;
	(3) 442190	Other articles of wood: Other;
	(4) 732429	Sanitary ware and parts thereof, *of iron or steel*: other, including parts
	(5) 761529	Sanitary ware and parts thereof, *of aluminum*
	(6) 841410	Vacuum pumps
Potential ex-out:	Sanitary ware for resource efficient vacuum toilets	
Norwegian producers:	Jets	
Description:	Toilets use air pressure, generated in the vacuum pump, rather than water to transport human waste to sewage/collection systems	
Content:	Toilet (similar to traditional flush toilet), vacuum pump (to suck waste into piping), pipes and fittings	
Use:	Used to manage human waste with much less water than traditional flush-toilet systems; can be applied from the individual household, to large scale establishments such as hotels and airports	
References:	UNEP, 2005; WaterAid.org; http://www.gatesfoundation.org/What-We-Do/Global-Development/Water-Sanitation-and-Hygiene; http://www.sswm.info/content/vacuum-toilet; Images: http://www.sswm.info/content/vacuum-toilet ; http://standard.jetsgroup.com/en/Products/Vacuumarator-pumps.aspx; http://standard.jetsgroup.com/en/Products/Toilets-and-urinals.aspx	



Evaluation

	Environment	Development	Other / comments
+	• Human waste no longer untreated and out in the open to pollute ground and drinking water sources and soil • Vacuum toilets use less than one liter of water, compared to 6-20 liters in traditional toilets – saving water and generating less sewage	• Even with limited water supply, human waste and sewage can be managed on a large scale • Costs are low in comparison to common flush toilets	• May be best for large scale installations such as city buildings, hotels, railway stations, airports, stadiums and arenas in developing countries
–		• High investment cost • Dependent on electricity supply • Expert design is required	

Waste Management

Although one of the least preferred means of waste disposal, the comparably low cost of landfilling directs its continuous implementation worldwide (Schiopu and Gavrilescu 2010; Öman and Manandhar 2011). A number of landfill management technologies exist, and along with proper planning, can help make landfills as safe and environmentally friendly as possible. In many developing countries however, the waste facilities that exist are very basic, and often consist of open, unmanaged dumps (Guerrero, Mass and Hogland 2012; Talyan, Dahiya and Sreekrishnan 2007). Such dumps are often unlined and uncovered causing both surface and groundwater contamination (leachate), and the unmanaged buildup of landfill gas (Ibid.).

Figure 7: Open dump
(http://www.thinkglobalgreen.org/wte.html)

Additionally, because of lacking institutional waste management, hazardous materials and chemicals are often present. According to UNEP (2005),

> Left unmanaged and uncontrolled, solid wastes openly dumped on the land: 1) generate liquid and gaseous emissions (leachate and landfill gas) that can pollute the environment, and 2) represent a breeding ground for disease-bearing animals and microorganisms (323).

Landfill liners and covers

Landfill liners and covers are environmental goods specifically relevant to developing countries. Managing the seepage of harmful chemicals and other waste particles into surface and groundwater sources is important in protecting and providing safe drinking and potable water and preventing the negative health impacts associated with unsafe water consumption in developing countries. Additionally, uncontrolled emission of landfill gases into the atmosphere, most often in developing countries, contribute as the third largest anthropogenic source of global methane (CH_4) emissions, the second most dangerous climate gas (US EPA 2011 as cited in Global Methane Initiative 2011).

There are three types of landfill liners and covers – those made from geosynthetic polymers (plastics), from expansive and absorptive natural clay, and from intermixtures thereof. *Geosynthetic liners and covers* (HS codes 392010, 392020, 392112, 560314) are flexible and prefabricated impermeable membranes made from a number of different polymers. High-

density polyethylene (HDPE) liners, for example, are often used because of their high resistance to chemical compounds found in leachate (Rowe and Sangnam 2002). *Clay liners and covers* are compacted layers of porous clays, and unlike geosynthetic liners, are made of natural materials. Clay liners are attractive to developing countries because of their, often, local material availability and abundance (Allen 2001). *Composite liners and covers* (HS codes 392690, 560290, 680620, 681599), or *geosynthetic clay liners (GCLs)*, combine the attractive properties of geosynthetic plastic and natural clay liners. They can be manufactured for specific conditions, and consist of a layer of bentonite clay attached to a geosynthetic material (Bouazza 2002). Landfill liners and covers fit into two EGA product categories:

(1) **Solid and hazardous waste management:** for their management of solid, and potentially hazardous waste, and

(2) **Wastewater management and water treatment:** for their protection of ground and drinking water sources from dangerous leachate.

Landfill liners and covers provide a good example of the need to consider local conditions when nominating and implementing EGs for developing countries. Before choosing an appropriate liner and/or cover, aspects of the local environment must be assessed, including the local climate, soil composition, amount of rainfall and composition of waste (Buozza 2002; Johannessen and Boyer 1999; Rowe and Sangnam 2002; UNEP 2005). Knowledge of such conditions, along with budget, will guide the choice of liner and/or cover material.

Additionally, the effects of landfill technology upgrades must be assessed in terms of local livelihoods. For example, liners and covers will help to protect surface and ground water sources, making the availability of uncontaminated water greater and positively affecting health. At the same time however, many open dumps and landfills are home to scavengers and waste traders, local peoples sorting through dumped waste for any recyclable or reusable materials to trade, sell or use (Johannessen and Boyer 1999; UNEP 2005). The degree to which these people are affected must be taken into account when deciding to apply landfill liners and covers.

Factsheets for landfill liners and covers of plastics and for GCLs are presented in Tables 6 and 7, respectively.

Table 6: Landfill liners and covers of flexible plastics Factsheet

Good:	Landfill liners and covers of flexible plastics	
EGA category:	Solid and hazardous waste management; Wastewater and water management	
HS code and description:	(1) 392010	Other plates, sheets, film, foil and strip, of plastics, non-cellular and not reinforced, laminated, supported or similarly combined with other materials: *of polymers of ethylene*;
	(2) 392020	Other plates, sheets, film, foil and strip, of plastics, non-cellular and not reinforced, laminated, supported or similarly combined with other materials: *of polymers of propylene*;
	(3) 392112	Other plates, sheets, film, foil and strip, of plastics: *of polymers of vinyl chloride*;
	(4) 560314	Nonwovens, whether or not impregnated, coated, covered or laminated: Weighing more than 150 g/m^2
Potential ex-out:	Geomembranes of plastics (polyethylene (including high-density polyethylene (HDPE), polypropylene and polyvinyl chloride (PVC)) for soil protection, water tightness, drainage, anti-erosion, leachate protection; Flexible membrane landfill liners and/or covers for methane collection	
Norwegian producers:	TeleTextiles AS	
Description:	Flexible geomembranes of plastics used as landfill drainage mats, bottom liners and covers; also used in water containment contexts	
Content:	Geosynthetic materials - polyethylene (including high-density polyethylene (HDPE)), polypropylene and polyvinyl chloride (PVC)	
Use:	Soil protection, water tightness, drainage, anti-erosion, leachate protection, methane collection	
References:	Allen, 2001; Bouazza, 2002; Katsumi et al., 2001; Rowe & Sangam, 2002; Schiopu & Gavrilescu, 2010; Talyan, Dahiya & Sreekishnan, 2008; UNEP, 2005; Images: http://landfill-site.com/portfolio-landfill-pictures.html ; http://www.americover.com/pvc_polyvinyl_chloride_liner_1018_prd1.htm	

Evaluation

	Environment	Development	Other / comments
+	• Liners prevent leachate (the seeping of waste and chemicals into groundwater), provide soil protection, anti-erosion • Covers trap landfill gases (methane) that can be converted to energy, prevent contaminated water runoff	• Likelihood for safer and cleaner surface and groundwater sources increases • Dangerous chemicals and heavy metals from waste degeneration are blocked from entering surface and groundwater sources • Contaminated runoff is limited	
–	• Eventual degradation due to physical and chemical aging • Landfill gases under cover must be properly vented – technology often lacking in developing countries • Chemicals in plastics may have negative health impacts themselves	• The effect on local livelihoods must be considered, e.g. scavengers and waste traders who make their living through the collection of waste in open dumps	

Table 7: Geosynthetic clay liners (GCLs) Factsheet

Good:	Geosynthetic clay liners (GCLs)	
EGA category:	Waste management	
HS code and description:	(1) 392690	Other articles of plastics and articles of other materials of headings 39.01 to 39.14: other;
	(2) 560290	Felt, whether or not impregnated, coated, covered or laminated: other;
	(3) 680620	Exfoliated vermiculite, expanded clays, foamed slag and similar expanded mineral materials (including intermixtures thereof);
	(4) 681599	Articles of stone or of other mineral substances (including carbon fibres, articles of carbon fibres and articles of peat), not elsewhere specified or included: other
Potential ex-out:	GCLs (clay and geosynthetic composite for the lining of landfills)	
Norwegian producers:	TeleTextiles AS	
Description:	Composite clay and geosynthetic liners used for landfill drainage and leachate protection	
Content:	Geosynthetic layer attached to clay layer (often expansive bentonite clay)	
Use:	Soil protection, water tightness, drainage, anti-erosion, leachate protection, methane collection	
References:	Allen, 2001; Bouazza, 2002; Rowe & Sangam, 2002; UNEP, 2005; Image: http://www.tradeboss.com/default.cgi/action/viewproducts/productid/135552/productname/Geosynthetic_clay_liner/ ; http://www.geotextile-fabric.com/sale-1929764-sealing-solution-landfill-liner-material-waterproof-composite-laminate-gcl.html	

Evaluation

	Environment	Development	Other / comments
+	• Liners prevent leachate (the seeping of waste and chemicals into groundwater), provide soil protection, anti-erosion • Covers trap landfill gases (methane) that can be converted to energy, prevent contaminated water runoff	• Likelihood for safer and cleaner surface and groundwater sources increases • Dangerous chemicals and heavy metals from waste degeneration are blocked from entering surface and groundwater sources • Contaminated runoff is limited	
–	• Eventual degradation due to physical and chemical aging • Landfill gases under cover must be properly vented – technology often lacking in developing countries • Landfill gases may escape during collection/harvesting (methane is most dangerous climate gas)	• The effect on local livelihoods must be considered, e.g. scavengers and waste traders who make their living through the collection of waste in open dumps	• Difficult to track trade statistics because traded using all HS codes listed above, based on various composite materials and combinations

Containers for the storage of hazardous waste, sewage, and drinking and potable water

Containers for the storage of hazardous waste, sewage, and other waste management purposes, along with the storage of drinking and potable water, are an important EG for developing countries. Containers made of iron or steel (HS codes 730900, 731010, 731021, 731029) and aluminum (HS code 761290) provide storage for hazardous waste, chemicals, and sewage, and protect the surrounding natural environment from exposure and contamination by their contents. Ex-outs for waste storage containers may be difficult to define because of their many possible uses, but, generally, waste containers for dangerous contents can be considered EGs. These containers may range in size from casks, drums, cans, or boxes, to tanks, reservoirs or vats.

Figure 8: Containers for the storage of waste, sewage, drinking and potable water – Storage drums (left), Storage tanks (right)
(http://ehs.ucr.edu/waste/ ; http://www.cstindustries.com/products/hydrotec/)

Waste containers serve the general purpose of keeping dangerous chemicals, waste and other contaminating substances out of the natural environment. Additionally, large tanks and vats may provide the place for waste treatment processes to be carried out. Without a storage container, such waste can easily contaminate ground water sources and soil, and produce a number of negative health effects for the people, animals and plants in the environment. Along with being used as waste containers, they may also be used to hold and treat wastewater, drinking water, and potable water. With such uses, they meet two EGA product categories:

(1) **Solid and hazardous waste management:** for their containment of waste, chemicals and sewage, and

(2) **Wastewater management and water treatment:** for their water storage and treatment properties.

Factsheets for waste and water storage containers of various sizes and materials are available in Tables 8 and 9.

Table 8: Iron or steel storage containers Factsheet

Good:	*Iron or steel* containers for the storage of hazardous waste, sewage, drinking water, potable water, and other sanitation, waste management and water access purposes	  
EGA category:	Solid and hazardous waste management; Wastewater management and water treatment	
HS code and description:	(1) 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;	
	(2) 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 : *Greater than 50l;*	
	(3) 731021 Tanks, casks, drums, cans, boxes and similar containers, of a capacity *not exceeding 300 l*: *To be closed by soldering or crimping*	
	(4) 731029 Tanks, casks, drums, cans, boxes and similar containers, of a capacity *not exceeding 300 l*: *Other*	
Potential ex-out:	Difficult to determine because of so many possible uses related to development and environmental protection; Possibilities may include containers for wastewater, sewage, and hazardous waste, storage containers for safe drinking water and solar preheating tanks	
Norwegian producers:		
Description:	Waste containers for wastewater, sewage, and hazardous waste; Storage containers for safe drinking water; Solar preheating tank	
Content:	Containers made of iron or steel	
Use:	Storage of wastewater, sewage, hazardous waste, drinking water, etc	
References:	WaterAid.org; Images: http://www4.nau.edu/itep/waste/hazsubmap/twrap_HzSubMap_ast.asp ; http://dir.indiamart.com/impcat/steel-drums.html ; http://www.arrow-environmental.co.uk/tank-cleaning.asp	

Evaluation

	Environment	**Development**	**Other / comments**
+	• Contain hazardous waste in order to prevent ground- and surface water contamination and the resulting health and ecological effects	• Containment of wastewater, sewage and hazardous waste prevents ground and surface water contamination • Important for human waste management (e.g. septic tanks and pit latrines) and the reduction of disease spread through open defecation • Essential parts for safe drinking water systems (e.g. gravity flow systems or the storage of clean drinking water)	
–			• Difficult to determine ex-outs because of so many potential uses

Table 9: Aluminum storage containers Factsheet

Good:	Aluminum containers for the storage of hazardous waste, sewage, drinking water, potable water, and other sanitation, waste management and water access purposes	 
EGA category:	Solid and hazardous waste management; Wastewater management and water treatment	
HS code and description:	761290	Aluminum casks, drums, cans, boxes and similar 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: other
Potential ex-out:	Difficult to determine because of so many possible uses related to development and environmental protection; Possibilities may include containers for wastewater, sewage, and hazardous waste, storage containers for safe drinking water and solar preheating tanks	
Norwegian producers:		
Description:	Waste containers for wastewater, sewage, and hazardous waste; Storage containers for safe drinking water; Solar preheating tank	
Content:	Containers made of aluminum	
Use:	Storage of wastewater, sewage, hazardous waste, drinking water, etc	
References:	WaterAid.org; Images: http://www.swampbuggiesfl.com/parts/all-aluminum-water-tank/; http://www.atschem.com/Chemical-process-equipments-india.aspx	

Evaluation

	Environment	**Development**	**Other / comments**
+	• Contain hazardous waste in order to prevent ground- and surface water contamination and the resulting health and ecological effects	• Containment of wastewater, sewage and hazardous waste prevents ground and surface water contamination • Important for human waste management (e.g. septic tanks and pit latrines) and the reduction of disease spread through open defecation • Essential parts for safe drinking water systems (e.g. gravity flow systems or the storage of clean drinking water)	
–			• Difficult to determine ex-outs because of so many potential uses

4.3.2 Wastewater management and water treatment

When searching for development EGs within EGA product category, wastewater management and water treatment, the study recognizes water access and delivery as the most relevant areas of concern. Such also reflects the objectives of the tender document, and the desperate need for better drinking water access in developing nations.

One must keep in mind the parallels and overlaps between the EGA product categories of solid and hazardous waste management (sanitation) and wastewater management and water treatment (access to clean water). Access to clean water is directly related to the treatment of waste and the likelihood of water contamination when it remains untreated. As stated by Shannon, Bohn, Elimelech, et al. (2008), "The many problems worldwide associated with the lack of clean, fresh water are well known: 1.2 billion people lack access to safe drinking water, 2.6 billion have little or no sanitation, millions of people die annually – 3,900 children a day – from diseases transmitted through unsafe water or human excreta" (301). Although the Millennium Development Goal (MDG) for clean water and improved sanitation has been met, the most basic human need of clean water is still not provided to all the world's peoples. Urbanization, climate change and increasing water scarcity, across both the developing and developed worlds, mean that it is becoming exponentially difficult to meet such need.

