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Beyond the Tariff: Non-Tariff Measures Affecting Environmental Goods Trade

Further to the draft paper TAD/ENV/JWPTE(2024)1/REV1, this final document builds on several data sources, and aims to feed into discussions around environmental goods (EGs) by examining their taxonomy and related current initiatives on trade liberalization; reviewing non-tariff measures affecting EGs, their design and scope; and providing quantitative analysis on the frequency, coverage and sectoral heterogeneity of NTMs on EGs. This final version incorporates comments and feedback received at the March 2024 and December 2024 meetings of the Joint Working Party on Trade and Environment (JWPTE). It has been declassified by written procedure in April 2025.

This paper was prepared by Evdokia Moïsé (TAD/TPD) and Enxhi Tresa (TAD/TPD), with inputs from Ilaria Espa (USI and WTI) and Ari van Assche (HEC Montréal), and research assistance from Firley Barbosa Banhos Junior (TAD/TPD). It incorporates useful comments from Andrea Andrenelli, Dylan Bourny, John Drummond, Matteo Fiorini, Gregoire Garsous, Marion Jansen, Jehan Sauvage, Silvia Sorescu, Julia Nielson, Przemyslaw Kowalski, Chloe Papazian and Shunta Yamaguchi from the OECD. The authors are grateful to Mahdi Ghodsi (WIIW), Rainer Lanz (WTO) and Dayong Yu (WTO) for data-related discussions at different stages of the paper. The authors would also like to thank Michèle Patterson and Inari Kurvinen for preparing this paper for publication.

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Evdokia MOISE(Evdokia.Moise@oecd.org)
Enxhi TRESA(Enxhi.Tresa@oecd.org)

JT03565267

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Table of contents

Abstract **4**

1. Introduction **6**

2. Discussions around a taxonomy of environmental goods **8**

2.1. EGs lists and negotiating rounds for trade liberalisation 9
2.2. Criteria for defining EGs 10

3. Updating the Combined List on Environmental Goods (CLEG) **16**

4. Non-tariff measures affecting EGs **23**

4.1. Outline of the variety of NTMs 23
4.2. Data sources for NTMs 25
4.3. Analysing NTMs on EGs through WTO notifications 26
4.4. Analysing NTMs targeting EGs via the TRAINS database 30

5. Supply chains for specific EGs: Trade measures beyond tariffs **38**

5.1. Supply chains for some EGs are characterised by high levels of concentration 39
5.2. Non-tariff measures affecting CRMs for selected EGs 41

6. The way forward and trade facilitation for EGs **43**

7. Conclusion **46**

References **48**

Annex A. List of Environmental Goods **55**

Annex B. Additional tables and figures **67**

Tables

Table 1. Characteristics of supply chains for selected EGs 40

Table A A.1. Combined List of Environmental Goods 55
Table A B.1. Non-tariff measures per MAST chapter 67
Table A B.2. Number of TBT decisions notified at the WTO and still in force in 2022, applied to EGs, per implementing country 68
Table A B.3. EGs regulated the most by TBT measures still in force (2000-2022) 69
Table A B.4. Illustrative TBT measures notified at the WTO 70
Table A B.5. Illustrative specific trade concerns on TBT measures notified at the WTO, for products mostly concerned by STC 71
Table A B.6. Countries included in the analysis using TRAINS, by income group 72
Table A B.7. Minerals used in selected environmental goods 73

Figures

Figure 1. Environmental goods per medium 18
Figure 2. Sectoral classification of EGs 19
Figure 3. Sectoral classification of EGs, per medium 20
Figure 4. Environmental goods according to the BEC classification 21
Figure 5. EGs exports per medium and income group 22
Figure 6. Tariffs on EGs per income group, 2019 23
Figure 7. Evolution of the stock of unilateral NTM notifications, 1995-2021 27
Figure 8. Cumulative stock of TBT specific trade concerns notified at the WTO on EGs, 2021 29
Figure 9. Trade defence measures targeting EGs 30

Figure 10. Percentage of measures on EGs, per MAST chapter (2019-2021) 31
Figure 11. Frequency index of EGs, per type of NTM (MAST chapters) 32
Figure 12. Percentage of traded EGs affected by at least one NTM, by country income group 33
Figure 13. Frequency index for EGs, per medium and type of NTM 34
Figure 14. Coverage ratio, per MAST chapter 35
Figure 15. Percentage of trade in EGs affected by at least one NTM, per country group 36
Figure 16. Coverage ratio of EGs, per medium and type of NTM 37
Figure 17. TBT sub-section regulating most of the traded EGs 38
Figure 18. NTM prevalence on CRMs in the supply chains for selected EGs 43

Abstract

Trade in environmental goods (EGs) has the potential to provide access to products that reduce environmental risks and minimise pollution and resource use, as well as to facilitate the diffusion of environmental technologies embedded in these goods. This paper aims to feed into discussions around the trade liberalisation of EGs by revisiting its taxonomy; reviewing non-tariff measures that affect the design and scope of EGs, and to provide quantitative analysis on the frequency, coverage and sectoral heterogeneity of non-tariff measures (NTMs) on EGs. This analysis also examines supply chains and related regulations that could lead to possible trade bottlenecks. Findings show that the number of NTMs affecting EGs trade has increased over time and that most EGs are affected by at least one NTM, with the most common being technical barriers to trade (TBT) and quantitative restrictions. A review of recent trade policies indicates that potential bottlenecks may involve components that enable deployment of EGs. Finally, it is shown that trade facilitation measures can significantly reduce costs by streamlining the processes that products must undergo to enter a market.

Key messages

The development, adoption, and diffusion of environmental goods (EGs) are crucial for transitioning to a low-carbon economy. EGs can reduce environmental risks, minimise pollution, and promote resource efficiency. As their production is worldwide, development and dissemination through trade is essential. Nevertheless, identifying products that are environmentally friendly throughout their lifecycle is challenging.

International trade facilitates access to EGs, promoting sustainable markets, technology diffusion, and greener supply value chains. This is particularly beneficial for developing countries, providing access to cleaner technologies and supporting emerging environmental industries.

Although there is no one-size-fits-all solution for identifying EGs, the process can be accelerated by combining multiple criteria and approaches at the product, project, firm, and country levels. Criteria for identifying EGs include an end-use that serves environmental purposes or characteristics that make such goods "environmentally preferable products" (EPPs) throughout their lifecycle. Reinforced and more explicit environmental requirements linked to the growth of sustainability initiatives will assist in identifying EGs.

While tariffs are generally low for environmental goods (EGs), there is scope for further liberalisation. Data using the Combined List on Environmental Goods (CLEG) indicates there is significant potential for further trade liberalisation of environmental goods in middle- and low-income countries.

Analysing trade policies beyond tariffs is also essential for a comprehensive understanding of trade restrictions on EGs and for promoting trade of these goods. There is a growing trend in the use of non-tariff measures (NTMs) on EGs, particularly technical barriers (TBTs) and quantitative restrictions, but also trade defence measures, especially for renewable energy and clean energy products. Nearly half of all traded EGs are subject to at least one NTM, with trade in EGs among OECD countries experiencing an even higher share. TBTs alone affect around 80% of traded EGs among OECD countries, reflecting the greater scope of upper-middle- and high-income countries to implement regulatory measures.

A supply chain analysis of key clean energy goods, such as wind turbines, solar panels, and EV batteries, confirms the presence of NTMs on raw materials critical for their production. Around 40% of trade in critical raw materials (CRMs) used as inputs in selected EGs is affected by at least one NTM, with TBTs being the most prevalent measures.

Trade facilitation measures can play a crucial role in reducing costs associated with diverse domestic regulations or unclear guidance resulting from imposition of a range of NTMs. By simplifying the procedures that products must follow to enter a market, trade facilitation measures help businesses comply with regulatory requirements, including those related to sustainability. Establishing mutual recognition agreements or other forms of regulatory collaboration for environmental certification can also simplify market access for environmentally friendly products. Finally, enhancing regulatory co-operation and technical interoperability can enable clarity in the reporting standards, as well as efficient exchange of data at the border and lower compliance costs.

1. Introduction

The development, adoption and diffusion of environmental goods (EGs) play an important role for the transition to a low-carbon economy (WTO, 2022[1]). Environmental goods encompass technologies and products that reduce environmental risks and minimise pollution and resource use.[1] The importance of promoting and facilitating trade in those goods is well recognized by the multilateral trading system.[2] International trade can enable access to EGs as products that reduce environmental risks, minimise resource use or serve as substitutes to polluting alternative products. It can also ease the diffusion of environmental technologies embodied in goods and services as well as promote the establishment and growth of markets for sustainable products and enhance the integration of more businesses into global value chains (UNEP and WTO, 2018[2]). In particular, trade in EGs can be beneficial to developing countries, not only through access to foreign environmental goods to meet domestic demand, but also by enabling international market access for their domestic environmental industry, which although still emerging, is currently a very dynamic and fast-growing sector providing new jobs (WTO, 2022[1]). Despite these benefits, developing economies have been reluctant to participate in trade liberalisation negotiations for EGs due to disagreements over product lists and concerns about losing competitiveness to cheaper imports (CSIS, 2021[3]), (de Melo and Solleder, 2020[4]) (Section 2).

The channels through which trade in EGs are expected to affect the environment are similar to the three effects that the environmental economics literature discusses in the context of trade in goods: the scale, composition and technique effect (Grossman and Krueger, 1995[5]). The scale effect refers to an increase in pollution due to the overall increase in production output (Copeland and Taylor, (2004[6]); Grossman and Krueger, (1995[5])). The composition effect implies that as countries shift towards capital-intensive sectors, their pollution potential is likely to increase (Antweiler, Copeland and Taylor (2001[7]). The opposite being true if countries turn their production to fewer polluting sectors. The technique effect, by enabling changes in production methods, may lead to a decrease in emissions per unit of output (Antweiler, Copeland and Taylor, 2001[7]). The overall impact of trade on the environment can be positive or negative, depending on the relative weight of these effects. Empirical and modelling work has studied how trade liberalisation in EGs could affect climate change, particularly through the technique and potentially composition channels, which could enhance environmental performance. Considering several lists of EGs, empirical studies indicate that the gap in per capita emissions is lower for country pairs that engage in bilateral trade in EGs (Tamini and Sorgho, (2018[8]), Sorgho and al., (2018[9])). The results are sometimes ambiguous due to opposite (positive and negative) effects, depending on how emissions are measured and whether certain goods are used for environmental or other purposes[3] (Zugravu-Soilita (2018[10]), (2019[11]).

[1] The definition of environmental goods has been the subject of many discussions that will be covered further in this paper. Past OECD analysis has defined EGs as goods used "to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems" (OECD and Eurostat, 1999[19]).

[2] In 2001, paragraph 31(iii) of the Doha Declaration provided a mandate for negotiations "with a view to enhancing the mutual supportiveness of trade and environment" on "the reduction, or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services" (WTO, 2001[93]).

[3] The challenges raised by the potential of some EGs to be used for environmental purposes or in conventional sectors that pollute more (dual use) is discussed further in this paper.

Tariffs on EGs are generally no higher than tariffs on other goods (WTO, 2022[1]) and the scope for further reductions in tariffs on EGs, while important for low- and middle-income economies, remains limited for many OECD countries. Even though the efforts for reductions of tariffs on EGs continue to be substantial, in particular for developing economies, it is important to also address *non-tariff measures* that are barriers to EGs trade (Tamini and Sorgho, 2017[12]), (Bacchetta et al., 2025[13]). In particular, Tamini and Sorgho (2017[12]) find that removing tariff barriers for EGs would lead to modest impacts on trade, mainly for countries that are big importers and for trade flows with small cost elasticities (i.e. where changes in trade costs would have a limited effect on trade flows).[4] Bachetta et.al. (2025[13]) examine the effects of trade liberalisation in EGs on international trade and climate outcomes. Their findings highlight that removing tariff barriers for EGs has a modest impact on emissions overall. Moreover, the largest benefit in terms of trade is expected to primarily accrue to countries that are already dominant in EGs trade.[5] Overall, these results point out that addressing non-tariff barriers and standards is crucial for maximising benefits and ensuring fair competition.

Addressing non-tariff barriers is also important since trade restrictive non-tariff measures (NTMs) are shown to have a bigger impact on trade than tariffs (UNCTAD and The World Bank, 2018[14]). De Melo and Solleder (2019[15]) argue that NTMs to trade in EGs could result in average levels of protection ten times greater than tariffs alone and this seems to be the case for measures such as opaque licensing practices, product standards, and testing procedures which may pose more of a limit on trade in environmental goods than tariffs (CSIS, 2021[3]). Gisselman, Merkus and Norell (2025[16]) show that the effectiveness of EGs provisions in Regional Trade Agreements (RTAs) can be hampered by remaining obstacles elsewhere in the agreement and highlight the role that RTAs could play in further trade liberalisation. On this basis, analysing trade policies beyond tariffs seems a natural way forward for a more insightful reflection of the existing regulations affecting EGs trade.

Given that services are often complementary to environmental goods and technologies, limited market access for services may also pose a major obstacle to trading EGs. This is for instance the case in the renewable energy sector, where services could contribute to the planning, design, sale, installation, maintenance, repair or any other operation linked to these goods and technologies. Barriers to trade in environmental services remain an important topic for future analysis and easing negotiations (CSIS, 2021[3]), and complementary work is underway on services trade and environmental sustainability.[6] Incorporating services and non-tariff barriers into environmental trade discussions may complicate negotiations, but doing so would provide a more comprehensive understanding of the entire environmental goods supply chain and the obstacles affecting its resilience (CSIS, 2021[3]). A better understanding of the current landscape of trade measures affecting the movement of EGs would thus help enrich the discussions towards supporting trade in those goods by addressing potential barriers. Ongoing work also explores the role that environmental policies at the domestic level, such as environmental labelling and information schemes (ELIS), environmental sustainability standards and regulations (ESSR) or other policies such as green public procurement, can play in promoting environmental goods and environmentally sustainable supply chains (Yamaguchi and van der Ven, 2025, forthcoming[17]). Despite their diverse and complex nature, sustainability

[4] In particular, trade cost elasticities are very low for major importers and exporters but high for most trading relationships, making it hard for small exporters to retain markets.

[5] In more details, the impact of liberalization depends on trade cost elasticities, which vary based on the size of the importing country and the number of EGs sourced from specific suppliers.

[6] See (Fiorini et al., 2025, forthcoming[94]) for more details.

initiatives (SI), are also important in the governance ecosystem for sustainability, providing potentially effective tools and bottom-up approaches that are geared to specific goals (OECD/ITC, 2024[18]).

The focus of this report is on trade policies and in particular on *NTMs* that regulate EGs trade.[7] This paper initially examines discussions on the identification of EGs. It then employs a list-based approach to analyse trade policies beyond tariffs, specifically NTMs applied to EGs trade, and concludes by highlighting potential bottlenecks related to NTMs within the supply chains of specific EGs.