Although it is outside the scope of the study to present water filtering and purifying machinery and apparatus (HS code 842121) because they are already listed on the APEC list, it should be noted that water purification is a key issue in meeting drinking water needs, and that a number of Norwegian companies develop and produce water treatment and purification methods relevant for developing contexts.

Issues of water storage, and access and distribution are other important issues in the global provision of clean water. The following section therefore presents development EGs in the categories of water access and distribution and water storage.

Water access and distribution

In order to provide water in developing contexts, efficient and cost-effective technologies for distribution and access must be employed. The following section presents those development EGs that support the delivery of drinking and potable water in areas where water may be scarce and difficult to reach, and where the health of local communities depends on it. Such EGs include hand and foot pumps for drinking water and agricultural purposes, renewable energy powered pumps for large and small scale use, and taps, valves and distribution stations for efficient drinking water delivery.

Hand and foot pumps

Hand and foot pumps (HS code 841320) are a simple EG that help with the delivery of clean drinking water in developing countries. They assist in the handling of drinking water and potable water, and are most often some type of positive displacement pump controlled by the manual raising or lowering of the pump handle to move water up toward the surface. Hand pumps may also be used to empty human waste and sewage from septic tanks and other waste pumps. Powered solely by the operator, hand and foots pumps do not rely on any outside fuel, removing the issues of extra expense and emissions. Hand and foot pumps therefore fit into two EGA product categories:

(1) **Wastewater management and water treatment:** for their ability to deliver drinking and potable water to the surface,

(2) **Solid and hazardous waste management:** for their assistance in the treatment of human waste.

Hand pumps may be attached to drinking water wells or boreholes to deliver drinking water to the surface. They may be in the form of positive displacement pumps, described above, or rope pumps, both shown in Figure 9. Although a simple technology, hand pumps help to meet the very basic need of clean drinking water, and can easily be applied across the developing world. The reliability of hand pumps is an important consideration for application. Pumps that have the lowest cost to install, may not work long enough to be cost-effective. Therefore, before choosing a hand pump, local conditions such as the frequency of use must be examined.

Figure 9: Hand pumps – Positive displacement pump (left), Rope pump (right)
(http://fab.cba.mit.edu/classes/863.12/people/egorbaty/index.html;
https://necofakenya.wordpress.com/category/uncategorized/page/2/)

Foot pumps, also known as treadle pumps, are usually attached to groundwater or potable water sources to be used for irrigation and other agricultural purposes. Many farmers rely on diesel powered pumps, powered by expensive fuel and often rented from outside parties, for irrigation. With treadle pumps however, pictured in Figure 10, crops can be watered without the expense, and emissions, of diesel pumps. Additionally, savings may even be used for additional crop planting or other livelihood improvements like sending a child to school.

Figure 10: Treadle foot pump

http://developeconomies.com/development-economics/aid-undermining-business-stop-sending-your-old-shoes/

Hand pumps may also be used for sanitation purposes such as the emptying of septic tanks and other human waste pits in urban environments. In order for septic tanks and latrine pits to run as efficient waste management technologies, they must eventually be emptied and the waste disposed of. Hand pumps may assist in this task, and are much more affordable to install and maintain than fossil fuel powered pumps. Once the sewage is pumped from the pits, it can be disposed of properly. The need for human operators presents business opportunities, as private contractors, or contractors hired by the municipality may be hired to collect and dispose of the waste (Tilley, Ulrich, Luethi et al. 2014). Additionally, hand pumps can be used to manage waste even in areas without electricity. Health and safety precautions must of course be taken in the manual handling of sewage, shown in Figure 11. Table 10 shows the factsheet for hand and foot pumps.

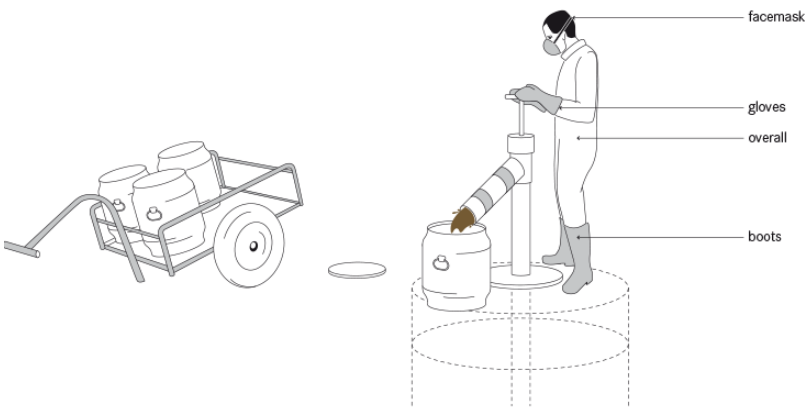


Figure 11: Hand pump for human waste disposal

(Tilley et al. 2014)

Renewable energy powered pumps

Reducing the emissions produced by traditional fossil fuel powered pumps, renewable energy powered pumps (HS code 841381) are another EG relevant for developing countries. Most commonly powered by solar or wind energy, these pump systems integrate solar PV panels (HS code 854140 - already on APEC list) or wind turbines to generate enough electricity to power a water pump. In most instances, the pump, connected to a water source, will then pump water for use in irrigation, the watering of livestock, and other agricultural purposes. Water sources may include lakes, rivers, groundwater sources, boreholes and other wells. Once pumped from the initial water source, the water is stored in a tank for use. These tanks are then connected to irrigation equipment or other fittings for use. Water may also be pumped for drinking purposes. On a larger scale, renewable energy powered water pumps can be used in industrial water treatment plants to replace existing pumps powered by fossil fuels.

Renewable energy powered pumps fit into three EGA product categories:

(1) **Wastewater management and water treatment:** for their ability to deliver drinking and potable water to the surface,

(2) **Cleaner and renewable energy:** for their reliance on renewable energy sources such as solar and wind energy, and their removal of fossil fuel emissions, and

(3) **Environmentally preferable products:** for their preferred advantage of traditional fossil fuel pumps.

The development and design of renewable pumps specifically for developing countries has helped to make them affordable for local contexts. Additionally, once installed, farmers will no longer need to rely on expensive and environmentally harmful diesel pumps, and may actually save money. Renewable energy powered pumps are currently traded and grouped together under one HS code, but could be separated to distinguish power source and environmental implications. Figure 12 shows a basic solar water pump set-up. The factsheet for renewable energy powered pumps is available in Table 11.

Figure 12: Solar powered water pump set-up
(http://sunculture.com/wp-content/uploads/AgroSolar-Installation-2.jpg)

Table 10: Hand and foot pumps Factsheet

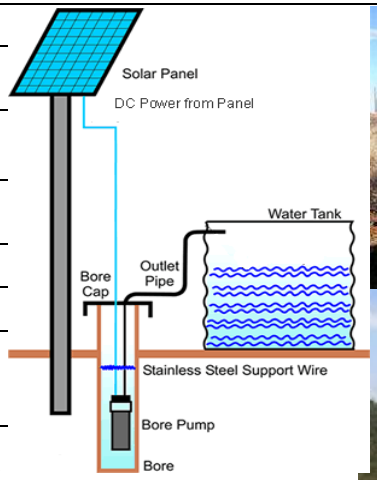
Good:	Hand and foot pumps	
EGA category:	Wastewater management and water treatment; Solid and hazardous waste management	
HS code and description:	841320	Pumps for liquids, whether or not fitted with a measuring device: Hand pumps, other than those of subheading 841311 or 841319
Potential ex-out:		
Norwegian producers:		
Description:	For the handling of wastewater, drinking water, potable water and human waste	
Content:	Most often a positive displacement pump with reciprocating pistons or plungers that are controlled by raising and lowering the pump handle to move water (or sewage) up toward the surface	
Use:	To deliver water from underground sources to the surface – can be attached to a well or bore hole to deliver drinking water to the surface, or to other ground water sources for irrigation and other agricultural purposes. May also be used to manually pump human waste from septic tanks or pits	
References:	Tilley et al. 2014; WaterAid.org ; Images: http://www.top-pumps.com/products.php?showlei=&Leiid=149; http://www.fao.org/english/newsroom/highlights/2001/010103-e.htm; http://foundationrehabindia.blogspot.no/2013/12/drinking-water-project-in-rajasthan.html; http://blogs.worldwatch.org/nourishingtheplanet/tag/treadle-pump/	

Evaluation

	Environment	Development	Other / comments
+	• Reduction in CO_2 emissions from traditional fossil fuel powered pumps	• Used in conjunction with wells to deliver drinking and potable water to the surface • May assist in the proper collection and disposal of human waste from pits or septic tanks for safe disposal, and with no reliance on additional fuels • Hand pumps and foot pumps can be used for the irrigation of individual farms, allowing the farmer to remove his dependence on an outside provider of a diesel pump and the diesel needed to run it (saved money can be saved, spent on additional crops, etc.)	
–			

Table 11: Renewable energy powered pumps Factsheet

Good:	Renewable energy powered water pumps	
EGA category:	Wastewater management and water treatment; Cleaner and renewable energy; Environmentally preferable products	
HS code and description:	841381	Pumps for liquids, whether or not fitted with a measuring device: other pumps
Potential ex-out:	Pumps powered by or integrated with renewable energy sources (e.g. wind turbines, solar-pumping systems)	
Norwegian producers:		
Description:	Water pumps powered by renewable energy sources such as solar or wind	
Content:	Renewable energy collector (solar panel or wind turbine); renewable energy powered pump; water source (lake, river, borehole, well); water tank (for pumped water)	
Use:	Renewable energy (solar or wind) is converted to electricity to power a water pump. The water pump then pumps water from a water source into a water tank for storage until use in irrigation, watering of livestock or other agricultural purposes. May also be used in water treatment plants.	
References:	SunCulture.com	



Evaluation

	Environment	Development	Other / comments
+	• Replace the emissions and pollution of traditional diesel or other fossil fuel powered pumps • Powered by renewable energy sources	• Solar- and wind-powered pumps help deliver water for irrigation and watering livestock (small scale) • No longer need to buy expensive fuel such as diesel to power pumps • Pumps are integral components of water treatment plants (industrial scale)	• Can be applied from the small scale (individual farm) to the large scale (industrial water treatment plants)
–			

Drinking water taps, valves, and distribution stations

Drinking water taps, valves, and distribution stations (HS code 848180) are an EG that directly address the need for clean drinking water in developing countries. There are a number of different set-ups and designs produced by various manufacturers, but the general concept surrounds the connection to a water source and efficient delivery through taps or valves. In areas where water is scarce, it is important that drinking water can be easily collected. The collection of drinking water can be an extremely time consuming task, taking time away from other household duties, and even education. Additionally, leaky and unreliable taps mean that valuable water may be spilled before it can be put to use. Water station delivery kits, and their taps and valves, help to meet the important need for clean drinking water, and fit into the EGA product category:

- **Wastewater management and water treatment**: for their efficient distribution of clean drinking water.

The Water Station Kit from A-Aqua, a Norwegian producer, for example, is designed with the safe and efficient distribution of clean drinking water in mind. A-Aqua's water kit can be applied in both rural and emergency contexts, and can be packed and stored flat for easy shipping across the globe. Made up of multiple high-flow taps that are also self-closing and water-saving, the A-Aqua water station kit helps to make drinking water delivery easy and efficient with limited spillage. The kit also comes with the necessary hoses, couplings and fittings for easy installation.

Figure 13: A-Aqua drinking water delivery kit in action
(http://www.a-aqua.no/products.php?vareid=114)

As the dangerous effects of climate change continue to increase, so too does the number of people displaced from their homes due to natural disasters, resource shortages and human conflicts – increasing the need for emergency response and management of displaced persons. Inclusive, simple and efficient taps, valves and water station delivery kits are, and will continue to be, especially important in these emergency settings.

The factsheet for efficient taps, valves and delivery kits for drinking water distribution is available in Table 12. It should be noted that all taps, valves, and delivery systems are placed under one HS code for drinking water delivery, and that further specification would be helpful to direct the flow of efficient and reliable goods for developing contexts.

Water storage

Along with the distribution of water, the storage of drinking and potable water is another important aspect of water management for developing countries. Briefly mentioned in section 4.3.1 on waste containers, there are many different types of containers for both waste, and drinking and potable water. The section below describes containers produced specifically for the storage of water.

Drinking and potable water storage tanks

Storage tanks for drinking and potable water are EGs relevant for developing countries. Storage containers made of iron and steel (HS codes 730900, 731010, 731021, 731029) were previously discussed, and will not be described further, but should be kept in mind throughout the following discussion.

Developed and produced specifically for drinking and potable water storage, water storage tanks made of a PVC coated polyester fabric, and of a capacity greater than 300 liters (HS code 392510) are especially applicable to developing contexts. Because HS code 392510 only specifies tanks of a capacity exceeding 300 liters, it is necessary to specify the material and use of such water storage containers in an ex-out. The factsheet for PVC coated water tanks is presented in Table 13.

Similar to tanks of iron and steel, these containers serve as a place to store potable or drinking water sources for eased and reliable usage. The special PVC coating on the fabric however, prevents light penetration and resulting algae growth, so that water can be stored without the worry of contamination. Additionally, because they are made of fabric, they can be folded, stored, and shipped easily. Such attributes also make the tanks ideal for emergency contexts. Water storage tanks made of PVC coated fabric meet the EGA product category:

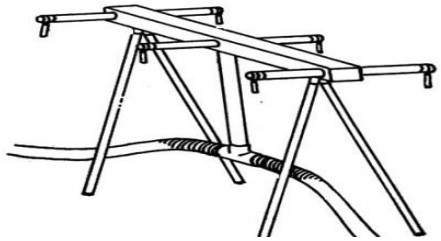
- **Wastewater management and water treatment**: for their storage of potable and clean drinking water.

PVC coated water storage tanks are produced by the Norwegian company A-Aqua, and come in two models of various sizes – the “onion tank” for potable water storage, and the “pillow tank” for drinking water storage, both ranging in sizes from 3,000-30,000 liters.

Figure 14: A-Aqua water storage tanks – “pillow tank” (left), “onion tank” (right)
(http://www.a-aqua.no/products.php?vareid=76; http://www.a-aqua.no/products.php?vareid=99)

Table 12: Drinking water taps, valves and distribution stations Factsheet

Good:	Drinking water taps, valves and distribution stations (The Water Station Kit from A-Aqua)	
EGA category:	Wastewater management and water treatment	
HS code and description:	848180	Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, including pressure-reducing valves and thermostatically controlled valves: Other appliances
Potential ex-out:	Taps and valves for the delivery of clean drinking water in developing countries and emergency situations	
Norwegian producers:	A-Aqua	
Description:	Taps and valves for drinking water delivery that reduce the spillage of valuable water; Water station set-up designed with safe and efficient distribution of drinking water in mind – self-closing taps, and packed and stored flat for easy shipping anywhere in the world	
Content:	Six high-flow taps (self-closing and water-saving) with low head pressure making water delivery easy and efficient with limited spillage; flexible hose, couplings and other fittings for installation	
Use:	For the efficient delivery of drinking water	
References:	www.a-aqua.no; Images: http://www.a-aqua.no/products.php?vareid=90	



Evaluation

	Environment	Development	Other / comments
+	• Self-closing and water-saving taps prevent wasteful water spillage in areas where water is scarce	• Aids in the delivery of drinking water in developing and emergency contexts, keeping ease and efficiency at the forefront of design • Sealed fittings and water-saving taps prevent the spillage of scarce water – helping to prevent water waste and to distribute water most widely • All necessary parts and installation instructions enclosed	• The dangerous effects of climate change mean that more people are, and will be, displaced due to both natural disasters and human conflicts – increasing the need for emergency response and the management of displaced persons
–		• Must be connected to a drinking water source	

Table 13: Flexible drinking and potable water storage tanks Factsheet

Good:	Water storage tanks made of PVC coated fabric (Tanks from A-Aqua)	 
EGA category:	Wastewater treatment and water management (Water storage)	
HS code and description:	392510 Reservoirs, tanks, vats and similar containers, of a capacity exceeding 300 l	
Potential ex-out:	Tanks for storage of drinking and potable water made of PVC coated fabric	
Norwegian producers:	A-Aqua	
Description:	PVC coated fabric (polyester) tanks in sizes ranging from 3,000- 30,000l; easily folded for storage and transport; easily fitted to dispersal units	
Content:	PVC coated fabric tanks with internal black barrier to prevent light penetration, standard couplings to easily attach to dispersal units; flat storage for easy transport	
Use:	To store large amounts of drinking and potable water	
References:	www.a-aqua.no; Images: http://www.a-aqua.no/products.php?vareid=76; http://www.a-aqua.no/products.php?vareid=99	

Evaluation

	Environment	**Development**	**Other / comments**
+		• Allows storage of large amounts of drinking and potable water • PVC coated fabric protects water from algae growth and contamination, and is non-toxic • Easy storage and transport is ideal for rural areas and in emergency response situations	• A-Aqua's Pillow Tank (pictured left) is used to store drinking water • A-Aqua's Onion Tank (pictured right) is used to store potable water • The dangerous effects of climate change mean that more people are, and will be, displaced due to both natural disasters and human conflicts – increasing the need for emergency response and the management of displaced persons
–			

4.3.3 Cleaner and renewable energy

Increasing renewable energy supply and access, for both the developed and developing worlds, is an essential step in combating climate change, and an extremely relevant industry for EGs. Although the number of people without energy access has decreased over the past decades, 2.6 billion people still lack reliable energy access to meet their basic energy needs, most in the rural or poor urban areas of developing countries (Terrapon-Pfaff, Dienst, König and Ortiz 2014). Nations cannot possibly be expected to further develop their infrastructures and economies without energy access, however. Renewable energy therefore presents an optimal way to further development and combat climate change – providing clean and sustainable energy to meet basic needs.

The APEC list contains a few renewable energy (RE) EGs, including solar PV cells (HS code 854140) and wind power generating sets (HS code 850231). The potential for RE EGs, however, is not realized and should be expanded by the EGA. The following sections describe three RE EGs for developing countries for potential nomination to the EGA – Fresnel reflectors for solar energy, hydraulic turbines for hydropower, and biomass burners for the production of energy through the burning of waste.

Fresnel mirrors

Harnessing the power of solar energy, Fresnel mirrors and reflectors are EGs that can help provide energy access in developing countries. Fresnel mirrors (HS code 900190, unmounted flat panel mirrors) and Fresnel reflector modules (HS code 900290, mounted flat panel mirrors) are important components in the collection of concentrated solar power (CSP) and resulting electricity production. Fresnel mirrors and reflector modules contribute to the EGA product category:

- **Cleaner and renewable energy**: for their collection of solar energy, and contribution to renewable electricity generation.

CSP devices concentrate solar energy to heat a receiver to high temperatures. This heat is then transformed to electricity, usually through the production of steam (IEA 2015). There are for different kind of CSP plants: linear Fresnel, parabolic trough, tower, and parabolic dish systems (Ibid.).

In Linear Fresnel Reflector Systems, flat mirrors are mounted on single-axis trackers and configured to reflect the sun's rays into a receiver. The receiver is in the shape of a tube and is fixed above the mirrors. The receiver reaches a high enough temperature to create steam and power a turbine for electricity generation (US Office of Energy Efficiency & Renewable Energy 2013). Figure 15 shows that basic set-up of a Linear Fresnel Reflector System.

The main benefits of Fresnel mirrors and reflector modules compared to other CSP set-ups are their shape and manufacturing. Because they are flat mirrors and reflectors, they are much easier, faster, and cheaper to manufacture, and do not contain the difficult joints that make up parabolic reflectors. They still utilize the principles of curved collectors for optimal solar energy concentration, however, but with flat panel mirrors. They are also thinner than a conventional parabolic reflector and therefore require less material (Madhugiri and Karale 2012).

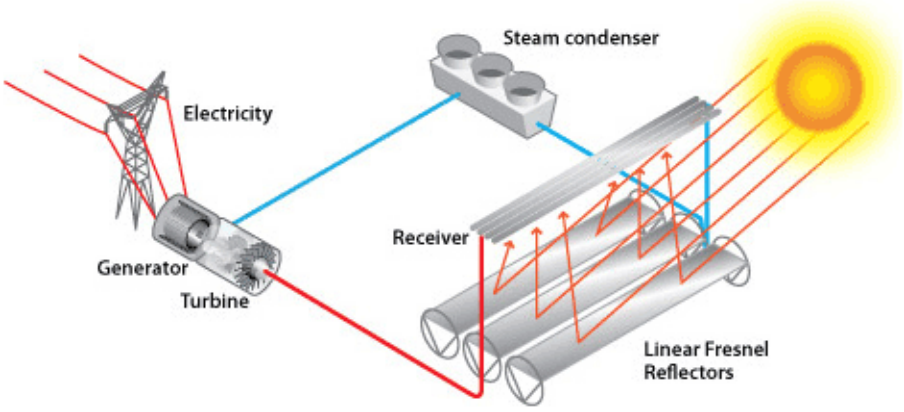


Figure 15: Linear Fresnel Reflector Power Plant System
(US Office of Energy Efficiency & Renewable Energy 2013)

Figure 16: Linear Fresnel reflectors and fixed receiver
(http://nextenergynews.com/news1/nextnews7.13b.html)

Additionally, because Fresnel reflectors track only on a single-axis, their receiver can be fixed above them and does not need to be on a tracker itself, as in parabolic reflector systems (Kulichenko and Wirth 2012). Fresnel mirrors and reflector modules are also much cheaper and easier to manufacture than solar PV cells (HS code 854140 – already on the APEC list).

The comparative advantages of Fresnel mirrors and reflectors make them an ideal candidate as a renewable energy EG for developing countries. Affordability and simpler maintenance means that Fresnel CSP plants can be installed and managed in contexts with lower operating budgets. Their comparably simpler technology is also said to be easier to maintain and to manufacture, making local maintenance, production, and trade possible – creating jobs, and providing clean energy to those previously off-grid or reliant on expensive fossil fuel energy (Kulichenko and Wirth 2012). They can also be used on a smaller scale to collect solar thermal energy for space heating and for water heating and purification. Fresnel mirrors are also used in some solar cookers, again replacing expensive parabolic reflectors. This can greatly benefit the health and budgets of those living off-grid or with unreliable or expensive electricity systems. Table 15 presents the factsheet for Fresnel mirrors and reflectors. It should be noted that heliostats (HS code 901380), a type of CSP tracker device, are already on the APEC list.

Hydraulic turbines

Essential for the production of energy from flowing water, hydraulic turbines (HS codes 841011, 841012, 841013), and their parts (HS 841090), are an ideal RE development EG. Turbines, ranging from small to large, and of various designs, can be applied in a number of settings to produce ranges of emission-less power, from the small scale to the industrial scale. Most basically, hydro turbines capture the kinetic energy of flowing or falling water. The kinetic energy is then transformed into mechanical energy as it spins the turbine blades and turns the turbine. The turning turbine produces mechanical energy which in turn turns a generator[3] that produces electricity. The basic workings of an industrial hydropower plant are demonstrated in Figure.

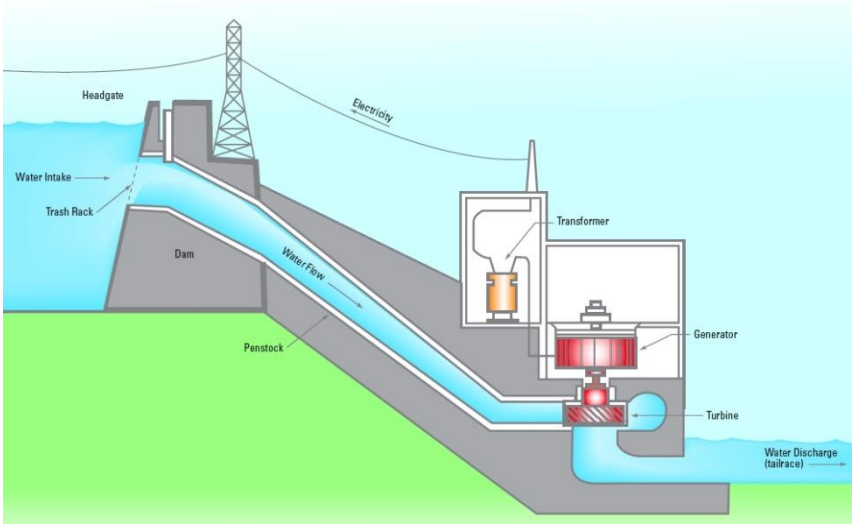


Figure 17: Diagram of hydropower plant
(http://inwallspeakers1.com/hydroelectric-energy-diagram/)

Hydraulic turbines meet the EGA product category:

- **Cleaner and renewable energy**: for their part in the production of emission-less hydropower energy.

Hydropower is classified by its generating capacity, or the capacity to which the water source can produce energy, described in Table 14. In developing country contexts, hydropower projects typically range from Pico, Micro and Mini projects (HS code 841011) to Small projects (HS code 841012), rather than large projects that entail the damning of massive rivers (HS code 841013).

[3] Generators for the production of hydropower and other RE (HS codes 850161, 850161, 850163) are an environmental good not on the APEC list, and are therefore included in the study's initial EG list. Because they have so many uses, however, and are not exclusively relevant for developing countries, they are excluded from the Development EG and are not discussed in detail. Although not a core part of study, they are an extremely important good in the production of electricity from renewable energy and should be considered for EGA nomination.

Table 14: Hydropower classification (adapted from Williams and Porter 2006)

Classification	Power output	HS code
Pico	< 5kW	841011
Micro	5 - 100 kW	841011
Mini	100kW - 1MW	841011
Small	1 - 10MW	841012
Medium	10 – 100MW	841013
Large	> 100MW	841013

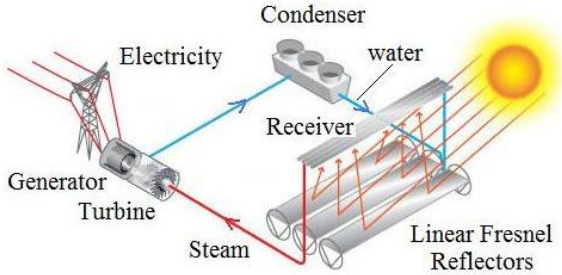
Hydropower on a small-scale (Pico, Micro and Mini projects), is an extremely cost-effective and relevant technology for electricity generation in developing countries, providing small-scale solutions to those most widely affected by energy poverty (Paish 2002; Terrapon-Pfaff et al. 2014). Small-scale hydropower is not a small version of an industrial plant, but "run of the river" using the natural flow of water to create local electricity (Paish 2002; Yüksel 2007). Unlike larger hydro, small-scale hydro does not rely on the expensive damning of rivers to capture energy, but the natural flow of the water source. The general principles of energy production are the same however, as the energy of flowing water turns turbines, and is converted in electricity. In Pico, Micro and Mini projects, local rivers and streams are harnessed to generate small amounts of power for the village directly surrounding them (Williams and Porter 2006). These hydropower projects are especially attractive to off-grid rural areas, where larger infrastructure is not likely to exist.

Figure 18: A Pico hydropower project
(http://www.ruralelec.org/385.0.html)

Larger hydropower turbines are important for the international production of renewable energy. Developed countries, especially Norway, rely on larger hydro installations to produce electricity. These large turbines, however, may not be as applicable to developing contexts. The HS code for larger turbines (841013) is still included in the factsheet (Table 16) for hydropower turbines as large projects have been implemented in developing countries, but it should be noted that turbines of smaller capacities are more generally relevant for developing countries.

Table 15: Fresnel mirrors and reflector modules Factsheet

Good:	Solar Fresnel mirrors and reflectors	
EGA category:	Cleaner and renewable energy	
HS code and description:	(1) 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
	(2) 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
Potential ex-out:	(1) Fresnel mirrors (2) Fresnel reflector modules	
Norwegian producers:		
Description:	Fresnel lenses, reflectors and/or mirrors used in solar collectors that concentrate light by refraction; may boil water to make steam for direct power generation, or be used on smaller scale for water or space heating applications	
Content:	Flat solar mirrors attached at an angle to direct solar energy into a receiver/ absorber	
Use:	For the collection of solar thermal energy for electricity generation or thermal applications, such as water or space heating	
References:	IEA 2015; Kulichenko and Wirth 2012;Madhugiri and Karale 2012; US Office of Energy Efficiency & Renewable Energy 2013; Vossenaar, 2014; http://www.seia.org/policy/solar-technology/concentrating-solar-power; Images: http://www.seia.org/policy/solar-technology/concentrating-solar-power; http://www.brighthub.com/environment/renewable-energy/articles/66917.aspx	



Linear Fresnel Reflector Solar Power Plant

Evaluation

	Environment	**Development**	**Other / comments**
+	• Renewable energy source • Electricity produced without the emissions of fossil fuel based electricity • Utilizes the principles of curved solar power reflector concentration, but at a much lower cost with flat panel mirrors	• Lower manufacturing, installation and maintenance costs than other solar technologies • May provide electricity to those previously off-grid • Can be locally produced • On a smaller scale, solar thermal energy collected from Fresnel mirrors can also be used for water and space heating and in water purification systems	• Heliostats on APEC list (HS 901380)
–	• May not reach temperatures as high as parabolic reflectors		

Table 16: Hydraulic turbines Factsheet

Good:	Hydraulic turbines	
EGA category:	Cleaner and renewable energy	
HS code and description:	(1) 841011	Hydraulic turbines, water wheels, and regulators therefor, of a power *not exceeding 1,000 kW;*
	(2) 841012	Hydraulic turbines, water wheels, and regulators therefor, of a power *exceeding 1,000 kW but not exceeding 10,000 kW;*
	(3) 841013	Hydraulic turbines, water wheels, and regulators therefor, of a power *exceeding 10,000 kW*
	(4) 841090	Parts for 841011, 841012, 841013
Potential ex-out:	N/A	
Norwegian producers/ sellers/traders:	Small Turbine Partner	
Description:	Turbines for the generation of hydropower – the force of flowing or falling water turns the turbine's blades causing the turbine to spin. The turbine converts the kinetic energy of the water to mechanical energy, which then connects to a generator, converting the mechanical energy to electric energy.	
Content:	Hydraulic turbine	
Use:	For the collection of kinetic energy from flowing water, and its conversion into mechanical energy to turn a generator to produce electrical energy	
References:	Images: http://www.lotusenergy.com/Products/pico.htm ; http://www.ruralelec.org/385.0.html	

Evaluation

	Environment	Development	Other / comments
+	• Renewable energy source • Electricity produced without the emissions of fossil fuel based electricity	• Small-scale turbines provide electricity to rural and other off-grid communities, delivering the basic human development need of energy access without the emissions from traditional sources • Large-scale turbines provide renewable electricity to cities and urban populations • Reliable energy access allows the development of local communities, and of infrastructures and economies	• Norway specializes in the production of hydropower
–			

Biomass boilers

Biomass boilers are other RE EGs specifically relevant to developing countries. Burning solid and gaseous biomass waste, biomass boilers (HS code 840219), and their parts (HS code 840390), when used in conjunction with steam turbines, assist in the production of renewable electricity. The process of electricity production from biomass combustion begins with the direct combustion of solid or gaseous biomass in a biomass boiler. Within the boiler, hot gases produced during combustion heat water into steam. Next, steam turbines[4] are spun by the produced steam, which then power a generator to produce electricity (Evans, Strezov and Evans 2010). Although direct combustion, the combustion of solid biomass, is not the most efficient biomass process, it is the oldest and simplest (Ibid.). Biomass gas processes are more efficient, but require the more difficult harvesting of biomass gas – a process that may not be supported by local infrastructure in developing countries. The following discussion therefore focuses mostly on the use of solid biomass fuels.