This paper is structured as follows. Section 2 elaborates on the existing taxonomy and lists of EGs and discusses criteria for their identification. The paper then discusses the update of the Combined List on Environmental Goods (CLEG) to the latest 2022 harmonised system (HS) code classification (Section 3). Section 4 uses the updated list discussed in Section 3 to analyse NTMs affecting selected goods deemed to be environmental by focusing on the types of NTMs and their evolution in time, number of products affected, and amount of trade covered by those measures. Lastly, Section 5 aims to showcase the significance of NTMs in three specific EGs supply chains: solar panels, wind turbines and batteries for electric vehicles (EV). It revisits the composition of their supply chains by focusing in particular on the identification of NTMs, applied to inputs such as critical raw materials that are crucial for the production of EGs.

2. Discussions around a taxonomy of environmental goods

To conduct a thorough analysis of EGs, it is crucial to initially comprehend the specific goods under consideration, their definition, and the approaches that delineate their scope. Yet, defining EGs has proven to be a challenging task. This is mainly due to the complexity of defining the *environmentally friendly* function of a specific good along its lifecycle: from production, use and end of life stages.

The definition of OECD and Eurostat (1999[19]), adopted mainly for analytical and statistical purposes, has found a broad consensus, however it has not resulted in lists of EGs that could be used for trade negotiations. This definition considers EGs as goods used "to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems". Such definition together with the list of EGs compiled following it, have served as basis for negotiation rounds mainly focused on tariff reductions. Although negotiations since the launch of the WTO Doha Round did not produce results (Section 2.1), the questions of trade liberalisation of EGs and its significance on tackling climate change has regained momentum through the Trade and Environmental Sustainability Structured Discussions (TESSD), where trade in environmental goods and services is one of the four main thematical work areas.[8]

This section reviews existing EGs classifications with the aim of identifying pertinent criteria that could both serve as a basis for a conceptual definition of EGs and inform practical approaches towards their identification. It explores the landscape of definitions and classifications/lists by elaborating on the differences and similarities in their coverage and purpose, so as to highlight and raise *awareness* regarding the strengths and weaknesses

[7] Other work underway in the Environment Directorate focuses on environmental policies affecting EGs, and possible synergies with trade policies. See Yamaguchi and van der Ven (2025, forthcoming[17]).

[8] See WT/MIN(21)/6/Rev.2.

of those approaches and guide ongoing and future discussions on the liberalisation of trade in EGs.

2.1. EGs lists and negotiating rounds for trade liberalisation

Amongst the pioneers in defining and classifying EGs in the late 1990s, the OECD developed an illustrative list of environmental goods, mainly compiled for statistical purposes, based on the OECD/Eurostat classification system.[9] To complement this work, an illustrative list of environmentally preferable products (EPP) was elaborated, "*to extend the coverage to the entire life cycle of a product, including production, processing, consumption and disposal*" (Tothova, 2005[20]).[10] OECD have since focused on identifying EGs that would have a direct impact on tackling climate change.[11]

Several rounds of negotiations on EG trade liberalisation have taken place, starting with the Fourth WTO Ministerial Conference (MC4) in Doha, Qatar, in November 2001.[12] Members rapidly found it difficult to make progress as there was no consensus on the approach for determining the scope of EGs for the purposes of tariff liberalisation (e.g. project, request and offer, list, or a combined approach). Designed primarily for commercial purposes, the list-based approach was unable to accommodate the interests of all members.

A coalition of 14 countries committed in 2014 to start negotiations with a view to concluding an Environmental Goods Agreement (EGA) in the form of a "critical mass" WTO plurilateral. The EGA initiative was meant to build on the list of environmental goods that APEC members endorsed in 2012, with an agreement to reduce applied tariff rates to 5% or less by the end of 2015.[13] Ultimately, EGA negotiations collapsed in December 2016, revealing a general lack of consensus on the products to cover in an EGs list.[14]

At present, EGs are once again under consideration. Within the framework of TESSD, a group of 74 WTO Members have agreed to advance discussions on a number of priority

[9] Based on the agreed definition (OECD and Eurostat, 1999[19]), a classification system consisting of three main categories (A. Pollution Management, B. Cleaner Technologies and Products, and C. Resource Management Group) and a total of eighteen sub-categories was established for the purposes of identifying relevant HS commodity codes.

[10] The list builds on the 1995 UNCTAD definition, interpreted broadly, and expands the original UNCTAD list by including environmentally preferable products (EPPs) based on: "i) the function the product performs by design or function (for example, soda or soap); ii) its own environmental impact using life cycle analysis (for example, bicycles as a form of transport; or iii) the environmental impact of other goods which the product could improve ".

[11] Examples include the OECD indicative list of climate-change-relevant goods for a plurilateral environmental goods and services agreement (PEGS) and the CLEG list, which combines the PEGS list with the Friends of EGs list and the APEC list (Sauvage, 2014[41]).

[12] The Doha negotiations on environmental goods were originally assigned to the negotiating group on Non-Agricultural Market Access (NAMA), although the definitional aspects were discussed within the special sessions of the Committee on Trade and Environment (CTESS).

[13] APEC had developed a product-specific list of environmental goods in the context of its Early Voluntary Sectoral Liberalization (EVSL) initiative and its later Accelerated Tariff Liberalization initiative (Steenblik, 2005[22]). See ANNEX C - APEC List of Environmental Goods | 2012 Leaders' Declaration | APEC.

[14] It is important to note that the EGA negotiations mainly involved OECD Members, with the notable exceptions of China and Costa Rica, an OECD Member since 2021.

areas of common interest, including on "*promoting and facilitating access to environmental goods and services, including encouraging the global uptake of new and emerging low-emissions and other climate-friendly technologies*" (WTO, 2021a[21]).

Several bilateral and multilateral negotiations in recent years have also focused on liberalising trade in EGs. These include the EU-New Zealand trade agreement which aims at removing tariffs on green goods as well as liberalising green services. The UK-New Zealand agreement encourages trade and investment in low carbon goods, services and technology, including a comprehensive list of EGs for which tariffs are liberalised. The Green Economy Agreement (GEA) between Australia and Singapore aims to promote trade in environmental goods and services (EGS), accelerating both countries' transition towards a green and sustainable future and driving green economy co-operation regionally and globally.[15]

On 15 November 2024, New Zealand with Costa Rica, Fiji, Iceland, Norway and Switzerland concluded the Agreement on Climate Change, Trade and Sustainability (ACCTS)[16]. The agreement aims to achieve environmental policy objectives through legally binding trade rules. The parties have committed to eliminating import and export duties on 360 EGs in order to foster a low-emission, climate-resilient, circular, and sustainable economy. The listed EGs serve a range of environmental purposes, including resource management, climate change adaptation and mitigation, and environmental protection, including pollution prevention and control. The list may be reviewed regularly.[17]

The history of negotiations within the WTO indicates that in the absence of a universally agreed-upon definition of EGs, the likelihood of advancing discussions on ways to enhance and facilitate access to these goods is limited (de Melo and Solleder, 2019[15]). Hence, the discussion of some formal eligibility criteria for the selection of EGs remains a crucial issue, as explored below.

2.2. Criteria for defining EGs

Several reasons explain the lack of consensus on the classification of EGs. First, most of the proposed lists to date have been broad -and often were not destined to advance a specific policy agenda- while also non-exhaustive (Steenblik, 2005[22]). Second, in the context of negotiations on a possible agreement on trade liberalisation of EGs, the proposed lists were arguably shaped by product-specification nominations put forward by a minority of high-income economies that reflected their own commercial considerations.[18]

[15] Through the trade and investment area of cooperation the two countries seek to identify a comprehensive list of EGS to support the transition to sustainable economic growth and facilitate trade and investment flows; continue addressing tariff and non-tariff barriers where they exist, facilitate and promote trade and investment, and align and co-operate on appropriate standards, technical regulations and conformity assessment procedures.

[16] Check Agreement on Climate Change, Trade and Sustainability (ACCTS) Overview | New Zealand Ministry of Foreign Affairs and Trade for more information.

[17] The agreement goes beyond the removal of tariffs on EGs and makes new commitments on environmental services – it also aims at establishing concrete commitments to eliminate fossil fuel subsidies and develop voluntary guidelines for eco-labelling programs and mechanisms.

[18] In this respect, participating countries have tended to systematically exclude from their lists products having high tariffs, thereby reducing the potential environmental benefits arising from tariff liberalisation (de Melo and Solleder, 2019[15]).

Independently of whether a set of formal criteria for selecting EGs is explicitly spelled out in a working definition and then translated into a classification system and a list of associated HS codes, or if the list is formed via product-specific nominations, the identification of EGs depends on the underlying assumptions as to which factors should be considered suitable to grant the "environmental" label. Certain products might be deemed "environmentally beneficial" due to their relative performance rather than their absolute attributes. Others may have a dual use which does not allow them to be classified as environmental along their whole life cycle. Such considerations and the feasibility from an operational point of view of identifying these environmental characteristics at the border is discussed in the context of this study.

2.2.1. End-use factors

What characteristics designate a product as environmentally friendly? A basic approach would be to select goods that directly contribute to environmental protection; that is, goods whic, in their end-use serve environmental purposes (even if they do not exhibit inherently environmental characteristics). An example would be solar panels which convert sunlight into electricity (Section 5). End-use based lists may also differ depending on whether they reflect a narrow conception of EGs as covering only established environmental technologies (e.g. in the case of the APEC list) or more ambitious efforts meant to accommodate for technological change by including "cleaner technologies" (e.g. in the case of the OECD lists). This can affect the extent to which a product will be considered environmentally friendly, as the environmental characteristics of a product can differ at various stages of its life cycle.

For example, the limitations inherent in end-use approaches is that products are rarely solely used for environmental purposes at HS 6-digit level. Most often HS subheadings include both environmental and non-environmental products and products with dual or multiple uses. From an analytical perspective, this means that statistics on the volume and composition of trade in environmental goods that refer to HS 6-digit subheadings are at best imprecise and generally risk being overestimated (Vossenaar, 2014[23]). From a trade facilitation perspective, the lack of specificity in HS subheadings makes it difficult to expedite the movement of products used for environmental protection so as to enhance the benefits linked to tariff liberalisation for those goods. Excluding dual or multiple use goods outright -including because they cannot be precisely identified at the border- would in fact exclude the lion's share of potentially eligible products (Kim, 2007[24]).

An option for solving the issue of dual or multiple uses is through "ex-outs", that is, specific product descriptions that identify environmental applications within HS 6-digit subheadings.[19] Such an approach has recently been adopted by the EGs list of ACCTS, which gives detailed descriptions of products that reflect a more direct environmental purpose compared to the characteristics included in the HS 6-digit level heading.[20] Given the dual-use nature of some EGs, ACCTS Article 2.3 states that the list of EGs contained in its Annex II (List of Environmental Goods) is "not intended to include goods which

[19] This includes goods which are not separately identified at the 6-digit level of the HS system and that have to be identified in national tariff schedules at the 8- or 10-digit level.

[20] For instance, within the HS6 code 8402.11 that stands for Steam or other vapour generating boilers, Chemical recovery boilers are mentioned as an ex-out given that black liquor, a by-product of the pulping process in paper production, is used to generate electricity, as well as retrieve chemicals used in the pulping process for reuse. They serve purposes of environmental protection (waste management), resource management and climate change adaptation and mitigation.

significantly harm any purpose referred to (…)".[21] Ex-outs can be operationalised more immediately by countries that establish additional sub-divisions in national customs nomenclatures (Kim, 2007[24]).[22] Another option would be to amend the HS in order to accommodate for ex-outs beyond the HS 6-digit level. This would be a longer-term solution to the extent that amendments of the HS are considered by the World Customs Organization's Council every five years, with implementation taking place from one to two years following notification to Members (Vaca Eyzaguirre and Deere Birkbeck, 2022[25]).

A practical solution combining the two options for the purposes of achieving a deal on EGs tariff liberalisation may consist of producing two-product lists, similar to the approach followed by the Information Technology Agreement (ITA): an A-list, which would comprise the HS subheadings or parts thereof covering environmental goods, and a B-list, which would list specific products for which HS codes do not (yet) exist but which the Parties agree to liberalize under an EGs deal regardless of where they might fit within existing HS codes (Steenblik, 2005[26]), (Howse and van Bork, 2006[27]). Other options put forward include designing a system for clearing products through customs differentiated by end-use, for example, via labels (see Yamaguchi and van der Ven (2025, forthcoming[17]) or other identifiers, matched with post-clearance audits; and the creation of new tariff lines for entire EG-relevant plants (e.g. pollution control equipment, geothermal power plants), accompanied by special customs clearance procedures so that the products thereof would benefit from tariff liberalisation despite being covered under separate general (i.e. not "environmental") HS subheadings.[23]

2.2.2. Lifecycle based factors

A complementary approach for defining and/or selecting environmental goods is to include so-called "environmentally preferable products" (EPPs).[24] EPPs are generally used in commercial and household applications (e.g. organic agriculture or energy efficient lighting) so they do not have an inherently environmental end-use. They are however preferable to other products in terms of use of natural resources and energy (e.g. use of

[21] For more details: https://www.mfat.govt.nz/assets/Trade-agreements/ACCTS/ACCTS-Chapter-2-Trade-in-Environmental-Goods.pdf

[22] The problem, however, is that national tariff lines (TLs) are not harmonized and may differ considerably per degree of differentiation and level of detail (Vossenaar, 2014[79]). An internationally agreed exercise building on the use of ex-outs should therefore seek harmonisation across EG-relevant TLs with a view to ensuring consistency of the product specifications and encoding of ex-outs (Kim, 2007).

[23] This is the case for food-processing plants (HS 8438.10 and 8438.20), brewery machinery (HS 8438.40), and floating or submersible drilling or production platforms (HS 8905.20) (Kim, 2007).

[24] As already mentioned above, UNCTAD first defined EPPs in 1995 as "*products which cause significantly less environmental harm at some stage of their life cycle (production, processing, consumption, and waste disposal) than alternative products that serve the same purposes, or products the production and sales of which contributes significantly to the preservation of the environment*" (UNCTAD, 1995[28]). Similar definitions come from the US Environmental Protection Agency (EPA), which states that "Environmentally preferable products are those that have a reduced impact on human health and the environment compared to other products that serve the same purpose."; and (OECD/IEA, 2006[90]) states that EPPs are "Products that are less harmful to the environment throughout their life cycle than comparable products."; while, for the European Commission , EPPs are "Products that have a lower environmental impact compared to other products with similar functions, throughout their life cycle." Check (Yamaguchi and van der Ven, 2025, forthcoming[17]) for more details on trade agreements covering environmentally preferable products.

renewable vs. non-renewable energy sources), amount of waste generated along the life cycle (e.g. lower emissions of CO2 and other GHGs), impact on human and animal health (e.g. absence of toxic residues), and the preservation of the environment (e.g. timber from sustainably managed forests) (UNCTAD, 1995[28]). Broadly defined, the concept of environmentally preferable products (EPPs) is significant and is considered an entry point in opening up liberalisation opportunities for products manufactured in developing countries, thus extending beyond high-tech products from advanced economies (ILA, 2018[29]). Furthermore, it may become increasingly relevant as the increase in initiatives having climate objectives, such as encouraging cleaner industrial production, may lead to more discussions on which products are environmentally preferable compared to more carbon intensive alternatives.[25]

While the EPP definition proposed by UNCTAD is broad enough to include products that generate environmental benefits at any stage of the life cycle, narrower approaches have broken it down with a view to distinguishing goods that are environmentally preferable compared to their substitutes in view of the reduced negative environmental impacts in end-use or disposal (Howse and van Bork, 2006[27]). Such narrower approaches tend to focus on those EPPs that have a high environmental performance or low environmental impact on the basis of objective and quantitative criteria, such as composition (e.g. components of renewable energy technologies) or environmental performance (e.g. energy consumption, efficiency, recyclability or biodegradability), while (more or less completely) leaving aside considerations linked to cleaner processes and production methods (PPMs). Despite proposals to further expand the UNCTAD list of EPPs (Tothova, 2005[20]), existing lists, mainly those used for negotiations, accommodate EPPs only in a limited manner, notably PPMs-based EPPs.[26] A discussion on PPMs showcasing the difficulty in their implementation is provided included in Yamaguchi and van der Ven (2025, forthcoming[17]).