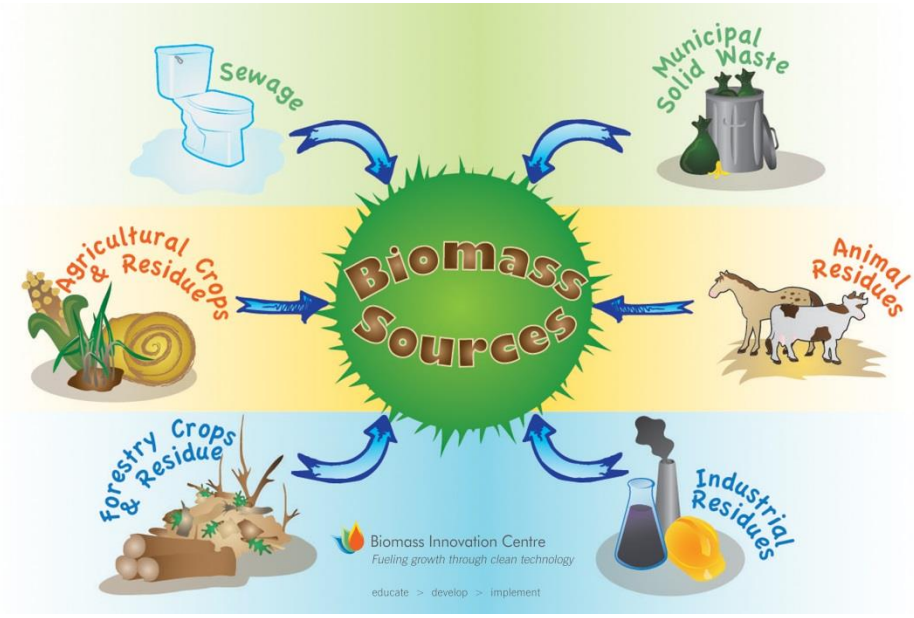


Figure 19: Sources of biomass
(http://www.biomassinnovation.ca/biomassandbioenergy.html)

Biomass boilers also assist in the management of solid waste, making them attractive to developing countries that lack both energy access and waste management. Most commonly, solid biomass used for electricity production comes from agricultural residues, forest residues and wood waste, and municipal solid waste (Evans, Strezov and Evans 2010; IRENA 2012).

[4] Similar to generators described in the previous section, steam and vapor driven turbines (HS codes 840681, 840682) are listed on the study's initial EG list because they are not on the APEC list. Due to their numerous uses, however, they were not selected as a core EG for the study and are not on the Development EGs List. Although not a core part of study, they are an extremely important good in the production of electricity from renewable energy, especially from biomass, and should be considered for EGA nomination.

Biomass boilers therefore meet three EGA product categories:

(1) **Cleaner and renewable energy:** for their part in the production of electricity from biomass, and

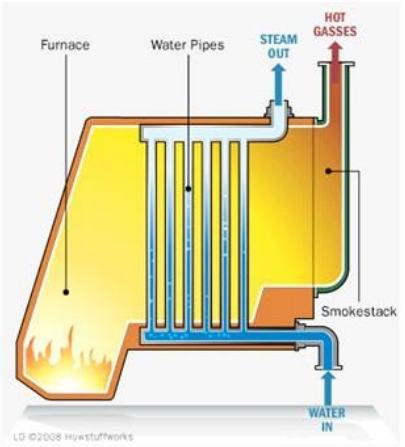
(2) **Solid and hazardous waste management:** for their use of waste as fuel.

Biomass is especially attractive because it is the only renewable fuel for electricity generation based on combustion, and therefore seen as a possible direct replacement for fossil fuels. As a direct replacement, the transition to biomass from fossil fuels like coal could be simple and cost-effective compared to other RE technologies. The sustainability of biomass resources must be kept in mind in this line of thinking however. To remain sustainable, the burning of biomass cannot surpass its generation, which may cause problems if implemented on a large scale (Evans, Strezov and Evans 2010). Additionally, although technically already a part of the carbon cycle, emissions produced through the burning of biomass may be trapped in the atmosphere for many years affecting global warming.

Overall, the study recommends biomass boilers for small-scale use in developing countries for their waste management possibilities and the supply of small-scale electricity. In many developing countries waste incineration is already the dominant waste disposal technology, and should at least contribute to energy production as well. The factsheet for biomass boilers is available in Table 17.

Table 17: Biomass boilers Factsheet

Good:	Biomass boilers	
EGA category:	Cleaner and renewable energy; Waste management	
HS code and description:	840219	Steam or other vapor generating boilers: Other vapor generating boilers, including hybrid boilers
	840390	Parts
Potential ex-out:	To be used in conjunction with steam and other vapor turbines (HS codes 840681, 840682)	
Norwegian producers:		
Description:	Boilers for the combustion of biomass, containing a source of water (often in tubes or pipes) heated by the furnace to produce steam for the next steps in the process of biomass electricity generation	
Content:	Boiler containing furnace and water source for conversion to steam	
Use:	For the production of energy from biomass waste	
References:	Evan, Strezov and Evans 2010; IRENA 2012; Image: http://www.alternative-heating.com/steam_boiler.html	



Evaluation

	Environment	Development	Other / comments
+	• Powered by renewable fuels to be converted to steam and energy • Fuels may include straw (residue from global agriculture), forest and wood waste, or municipal solid waste (contributing to waste management)	• Biomass combustion can assist in the management of municipal solid waste • Help to meet the need for renewable energy access • Biomass is the only renewable fuel for electricity generation based on combustion – often seen as a possible substitute for fossil fuels	• Biomass boiler parts (HS840290) on APEC list
–	• Biomass boilers are debated because of the pollution they produce through combustion (carbon monoxide, VOCs, nitrogen oxides). Biomass fuel technically considered to already be a part of the carbon cycle, but may remain in atmosphere for many years • Heavy reliance on biomass from forests is can become unsustainable over time and effect habitats and biodiversity		

4.3.4 Environmentally preferable products

Environmentally preferable products (EPPs) provide the possibility to meet development needs in an environmentally friendly manner. Defined as, "products that cause significantly less 'environmental harm' at some stage of their life cycle than alternative products that serve the same purpose, or products the production or sale of which contribute significantly to the preservation of the environment," EPPs are the Class B environmental goods first described in section 2.1 (Vikhlyaev 2003: 35).

Existing EG lists, including the APEC list do not focus on EPPs because of the difficulty of tracking a good's environmental performance throughout its life cycle – from production, to use, to disposal. For example, a good may be produced in an environmentally beneficial way, but not benefit the environment in its use or in its disposal. The classification of EPPs is outside the scope of this study, but was taken into consideration in the search for EPPs for developing contexts. The EPPs identified in the study have clear environmental benefit, and were selected with the hope of limiting distracting debate over their EPP classification.

The following sections describe three EPPs with clear relevance to developing countries and to meeting development needs. Solar stoves and renewably powered lamps lead the first two sections – EPPs that provide a service that benefits development in an environmentally friendly way. Next, a section on products and materials made of sustainable natural materials, introduces a number of specific goods that are more environmentally friendly than their alternatives.

Solar stoves and cookers

Solar stoves and cookers (HS code 732111), devices that use solar energy to cook food, and their corresponding parts (HS code 732190) are clearly identifiable environmental goods. Using the Sun's energy to cook food, they rely on a renewable fuel source (the Sun) and produce zero emissions. Additionally, the negative health effects associated with the burning of biomass in traditional cooking fires are prevented (Otte 2013). A factsheet for solar cookers is presented in Table 19. Solar stoves and cookers fit into four EGA categories:

(1) **Environmentally preferable products:** for their comparative development and environment advantages over other stoves and cookers and traditional cook fires,

(2) **Cleaner and renewable energy:** for their reliance on solar energy,

(3) **Resource efficiency**: for their transition from unsustainable fuels to a sustainable power source, and

(4) **(Indoor) Air Pollution Control:** for their removal of hazardous indoor air pollution and its negative health effects.

Without access to electricity, many people in developing countries depend on biomass, charcoal and other unsustainable fuels for their energy needs. Biomass fuels consist of biological material, often plant-based, derived from living or recently living organisms, such as fuel wood, plant shavings, and other plant based materials collected in local environments

(Biomass Energy Centre 2011). Because biomass fuel is most often collected directly from local environments, there is a limited supply available. The heavy reliance on the burning of biomass – accounting for 90% of household energy consumption in developing countries – means that the limited supply may be quickly depleted, and that finding additional sources is constantly necessary (International Energy Agency 2006 as cited in Otte 2013).

In addition to being an unsustainable fuel source, the burning of biomass and other fuels for cooking is associated with negative health effects due to indoor smoke and air pollution (Otte 2009; 2013; Mussard, Gueno and Nydal 2013). Solar cookers, however, present an alternative for those in developing countries, and solve both the environmental and health issues associated with traditional fire cooking.

The development and livelihood improvements provided by solar cookers, ranges, ovens and grills are numerous. It is argued that their implementation and use contributes to meeting all eight Millennium Development Goals (MDGs) (Otte 2009), a claim summarized in Table 18. In regards to health, smokeless solar cooking reduces negative health effects associated with indoor air pollution and smoke inhalation, such as persistent cough and respiratory diseases (Ibid.). Additionally, the long hours spent collecting unsustainable biomass, usually by women and girls, and often on a daily basis, can be transferred to other activities including education (Ibid.).

Table 18: Solar cooking contributions to meeting the MDGs

MDG	Solar cooker contribution
1) Eradicate extreme poverty and hunger	Money spent on expensive fuel for cooking (e.g. wood, biomass, or charcoal) is saved and can be spent on other necessities, such as food.
2) Achieve universal primary education	Time spent collecting fuel, typically by women and girls, often prevents school attendance. This time is now saved and allows girls to go to school rather than collect fuel.
3) Promote gender equality and empower women	Women and girls no longer have to spend long periods of time collecting fuel. Additionally, the negative health effects associated with the smoke of traditional cooking fires are avoided.
4) Reduce child mortality	Diseases caused by smoke contribute to child mortality. Meals prepared using solar energy are smoke-free and therefore safer.
5) Improve maternal health	The smoke from traditional cooking fires affects the health of the young women surrounding them, and can be attributed to low birth weight and infant mortality.
6) Combat HIV/AIDS, malaria and other diseases	Solar cookers can reach high temperatures and assist sanitation in rural clinics.
7) Ensure environmental sustainability	Scarce fuel wood and other biomass sources are less vulnerable. Solar cookers produce zero GHG emissions.
8) Develop a global partnership for development	The widespread implementation and use of solar cookers will require coordinated efforts between governments, NGOs and the private sector.

Source: adapted from Otte, 2009; Solar Cooking International, 2009 as cited in Otte, 2009

Even with all of their social and environmental benefits, the use of solar cookers is not as widespread as it could be (Otte 2013). Research and development into different designs, and their uses, is therefore extensive. Although a number of solar cooker models exist – variations of concentrated or parabolic reflector cookers, box cookers, and conductive cookers – local cultural and contextual norms must also be taken into consideration (Otte 2013; Mussard, Gueno and Nydal 2013). Additionally, those cookers with the ability to store collected solar energy for later use allow cooking to be completed indoors, which may fit better with local cultural norms, and on cloudy days, which may be especially beneficial in some climates (Otte 2014; Mussard, Gueno and Nydal 2013).

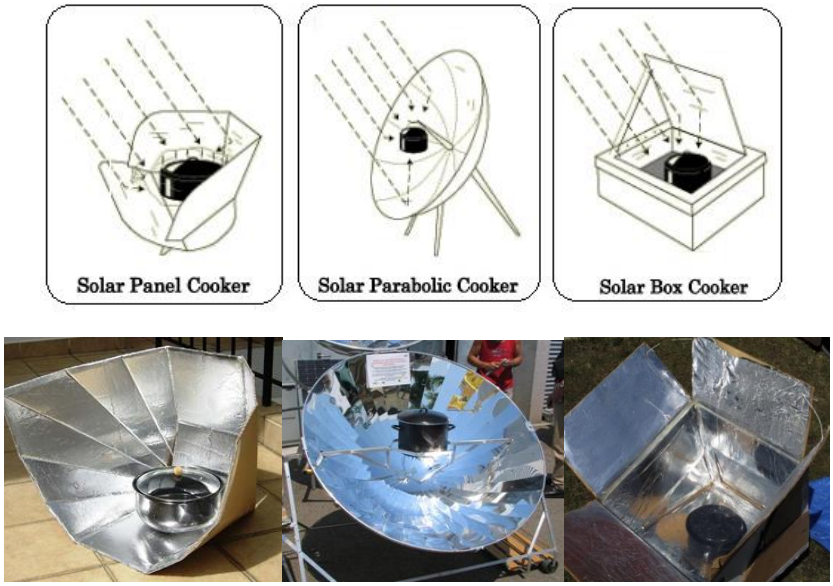


Figure 20: Types of solar cookers
(http://www.electronicshub.org/solar-cooker-information/; http://climatekids.nasa.gov/smores/ http://www.conserve-energy-future.com/DIY-SolarPanelCooker.php; http://20minutegarden.com/2010/04/04/solar-supper/

Solar powered lamps

Another EG for developing countries is the solar powered lamp. Solar powered lamps (HS codes 851310, 940540, 940550) are lighting fixtures, often portable, powered by the solar energy that is converted into electricity to provide light and possible USB charging. Solar lamps come in various designs, but most are generally composed of a solar PV cell, a lamp (usually efficient LED lamps) and some kind of battery or other energy storage device. Solar lamps can be small and portable for individual usage, or in the form of streetlights for communal benefit. Using a renewable fuel source to provide light and electric charging abilities in off-grid settings, solar lamps fit into three EGA product categories:

(1) **Environmentally preferable products:** for their comparative environmental and development advantages over other lighting sources,

(2) **Cleaner and renewable energy:** for their reliance on solar energy, and

(3) **Resource efficiency**: for their use of renewable energy rather than other unsustainable and emissions producing fuels.

Not only do solar powered lamps benefit the environment, but they provide numerous human development benefits as well – the first being the human right to energy access. Over 1.3 billion people have no reliable access to electricity, and instead rely on kerosene for lighting (Gravity Lamp 2013). Using the sun instead of any other fuel source, solar lamps can effectively provide lighting in off-grid settings to allow cooking, reading, education and other activities otherwise halted at night, or lit by smoky fires or expensive kerosene stoves. Additionally, some models provide USB charging abilities, allowing the charging of mobile phones and other small electronics for eased and reliable communication. Solar powered lamps also come with health benefits. Similar to solar stoves and cookers, fumes and air pollution created from fires are removed. Additionally, burns often caused from overturned or spilled kerosene lamps are reduced (Gravity Lamp 2013).

Figure 21: The SunBell Solar Lamp and Mobile Charger
(BRIGHT Products AS, http://www.bright-products.com)

The SunBell Solar Lamp and Mobile Charger, for example, is designed and produced by the Norwegian company, BRIGHT Products AS, to provide light and charging in a number of versatile settings. It is small and portable, and can be used as a lantern, reading lamp, flashlight/torch and charger. Three different light settings also allow the user to manage the brightness and maximize the use of the solar energy stored in its rechargeable battery.

When choosing a specific solar lamp design for a developing context, it is again important to consider local conditions and cultural norms for successful and long-term implementation. One issue for consideration is the charging and light output times. The lamp should at least be able to generate light for a time long enough to complete nightly activities, and should be able to fully charge in a reasonable amount of time. Additional considerations include the battery and light source life, as batteries and bulbs can be too expensive to replace, and the initial cost of the lamp, which must be low for widespread application. The SunBell meets such considerations as it can be fully charged in 3-4 hours of good sunlight, allows the user to manage the intensity and control its operating time for relevant activities, and contains a long-lasting and efficient battery and LED bulb.