The inclusion of EPPs in definitional and classification efforts at the international level has met with resistance due to a number of challenges. For end-use approaches, the inclusion of EPPs cannot be easily accommodated within the HS nomenclature due to the lack of specificity of 6-digit subheadings. Several additional challenges arise in cases where environmental preference depends on PPMs, particularly non-product-related PPMs (npr-PPMs), due to the uncertainties surrounding their status under WTO law (Moisé and Steenblik (2011[30]), Holzer (2014[31]), Cottier (2016[32]). While PPM-based differentiation is widespread in statistical exercises (e.g. national statistical nomenclature often distinguish organic products from agricultural products and in international accounting systems such as the System of Environmental Economic Accounting -SEEA-), countries have been hesitant to rely on such types of criteria (e.g. the carbon intensity of processed and production methods) for the purposes of identifying EGs eligible for tariff liberalisation in the context of WTO negotiations (Howse and van Bork, 2006[27]). Among other reasons, even if the HS nomenclature were adjusted to allow for differential tariff treatment for

[25] This is argued to be the case, for example, with the EU's Carbon Border Adjustment Mechanism (CBAM).

[26] This applies to both the lists elaborated at the international level and the lists of products submitted by individual WTO members within the Doha Round and the EGA negotiations. As to the former, the APEC list is generally geared towards established environmental technologies identifiable by end-use, with only one product (bamboo) formally covered under the EPPs category. The early OECD list of environmental goods does not explicitly provide for an EPP category but arguably accommodates for the inclusion of (product-related) PPMs to the extent that it envisages a "cleaner technologies" category within the scope of the 1999 definition ("…prevent, limit or minimise environmental damage") (Tothova, 2005[20]).

EPPs, it would remain problematic for customs officials to distinguish PPM-based EPPs from their non-environmentally preferable alternatives (Steenblik, 2005[22]). A question that arises is whether the increased use by some WTO Members of corporate accountability tools that aim to ensure sustainability throughout the supply chains[27] will change the position towards EPPs. While most of these tools are adopted as part of environmental or financial regulations, they are highly relevant for trade policy since they require information on npr-PPMS to be provided at the border (Jansen, 2024[33]). However, customs authorities cannot check compliance with most of these requirements just by physically inspecting the imported goods (Pauwelyn, 2024[34]).[28]

To the extent that accommodating for PPM-based EPPs would require adjusting the HS nomenclature, the solutions described above for end-use approaches (i.e. HS amendments and/or the creation of new national tariff lines (TLs) to be harmonized) are also applicable here. Latest updates of the HS nomenclature show increasing receptivity towards EPPs differentiation: for instance, in the HS-2017 amendments, several separate HS sub-headings were created with a view to distinguish products in terms of their energy performance (e.g. LED light bulbs/incandescent light bulbs; hybrid-electric/plug-in hybrid electric/all-electric vehicles) (de Melo and Solleder, 2019[15]). HS-2022 amendments, furthermore, include new classification for LEDs, non-modalized photovoltaic cells, and modular photovoltaic cells, and established subheadings for electric and hybrid vehicle tractors and trucks. Several recent proposals for further HS amendments reflect PPM-based EPPs differentiation, for instance in the plastics sector (Vaca Eyzaguirre and Deere Birkbeck, 2022[25]) or, more generally, in the case of environmental preference linked to non-product-related PPMs for climate change mitigation purposes (e.g. to allow for a different tariff treatment based on the carbon intensity of the electricity generation process) (Cottier, Nartova and Anirudh, 2014[35]); (Cottier, 2014[36]).

These proposals presume that, at least under certain conditions, npr-PPM-based differentiation may also be accommodated under WTO law (namely, in the context of the exceptions under Article XX GATT) (Regan, 2009[37]), (Cottier, 2016[32]). WTO compatibility issues may also become less of a problem if EGs were defined on the basis of international standards on environmental performance elaborated and implemented in accordance with WTO TBT rules and, where appropriate, mechanisms for certification and conformity assessment, such that every WTO Member can potentially benefit from the preferences (Howse and van Bork, 2006[27]). Countries may for instance agree to define EPPs by reference to an existing international standard that sets a threshold (rather than a measurement method) and even agree that product specifications will automatically reflect the standard's regular updates, thus addressing the problem of the rapid change of environmental technologies (Steenblik, 2005[22]).

Alternatively, countries may agree to accept references to national or regional standards, but this would require recognition of the certifying bodies on the basis of equivalence given the proliferation of both government-run and private standards for environmental sustainability purposes (Espa and Imeli, 2022[38]). In such a scenario, it also appears more likely that countries may have an interest in creating an institutional framework (e.g. a

[27] An example is accountability for greenhouse gas (GHG) emissions along supply chains where the Greenhouse Gas Protocol invites multinationals to report on their so-called Scope 3 emissions—i.e. emissions that occur upstream or downstream in their supply chains. For more information, see Corporate Value Chain (Scope 3) Standard | GHG Protocol.

[28] Sustainability requirements generally focus on the processes and production methods used abroad, rather than the physical attributes of the product.

review committee or an expert technical group) for the purposes of maintaining control over technicalities and keeping the classification up to date.

2.2.3. Building upon complementarities in EGs taxonomy approaches

Although they target different phases of a product's lifecycle and usage, both the life cycle and end-use approaches aim to minimise environmental impact or environmental degradation by reducing emissions and resource consumption. Ideally, a product that is environmentally friendly throughout its entire life cycle and with a clear environmental end-use would be the perfect candidate for inclusion in the category of environmental goods (EGs). However, few products currently classified as environmental fully meet all these criteria. There is, nevertheless, room for improvement through innovations in product design, materials, and manufacturing processes, which can reduce environmental impacts, enhance product efficiency, and further minimise their environmental footprint.

The identification strategy outlined above involves selecting goods that directly or indirectly contribute to environmental sustainability. This includes goods that, in their end-use, serve environmental purposes, even if they might not inherently possess environmental characteristics (e.g. wind turbines or solar panels). It also encompasses goods that are cleaner than their polluting alternatives in production (such as sisal or jute fibres) and products that generate less pollution through consumption (e.g. electric vehicles compared to fossil fuel-powered vehicles).

In both cases, the identification of any given product as an EG can be significantly impacted by policies that aim to reduce the environmental effects of given products. The potential approach to address this issue encompass the use of ex-outs to develop more precise product descriptions within HS subheadings. For instance, excluding dual-use products would leave out many potentially eligible goods, such as electric generators under HS-6 850164, that are utilised in wind turbines and other renewable energy sources, but which can also be employed in less environmentally friendly applications. Additionally, the production of electric generators itself generates emissions, which may vary depending on the energy used in different producing countries. The use of ex-outs in this case ould allow to target generators that meet environmental life cycle and end-use criteria.

According to the lifecycle approach, non-product-specific processes and production methods (PPMs) can also serve as tools to address environmental issues by identifying the methods and techniques used in the production of goods and services that could affect the environment. However, as previously discussed, while PPMs have gained importance as instruments for promoting sustainable development, their integration into trade policy may raise concerns (Conrad, 2011[39]).

Additionally, to better identify EGs but also to reflect the transition of many products to more sustainable versions, different tools are being developed at different levels: product, project, firm and country. To this end, environmental impact assessment methods such as measuring the carbon footprint at the product level could be helpful in shedding more light into the environmental impacts of similar products that are produced differently or affect the environment differently across their life cycle (Deconinck, Jansen and Barisone, 2023[40]). Product level identification would help identify EGs that respect conditions deemed environmentally-friendly based on their carbon footprint.[29] Moreover, reporting at

[29] Such footprints can differ from one production chain to the other and may be different depending on a country's production processes as well as environment and trade policies. The European Commission has also developed the Product Environmental Footprint (PEF) methodology to provide

the project level (i.e. following schemes such as carbon offset schemes, emission trading schemes, clean development mechanisms); firm level reporting of environmental impacts[30]; or country level reporting taking into account consumption-based emissions (i.e. associated emissions along value chains of finally consumed products), could also help in better identifying the environmental nature of given products.

A combination of different instruments can pave the way towards a better identification of EGs. Although there is no one-size-fits-all solution for identifying products with an exclusively environmental purpose, the process can be greatly accelerated through the combination of multiple approaches for identifying EGs. In particular, reinforced and more explicit environmental requirements thanks to the growth of sustainability initiatives at various levels will be key. In the meantime, a list of EGs that identifies products with either an environmental end-use or those that cause less harm than their more polluting alternatives can help countries advance their green transition through increased trade in such goods. To this end, this work proposes an updated list of EGs, including more specific and granular product categories beyond existing sub-headings, as revised by the latest World Customs Organization (WCO) HS classifications, as well as new products that are considered environmentally beneficial.

3. Updating the Combined List on Environmental Goods (CLEG)

Insights from previous attempts on definitional approaches set out the challenges and opportunities for identififying EGs. In this section, for analytical purposes, the broad scope of an existing EGs list by the OECD is used as a basis for reviewing what might be included in a new list, while aligning more closely with recent product classifications and technological developments in terms of environmental objectives of goods. However, this broad perspective on the potential of products to achieve environmental goals may also include products that, despite the positive environmental impact of their end use, contain components, like steel or iron, produced through carbon-intensive processes. To this end, more details on the possible environmental risks associated with some of these products are provided in Annex A and could be referred to in the context of ex-outs of the indicated EGs. It is important to note that this list may be subject to updates in the future in line with further technological and scientific developments.

Using recent and more granular product codes, this report builds on the existing OECD Combined List on Environmental Goods (CLEG) (Sauvage, 2014[41]) and updates it by taking into account the latest revisions of HS codes by the World Customs Organization (WCO), as well as additional goods intended for environmental purposes not previously included.

The CLEG list was defined on the basis of the HS6 2007 classification and constructed as a compilation of three different lists : the more than 150 goods relevant to climate change included in the OECD's 2010 indicative list for a plurilateral environmental goods and

a uniform approach to environmental impact claims in the European Union (EU) (European Commission, 2021b[88]).

[30] The new EU Corporate Sustainability Reporting Directive, which came into effect in January 2023, establishes more rigorous sustainability reporting requirements for large companies and publicly traded small- and medium-sized enterprises (SMEs).

services (PEGS) agreement; the 154 products proposed by the "Friends Group"[31] as a subset of the more than 400 products suggested by WTO Members for the trade and environment segment of the Doha negotiations in 2009[32]; and the 54 products of the APEC list. The compiled list, including a total of 248 products offers a detailed breakdown into non-exclusive categories of goods corresponding to various environmental mediums.[33] It was later updated by (Garsous, 2019[42]) at the 6-digit of the HS 2017 version.

Although a list building on and supplementing the CLEG might still appear of a wide scope and with broad categories of goods, generating dual-use concerns as previously discussed, it offers a possibility to retrieve EGs having a particular environmental purpose (i.e. belonging to a specific green medium) and conduct analysis to answer more specific research questions. For instance, if one is interested in goods related to clean and renewable energy (CRE), goods corresponding to the CRE medium could be singled out for analysis so as to identify those that have the most significant environmental impact.

This paper proposes two main amendments to the CLEG list: first, to establish some correspondence to the HS 2022 version. Where the correlation is 1:1, -i.e. codes that have not changed or are not split into several other subheadings- the CLEG list remains unchanged. For most *1:n* (one 2017 subheading split to numerous subheadings in the 2022 classification) and *n:n* (split and merge of several 2017 subheadings in the 2022 classification) the codes retained in the updated CLEG list follow the "retained code" rule of UN Comtrade, i.e. retaining the subheading that is identical between the 2017 and 2022 version and dropping the rest of the codes.[34] In the few cases where there is no identical code between HS 2017 and HS 2022 (37 products that are split into more granular decompositions of products)[35] a text search is undertaken, dropping products that do not seem to have an environmental purpose as well as cases of "Waste and Scrap" of specific EGs. In fact, as there is no information about how waste and scrap is treated in its end-of-life (e.g. whether the product is recycled and re-used holding the same characteristics)[36], they are not considered as part of EGs. In total, adjusting CLEG to the HS 2022 classification results in a 272 products list.

[31] The Friends List consists of 153 HS6 lines and was published in 2009 by a group of WTO Members called the "Friends of environmental goods". Countries that are included are Canada, the European Union, Japan, Korea, New Zealand, Norway, Switzerland, Chinese Taipei, and the United States.

[32] See the declaration at http://www.nerpor.pt/component/phocadownload/category/2-nerpor?download=17:friends-list-2009

[33] The environmental mediums are: APC = Air pollution control; CRE = Cleaner or more resource efficient technologies and products; EPP = Environmentally preferable products based on end use or disposal characteristics; HEM = Heat and energy management; MON = Environmental monitoring, analysis and assessment equipment; NRP = Natural resources protection; NVA = Noise and vibration abatement; REP =Renewable energy plant; SWM = Management of solid and hazardous waste and recycling systems; SWR = Clean up or remediation of soil and water; WAT = Waste water management and potable water treatment.

[34] See https://unstats.un.org/HS2022conversiontables.pdf The "retained code" rule is based on the general WCO praxis that maintains the existing code only if there has been no substantial change of scope.

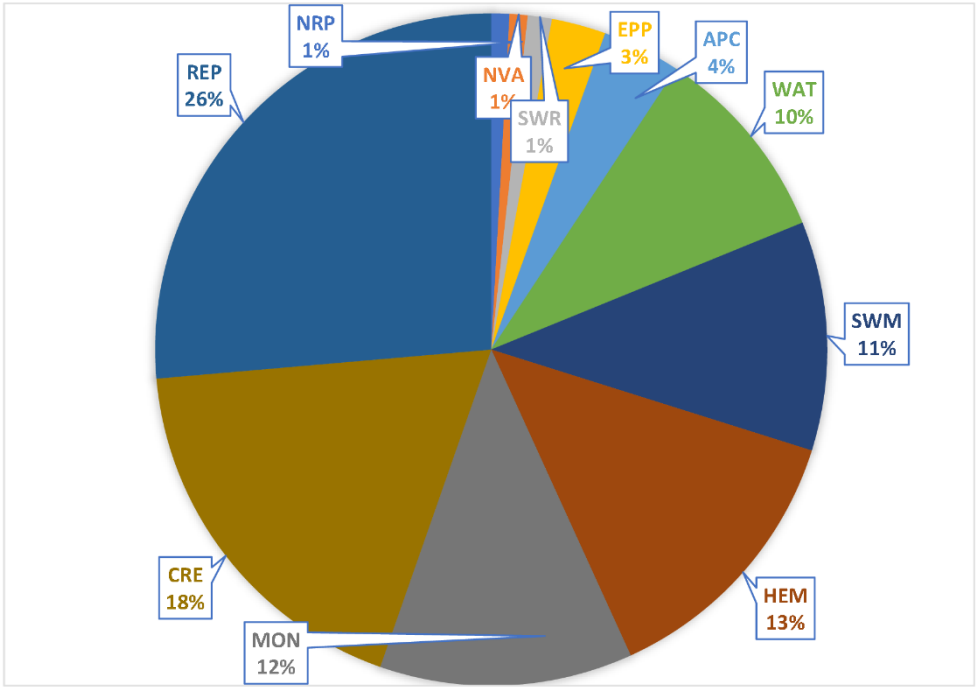
[35] For example, the HS code 2017 "701931" which corresponds to "Glass fibres; non-woven products, mats" is decomposed in three products in HS 2022, namely, "Glass fibres; (including glass wool), mechanically bonded mats" (HS6 701914); "Glass fibres; (including glass wool), threads and mats, other than mechanically or chemically bonded mats" (HS6 701919); "Glass fibres; (including glass wool), chemically bonded mats" (HS6 701915).