Solar powered lamps do not have their own HS code in the international system, and are therefore traded across the three codes mentioned above. Such can make tracking trade statistics difficult, and suggests the creation of an HS code specifically for solar lamps. The factsheet for solar powered lamps is presented in Table 20.

Other renewable energy powered lamps (The Gravity Light)

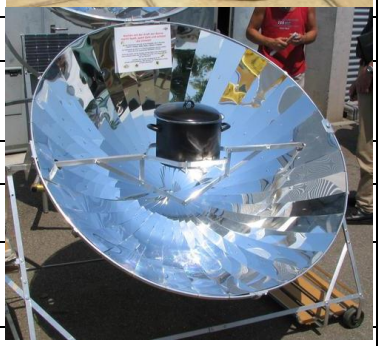
Similar to solar powered lamps and traded under one of the same HS codes (851310), portable lamps powered by other forms of renewable energy are also an EG for development recommended for the study. One product specifically relevant to developing countries and recommended for EGA nomination is the Gravity Lamp, a gravity powered lamp that uses the kinetic energy of a weight falling to produce 25 minutes of live electricity on its descent (GravityLight 2013). Users lift a weight (a bag filled with local rocks or dirt) that is attached to the light with a weight strap. As the weight falls, the weight strap pulls through the lamp, turning gears and producing enough kinetic energy to power an LED.

The Gravity Light has the same development and environmental implications as portable solar lamps and meets the same EGA categories. Such details will therefore not be discussed further. It is unique, however, in its reliance on no outside fuel or energy source. Users must simply lift the weight, as many times as he/she needs, to continue light production. This is not the case for solar lamps, as the solar energy collected during the day is all that is available until the next. Additionally, because the Gravity Lamp produces live electricity, there is no battery to worry about replacing. The factsheet for the Gravity Lamp is available in Table 21.

Figure 22: The Gravity Light
(http://gravitylight.org/gravitylight/)

Table 19: Solar stoves and cookers Factsheet

Good:	Solar stoves and cookers	
EGA category:	Environmentally preferable products; Cleaner and renewable energy; Resource efficiency; (Indoor) Air pollution control	
HS code and description:	(1) 732111	Stoves, ranges, grates, cookers, barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel: for gas fuel or for both gas and other fuels
	(2) 732190	Parts
Potential ex-out:	Solar powered stoves, ranges, cookers	
Norwegian producers:	MorphoSolar (NTNU start-up, not yet producing)	
Description:	Device that uses the energy of the sun to heat or cook food – sunlight converted to heat energy	
Content:	Solar reflectors to collect sunlight, pot, bowl or tray for cooking food; May be in the form of a box or in a curved parabolato better direct sunlight to food; May contain a feature to store solar energy for later use (e.g. molton salts)	
Use:	For the cooking of food	
References:	Mussard, Gueno & Nydal, 2013; Otte, 2009; 2013; 2014a; 2014b; Images: http://climatekids.nasa.gov/smores/; http://www.conserve-energy-future.com/DIY-SolarPanelCooker.php	



Evaluation

	Environment	Development	Other / comments
+	• Renewable energy source • No expenses for fuel or energy • Suitable for off grid usage • Reduction in deforestation for firewood	• Removal of indoor air pollution from the burning of biomass or charcoal • Quality of life benefits - daily time spent gathering firewood or biomass is saved and can be used for other activities, e.g. education for children • Increased safety for those gathering fuel (wood or other biomass), often women and children • No recurring expense for the purchasing of fuels such as firewood or charcoal	• Solar cookers with the ability to store solar energy allow local peoples to cook indoors, at night, and on cloudy days
–		• A lack of technological understanding or required maintenance of the cooker may prevent long-term usage after initial delivery or purchase	• Without the ability to store solar energy, the cookers may not be locally implemented, e.g. cooking outdoors may not fit with cultural norms - women may look forward to time spent gathering fuel for social reasons

Table 20: Solar powered lamps Factsheet

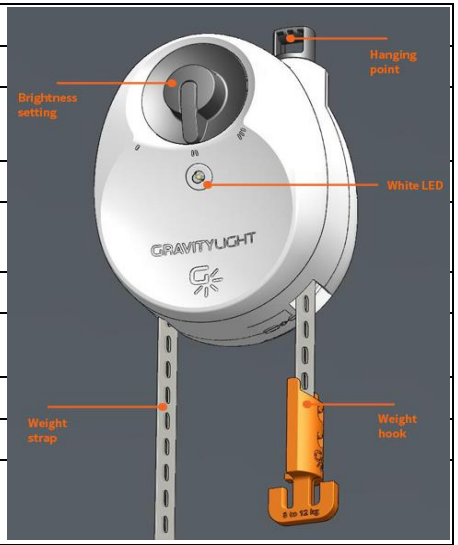
Good:	Solar powered lamps	
EGA category:	Environmentally preferable products; Cleaner and renewable energy; Resource efficiency	
HS code and description:	(1) 851310	Portable electric lamps designed to function by their own source of energy (for example, dry batteries, accumulators, magnetos), other than lighting equipment of heading 85.12.
	(2) 940540	Other electric lamps and lighting fittings
	(3) 940550	Nonelectricial lamps and lighting fittings
Potential ex-out:	Renewably powered lamps and lighting fittings	
Norwegian producers/ sellers/traders:	BRIGHT Products AS	
Description:	Lighting fixtures of various designs powered by solar energy that is converted into electricity to provide lighting and possible USB charging abilities	
Content:	Solar cell, lamp (often efficient LED lamps), batteries (often long-lasting or rechargeable)	
Use:	To provide lighting, often in off-grid settings	
References:	Norad, 2013; Vossenaar, 2014; BRIGHT Products at http://www.bright-products.com/; Images: http://www.bright-products.com/#!sunbell/c1dg5; http://www.littlesun.com/index.php?sec=journey; http://www.gizmag.com/panasonic-solar-lantern/27493/	

Evaluation

	Environment	Development	Other / comments
+	• Renewable energy source • No expenses for fuel or energy • No emissions in the production of energy • Suitable for off grid usage	• Provide off grid lighting to allow cooking, reading, education and other activities otherwise halted at night, or lit by smoky fires or kerosene stoves • Some models provide USB charging port to support mobile phones and eased communication • Many models are easy to carry around and can be used as a flashlight/ torch to provide increased safety for activities at night • Solar streetlamps can help make previously dangerous areas safe at night	
–		• Light output time must be considered for likelihood of application • Battery life and light source (often LED) lifspan must be considered because often difficult to replace • Initial cost should be low for widespread application	• No specific HS subheading for solar powered lamps – traded under all three codes listed above, makes tracking trade statistics difficult

Table 21: Gravity Lamp Factsheet

Good:	Renewably powered lamps, other than solar (The Gravity Lamp)	
EGA category:	Cleaner and renewable energy	
HS code and description:	851310	Portable electric lamps designed to function by their own source of energy (for example, dry batteries, accumulators, magnetos), other than lighting equipment of heading 85.12.
Potential ex-out:	Renewably powered lamps and lighting fittings	
Norwegian producers/ sellers/traders:	(UK producer)	
Description:	Gravity powered lamp that uses the kinetic energy of a weight falling to produce live electricity	
Content:	Weight (bag filled with local soil, rock, etc.), weight strap, lamp (housing a series of small gears that produce electricity, a LED and a DC socket)	
Use:	To provide lighting, often in off-grid settings	
References:	Gravitylight.org; Image: http://gravitylight.org/gravitylight/	



Evaluation

	Environment	Development	Other / comments
+	• Renewable energy source • No expenses for fuel or energy • No emissions in the production of energy • Suitable for off grid usage	• Provide off grid lighting to allow cooking, reading and other activities otherwise halted at night, or lit by smoky fires or kerosene stoves • Can be used over and over (as many times as someone will lift the weight), with no running costs • No battery life and replacement to consider	
–		• LED lifespan should be considered	

Sustainable natural materials

Products and materials made of sustainable vegetable materials are another important environmental good. Natural materials, also called vegetable materials, are those materials made from parts of plants (FAO). To be sustainable, the consumption of such materials must not surpass the production and growing rate of the plant species.

The study specifically suggests construction and building materials made of sustainable natural materials, especially bamboo, as the final development EG of the study. Although there are a of number sustainable natural materials and resulting products, the study focuses on products and materials made of bamboo for their environmental benefits and likely production in developing countries, meeting both the environmental and development criteria of the study. The potential for bamboo to be used as textiles and clothing, and in consumer products such as dishes (HS code 482361) and furniture (HS codes 940151, 940381) should also be recognized. Although not selected as a core development EG in the study, they are listed on the initial list of EGs.

Building materials of sustainable natural materials

The construction industry is one of the most resource intensive industries, and also contributes significantly to climate gas emissions (Pacheco-Torgal and Jalali 2011). Particularly in developing countries, steel and cement are high energy consuming and high pollution producing products (Xiao, Zhou and Shan 2010). Even so, the construction of buildings, roads, and other infrastructural projects are clear necessities of development. Identifying EPPs for construction can therefore help preserve natural resources and reduce emissions, while allowing the progression of sustainable development.

Bamboo is an extremely durable and fast-growing plant, and therefore makes up the majority of sustainable building materials selected in the study. These materials include wood of bamboo (HS code 440921), plywood and veneered panels of bamboo (HS code 441210), and mats, matting and screen of bamboo (HS code 460121). Bamboo flooring (HS code 441872) is already listed on the APEC list. Other EGs of sustainable natural materials include mats, matting and screen of vegetable materials other than bamboo (HS code 460129), and panels, boards, tiles and blocks of other vegetable fibers (HS code 680800). The factsheet in Table 22 further clarifies and summarizes the various building material goods and their HS codes.

Sustainable natural building materials are ideal for infrastructural projects in developing countries. Not only do they benefit the environment, but are often locally and affordably produced. Many durable vegetable materials are grown and processed in developing parts of the world, and can therefore be traded amongst developing nations, promoting South-South trade.

Bamboo, for example, comes in many varieties that grow predominantly in developing countries, especially India and China, grows much faster than trees, and can be harvested, typically, in less than four years from planting (Xiao, Zhou and Shan 2010). Most notably, bamboo is stronger than many types of timber, including Douglas-fir and White pine, commonly

used for building in North America, and can even be used to reinforce concrete (Ibid.). Bamboo provides an affordable and reliable opportunity for infrastructural improvement in developing nations, and is used today in the structure and support of large buildings, homes and bridges. It can even be used as a replacement for traditional steel reinforcement in concrete (Pacheco-Torgal and Jalali 2011). Currently, bamboo is used for building mostly in developing nations due to the reliance on traditional wood sources in developed nations. The further development and acceptance of modern bamboo structures and materials could help both developed and developing nations transition to a sustainable construction industry, and help benefit the economies of bamboo-rich nations (Ibid.). Building materials made of sustainable natural materials are therefore supported by the study as EGs specifically relevant to developing countries, and for potential nomination to the EGA.

Figure 23: Bamboo and its many uses – Concrete reinforcement in Vietnam (top left), Bridge in Cambodia (top right), School building in Indonesia (bottom)

(http://www.colinbrydon.net/images/north-west-people; http://www.rickmann-uk.com/index.php/categories/Cambodia/facts/; http://www.cultureofpermaculture.org/blog/2014/01/all-praise-bamboo/)

Table 22: Building materials of sustainable natural materials Factsheet

Good:	Building materials of sustainable natural materials (e.g. bamboo)	
EGA category:	Environmentally preferable products	
HS code and description:	(1) 440921	Wood (including strips and friezes for parquet flooring, not assembled) continuously shaped (tongued, grooved, rebated, chamfered, V-jointed, beaded, moulded, rounded or the like) along any of its edges, ends or faces, whether or not planed, sanded or end: of bamboo;
	(2) 441210	Plywood, veneered panels and similar laminated wood: of bamboo;
	(3) 460121	Mats, matting and screen, of bamboo;
	(4) 460129	Mats, matting and screen of vegetable materials, other;
	(5) 680800	Panels, boards, tiles, blocks and similar articles of vegetable fiber
Potential ex-out:	Products made from *sustainable* natural materials	
Norwegian producers:		
Description:	Various building materials made of sustainable natural materials, especially bamboo	
Content:	Boards, mats, screens, plywood, panels, tiles, blocks, etc, of sustainable natural materials	
Use:	For building projects including large building, individual homes, bridges and other infrastructural projects	
References:	FAO; Pacheco-Torgal and Jalali 2011; Xiao, Zhou and Shan 2010; Images: www.amicusgreen.com/browse.cfm/plyboo-bamboo-plywood/4,1381.html ;http://www.foreverbamboo.com/bamboo-matting-4-x-25.html ; http://www.blankclothing.com.au/bamboo-clothing/ ; http://www.colinbrydon.net/images/north-west-people;	




Evaluation

	Environment	Development	Other / comments
+	• The use of sustainable natural materials for construction helps to replace use of the resource extensive and polluting traditional materials such as steel and concrete • Bamboo is more sustainable than other woods – it grows quickly and abundantly and can grow in nutrient depleted soil	• Sustainable building materials are more affordable and locally available to allow infrastructural advancement at a much lower cost than with traditional materials of concrete and steel • Because most bamboo-rich countries are developing countries, an expansion of its use in both developed and developing nations provides export opportunities and market development in the developing world • Bamboo and other vegetable material matting and screening helps to control erosion and may protect those in vulnerable areas, also used to line water wells	
–			• Developed nations tend to look down at the use of bamboo as a building material because often seen as cheap

4.4 A list of Norwegian EGs

In addition to the initial list of EGs and the development list of EGs, a final list demonstrates the Norwegian producers of identified goods. This list is not exclusive, but contains examples of companies that produce the goods identified in the study as EGs. The first section of Table 23, lists producers of eight of the core development EGs, and is followed by a list of companies that produce other EGs relevant to the study.

Table 23: Norwegian producers of environmental goods

Environmental Good	Producers
Norwegian producers of Development EGs	
Composting toilets	• Danfo: http://danfo.no/ • Snurredassen • Vera
Vacuum toilets	• Jets: http://www.jetsgroup.com/no/
Landfill liners and covers	• Teletextiles: http://www.teletextiles.com/
Drinking water taps, valves and distribution kits	• A-Aqua: http://www.a-aqua.no/home.php • Raufoss Water & Gas: http://www.isiflo.no/
Flexible drinking and potable water storage tanks	• A-Aqua: http://www.a-aqua.no/home.php
Hydraulic turbines	• BN Turbin: http://www.bnturbin.no/ • Hydroenergi: http://www.intpow.no/?id=140 • Rainpower: http://www.rainpower.no • Small Turbine Partner: http://www.turbinepartner.no/ • Spetals verk: http://www.spetalsverk.no/ • Steis Mekaniske Versted: http://www.steis.no/
Solar stoves and cookers	• MorphoSolar: http://morphosolar.com/
Solar powered lamps	• BRIGHT Products: http://www.bright-products.com/
Norwegian producers of other EGs (on the initial list)	
Glasopor (filler for building projects)	• Glasopor: http://www.glasopor.no/
Ozone generators for water purification	• Normex: http://www.normex.no/
Towers and lattice masts (for wind power)	• Blaaster: http://www.blaaster.no/ • Sway: http://www.sway.no/
Tidal Energy:	• Andritz Hydro Norway: http://www.andritz.com/group.htm
Sustainable pipes and piping	• Pipelife: http://www.pipelife.com/com/
Parts for PV cells	• Elkem: https://www.elkem.com/ • REC: http://www.recgroup.com/
Multiplewalled insulating units of glass	• NorDan: http://www.nordan.no/ • Norgesvinduet: http://norgesvinduet.no/
Rockwool insulation	• Rockwool: http://www.rockwool.no/
Water saving shower head	• ShowerGreen Norway: http://www.showergreen.eu/NO/

4.4.1 Relevant industries

The environmentally friendly goods and technologies industry in Norway is expansive, and reflects the sustainability focus of the nation. Industries such as hydropower, ecological sanitation, insulation and water are especially developed because of their national relevance.

Hydropower, for example, produces 99% of Norway's power, therefore demanding an advanced and competitive hydropower industry. Because Norway's Hydropower industry is so advanced, many of the companies listed in Table 23, produce hydraulic turbines on a scale much large than those needed and applicable in developing contexts. The technology is very similar, however, and could likely be translated to a smaller sale.

The water industry is another highly developed Norwegian industry. Issues of filtration, purification, distribution and access are addressed by a number of Norwegian companies. Although devices for the filtration and purification of water (HS code 842121) are already on the APEC list, and therefore out of the scope of the study, it is worth noting the range of Norwegian companies that offer development relevant filtration technologies. Many of such companies are members of Vannklyngen, and should be investigated more thoroughly in future research.

In terms of development EGs for water access and distribution relevant to the study, A-Aqua is identified as an important company. They produce a number of water technologies, including filtration units, but are recognized here for their water distribution kits and flexible water storage tanks. These products are described in detail in section 4.3.2.

Rural sanitation technology is another industry relevant to Norwegian producers. Developed to meet sanitation needs in cabins and other rural dwellings, composting and other dry toilets can easily be applied to meet sanitation and waste management needs in developing countries.

Other relevant environmentally friendly industries and products include wind energy, tidal energy, insulated building materials, and others listed in Table 23. Many of these industries are in early stages of development, and are working off of momentum to develop products that prevent climate change and protect the environment. It is likely this momentum will continue to build, especially in university research groups, and that a number of new environmental industries and products will be developed over the next few years.

5 Recommendations

15 development EGs are identified by the study for potential nomination to the EGA. All selected development EGs contribute to meeting the basic human needs required for development, and can be considered as environmentally friendly. Using a multi criteria decision making approach, each EG is evaluated for its positive and negative contributions to development and the environment. Such evaluation is detailed in Chapter 4, and summarized in individual factsheets that contain the necessary information for each EG's identification.

The initial list of EGs presented in section 4.1 contains all those EGs identified by the study that are not already on the APEC list. Not all EGs on this list are specifically relevant to developing countries, although many are. The 15 development EGs identified from the initial list are in no way the only development EGs for potential nomination. Instead, they are those EGs with a solid and documented case for both environmental and human development benefit.

The goal of selecting uncontroversial EGs for development is to help streamline the trade negotiating process. In doing so however, EGs influential and necessary for environmental or development impact may be excluded. The use of more concrete and quantitative indicators for environmental impact could help to solve this problem. Additionally, a more extensive evaluation of contextual factors surrounding each EG could help to qualify their likelihood of use and implementation.

5.1 Substantive environmental assessment

The evaluation of goods and technologies that benefit the environment is simplified in this study to, most basically, whether or not the good poses environmental harm. As mentioned above, keeping evaluation simple is helpful for the proceedings of international negotiations, in which varying opinions and levels of expertise often get in the way of actual progress. In terms of evaluating the environmental impact of specific products, however, the science and methods are already established. The methodologies of Life Cycle Assessment (LCA), Environmental Product Declaration (EPD), environmental performance, and environmental product labeling could easily be implemented to better inform organizations and governments of a good's environmental impact through production, use and disposal. Although such assessments take time and expert researchers, they provide the scientific and quantifiable arguments for why or why not a good is environmentally friendly. When defined by scientific standards, the general discussion of an EG's positive and negative environmental impacts can be replaced by scientifically verified information, and excludes the opinions of involved parties.

5.2 An emphasis on contextual factors

The study also seeks to emphasize the importance of the individual analysis of local contextual factors in the design and implementation of development EGs, but also EGs in general. The overall goal of economic liberalization in environmental goods cannot be met unless identified EGs are actually utilized in local contexts. This includes both contexts in the developed and

developing nations, and the recognition of local needs. For EGs to affect change on the environment and the progression of climate change, they must actually be used, and be competitive with more harmful alternatives.

Issues of cost, life cycle, alternatives, technological know-how, and cultural norms contributed to the selection of development EGs in the study. Further definition and application of these factors could help to strengthen the evaluation of EGs for developing countries.

6 Conclusion

This study was undertaken in line with a consultancy agreement from the Norwegian Ministry of Foreign Affairs in order to identify EGs specifically relevant to meeting basic needs in developing countries. Supporting the Norwegian Government's long-term focus on assisting the developing world, selection of such goods will allow the Norwegian Delegation to assert EGs that benefit developing nations in the WTO EGA Negotiations.

The following objectives for EG identification direct the study:

(1) EGs that are not already on the APEC list of environmental goods,
(2) EGs that contribute to one or more of the 10 EGA environmental product categories,
(3) EGs specifically relevant to meeting basic needs in developing countries, and
(4) EGs produced by Norway's clean-tech industry.

Goods and technologies that meet objectives 1 and 2 are mapped and listed on an initial, and extensive, list. Then, using Material Flow Analysis and human needs literature, development needs, including waste management and sanitation, food and water access, health, and energy access, are identified as criteria to qualify an EG as specifically relevant to development. Using a multi criteria decision making approach, described in Chapter 3, identified EGs are evaluated against both environmental and development criteria. Those that meet both criteria, and objectives 1, 2 and 3, then become a development EG, and make up the core of the study.

15 such development EGs are identified and discussed in Chapter 4. They include:

- **Goods for waste management and sanitation:** composting toilets, vacuum toilets, landfill liners and covers, and containers for waste management and sanitation purposes,
- **Goods for drinking water delivery and storage**: hand pumps, RE powered pumps, drinking water taps and valves, and flexible storage tanks for drinking and potable water,
- **Goods for cleaner and renewable energy:** Fresnel reflectors for solar energy, biomass boilers, hydraulic turbines, and
- **Environmentally preferable goods**: solar stoves and cookers, solar and other RE powered lamps, and building and construction products of sustainable natural materials.

Meeting the goal of the study, and the objectives of the EGA negotiations, each development good fits into at least one EGA product category, and contributes to meeting the basic development needs of energy access, sanitation, waste management, health, nourishment and safety, and access to clean water.

The potential for development EGs to help in developing countries is extensive. By utilizing a needs-based approach, identified human development needs can be directly addressed. Identifying human needs helped to direct the study toward EGs that help solve relevant issues – An important step in a context where developing nations are not wholly represented, such as the EGA negotiations.

An additional list, presented in section 4.3, meets the fourth objective of the study and lists EGs manufactured by Norwegian producers. Examples of Norwegian companies that produce identified EGs demonstrate the potential industries in which Norway will contribute most to the production of EGs in the future.

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Appendix 1: Initial List of EGs

The following table presents all of the EGs gathered in initial mapping, and is made up of environmental goods that are not on the APEC list. This list contains the same EGs that are presented in the initial EG list in the text (Table 2), but also contains notes on their environmental benefit and Norwegian producers if applicable. Goods marked with an asterisk (*) are listed more than once in the table.

HS Code	HS Code Description	Ex-out / Additional Product Specification	Remarks / Environmental Benefit	Environmental product category	Norwegian producers, if applicable
		AIR POLLUTION CONTROL			
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	Generators with purifiers	Purifiers remove contaminants (such as cyanide and sulphur compounds) produced in the manufacture of gases	Air pollution control	
841410*	Vacuum pumps	Industrial hoods for the transportation or extraction of air pollutants such as exhaust gas or dust	Air handling equipment	Air pollution control	
841430	Compressors of a kind used in refrigerating equipment	Compressors used in air handling equipment	Transport or extraction of polluted air, corrosive gases, or dust	Air pollution control	
841440	Air compressors mounted on a wheeled chassis for towing	Air compressors used in the transportation or extraction of polluted air, corrosive gases, or dust		Air pollution control	
841459	Fans other than table, floor, wall, window, ceiling or roof fans, with a self-contained electric motor of an output not exceeding 125W	Fans for the transport or extraction of polluted air, corrosive gases, or dust	Fans for the transport or extraction of polluted air, corrosive gases, or dust	Air pollution control	
841480	Air pumps, other than compressors and fans; ventilating/recycling hoods incorporating a fan, whether or not fitted with filters	Industrial hoods, aerators, blowers and diffusers		Air pollution control	

392010	Other plates, sheets, film, foil and strip, of plastics, non-cellular and not reinforced, laminated, supported or similarly combined with other materials: of polymers of ethylene	HDPE or flexible membrane landfill liners and/or covers for methane collection; Geomembranes for soil protection, water tightness, anti-erosion, leachate protection	Flexible geomembranes of plastics used as landfill drainage mats, bottom liners and covers; also used in water containment contexts	Solid and hazardous waste management	Teletextiles: http://www.teletextiles.com/
392020	Other plates, sheets, film, foil and strip, of plastics, non-cellular and not reinforced, laminated, supported or similarly combined with other materials: of polymers of propylene	Flexible membrane landfill liners and/or covers for methane collection; Geomembranes for soil protection, water tightness, anti-erosion, leachate protection	Flexible geomembranes of plastics used as landfill drainage mats, bottom liners and covers; also used in water containment contexts	Solid and hazardous waste management	Teletextiles: http://www.teletextiles.com/
392220*	Lavatory seats and covers, of plastics	Seats and covers for resource efficient sanitary fixtures including composting toilets, dry closets, waterless urinals, vacuum toilets	Seats and covers for toilets/urinals that use little to no water; In composting systems, human waste can be composted for later use as chemical free fertilizer	Solid and hazardous waste management	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php Jets (Vacuum toilet): http://www.jetsgroup.com/no/
392290 *	Bidets, lavatory pans, flushing cisterns and similar sanitary ware, of plastics	Resource efficient sanitary fixtures including composting toilets, dry closets, waterless urinals, vacuum toilets	Toilets/urinals that use little to no water; In composting systems, human waste can be composted for later use as chemical free fertilizer	Solid and hazardous waste management	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php Jets (Vacuum toilet): http://www.jetsgroup.com/no/
392690	Other articles of plastics and articles of other materials of headings 39.01 to 39.14: other	Geosynthetic clay liners (GCLs)	Composite clay and geosynthetic liners used for landfill drainage and leachate protection; Geosynthetic layer attached to clay layer (often expansive	Solid and hazardous waste management	Teletextiles: http://www.teletextiles.com/

			bentonite clay)		
442190*	Other articles of wood: Other	Wooden fixtures (e.g. seats) for composting and dry toilets	Seats and covers for toilets/urinals that use little to no water; In composting systems, human waste can be composted for later use as chemical free fertilizer	Solid and hazardous waste management	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php Jets (Vacuum toilet): http://www.jetsgroup.com/no/
560290	Felt, whether or not impregnated, coated, covered or laminated: other	Geosynthetic clay liners (GCLs)	Composite clay and geosynthetic liners used for landfill drainage and leachate protection; Geosynthetic layer attached to clay layer (often expansive bentonite clay)	Solid and hazardous waste management	Teletextiles: http://www.teletextiles.com/
560314*	Nonwovens, whether or not impregnated, coated, covered or laminated, Weighing more than 150 g/m²	Landfill drainage mats of fabric of polyethylene, polypropylene or nylon for filtering waste water; filter cloth; filter sleeve	Flexible geomembranes of plastics used as landfill drainage mats, bottom liners and covers; also used in water containment contexts	Solid and hazardous waste management	Teletextiles: http://www.teletextiles.com/
680620	Exfoliated vermiculite, expanded clays, foamed slag and similar expanded mineral materials (including intermixtures thereof)	Geosynthetic clay liners (GCLs)	Composite clay and geosynthetic liners used for landfill drainage and leachate protection; Geosynthetic layer attached to clay layer (often expansive bentonite clay)	Solid and hazardous waste management	Teletextiles: http://www.teletextiles.com/
681099	Other articles of cement, of concrete	For the storage of solid and hazardous waste		Solid and hazardous waste management	
681599	Articles of stone or of other mineral substances (including carbon fibres, articles of carbon fibres and articles of peat), not elsewhere specified or included: other	Geosynthetic clay liners (GCLs)	Composite clay and geosynthetic liners used for landfill drainage and leachate protection; Geosynthetic layer attached to clay layer (often expansive bentonite clay)	Solid and hazardous waste management	Teletextiles: http://www.teletextiles.com/

691010*	Ceramic sinks, wash basins, wash basin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures of *porcelain or china*	Resource efficient sanitary fixtures including composting toilets, dry closets, waterless urinals, vacuum toilets	Toilets/urinals that use little to no water; In composting systems, human waste can be composted for later use as chemical free fertilizer	Solid and hazardous waste management	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php Jets (Vacuum toilet): http://www.jetsgroup.com/no/
700100	Cullet and other waste and scrap of glass; glass in the mass	In the form of Glasopor	Glasopor is made of recycled consumer glass waste (food and drink packaging), and is used as a light weight filler for building projects (roads, sewage pipelines, athletic fields, excavation pits)	Solid and hazardous waste management	Glasopor: http://www.glasopor.no/
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	Waste containers, drinking water storage containers	Possible uses: tanks for anaerobic digesters to turn biomass to gas; solar pre-heating storage tank; waste containers; storage of safe drinking water; septic tanks; tanks for wastewater treatment; waste containers for wastewater or sewage, hazardous waste, etc.	Solid and hazardous waste management	
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 : Greater than 50l	Waste containers, drinking water storage containers	Possible uses: tanks for anaerobic digesters to turn biomass to gas; solar pre-heating storage tank; waste containers; storage of safe drinking water; septic tanks; tanks for wastewater treatment; waste containers for wastewater or sewage, hazardous waste, etc.	Solid and hazardous waste management	
731021*	Tanks, casks, drums, cans, boxes and similar containers, of a capacity not exceeding 300 l: To be closed by soldering or crimping	Waste containers, drinking water storage containers	Possible uses: tanks for anaerobic digesters to turn biomass to gas; solar pre-heating storage tank; waste containers; storage of safe drinking water; septic tanks; tanks for wastewater treatment; waste	Solid and hazardous waste management	

			containers for wastewater or sewage, hazardous waste, etc.		
731029*	Tanks, casks, drums, cans, boxes and similar containers, of a capacity not exceeding 300 l: Other	Waste containers, drinking water storage containers	Possible uses: tanks for anaerobic digesters to turn biomass to gas; solar pre-heating storage tank; waste containers; storage of safe drinking water; septic tanks; tanks for wastewater treatment; waste containers for wastewater or sewage, hazardous waste, etc.	Solid and hazardous waste management	
732429*	Sanitary ware and parts thereof of *iron or steel:* other, including parts	Resource efficient sanitary fixtures including composting toilets, dry closets, waterless urinals, vacuum toilets	Toilets/urinals that use little to no water; In composting systems, human waste can be composted for later use as chemical free fertilizer	Solid and hazardous waste management	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php Jets (Vacuum toilet): http://www.jetsgroup.com/no/
761290*	Aluminum casks, drums, cans, boxes and similar 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: other.	Waste containers	Possible uses: tanks for wastewater treatment; waste containers for wastewater or sewage, hazardous waste, etc.	Solid and hazardous waste management	
761529*	Sanitary ware and parts thereof, of aluminum	Resource efficient sanitary fixtures including composting toilets, dry closets, waterless urinals, vacuum toilets	Toilets/urinals that use little to no water; In composting systems, human waste can be composted for later use as chemical free fertilizer	Solid and hazardous waste management	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php Jets (Vacuum toilet): http://www.jetsgroup.com/no/
840219*	Steam or other vapour generating	Biomass boilers	Powered by the boiling of	Solid and	

	boilers (other than central heating hot water boilers capable also of producing low pressure steam); super-heated water boilers: Other vapour generating boilers, including hybrid boilers		renewable biomass, e.g. straw (residue from global agriculture) or municipal solid waste, to be converted to steam, and later, electricity → Biomass boiler parts (HS 840290) are on APEC list	hazardous waste management	
841320*	Hand pumps, other than those of subheading 841311 or 841319		Facilitate the delivery of water or other liquids to the surface Examples: Hand pumps for the emptying of pits that store human waste	Solid and hazardous waste management	
841410*	Vacuum pumps	Vacuum pumps for resource efficient toilet systems (vacuum toilets)	Lower water use, reduced sewage volumes, and less power consumption compared to regular gravity powered toilet systems	Solid and hazardous waste management	Jets (Vacuum toilet): http://www.jetsgroup.com/no/
842220	Machinery for cleaning or drying bottles or other containers		Used to clean and dry bottles for recycling and reuse	Solid and hazardous waste management	
842290	Parts for 842220			Solid and hazardous waste management	