[36] In fact, difficulties in defining the products end-use – and thus related to issues of HS identification as well –set challenges for border clearance for these types of materials that could support circular economy. For instance, if properly identified, waste and scrap destined for certified environmentally sound waste management facilities could benefit from an accelerated procedure for cross-border movement as foreseen by the OECD Decision for shipments to pre-consented recovery facilities.

Second, to add *new products* drawing on, and cross-checking with, other proposed lists as well as documents that discuss new environmental products from the HS 2022 classification as in (Steenblik, 2020[43]). There are 73 more products that come from a combination of APEC's new list, WEF, UNEP, or in agreements such as that of EU-New Zealand, UK-New Zealand and Singapore-Australia.[37] In total, the resulting updated CLEG list contains 345 products.[38]

Figure 1 shows a decomposition of the updated list of EGs at the HS6 2022, per medium. Most of environmental goods belong in the renewable energy plant (REP) and cleaner or more resource efficient technologies and products (CRE) category.[39] Although EGs are classified by medium, based on the most obvious environmental purpose, many of these products could serve several environmental purposes and thus belong to more than one medium. As an illustration, "railway or tramway coaches" belong to the category *cleaner or more resource efficient technologies and products* (CRE). However, they could also serve as environmentally preferable alternative means of transport that help in trading goods in a way that causes less emissions.

Figure 1. Environmental goods per medium



[37] Among the newly included products, 14 goods come from the APEC list and did not belong to the initial CLEG (check APEC#221-CT-01.10). The other 23 additions are environmental goods that appear in at least two of the lists proposed by trade agreements.

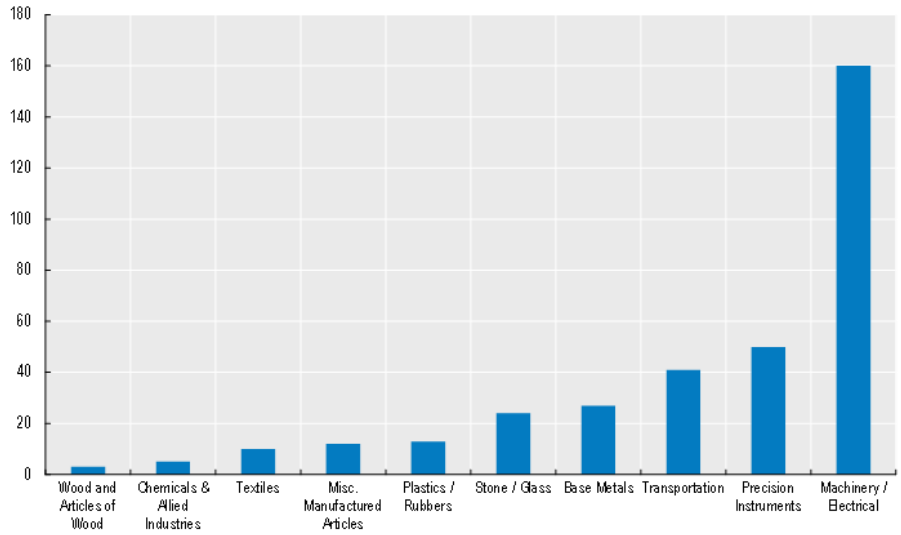
[38] See Annex A for a detailed description of CLEG products.

[39] Some examples for renewable energy plant (REP) products include turbines, heaters, heat pumps, electric generators. Some examples of products classified as cleaner or more resource efficient technologies and products (CRE) are hydrogen, ammonia, containers, engines, railway or tramway coaches, vehicles, public transport type.

Note: The environmental mediums are: APC = Air pollution control; CRE = Cleaner or more resource efficient technologies and products; EPP = Environmentally preferable products based on end use or disposal characteristics; HEM = Heat and energy management; MON = Environmental monitoring, analysis and assessment equipment; NRP = Natural resources protection; NVA = Noise and vibration abatement; REP =Renewable energy plant; SWM = Management of solid and hazardous waste and recycling systems; SWR = Clean up or remediation of soil and water; WAT = Waste water management and potable water treatment.
Source: OECD compilation.

A sectoral breakdown grouping 6-digit level products into the 21 sections of the HS shows that most of the environmental goods belong to the manufacturing sectors, with a few of them under wood or articles of wood (agriculture). Machinery, electrical equipment, precision instruments and transportation are the most present, followed by base metals, stone and glass (Figure 2).

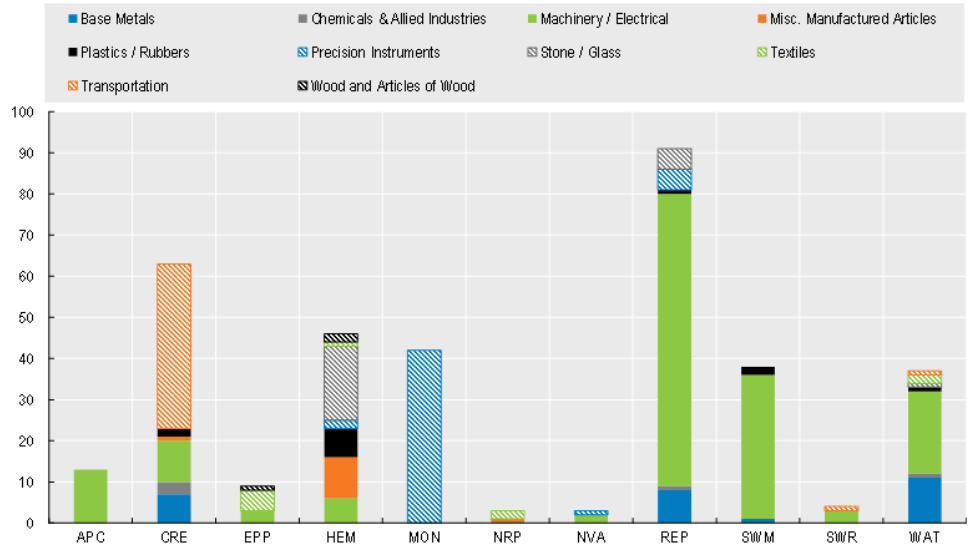
Figure 2. Sectoral classification of EGs



Note: Authors' computation based on sections of the 2-digit harmonized system classification.

This sectoral breakdown provides insights about the types of non-tariff measures expected to affect EGs: non-tariff measures like safeguards or sanitary and phytosanitary measures (SPS), which regulate mostly the agricultural sector, are expected to be less present for trade in EGs. Figure 3 provides an even finer decomposition of the EGs sectors, showing that transportation is highly present at the CRE group, while the machinery and electric equipment sector concerns mostly goods for renewable energy plants (REP) and management of solid and hazardous waste and recycling systems (SWM).

Figure 3. Sectoral classification of EGs, per medium

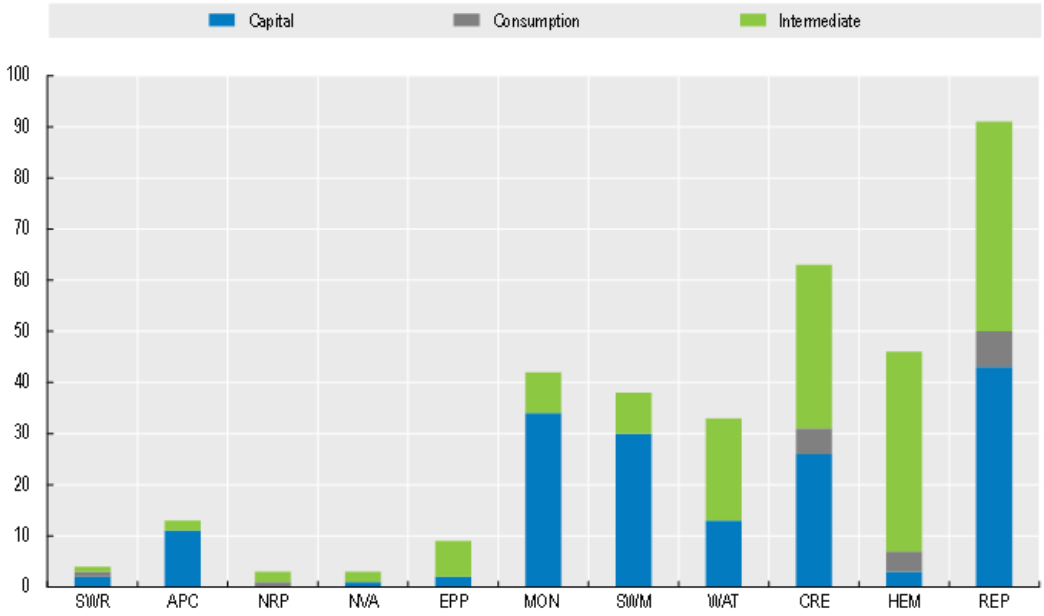


Note: Authors' computation based on sections of the 2-digit harmonized system classification. The environmental mediums are: APC = Air pollution control; CRE = Cleaner or more resource efficient technologies and products; EPP = Environmentally preferable products based on end use or disposal characteristics; HEM = Heat and energy management; MON = Environmental monitoring, analysis and assessment equipment; NRP = Natural resources protection; NVA = Noise and vibration abatement; REP =Renewable energy plant; SWM = Management of solid and hazardous waste and recycling systems; SWR = Clean up or remediation of soil and water; WAT = Waste water management and potable water treatment.

The Broad Economic Categories (BEC) classification[40] reveals that, within the production chain, most EGs are intermediate inputs (47%) and capital goods (48%), followed by final consumption products, which represent around 5% of EGs (Figure 4). This suggests that any restrictive measures on environmental goods would primarily pertain to the upstream or midstream segments of production chains.

[40] The Broad Economic Categories is a three-digit classification, which groups transportable goods according to their main end use. It is most often used for the general economic analysis of international merchandise trade data. The BEC system is defined in terms of the Standard International Trade Classification system.

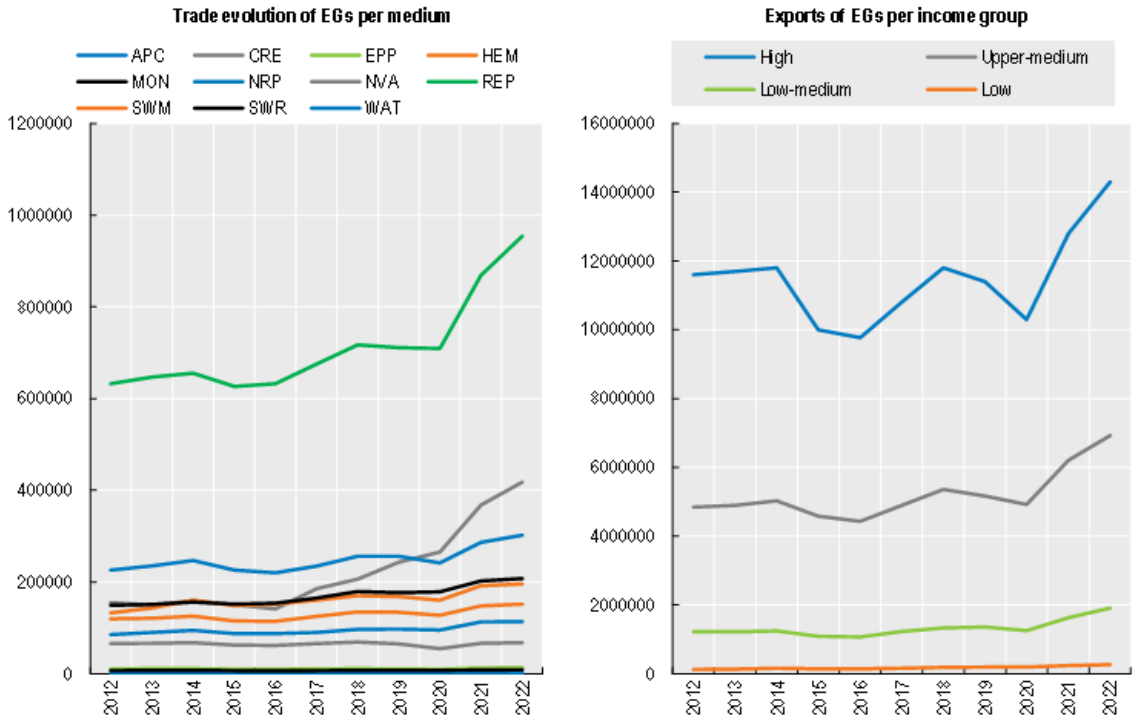
Figure 4. Environmental goods according to the BEC classification



Note: Authors' computation based on the BEC classification. The environmental mediums are: APC = Air pollution control; CRE = Cleaner or more resource efficient technologies and products; EPP = Environmentally preferable products based on end use or disposal characteristics; HEM = Heat and energy management; MON = Environmental monitoring, analysis and assessment equipment; NRP = Natural resources protection; NVA = Noise and vibration abatement; REP =Renewable energy plant; SWM = Management of solid and hazardous waste and recycling systems; SWR = Clean up or remediation of soil and water; WAT = Waste water management and potable water treatment.

When looking at the evolution of exports in EGs, renewable energy plants and cleaner and renewable products are the most exported. The most important exporters are high-income and medium-income countries (Figure 5).

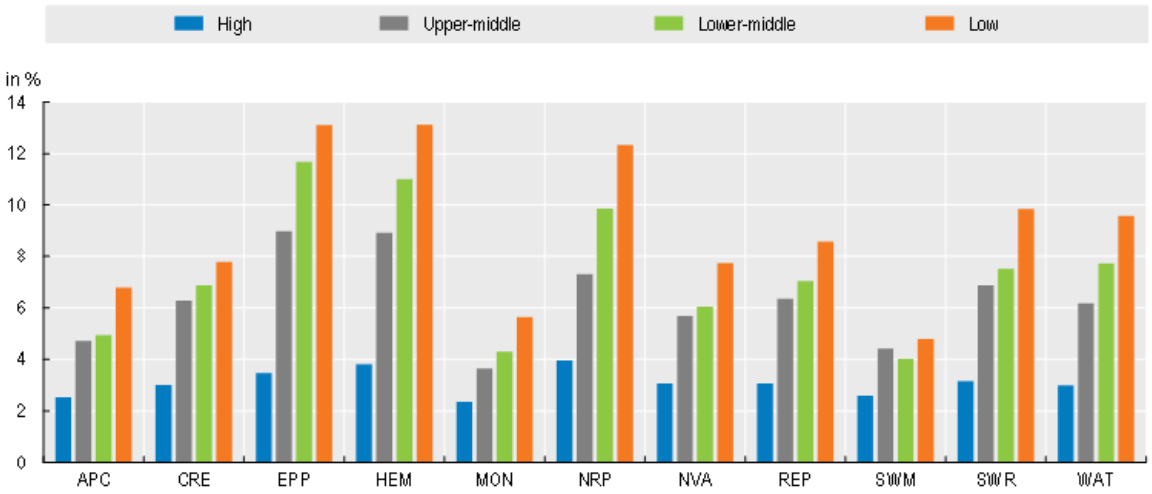
Figure 5. EGs exports per medium and income group



Note: Authors' elaboration based on World Bank country classification for income-groups. The environmental mediums are: APC = Air pollution control; CRE = Cleaner or more resource efficient technologies and products; EPP = Environmentally preferable products based on end use or disposal characteristics; HEM = Heat and energy management; MON = Environmental monitoring, analysis and assessment equipment; NRP = Natural resources protection; NVA = Noise and vibration abatement; REP =Renewable energy plant; SWM = Management of solid and hazardous waste and recycling systems; SWR = Clean up or remediation of soil and water; WAT = Waste water management and potable water treatment.
Source: BACI database, CEPII and CLEG.

Following several trade liberalisation rounds of negotiation and the increase in trade agreements over the years, tariffs have decreased substantially for all goods in general including EGs (WTO, 2022[1]). However, this trend appears to be predominantly observed in developed economies. Data using the Combined List on Environmental Goods (CLEG) indicates that there remains significant potential for further trade liberalisation of environmental goods in middle- and low-income countries (Figure 6). Therefore, while tariffs are generally low for environmental goods (EGs), there is scope for further tariff liberalisation, particularly in developing countries.

Figure 6. Tariffs on EGs per income group, 2019



Note: The environmental mediums are: APC = Air pollution control; technologies and products; EPP = Environmentally preferable products based on end use or disposal characteristics; HEM = Heat and energy management; MON = Environmental monitoring, analysis and assessment equipment; NRP = Natural resources protection; NVA = Noise and vibration abatement; REP =Renewable energy plant; SWM = Management of solid and hazardous waste and recycling systems; SWR = Clean up or remediation of soil and water; WAT = Waste water management and potable water treatment.
Source: Authors' elaboration using MAcMap database based on the CLEG list. Income groups are based on the World Bank classification.

4. Non-tariff measures affecting EGs

While further liberalisation of tariff measures by more countries is important, the successive tariff reductions among all products, including those classified in this study as environmental, have shifted trade liberalisation discussions towards trade measures that go *beyond* tariffs. Using the updated CLEG, this section offers an overview of non-tariff measures (NTMs) that affect those products, distinguishing amongst the different types of NTMs, including based on their potential intent.

4.1. Outline of the variety of NTMs

The use of NTMs has been increasing since the 1990s, both in terms of countries applying these measures, as well as in their variety (Nicita and Gourdon, 2013[44]). NTMs encompass "policy measures other than ordinary customs tariffs that can potentially have an economic effect on international trade in goods, changing quantities traded, or prices or both" (UNCTAD, 2019[45]). There are several challenges related to the identification and measuring of trade impacts of NTMs. The first is related to data availability. NTMs are currently collected through country surveys (e.g. UNCTAD database) or through notifications to the WTO (e.g. I-TIP). Given that notifications to the WTO rely mainly on transparency in administrative rules and processes, cross-country variation in publicly available statistical data may lead to selection bias. Similar challenges can be found in the UNCTAD database, where the country coverage between two waves of data collection differs leading to difficulties in tracking information over time. On this matter, Ing, Cadot and Walz (2017[46]) construct an index of transparency of NTMs based on different

sources[41] and find that that OECD countries are largely the most transparent, but also that ASEAN countries score well compared to other developing countries.

Secondly, given the diverse nature and the challenge of evaluating their restrictiveness, measuring NTMs and their effect on trade is a complex task. For example, requirements on marking, labelling and packaging, while adding to costs of production, typically exhibit non-discriminatory characteristics with low compliance costs, and thus have relatively less significant trade effects (Gourdon, 2014[47]). Conversely, measures such as quotas, voluntary export restraints, and non-automatic import authorizations often wield more substantial effects.

Moreover, NTMs may have a precautionary or a protectionist intent. NTMs with a protectionist intent are referred to as non-tariff barriers (NTBs) and include contingent trade-protection measures (i.e. measures implemented to counteract particular adverse effects of imports in the market of the importing country), local content requirements, as well as some at-the-border measures (e.g. quotas or import prohibitions) (Ederington and Ruta, 2016[48]), (de Melo and Solleder, 2020[4]) that result in a trade distorting effect.[42] Precautionary NTMs, as defined by (Ederington and Ruta, 2016[48]), may include consumer, process, and product regulations, as they are more likely to have a precautionary (oftentimes implementing health standards) rather than protectionist intent. Such measures have also been argued to even potentially enable trade, by helping provide consumers with assurances regarding product quality or safety.

The literature groups quantitative restrictions, import licensing, customs procedures, export taxes or quotas as *discriminatory* when they only apply to either foreign or domestic goods and are referred to as customs regulation measures, or at-the-border measures (Ederington and Ruta, 2016[48]). Another category of NTMs consists of behind-the-border NTMs that include domestic legislation covering health, product, environmental or other types of standards, and domestic taxation. Such measures are non-discriminatory because they apply to production or consumption regardless of the product's origin or destination. That said, even such domestic measures can be discriminatory if designed in a way to favour domestic producers. For example, firms in an import-competing industry might pressure the government to impose more stringent regulations if these firms can comply with those regulations more easily than their foreign competitors.

This report focuses on NTMs that affect environmental goods, by identifying them based on their intent, irrespective of whether it is precautionary or protectionist. However, whether different forms of NTMs can be considered as NTBs can depend on how they are implemented or applied. Identical NTMs may have different effects depending on their implementation and enforcement.

This study aims at identifying the types of NTMs applied to EGs, and in particular to analyse their frequency (as revealed by the frequency index) and their trade coverage (identified by the coverage ratio). That is, the frequency index measures the *proportion of*

[41] The considered data sources are notifications to the WTO under the Agreements on Sanitary and Phytosanitary Measures and Technical Barriers to Trade, the existence of a trade portal giving ready access to trade-relevant regulations, the existence of NTM data collected under the MAST classification, and the results of a survey in the form of an experiment conducted between 2015 and 2016, consisting of sending a specific request for regulatory information, on behalf of a private company, to various national agencies including SPS/TBT enquiry points, and rating the quality of the response, when a response was received.

[42] That said, even though some custom measures can result in a trade-impeding effect, they may be applied for a legitimate policy reason and not necessarily with a trade distorting effect.

environmental goods (EGs) impacted by non-tariff measures (NTMs), while the coverage ratio reflects the *proportion of EGs imports* that are subject to at least one non-tariff measure (NTM). Furthermore, from a political economy perspective, the analysis aims at identifying those economies that most frequently apply NTMs, based on their level of development, and to better understand the categories of EGs affected by such measures.

4.2. Data sources for NTMs

Two main sources of data are used for conducting analysis on the prevalence of non-tariffs measures on environmental goods. The first one is the Trade Analysis and Information System (TRAINS) database from UNCTAD. To explore the evolution of such measures in time, we then complement the analysis with information from a second source of data, namely the Integrated Trade Intelligence Portal (I-TIP) available on the WTO website.[43]

4.2.1. TRAINS -UNCTAD

TRAINS covers 90% of trade and all large importers that serve as main destination markets for developing countries. TRAINS data on NTMs is collected by UNCTAD, based on the Multi-Agency Support Team (MAST) classification (UNCTAD, 2023[49]) and include import (technical and non-technical measures)[44] and export measures (see Table B.1 of the Appendix). Such information is often obtained from official national and international sources but could also come from more subjective sources such as specific surveys. For some countries, there is yearly data but for others there may be just one or two data points over time. Information on NTMs may be reported for an entire HS6 subheading or partially cover specific HS8 lines within an HS6 category. It can also be horizontal, covering all products, or narrowly cover only some HS6 codes.

For this analysis, horizontal measures as well as those measures that do not have a full coverage of the product at the HS6 level (UNCTAD, 2023[50]) are excluded, so as to ensure that relative changes in NTMs presence in both the frequency and coverage ratio are captured.[45] Partial coverage measures are excluded to avoid overestimating results where only a small sub-heading of the product is affected. As the data collection is not undertaken on a regular basis (i.e. not all countries are surveyed in the same years), we were not able to track the evolution of the measures in time for the same countries and thus conduct quantitative analysis. Data from 2020 was selected as it is the most recent and comprehensive. For reporting countries missing 2020 data, data from the year before or after was used on the assumption that the legislation did not change. Lastly, TRAINS does not provide information on all chapters noted in Annex Table B.1. For instance, subsidies

[43] Such database is also provided in a panel format for the period (1995-2022) by Ghodsi, Gruebler and Stehrer (2016[51]) from the Vienna Institute on International studies (WIIW).

[44] Technical import measures are generally not discriminatory, as they usually apply equally to domestic and imported goods and are often motivated by safety, health, national security, and other domestic policy concerns. However, technical measures can also hinder trade due to asymmetric information, difficulty to comply with requirements, or lack of harmonization. Non-technical measures include traditional trade policies such as quotas, subsidies, and trade remedies (e.g. measures to address unfairly traded goods).

[45] Following TRAINS guidelines, excluding horizontal measures from the statistical analysis is crucial because their inclusion would result in both the frequency index and coverage ratio being equal to 1. This situation could obscure a country's regulatory pattern, as these indices would not capture the diversity of NTMs beyond a limited number of horizontal ones, frequently administrative in nature. The exclusion of such measures enables a more nuanced analysis of the broader regulatory landscape.

(chapter L) are not included in the present analysis (they are, however, covered in other OECD work).[46]

4.2.2. WTO – TIP

The second source of data draws information on NTMs notified to the WTO via the Integrated Trade Intelligence Portal (I-TIP). The notifications in the I-TIP cover anti-dumping (ADP), countervailing (CV), quantitative restrictions (QR), safeguards (SG), sanitary and phytosanitary (SPS), special safeguards (SSG), technical barriers to trade (TBT), tariff-rate quotas (TRQ), export subsidies (XS). Sanitary and phytosanitary (SPS) measures and technical barriers to trade (TBTs) constitute the most prominent NTM notifications to the WTO –an NTM coverage that is expected to be similar for *environmental goods trade*.[47] All information available through I-TIP refers to WTO members' notifications to the WTO.[48] WTO Members must adhere to various notification requirements for trade-related measures under the GATT, TBT, and SPS agreements (direct notifications). As a result, the availability of information for a given WTO Member depends on its level of compliance with the WTO's notification obligations. Additionally, governments can raise in relevant WTO bodies specific trade concerns (STCs) regarding TBT and SPS measures implemented by other WTO Members. This, in turn, could indicate the presence of a discriminatory measure. Notifications are provided as a flow (including new notifications) and stock (the accumulated notifications that are still in force).

Two key points regarding notifications data are worth noting. First, there may be a double counting issue specific to agreements such as those on subsidies or import-licensing as Members notify their subsidy programmes every two years, and the same subsidy programme might be notified in multiple years. In most cases, measures notified at different times have been mapped as a single measure to avoid duplication. However, the situation is different for TBT and SPS notifications. A TBT or SPS measure is notified only once (generally before adoption/entry into force) and in some cases there could be revisions to the notification, but cases of double counting should be rare. Second, some measures may be reported under multiple policy areas. For example, an SPS measure could also be notified as a QR. While such cases occur occasionally, they are monitored and controlled.[49]

4.3. Analysing NTMs on EGs through WTO notifications

To conduct quantitative analysis, the updated CLEG list is concorded to the corresponding classifications of the NTMs databases. Data from I-TIP WTO allow for the review of time variations of NTMs notifications to the WTO that are applied to EGs. Similar to the increase of NTMs for trade in all goods (Nicita and Gourdon, 2013[44]), NTMs targeting EGs have been on the rise (Figure 7). During the period 1995-2022 the number of NTMs increased, particularly as regards TBTs. The number of SPS and quantitative measures also increased.[50] In the cumulative stock of notifications per medium since 1995, renewable energy plants (REP) and cleaner and renewable energy (CRE) have been most frequently

[46] See Subsidies and government support | OECD for more details.

[47] See Notifications - ePing SPS&TBT platform for more details and https://data.wto.org.

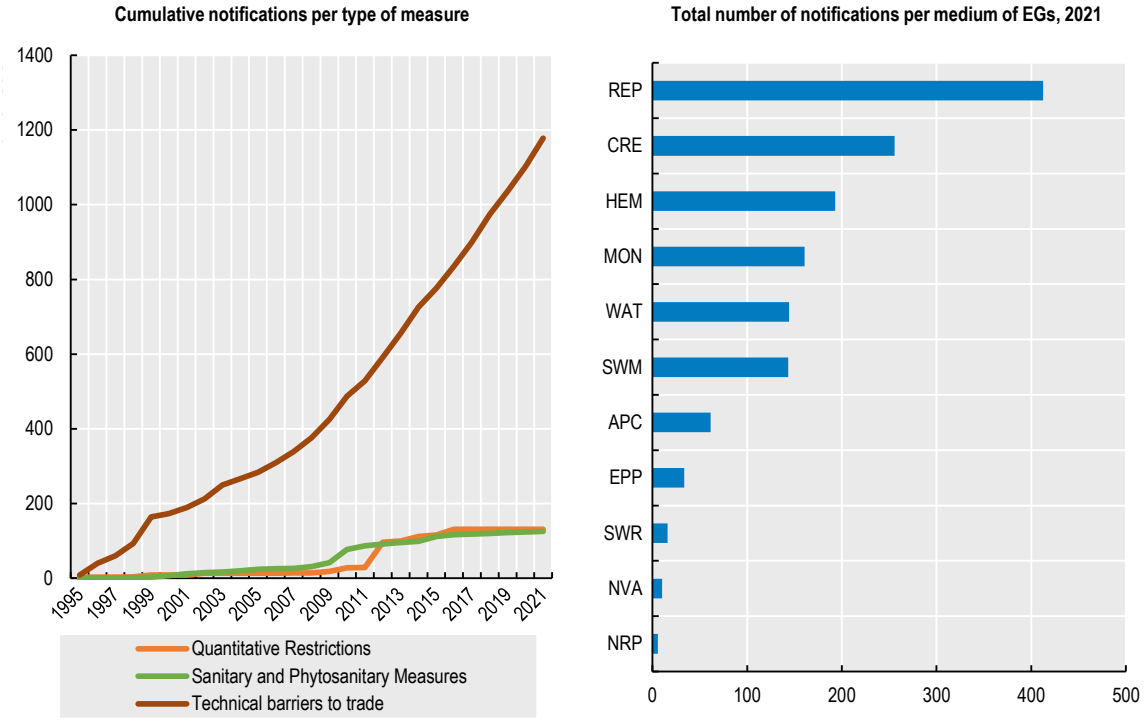
[48] See this link for reference: World Trade Organization - Integrated Trade Intelligence Portal - Home page

[49] With thanks to the WTO Secretariat, and in particular to Rainer Lanz and Dayong Yu for clarifying data caveats related to I-TIP and similarly WTO's Environmental Database (EDB) notifications.