WASTEWATER MANAGEMENT AND WATER TREATEMENT

391400	Ionexchangers based on polymers of headings 39.01 to 39.13, in primary forms.	Ionexchangers used in water purification systems		Wastewater management and Water treatment	
392510	Reservoirs, tanks, vats and similar containers, of a capacity exceeding 300 l	Tanks for storage of drinking and potable water	Example: A-Aqua's foldable water storage tanks made of PVC coated fabric ("pillow tank" for drinking water and "onion tank" for potable water)	Wastewater management and Water treatment	A-Aqua: http://www.a-aqua.no/home.php
560314*	Nonwovens, whether or not impregnated, coated, covered or laminated, Weighing more than	Landfill drainage mats of fabric of polyethylene, polypropylene or nylon for	Flexible geomembranes of plastics used as landfill drainage mats and liners to protect	Wastewater management and Water treatment	Teletextiles: http://www.teletextiles.com/

	150 g/m²	filtering waste water; filter cloth; filter sleeve	groundwater sources from leachate; also used in water containment contexts		
591190	Textile products and articles, for technical uses, specified in Note 7 to this Chapter: Filter bags and similar for use in purifying plants		Solids separation treatment, industrial and municipal wastewater applications including sludge processes, stormwater treatment, aquaculture, food processing, etc. Example: Salsnes wastewater filters	Wastewater management and Water treatment	Salsnes Filter: http://www.salsnes-filter.com/
680620*	Exfoliated vermiculite, expanded clays, foamed slag and similar expanded mineral materials (including intermixtures thereof)	Expanded clay products used as filter media for drinking water and waste water treatment; Geosynthetic clay liners (GCLs)	Used for drinking and waste water filtration Example: Filtralite	Wastewater management and Water treatment	Weber Norway (Filtralite): http://www.filtralite.com/
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	Waste containers, drinking and potable water storage containers	Possible uses: tanks for anaerobic digesters to turn biomass to gas; solar pre-heating storage tank; waste containers; storage of safe drinking water; septic tanks; tanks for wastewater treatment; waste containers for wastewater or sewage, hazardous waste, etc.	Wastewater management and Water treatment	
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 : Greater than 50l	Waste containers, drinking and potable water storage containers	Possible uses: tanks for anaerobic digesters to turn biomass to gas; solar pre-heating storage tank; waste containers; storage of safe drinking water; septic tanks; tanks for wastewater treatment; waste containers for wastewater or sewage, hazardous waste, etc.	Wastewater management and Water treatment	
731021*	Tanks, casks, drums, cans, boxes and similar containers, of a capacity not exceeding 300 l: To be closed by soldering or crimping	Waste containers, drinking and potable water storage containers	Possible uses: tanks for anaerobic digesters to turn biomass to gas; solar pre-heating storage tank; waste containers; storage of safe	Wastewater management and Water treatment	

			drinking water; septic tanks; tanks for wastewater treatment; waste containers for wastewater or sewage, hazardous waste, etc.	
731029*	Tanks, casks, drums, cans, boxes and similar containers, of a capacity not exceeding 300 l: Other	Waste containers, drinking and potable water storage containers	Possible uses: tanks for anaerobic digesters to turn biomass to gas; solar pre-heating storage tank; waste containers; storage of safe drinking water; septic tanks; tanks for wastewater treatment; waste containers for wastewater or sewage, hazardous waste, etc.	Wastewater management and Water treatment
761290*	Aluminum casks, drums, cans, boxes and similar 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: other.	Waste containers, drinking and potable water storage containers	Possible uses: tanks for wastewater treatment; waste containers for wastewater or sewage, hazardous waste, etc.	Wastewater management and Water treatment
820750	Interchangeable tools for hand tools, whether or not power-operated, or for machine-tools (for example, for pressing, stamping, punching, tapping, threading, drilling, boring, broaching, milling, turning or screw driving): Tools for drilling, other than rock drilling	For the drilling of drinking water wells and bore holes	Provides access to drinking water and other groundwater sources located meters under the surface	Wastewater management and Water treatment
820760	Interchangeable tools for hand tools, whether or not power-operated, or for machine-tools (for example, for pressing, stamping, punching, tapping, threading, drilling, boring, broaching, milling, turning or screw driving): Tools for boring or broaching	For the drilling of drinking water wells and bore holes	Provides access to drinking water and other groundwater sources located meters under the surface	Wastewater management and Water treatment

841320*	Hand pumps, other than those of subheading 841311 or 841319		Facilitate the delivery of water Examples: Treadle pumps (foot pumps) for irrigation, hand water pumps for drinking water pumping from wells and boreholes	Wastewater management and Water treatment	
841381	Pumps	Pumps powered by renewable energy sources, for example, integrated with wind turbines or solar pumping systems	Help deliver clean water through the use of renewable energy Examples: Small scale – pump for irrigation or watering livestock; Industrial scale – pumps as integral component of water treatment plants	Wastewater management and Water treatment	
848180	Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, including pressure-reducing valves and thermostatically controlled valves: Other appliances	Taps and valves for the delivery of clean drinking water in developing countries and emergency situations	Examples: Water Station Taps Kit (A-Aqua)	Wastewater management and Water treatment	A-Aqua: http://www.a-aqua.no/home.php Raufoss: http://www.isiflo.com/
854370	Other electrical machines and apparatus having individual functions (not specified elsewhere in chapter 85)	Ozone generators for water purification	Ozone purification used as alternative to chlorine; may be expensive for wide use in developing contexts	Wastewater management and Water treatment	Normex: http://www.normex.no/
			ENVIRONMENTAL REMEDIATION AND CLEAN-UP		
842119	Centrifuges, including centrifugal dryers; filtering or purifying machinery and apparatus, for liquids or gases: Other	Oil skimmers	Help to clean-up and separate oil from water	Environmental remediation and clean-up	
842191	Parts for 842119			Environmental remediation and clean-up	
			CLEANER AND RENEWABLE ENERGY		

730820	Towers and lattice masts	Wind turbine towers and masts	Used to elevate and support wind turbine for generation of energy	Cleaner and renewable energy	Blaaster: http://www.blaaster.no/ Sway: http://www.sway.no/
732111*	Stoves, ranges, grates, cookers, barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel: for gas fuel or for both gas and other fuels	Solar powered stoves/ appliances	Solar energy for cooking: no pollution, renewable energy source, allows preservation of firewood, suitable for off-grid usage	Cleaner and renewable energy	MorphoSolar: http://morphosolar.com/
732190*	Parts for 732111			Cleaner and renewable energy	MorphoSolar: http://morphosolar.com/
840211	Watertube boilers with a steam production exceeding 45 t per hour	For the production of bioenergy		Cleaner and renewable energy	
840212	Watertube boilers with a steam production not exceeding 45 t per hour	For the production of bioenergy		Cleaner and renewable energy	
840219*	Other vapour generating boilers, including hybrid boilers	Biomass boilers; For the production of bioenergy		Cleaner and renewable energy	
840220	Superheated water boilers	For the production of bioenergy		Cleaner and renewable energy	
840310	Central heating water boilers other than those of heading 84.02	For the production of bioenergy		Cleaner and renewable energy	
840390	Parts for 840310	For the production of bioenergy		Cleaner and renewable energy	
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	For the production of bioenergy		Cleaner and renewable energy	

	purifiers				
840590	Parts for 840510	For the production of bioenergy		Cleaner and renewable energy	
840681	Steam and other vapor turbines of an output exceeding 40 MW	Turbines used for renewable energy processes	Turbines used in geothermal, wind, solar thermal, biomass power production → Parts for 840681 on APEC list (HS 840690)	Cleaner and renewable energy	
840682	Steam and other vapor turbines of an output not exceeding 40 MW	Turbines used for renewable energy processes	Turbines used in geothermal, wind, solar thermal, biomass power production → Parts for 840682 on APEC list (HS 840690)	Cleaner and renewable energy	
841011	Hydraulic turbines, water wheels, and regulators therefor, Of a power *not exceeding 1,000 kW*	For hydropower energy generation		Cleaner and renewable energy	BN Turbin: http://www.bnturbin.no/ Hydroenergi: http://www.intpow.no/?id=140 Rainpower: http://www.rainpower.no Small Turbine Partner: http://www.turbinepartner.no/ Spetals verk: http://www.spetalsverk.no/ Steis Mekaniske Versted: http://www.steis.no/
841012	Hydraulic turbines, water wheels, and regulators therefor, Of a power *exceeding 1,000 kW but not exceeding 10,000 kW*	For hydropower energy generation		Cleaner and renewable energy	BN Turbin: http://www.bnturbin.no/ Hydroenergi: http://www.intpow.no/?id=140 Rainpower: http://www.rainpower.no Small Turbine Partner: http://www.turbinepartner.no/ Spetals verk: http://www.spetalsverk.no/ Steis Mekaniske Versted:

					http://www.steis.no/
841013	Hydraulic turbines, water wheels, and regulators therefor, Of a power *exceeding 10,000 kW*	For hydropower energy generation		Cleaner and renewable energy	BN Turbin: http://www.bnturbin.no/ Hydroenergi: http://www.intpow.no/?id=140 Rainpower: http://www.rainpower.no Small Turbine Partner: http://www.turbinepartner.no/ Spetals verk: http://www.spetalsverk.no/ Steis Mekaniske Versted: http://www.steis.no/
841090	Parts for 841011, 841012, 841013	For hydropower energy generation		Cleaner and renewable energy	BN Turbin: http://www.bnturbin.no/ Hydroenergi: http://www.intpow.no/?id=140 Rainpower: http://www.rainpower.no Small Turbine Partner: http://www.turbinepartner.no/ Spetals verk: http://www.spetalsverk.no/ Steis Mekaniske Versted: http://www.steis.no/
841280	Other engines and motors: Other	Wind motors	→ Parts for 841280 on APEC list (HS 841290)	Cleaner and renewable energy	
848610	Machines and apparatus for the manufacture of boules or wafers	Machines for the production of silicon boules and wafers for use in PV cells		Cleaner and renewable energy	
850161	AC generators of an output not exceeding 75 kVA	To be used with turbines and generators in combination to produce electricity from renewable energy sources	→ AC generators of an output exceeding 750 kVA (HS 850164) are included on the APEC list	Cleaner and renewable energy	

850162	AC generators of an output exceeding 75 kVA but not exceeding 375 kVA	To be used with turbines and generators in combination to produce electricity from renewable energy sources	→ AC generators of an output exceeding 750 kVA (HS 850164) are included on the APEC list	Cleaner and renewable energy	
850163	AC generators of an output exceeding 375 kVA but not exceeding 750 kVA	To be used with turbines and generators in combination to produce electricity from renewable energy sources	→ AC generators of an output exceeding 750 kVA (HS 850164) are included on the APEC list	Cleaner and renewable energy	
850300	Parts suitable for use solely or principally with the machines of heading 85.01 or 85.02	Parts for generators used to produce electricity from renewable energy sources		Cleaner and renewable energy	
850440	Static converters	When used in conjunction with solar panels or wind turbines	Static converters are used with solar panels and wind turbines to produce electricity from renewable sources	Cleaner and renewable energy	
854190	Parts for 854140 – photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes	PV cell parts	→ PV cells and LEDs (HS 854140) on APEC list	Cleaner and renewable energy	Elkem: https://www.elkem.com/ REC: http://www.recgroup.com/
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	Fresnel mirrors	Reflective solar collectors/cells, like those used in solar water heaters, or concentrated solar power (CHP). → Heliostats (HS 901380) on APEC list	Cleaner and renewable energy	
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	Fresnel reflector modules	Reflective solar collectors/cells, like those used in solar water heaters, or concentrated solar power (CHP). → Heliostats (HS 901380) on	Cleaner and renewable energy	

	optically worked: Other		APEC list		
			ENERGY EFFICIENCY		
680610	Slag wool, rock wool and similar mineral wools (including intermixtures thereof), in bulk, sheets or rolls		Building insulation to increase efficiency when heating or cooling	Energy efficiency	Rockwool: http://www.rockwool.no/
700800	Multiplewalled insulating units of glass		Multiple walled/ triple glazed windows keep heat/cold inside and block cold/heat from outside	Energy efficiency	NorDan: http://www.nordan.no/ Norgesvinduet: http://norgesvinduet.no/
730830	Structures and parts of structures: Doors, windows and their frames and thresholds for doors	Insulated door and window frames	For improved insulation in buildings, homes and other structures	Energy efficiency	
841861	Compression type units whose condensers are heat exchangers	Heat pumps powered by renewable energy sources	Heat pumps powered by renewable energy sources such as wind, geothermal, solar, hydro	Energy efficiency	
841950	Heat exchange units			Energy efficiency	
841990	Parts for 841950			Energy efficiency	
850240	Electric rotary converters	Waste heat converters		Energy efficiency	
853931*	Electric filament or discharge lamps: Fluorescent, hot cathode	Fluorescent lights	Keep in mind that these are more efficient than halogen bulbs, but less efficient than LEDs	Energy efficiency	
			NOISE AND VIBRATION ABATEMENT		
450410	Blocks, plates, sheets and strip; tiles of any shape; solid cylinders, including discs of agglomerated cork with or without binding substance	Agglomerated cork underlay used for vibration or noise abatement	Assists in the reduction of noise levels in buildings; thermal and acoustic insulation; cork as somewhat renewable material	Noise and vibration abatement	
840991	Parts suitable for use solely or principally with spark-ignition internal combustion piston engines	Industrial mufflers	Used to reduce engine noise	Noise and vibration abatement	

840999	Parts suitable for use solely or principally with other engines (not spark-ignition internal combustion piston engines or aircraft engines)	Industrial mufflers	Used to reduce engine noise	Noise and vibration abatement	
		ENVIRONMENTALLY PREFERABLE PRODUCTS			
392220*	Lavatory seats and covers, of plastics	Seats and covers for resource efficient sanitary fixtures including composting toilets, dry closets, waterless urinals, vacuum toilets	Seats and covers for toilets/urinals that use little to no water; In composting systems, human waste can be composted for later use as chemical free fertilizer	Environmentally Preferable Products	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php Jets (Vacuum toilet): http://www.jetsgroup.com/no/
392290 *	Bidets, lavatory pans, flushing cisterns and similar sanitary ware, of plastics	Resource efficient sanitary fixtures including composting toilets, dry closets, waterless urinals, vacuum toilets	Toilets/urinals that use little to no water; In composting systems, human waste can be composted for later use as chemical free fertilizer	Environmentally Preferable Products	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php Jets (Vacuum toilet): http://www.jetsgroup.com/no/
442190*	Other articles of wood: Other	Wooden fixtures (e.g. seats) for composting and dry toilets	Seats and covers for toilets/urinals that use little to no water; In composting systems, human waste can be composted for later use as chemical free fertilizer	Environmentally Preferable Products	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php Jets (Vacuum toilet): http://www.jetsgroup.com/no/
691010*	Ceramic sinks, wash basins, wash basin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures of *porcelain or china*	Resource efficient sanitary fixtures including composting toilets, dry closets, waterless urinals, vacuum toilets	Toilets/urinals that use little to no water; In composting systems, human waste can be composted for later use as chemical free fertilizer	Environmentally Preferable Products	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php