[50] Apart from trade defence measures (such as anti-dumping and countervailing as well as safeguards, discussed further in the text), there were no notifications on other NTMs measures in WTO I-TIP for the list of EGs that we consider.

notified. Although TBTs are the most prevalent type of NTM, when examining the growth in the number of measures across different categories (as shown in Annex Figure B.1), quantitative restrictions and SPS measures have seen the largest increase compared to the base year 2005.

Figure 7. Evolution of the stock of unilateral NTM notifications, 1995-2021



Note: One data point corresponds to a triplet importer-product-year. Cumulative notifications are expressed per hundreds. On both panels there are as many notifications as there are importers implementing and products affected by those notifications. The European Union notifications as a bloc are considered as one data point. The environmental mediums are: APC = Air pollution control; technologies and products; EPP = Environmentally preferable products based on end use or disposal characteristics; HEM = Heat and energy management; MON = Environmental monitoring, analysis and assessment equipment; NRP = Natural resources protection; NVA = Noise and vibration abatement; REP =Renewable energy plant; SWM = Management of solid and hazardous waste and recycling systems; SWR = Clean up or remediation of soil and water; WAT = Waste water management and potable water treatment.
Source: Authors' elaboration using the Integrated Trade Intelligence Portal (I-TIP), WTO.

Focusing on Technical Barriers to Trade (TBT), which are the most prevalent non-tariff measures to environmental goods, WTO notifications show that between 1995 and 2022, Members adopting the most technical regulations and conformity assessment procedures measures were Israel, China, the United States, and Brazil (Annex Table B.3 ix). EGs which were most frequently regulated by TBT measures fall under the machinery/ electric and transportation sections. More specifically, products that were regulated the most by TBT measures are vehicles for transport of persons; discharge, (excluding ultra-violet), fluorescent and hot cathode lamps; electric filament lamps; and public transport type vehicles (Annex Table B.4).

It is important to note that notifications on NTMs are frequently applied at the HS4 and HS2 levels. As a result, these NTMs are not only applied to EGs within a specific HS group, but also to other polluting goods within the same HS section. It becomes difficult as a result

to determine whether EGs are more specifically affected by NTMs compared to their polluting counterparts. Additionally, the proliferation of regulatory measures can be indicative of consumer demand for safe and high-quality products, in addition to the growing problems related to environmental protection. For instance, notified technical regulations often intend to protect the environment and aim to ensure that more environmentally friendly products are traded (at the expense of trade in less environmentally friendly products).

In fact, most TBT measures actually specify requirements related to safety, conformity assessment procedures or regulation related to environmental standards such as fuel consumption. Some examples include regulations for mandatory fuel economy labelling schemes for all vehicles under a specific weight or requirements for vehicle manufacturers to perform greenhouse gas (GHG) testing on specific types of vehicles; requirements for manufacturers to make available to the service and repair industry information necessary to perform repair and maintenance service on On-Board Diagnostics systems and other emission related engine components (see Annex Table B.5 for more details).

NTMs may become non-tariff trade barriers if a technical regulation or conformity assessment procedure is applied more strictly than necessary, resulting in excessive costs and compliance burdens.[51] While technical barriers to trade do not necessarily hinder trade flows, and may not be implemented with a discriminatory intent, trade concerns raised at the WTO regarding TBT measures may help clarify the restrictive or *concerning* nature of some NTMs. Specific trade concerns (STCs) are raised by countries at the WTO SPS and TBT Committees, to seek clarification about measures put in place by other countries, or to signal that the draft or final measure may be considered more trade restrictive than necessary. However, not all STCs are associated with perceived trade restrictions; at times, countries may seek clarification on a measure adopted by a partner or remind a partner of missing notifications. Notifications at the WTO show that between 1995 and 2022, the highest number of STCs were raised on TBTs. Almost half of notified concerns (49%) apply to renewable energy plant (REP) and Environmental monitoring, analysis and assessment equipment (MON) products. Zooming in on trade concerns related to technical barriers to trade, the most notified environmental goods are centrifuges, fishhooks, heat pumps, air conditioning machines, and refrigerating or freezing equipment (Figure 8).[52]

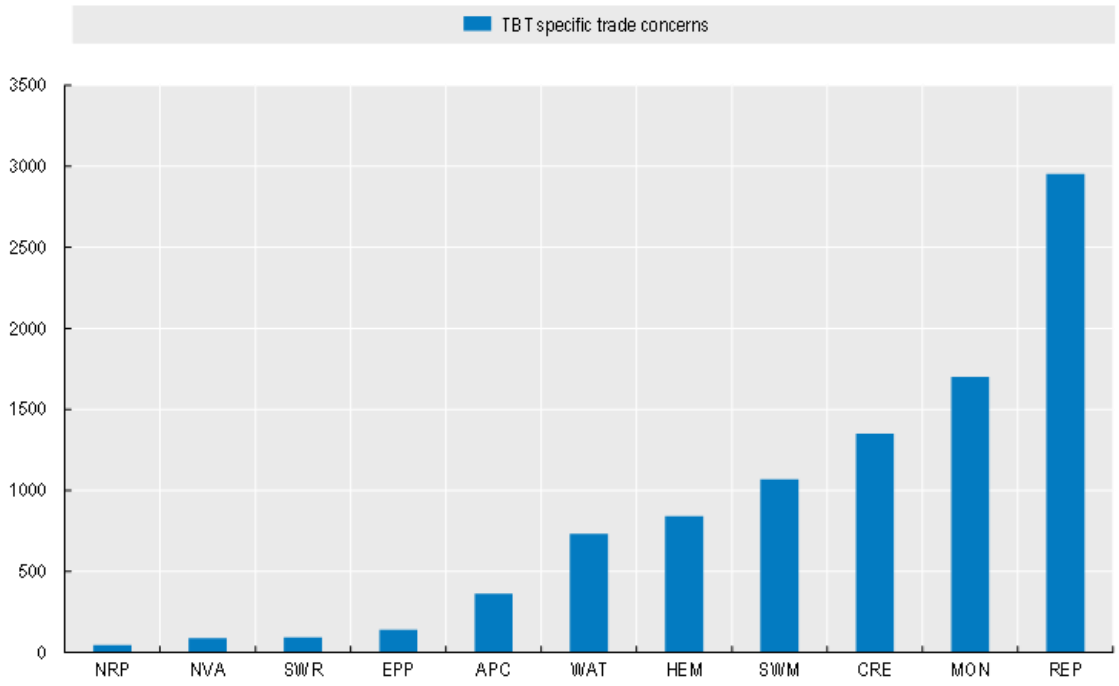
Although technical barriers to trade may set specific environmental requirements for trade partners, concerns may arise about their capacity to meet these standards or to have a clear understanding of the technical regulations. Additional concerns may be raised due to the lack of transparency in the technical regulations, the duplication of conformity assessment procedures, or the need for clarity and consistency to prevent conflicting information. While such concerns may in some cases be an impediment to trade, conclusions on the final

[51] Unnecessary obstacles to trade can result when (i) a regulation is more restrictive than necessary to achieve a given policy objective, or (ii) when it does not fulfil a legitimate objective. Article 2.2 of the TBT Agreement specifies that legitimate objectives include inter alia: national security requirements, prevention of deceptive practices, protection of human health or safety, protection of animal and plant life or health or the environment. See for more information: WTO | Technical barriers to trade - Technical Information

[52] Examples include *"(EU) draft Regulation (on) minimum energy performance, maximum sound power level and information requirements for air conditioners (…)"; or* "*US Department of Energy (DOE) measures to promote energy efficiency of appliances, lighting and other consumer products (…)".* More details on the notifications are provided in Annex Table B.6.

effect this has on trade flows can be ambiguous.[53] Additionally, specific trade concerns are often raised on NTMs that apply to product groups defined at the HS2 chapter level, encompassing not only environmental goods but also other similar products within the same sector classification. As a result some trade could be impeded within a sector, but it is not possible to draw conclusions at the level at which the NTM is implemented.[54]

Figure 8. Cumulative stock of TBT specific trade concerns notified at the WTO on EGs, 2021



Note: Authors' elaboration based on panel data from Ghodsi, Gruebler and Stehrer (2016[51]). It concerns STC still in force in 2021. When the STC are raised by the European Union, a measure appears as raised by one country. It encompasses the importer-exporter-product covered by the specific trade concern.
Source: Integrated Trade Intelligence Portal (I-TIP), WTO.

In addition to measures that could limit trade through TBTs, the notified actions under I-TIP include trade defence measures such as anti-dumping, countervailing actions and safeguards (i.e. which allow temporary restrictions on imports of a given product).[55] The cumulative number of measures up to 2021 reveals that anti-dumping and countervailing measures were increasingly applied to environmental goods (Figure 9). Although lower in relative terms, countervailing measures increased in particular after the 2009 COVID-19 crisis, probably in response to what were considered *unfair subsidies* by a trade partner.

[53] In particular, technical regulations that indicate meeting specific environmental requirements, may not only prevent trade in more polluting alternatives, but also impede trade in dual use environmental goods.

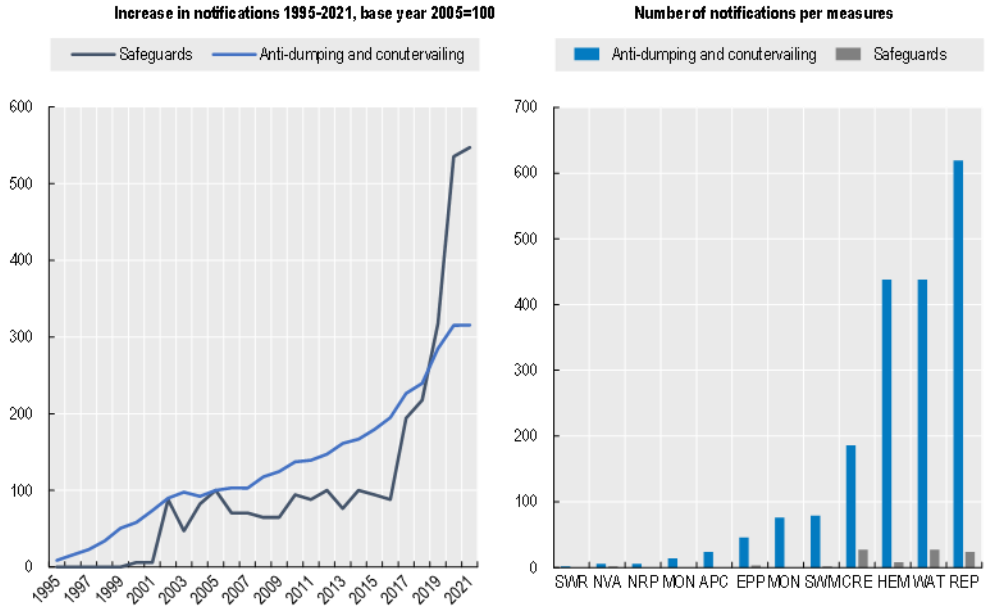
[54] This can also impact assessment of whether EGs are more affected by NTMs than other goods.

[55] Trade defence measures are defined as "*policies within the WTO framework preventing or correcting injury to domestic industry due to imports*".

The products most affected by anti-dumping and countervailing measures fall under the following categories: iron or non-alloy steel (excluding cast iron); seamless, cold-drawn or cold-rolled, tubes, pipes and hollow profiles of circular cross-section; Tubes, pipe and hollow profiles, iron; Structures and parts of structures; and among final products, solar panels. As demonstrated in OECD (2025[52]), countries have introduced a growing number of trade remedies, i.e. anti-dumping duties (ADD) and countervailing duties (CVD), on solar modules, wind turbines, and their components in response to concerns about subsidies and dumping practices. Most countervailing measures affect China, but also India and Mexico; anti-dumping measures on solar panels are also applied to Chinese Taipei, Viet Nam and United Arab Emirates in addition to China, coinciding with a proliferation in retaliatory trade remedies mostly by developed countries (OECD, 2015[53]).

Safeguard measures saw a significant increase in 2016, possibly in relation to measures undertaken by different economies in the steel sector, but also measures towards final products such as solar panels. Products most affected by safeguards are tubes, pipe and hollow profiles, iron or welded, DC motors, DC generators, and cooking appliances and plate warmers for gas fuel (mainly affected by the United States and Canada), or sacks and bags of jute (mainly affected by Peru and Ecuador).

Figure 9. Trade defence measures targeting EGs



Note: Authors' elaboration based on panel data provided from Ghodsi, Gruebler and Stehrer (2016[51]). The European Union appears as one country bloc. This is a cumulated stock of measures at the bilateral level from 1995-2021. It includes triplet's importer-exporter-product covered by the trade defence measure.
Source: Integrated Trade Intelligence Portal (I-TIP),WTO.

4.4. Analysing NTMs targeting EGs via the TRAINS database

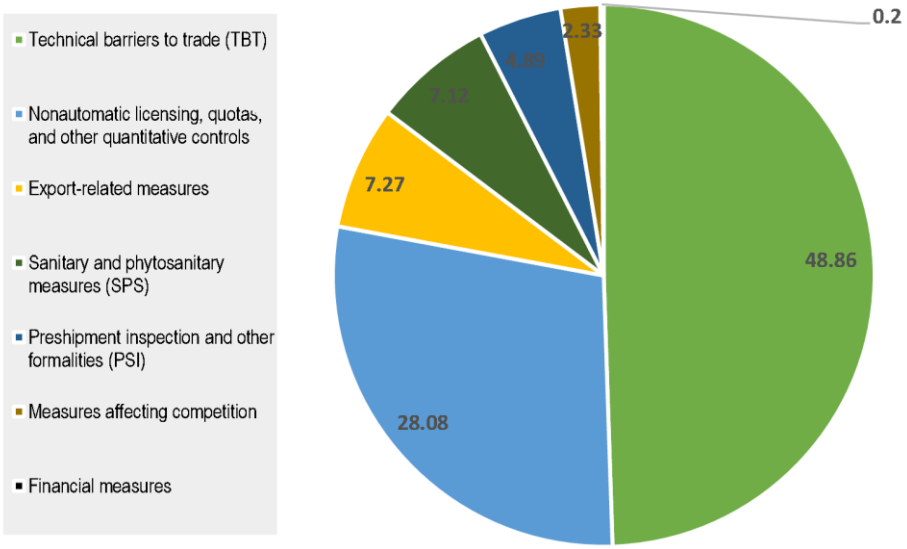
To ensure broader coverage and variety of NTMs, a second database, TRAINS-UNCTAD, is used. This data includes not only notifications of NTMs at the WTO, but also changes in legislation from country surveys. The latest year available with significant data collection is 2020, which is complemented in the present analysis by data from 2019 and 2021 using imputed values. The variety and complexity of non-tariff measures, and in particular the difficulty to keep track of them through available data, makes it challenging to understand

the exact number and incidence of specific measures on a given product. Different indicators such as the frequency index and coverage ratio have been developed to deal with this issue. This analysis uses frequency indices and coverage ratios using TRAINS. The frequency index is used to investigate the share of products affected by NTMs and the coverage ratio reveals the share of trade covered by at least one NTM among all traded EGs. While suffering from some weaknesses and limitations, these indices can help to understand the presence of NTMs on the trade in specific goods (Disdier and Fugazza, 2020[54]).

The TRAINS data confirms that, like other goods, environmental goods are mostly affected by TBTs (Figure 10). Using the MAST classification, data shows that EGs are also subject to measures related to non-automatic licensing, quotas, and other quantitative controls, SPS and export-related measures. Only a few are subject to pre-shipment inspection and other formalities, financial measures, or measures affecting competition.

Among applied TBTs (MAST chapter B), the most applied measures consist in requirements for authorisations, permits or approvals from a relevant government agency of the destination country (e.g. for reasons related to environmental protection) and certification requirements, including certification of conformity. Among export-related measures, most take the form of export price control measures, export quantitative restrictions n.e.s., and export prohibitions. Among quantitative measures, the most common are prohibitions for non-economic reasons, whereas pre-shipment inspections take the form of import monitoring and surveillance requirements and other automatic licensing measures. Finally, measures affecting competition include special rights and privileges of state-trading enterprises that affect the level or direction of imports for specific products.

Figure 10. Percentage of measures on EGs, per MAST chapter (2019-2021)

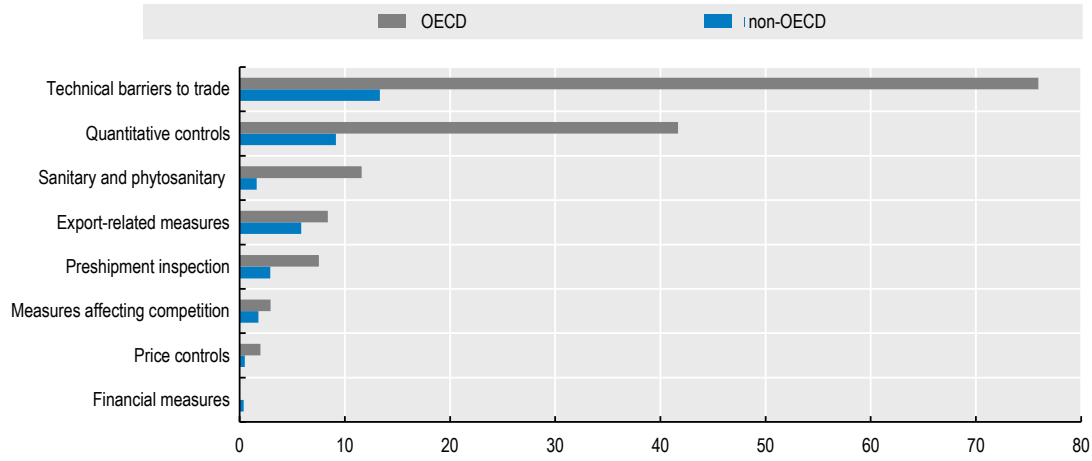


Note: Autors' elaboration by merging the updated CLEG list with TRAINS data.
Source: TRAINS, UNCTAD.

4.4.1. The extensive margin of NTMs revealed by the frequency index

The frequency index is computed as the share of EGs subject to at least one NTM, relative to all traded EGs.[56] Results show that amongst the various types of NTMs, technical barriers are the most pervasive, as most international trade is regulated by some form of technical barrier (Figure 11). Non-automatic licensing, quotas, and other quantitative controls cover a high number of EGs as well, followed by SPS and export measures.

Figure 11. Frequency index of EGs, per type of NTM (MAST chapters)



Note: Authors' computation based on UNCTAD compilation. Data missing for some reporting countries in 2020 is substituted by data collected in 2019 and 2021. Non-tariff measures based on MAST are as follows: technical barriers to trade (TBT), non-automatic licensing, quotas, and other quantitative controls (E), sanitary and phytosanitary measures (A), pre-shipment inspection and other formalities (C), price controls (F), financial measures (G).
Source: TRAINS, UNCTAD.

OECD countries target environmental goods through NTMs much more so than non-OECD countries. In fact, high income countries were the primary users of NTMs, for instance by requiring higher standards for both domestically-produced and imported products, with emerging countries following. It should, however, be noted that the database covers only 77 reporting economies, with low-income economies not highly represented (Figure 12).[57]

High and upper-middle income economies are those that impose most NTMs on their traded EGs. This evidence supports the conclusions of WTO (2012) regarding STCs (Ederington and Ruta, 2016[48]) and business survey results regarding NTMs targeting goods in general. One explanation is that more advanced economies have replaced reduced tariff barriers with stricter NTMs. Another reason is that the use of regulations for public

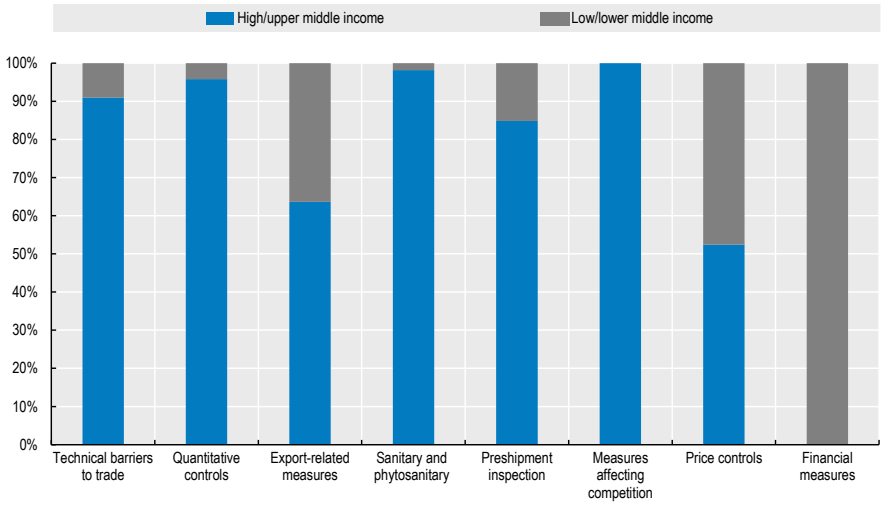
[56] $F_j = \frac{\sum_{i=1}^{77}\sum_{p=1}^{316} NTM_{ijp} D_{ijp}}{\sum_{i=1}^{77}\sum_{p=1}^{316} D_{ijp}} x100$ NTM_{ijp} is equal to 1 if there is an NTM applied by importing country j towards country i on the environmental good p. D_{ijp} is equal to 1 when there is trade between the i and j, for the environmental good p. It is important to mention that the frequency index sums over each partner i to account for the fact that some NTMs are bilateral, i.e. applied to some countries only (UNCTAD and The World Bank, 2018[14]). When calculating the frequency index for export measures (MAST chapter P), D_{ijp} takes exports instead of imports, and NTM_{ijp} denotes the presence of an export NTM in country j to country i.

[57] Check Annex Table B.7 on country coverage of TRAINS.

policy objectives is more closely tied to a country's level of development, rather than reflecting a straightforward policy replacement.

An exception to this includes financial measures and to some extent price controls. In the case of EGs, lower and low-middle income countries seem to be the main users of these measures. Financial measures are intended to regulate the access to and cost of foreign exchange for imports and define the terms of payment. Finance measures may increase import costs in the same manner as tariff measures. Some examples could be advance payment requirements, multiple exchange rates, or regulations on official foreign exchange allocation.

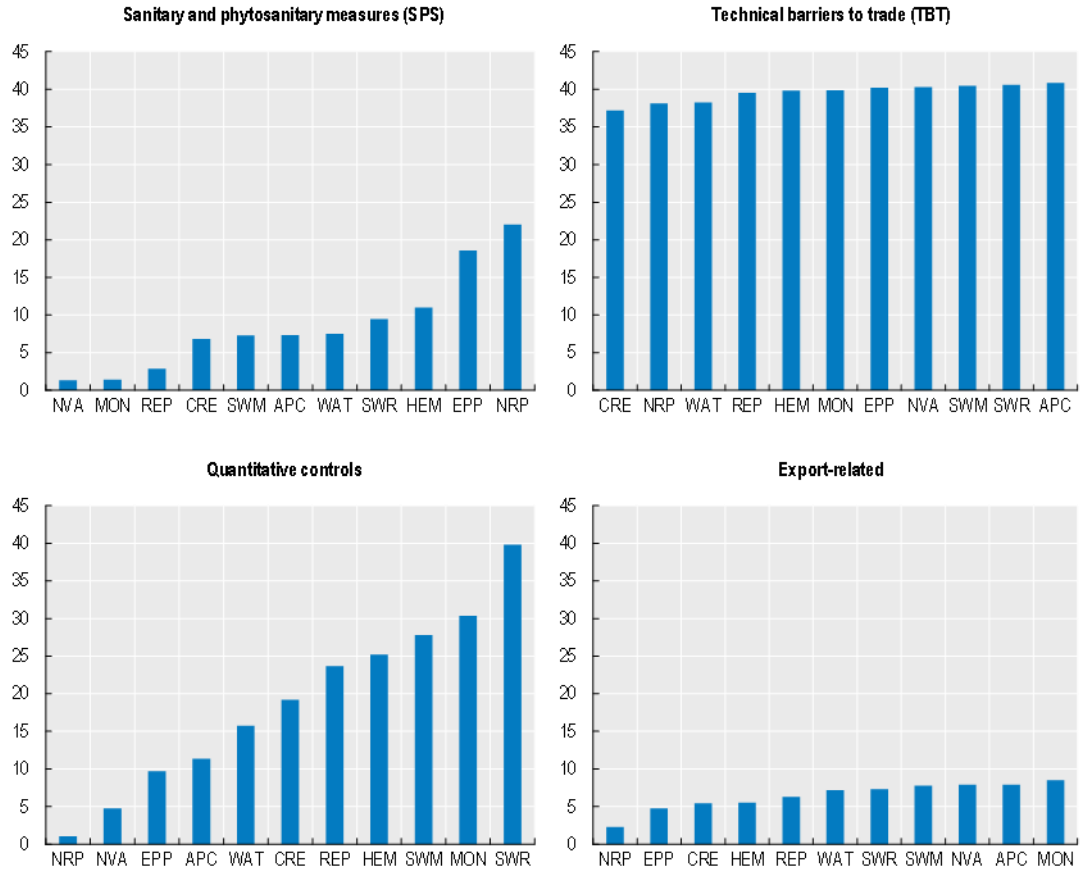
Figure 12. Percentage of traded EGs affected by at least one NTM, by country income group



Note: Authors' computation based on UNCTAD compilation. Data missing for some reporting countries in 2020, is substituted by data collected in 2019 and 2021.
Source: TRAINS, UNCTAD.

TBTs appear as the most prevalent NTM (Figure 13), mostly as they affect EGs used for air pollution control (APC), environmentally preferable products (EPP), and management of solid and hazardous waste and recycling systems (SWM). Export measures are applied mostly to products for air pollution control (APC), environmental monitoring, analysis, and assessment equipment (MON), and noise and vibration abatement (NVA). Quantitative measures target more categories: MON, SWR and SWM. As expected, SPS mostly target EPPs as this category often contains products belonging to the agricultural sectors and natural resources protection (NRP).

Figure 13. Frequency index for EGs, per medium and type of NTM



Note: The environmental mediums are: APC = Air pollution control; technologies and products; EPP = Environmentally preferable products based on end use or disposal characteristics; HEM = Heat and energy management; MON = Environmental monitoring, analysis and assessment equipment; NRP = Natural resources protection; NVA = Noise and vibration abatement; REP =Renewable energy plant; SWM = Management of solid and hazardous waste and recycling systems; SWR = Clean up or remediation of soil and water; WAT = Waste water management and potable water treatment.
Source: TRAINS, UNCTAD.

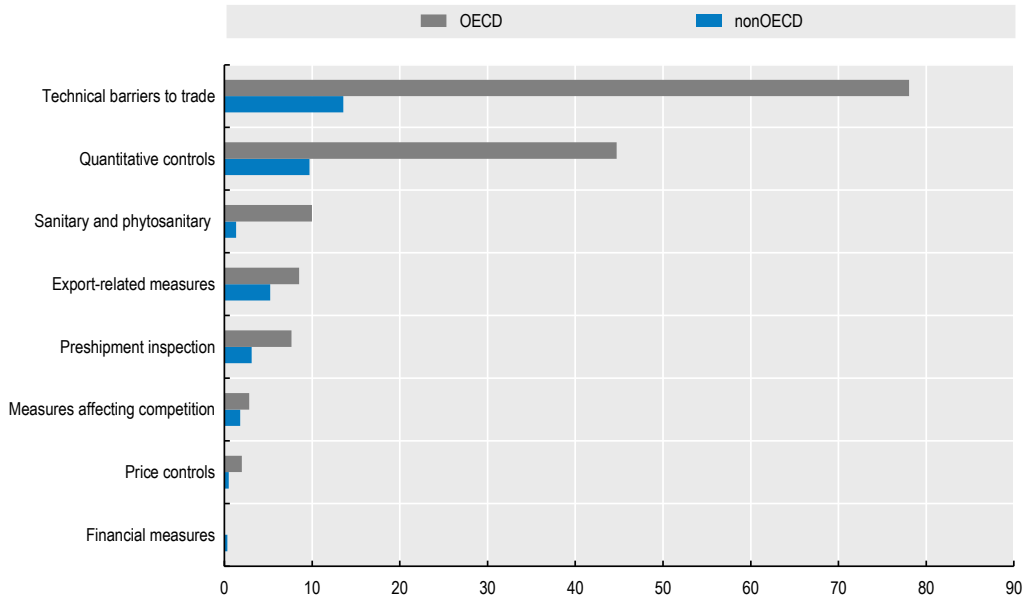
4.4.2. The intensive margin of NTMs revealed by the coverage ratio

While the frequency index provides insights into the share of products to which measures are applied, it is important to consider the share of trade that is subject to these measures. The coverage ratio captures the percentage of imports subject to at least one NTM.[58]

[58] $C_j = \frac{\sum_{j=1}^{77}\sum_{p=1}^{316} NTM_{ijp}V_{ijp}}{\sum_{j=1}^{77}\sum_{p=1}^{316} V_{ijp}} x100$ NTM_{ijp} is equal to 1 if there is an NTM applied by importing country *j* towards country *i* on the environmental good *p*. V_{ijp} is equal to the amount of trade between importer *j* and exporter *i* on the environmental good *p*. When calculating the coverage ratio for export measures (MAST chapter P), V_{ijp} takes exports instead of imports, and NTM_{ijp} denotes the presence of an export measure from country *j* towards country *i*. To account for the fact that trade values could be endogenous to measures in place and adjust for any year-specific fluctuations, export and import values are averaged in the period 2019-2021.

Results are similar to those of the frequency index, with some slight differences. Regarding specific NTM chapters, TBTs applied by OECD countries cover an important share of trade in environmental goods, followed by quantitative measures (Figure 14). SPS and export measures cover much less trade in EGs. It is mostly high income and upper-middle income countries that use NTMs, and more specifically through technical regulations and standards, on imports and exports, except for financial measures which are implemented and cover mostly imports from low-medium income countries. Figure 15 shows that TBT not only apply to most EGs, but they also cover nearly half of trade in environmental goods for high and upper-middle income countries. A similar trend is present for quantitative measures, where nearly 40% of trade from clean up or remediation of soil and water (SWR) is affected by at least one quantitative measure (Figure 16).