					Jets (Vacuum toilet): http://www.jetsgroup.com/no/
732429*	Sanitary ware and parts thereof of *iron or steel:* other, including parts	Resource efficient sanitary fixtures including composting toilets, dry closets, waterless urinals, vacuum toilets	Toilets/urinals that use little to no water; In composting systems, human waste can be composted for later use as chemical free fertilizer	Environmentally Preferable Products	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php Jets (Vacuum toilet): http://www.jetsgroup.com/no/
761529*	Sanitary ware and parts thereof, of aluminum	Resource efficient sanitary fixtures including composting toilets, dry closets, waterless urinals, vacuum toilets	Toilets/urinals that use little to no water; In composting systems, human waste can be composted for later use as chemical free fertilizer	Environmentally Preferable Products	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php Jets (Vacuum toilet): http://www.jetsgroup.com/no/
460129	Mats, matting and screens of vegetable materials: Other	From sustainable vegetable materials	Can be used to line water wells in developing countries. Also good for drainage purposes and erosion control	Environmentally Preferable Products	
482361	Trays, dishes, plates, cups and the like, of paper or paperboard: of bamboo		Biodegradable and more sustainable than disposable paper items. Come from sustainable sources	Environmentally Preferable Products	
530310	Jute and other textile bast fibers, raw or processed, but not spun, excluding flax, true hemp and ramie: raw or retted		Comes from sustainable sources and is biodegradable; used in packaging and woven fabric	Environmentally Preferable Products	
530110	Flax, raw or processed but not spun: raw or retted		Flax requires less water and fewer pesticides than cotton; price to produce flax is less than cotton	Environmentally Preferable Products	
530121	Flax, raw or processed but not		Flax requires less water and fewer	Environmentally	

	spun: broken or scotched	pesticides than cotton; price to produce flax is less than cotton	Preferable Products
530129	Flax, raw or processed but not spun: other	Flax requires less water and fewer pesticides than cotton; price to produce flax is less than cotton	Environmentally Preferable Products
530390	Jute and other textile bast fibers, raw or processed, but not spun, excluding flax, true hemp and ramie: other	Comes from sustainable sources and is biodegradable; used in packaging and woven fabric	Environmentally Preferable Products
530500	Coconut, abaca (Manila hemp or Musa textilis Nee), ramie and other vegetable textile fibres, not elsewhere specified or included, raw or processed but not spun; tow, noils and waste of these fibres (including yarn waste and garnetted stock), raw of processed but not spun	Comes from sustainable sources and is biodegradable; used in textiles and recycled paper	Environmentally Preferable Products
530610	Flax yarn: single	Flax requires less water and fewer pesticides than cotton; price to produce flax is less than cotton	Environmentally Preferable Products
530620	Flax yarn: multiple (folded) or cabled	Flax requires less water and fewer pesticides than cotton; price to produce flax is less than cotton	Environmentally Preferable Products
530710	Yarn of jute or other textile bast fibers of heading 53.03: single		Environmentally Preferable Products
530720	Yarn of jute or other textile bast fibers of heading 53.03: multiple (folded) or cabled		Environmentally Preferable Products
530911	Woven fabrics of flax, containing 85% or more by weight of flax: unbleached or bleached	Flax requires less water and fewer pesticides than cotton; price to produce flax is less than cotton	Environmentally Preferable Products
530919	Woven fabrics of flax, containing	Flax requires less water and fewer	Environmentally

	85% or more by weight of flax: other	pesticides than cotton; price to produce flax is less than cotton	Preferable Products
530921	Woven fabrics of flax, containing less than 85% by weight of flax: unbleached or bleached	Flax requires less water and fewer pesticides than cotton; price to produce flax is less than cotton	Environmentally Preferable Products
530929	Woven fabrics of flax, containing less than 85% by weight of flax: other	Flax requires less water and fewer pesticides than cotton; price to produce flax is less than cotton	Environmentally Preferable Products
531010	Woven fabrics of jute or of other textile bast fibers: unbleached		Environmentally Preferable Products
531090	Woven fabrics of jute or of other textile bast fibers: other		Environmentally Preferable Products
560710	Twine, cordage, ropes and cables, whether or not plaited or braided; whether or not impregnated, coated, covered or sheathed with rubber or plastics, of jute or other textile based fibers (of heading 53.03)	More biodegradable than synthetic fibers and made from renewable resources	Environmentally Preferable Products
560721	Twine, cordage, ropes and cables, whether or not plaited or braided; whether or not impregnated, coated, covered or sheathed with rubber or plastics, of sisal or other textiles fibers of the genus Agave: binder or baler twine	More biodegradable than synthetic fibers and made from renewable resources [often sisal]	Environmentally Preferable Products
560729	Twine, cordage, ropes and cables, whether or not plaited or braided; whether or not impregnated, coated, covered or sheathed with rubber or plastics, of sisal or other textiles fibers of the genus Agave: other		Environmentally Preferable Products

560900	Articles of yarn, strip or the like of heading 54.04 or 54.05, twine, cordage, rope or cables, not elsewhere specified or included			Environmentally Preferable Products	
630510	Sacks and bags, of a kind used for the packing of goods of jute or other textile based fibers (of heading 53.03)		More biodegradable than synthetic fibers and made from renewable resources	Environmentally Preferable Products	
680800	Panels, boards, tiles, blocks and similar articles of vegetable fibre, of straw or of shavings, chips	Panels, boards, tiles of sustainable vegetable fibers, straw or shavings		Environmentally Preferable Products	
732111*	Stoves, ranges, grates, cookers, barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel: for gas fuel or for both gas and other fuels	Solar powered stoves/ appliances	Solar energy for cooking: no pollution, renewable energy source, allows preservation of firewood, suitable for off-grid usage	Environmentally Preferable Products	MorphoSolar: http://morphosolar.com/
732190*	Parts for 732111			Environmentally Preferable Products	MorphoSolar: http://morphosolar.com/
851310	Portable electric lamps designed to function by their own source of energy (for example, dry batteries, accumulators, magnetos), other than lighting equipment of heading 85.12.		Solar lamps traded under the HS codes: 851310, 940540 and 940550 Examples include solar powered lamps and gravity powered lights	Environmentally Preferable Products	BRIGHT Products AS: http://www.bright-products.com/
853931*	Electric filament or discharge lamps: Fluorescent, hot cathode	Fluorescent lights	Keep in mind that these are more efficient than halogen bulbs, but less efficient than LEDs	Environmentally Preferable Products	
940151	Furniture, seats: of bamboo or rattan	Seats of bamboo	Rattan is not a sustainable material	Environmentally Preferable Products	

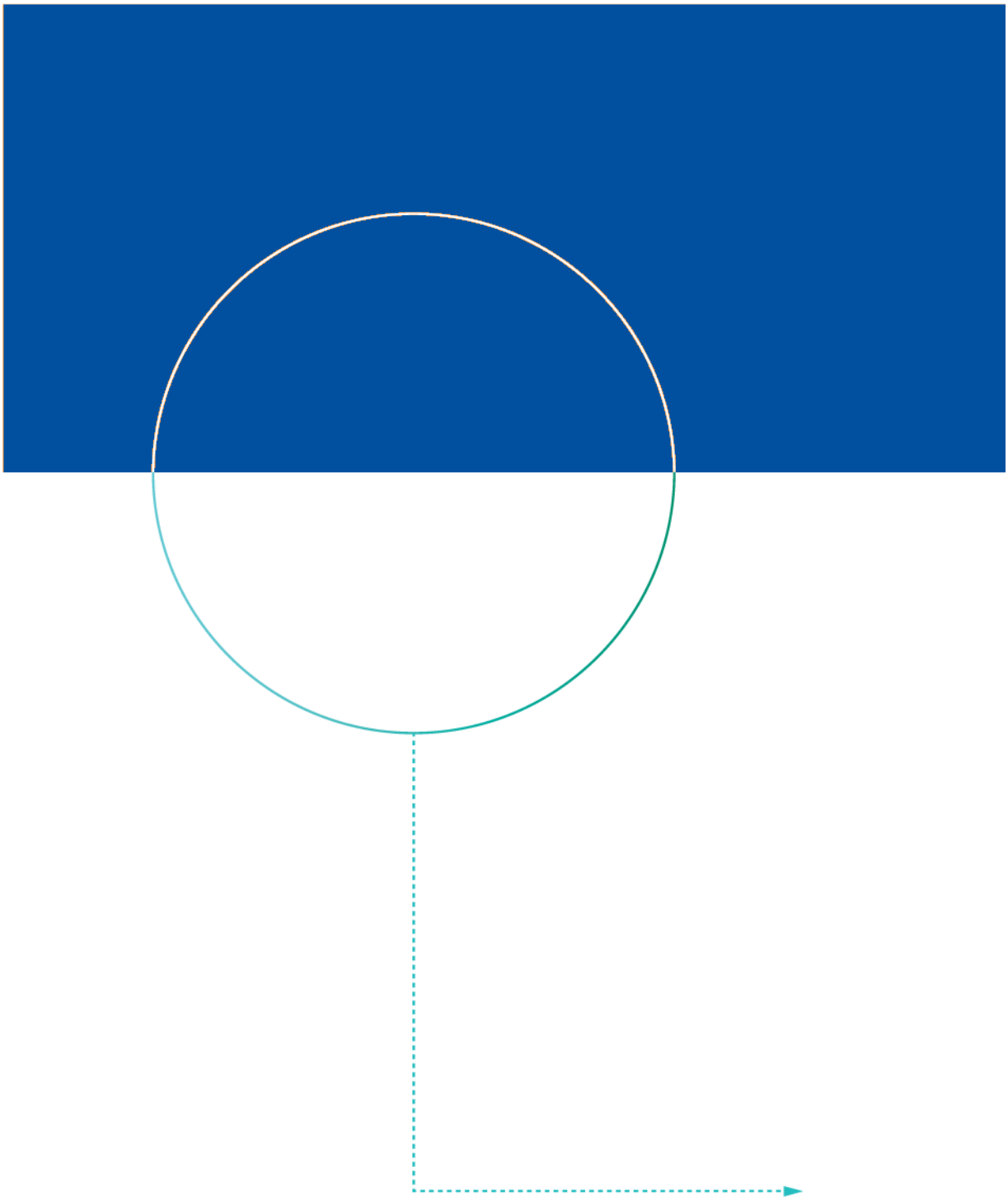
940381	Other furniture and parts thereof: of bamboo or rattan	Other furniture and parts thereof of bamboo	Rattan is not a sustainable material	Environmentally Preferable Products	
940540	Other electric lamps and lighting fittings	Solar powered lamps and fittings	Solar lamps traded under the HS codes: 851310, 940540 and 940550	Environmentally Preferable Products	BRIGHT Products AS: http://www.bright-products.com/
940550	Non-electric lamps	Solar powered lamps and fittings	Solar lamps traded under the HS codes: 851310, 940540 and 940550	Environmentally Preferable Products	BRIGHT Products AS: http://www.bright-products.com/
			RESOURCE EFFICIENCY		
691010*	Ceramic sinks, wash basins, wash basin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures of *porcelain or china*	Resource efficient sanitary fixtures including composting toilets, dry closets, waterless urinals	Toilets/urinals that use little to no water; human waste can be composted for later use as chemical free fertilizer	Resource efficiency	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php Jets (Vacuum toilet): http://www.jetsgroup.com/no/
732490*	Sanitary ware and parts thereof, or iron or steel	Water saving shower head, dry closets, composting toilets, vacuum toilets		Resource efficiency	Danfo (Pacto toilet): http://danfo.no/ Vera Snurredassen A-Aqua (VacuSan 4+4): http://www.a-aqua.no/home.php Jets (Vacuum toilet): http://www.jetsgroup.com/no/ ShowerGreen Norway: http://www.showergreen.eu/NO/
841410*	Vacuum pumps	Vacuum pumps for resource efficient toilet systems	Lower water use, reduced sewage volumes, and less power consumption compared to regular gravity powered toilet systems	Resource efficiency	Jets (Vacuum toilet): http://www.jetsgroup.com/no/

Appendix 2: Development EGs List

The following list contains the 15 development EGs and their corresponding HS codes and descriptions, organized by main EGA environmental product category.

Development EG	HS Code	HS Code Description
Solid and hazardous waste management		
Composting toilets	392220	Lavatory seats and covers: of plastics
	392290	Bidets, lavatory pans, flushing cisterns and similar sanitary ware: of plastics
	442190	Other articles of wood: other
	691010	Ceramic sinks, wash basins, wash basin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures of *porcelain or china*
	732490	Sanitary ware and parts thereof of *iron or steel*
	761529	Sanitary ware and parts thereof *of aluminum*
Vacuum toilets	392220	Lavatory seats and covers: of plastics
	392290	Bidets, lavatory pans, flushing cisterns and similar sanitary ware: of plastics
	442190	Other articles of wood: other
	691010	Ceramic sinks, wash basins, wash basin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures of *porcelain or china*
	732490	Sanitary ware and parts thereof of *iron or steel*
	761529	Sanitary ware and parts thereof *of aluminum*
	841410	Vacuum pumps
Landfill liners and covers	392010	Other plates, sheets, film, foil and strip, of plastics, non-cellular and not reinforced, laminated, supported or similarly combined with other materials: of polymers of ethylene
	392020	Other plates, sheets, film, foil and strip, of plastics, non-cellular and not reinforced, laminated, supported or similarly combined with other materials: of polymers of propylene
	392690	Other articles of plastics and articles of other materials of headings 39.01 to 39.14: other
	560290	Felt, whether or not impregnated, coated, covered or laminated: other
	560314	Nonwovens, whether or not impregnated, coated, covered or laminated, Weighing more than 150 g/m²
	681599	Articles of stone or of other mineral substances (including carbon fibres, articles of carbon fibres and articles of peat), not elsewhere specified or included: other
Containers for waste management and sanitation purposes	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
	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 : Greater than 50l
	731021	Tanks, casks, drums, cans, boxes and similar containers, of a capacity not exceeding 300 l: To be closed by soldering or crimping
	731029	Tanks, casks, drums, cans, boxes and similar containers, of a capacity not exceeding 300 l: Other
	761290	Aluminium casks, drums, cans, boxes and similar 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: other

Wastewater management and water treatment		
Hand and foot pumps	841320	Hand pumps, other than those of subheading 841311 or 841319
Renewable energy powered pumps	841381	Pumps
Drinking water taps, valves, and distribution systems	848180	Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, including pressure-reducing valves and thermostatically controlled valves: Other appliances
Flexible drinking and potable water storage tanks	392510	Reservoirs, tanks, vats and similar containers, of a capacity exceeding 300 l
Cleaner and renewable energy		
Reflective Fresnel mirrors for the collection of solar thermal energy	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
	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
Hydraulic turbines	841011	Hydraulic turbines, water wheels, and regulators therefor, Of a power *not exceeding 1,000 Kw*
	841012	Hydraulic turbines, water wheels, and regulators therefor, Of a power *exceeding 1,000 kW but not exceeding 10,000 kW*
	841013	Hydraulic turbines, water wheels, and regulators therefor, Of a power *exceeding 10,000 kW*
	841090	Parts for 841011, 841012, 841013
Biomass boilers	840219	Other vapour generating boilers, including hybrid boilers
Environmentally preferable products		
Solar stoves and cookers	732111	Stoves, ranges, grates, cookers, barbecues, braziers, gas-rings, plate warmers and similar non-electric domestic appliances, and parts thereof, of iron or steel: for gas fuel or for both gas and other fuels
	732190	Parts for 732111
Solar powered lamps	851310	Portable electric lamps designed to function by their own source of energy (for example, dry batteries, accumulators, magnetos), other than lighting equipment of heading 85.12.
	940540	Other electric lamps and lighting fittings
	940550	Non-electric lamps
Other renewable energy powered lamps (The Gravity Light)	851310	Portable electric lamps designed to function by their own source of energy (for example, dry batteries, accumulators, magnetos), other than lighting equipment of heading 85.12.
Building materials of sustainable natural materials	440921	Wood (including strips and friezes for parquet flooring, not assembled) continuously shaped (tongued, grooved, rebated, chamfered, V-jointed, beaded, moulded, rounded or the like) along any of its edges, ends or faces, whether or not planed, sanded or end: of bamboo
	441210	Plywood, veneered panels and similar laminated wood: of bamboo
	460121	Mats, matting and screen of bamboo
	460129	Mats, matting and screens of vegetable materials: Other
	680800	Panels, boards, tiles, blocks and similar articles of vegetable fibre, of straw or of shavings, chips



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