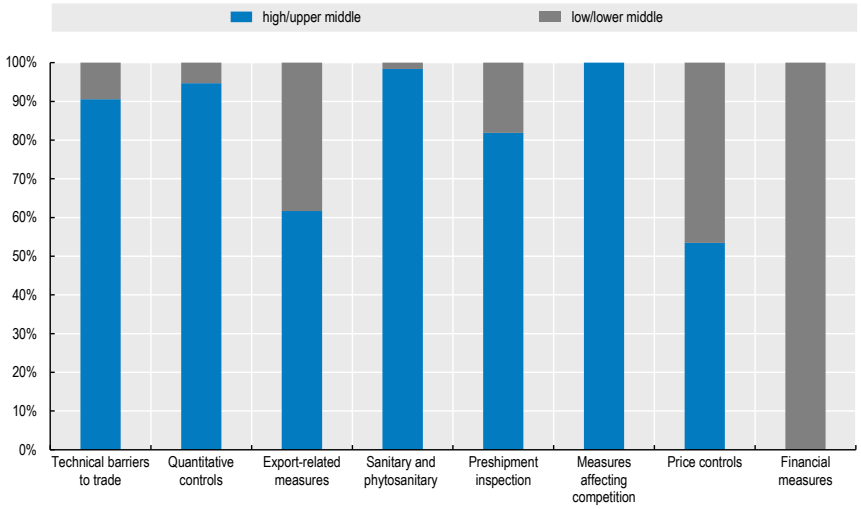
Figure 14. Coverage ratio, per MAST chapter



Source: TRAINS, UNCTAD.

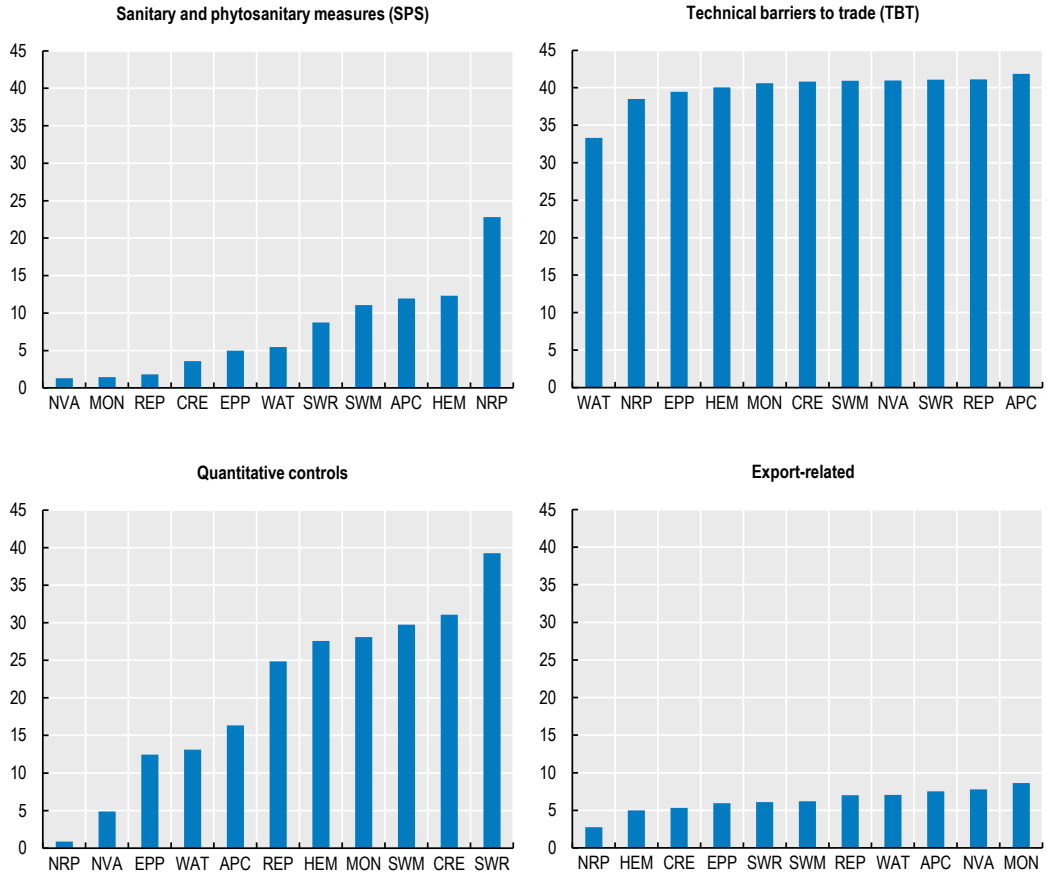
Finally, it is important to analyse with caution the *effect* that such NTMs could have on trade. While some NTMs can be unequivocally defined as non-tariff barriers (NTBs) (i.e. policy measures where the protectionist intent is clearly manifested such as quotas on imports), there are other measures that do not specifically discriminate against foreign producers to the advantage of domestic suppliers. The effect of these NTMs depends largely on how they are implemented or applied (De Melo and Nicita, 2018[55]). In fact, the general presumption in the TBT Agreement is that measures based on international standards are not likely to be NTBs except where they are more trade restrictive than necessary to achieve a legitimate objective or favour domestically produced products. In this context, the effect that NTMs have on trade can be context-specific and may depend on patterns such as specific trade relations between trading partners, as well as sectoral heterogeneity.

Figure 15. Percentage of trade in EGs affected by at least one NTM, per country group



Source: TRAINS, UNCTAD.

Figure 16. Coverage ratio of EGs, per medium and type of NTM

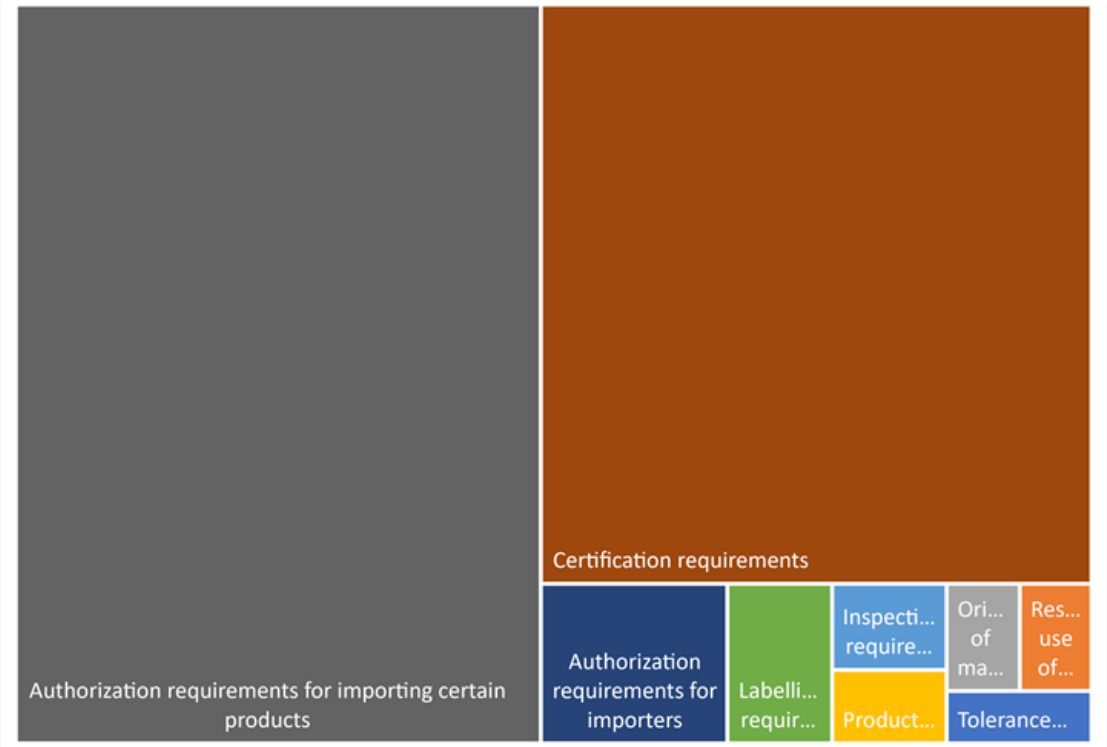


Note: The environmental mediums are: APC = Air pollution control; technologies and products; EPP = Environmentally preferable products based on end use or disposal characteristics; HEM = Heat and energy management; MON = Environmental monitoring, analysis and assessment equipment; NRP = Natural resources protection; NVA = Noise and vibration abatement; REP =Renewable energy plant; SWM = Management of solid and hazardous waste and recycling systems; SWR = Clean up or remediation of soil and water; WAT = Waste water management and potable water treatment.
Source: TRAINS, UNCTAD.

4.4.3. A more granular look at technical barriers to trade (TBTs)

Analysing TBTs at a more granular level (i.e. its sub-sections) through the computation of coverage ratios is a complex task. This is because the share of products with at least one measure in a sub-section of Chapter B of MAST, overall traded EGs, tends to be quite small. However, this ratio is indicative in relative terms of TBT sub-sections that are most prevalent for EGs. As shown in Figure 17, the TBTs that cover most of traded EGs are "Authorization requirements for importing certain products" (e.g. a licence being required for the importation of a product); "Certification requirements" (e.g. a certificate of conformity being required for a product); "Authorization requirements for importers" (e.g. requirements to the effect that the importers should be authorized, registered, receive a permit, licence or any other kind of approval to engage in the business of importing certain products to comply with relevant technical regulations or conformity-assessment procedures); and "Labelling requirements" (e.g. a product must carry a label indicating size, weight and level of electricity consumption) (UNCTAD, 2019[45]).

Figure 17. TBT sub-section regulating most of the traded EGs



Note: The TBT sub-sections are as follows starting from the most representative: Authorization requirements for importing certain products, Certification requirements, Authorization requirements for importers, Labelling requirements, Inspection requirements, Product registration/approval requirements, Origin of materials and parts, Restricted use of certain substances, Tolerance limits for residues of or contamination by certain substances
Source: TRAINS, UNCTAD.

5. Supply chains for specific EGs: Trade measures beyond tariffs

A supply chain analysis of trade measures that affect inputs associated with the production of specific EGs critical for the energy transition can help reveal certain chokepoints. Clean energy solutions like electrical vehicles, wind turbines, and solar panels are central to achieving national and corporate decarbonisation goals. Electric vehicles, powered by renewable energy sources, offer a sustainable alternative to traditional internal combustion engines, significantly reducing greenhouse gas emissions. Similarly, wind turbines harness the power of the wind to generate electricity, providing a renewable and abundant source of energy. Solar panels, which convert sunlight into electricity, are being widely adopted due to their efficiency and decreasing cost.[59]

Enabling access to the production of these EGs requires access to the main inputs used in their production. Concerns, however, have emerged about the resilience of the supply chains for these emerging clean energy technologies, notably in terms of access to essential inputs. Mapping of the global supply chains for electrical vehicles, solar panels, and wind

[59] Reflecting the criticality of clean energy technologies in the net-zero transition, the global capacity for renewable electricity increased 50% in 2023 compared to 2022 (IEA, 2024[89]). By 2028, renewably electricity generation is expected to increase by almost 70% from 2022, transforming the energy landscape and driving a global shift towards a more sustainable future.

turbines has revealed the dominance of one or several countries in key stages of the value chain, leading to concerns about potential trade dependencies (OECD, 2023[56]).

Many critical raw materials (CRMs) are key in the production of EGs and feature in different stages of production: the upstream stage, which consists of resource extraction; the midstream stage, covering raw material processing and the production of certain components; and the downstream stage that covers the manufacture of more complex components, assembly, sales, and end-of-life recycling. For example, in the case of cobalt, which is critical for the lithium-ion batteries used in electrical vehicles, 70%is mined in the Democratic Republic of Congo. In the case of polysilicon, which is key for the production for solar cells, 79% of global capacity is in China, and half of that is concentrated in the province of Xinjiang. In these situations, the concentration of production may create chokepoints, reducing access to EGs by countries not possessing the critical materials needed for their production, hindering the net-zero transition (Farrell and Newman, 2019[57]). In addition, requirements enforced at the border that pose unnecessary obstacles to trade may lead to higher costs for trade in critical minerals, as well as compromise the diversification and resilience of environmental goods supply chains.

While previous work has focused on the export restrictions of CRMs (OECD, 2023[56]), this section focuses on the import side, more specifically on NTMs that are applied to clean energy supply chains. It starts with a discussion of selected EGs supply chains and the possible chokepoints due to geographical concentration of the supply of key inputs, a key issue for the resilience of these supply chains. It then analyses NTMs affecting some important components used in the value chains for these EGs.

5.1. Supply chains for some EGs are characterised by high levels of concentration

Like many other manufacturing industries, the production process of clean energy technologies is dispersed in global supply chains across different countries (OECD, 2023[56]). A typical solar PV panel, for instance, relies on critical minerals that have been mined in Asia, the Americas and Oceania, has components manufactured in Asia, and is assembled in China (Table 1).

The supply chains for wind turbines and electrical vehicles are equally global in scope. The majority of production stages within Electric Vehicle (EV) battery supply chains exhibit significant geographical concentration, with over 70% of global production concentrated in the top three countries. China dominates the intermediate stages of the supply chain, including raw material processing and component production and competes with Japan and Korea in the downstream stages. Delving deeper into the supply chains of wind turbines reveals varying geographic concentration across different segments. Most production stages in wind turbine supply chains exhibit moderate geographic concentration, with between 30% and 70% of global production concentrated in the top three countries. This is largely attributed to the global segmentation of markets for wind turbines—supply chains dominated by China primarily cater to the Chinese market, while those dominated by G7 countries serve the G7 market. There are notable exceptions: for rare earth mining, rare earth processing, nacelles[60], and blades, all with high geographical concentration ratios, China plays a dominant role in supply across all markets.

[60] The nacelle in wind turbines holds the key electrical and mechanical equipment at the top of the tower, including the main shaft, gearbox and generator.

Table 1. Characteristics of supply chains for selected EGs

	EV batteries		Wind turbines		Solar PV panel	
Supply chain segment	Input	Largest producers	Input	Largest producers	Input	Largest producers
Resource extraction	Lithium	AUS (55%), CHL (26%), CHN (14%)	Zinc	CHN (32%), PER (12%), AUS (10%)	Copper	CHL (27%), PER (10%), CHN (8%)
	Cobalt	COG (71%), RUS (4%), AUS (3%)	Copper	CHL (27%), PER (10%), CHN (8%)	Bauxite	AUS (28%), CHN (22%), GIN (22%)
	Nickel	IDN (37%), PHL (14%), RUS (9%)	Rare earth	CHN (60%), USA (15%), MMR (10%)	Silver	MEX (23%), CHN (14%), PER (13%)
	Manganese	ZAF (37%), GAB (18%), AUS (16%)				
	Graphite (natural)	CHN (82%), BRA (7%), MOZ (3%)				
Raw material processing	Lithium	CHN (58%), CHL (29%), ARG (10%)	Zinc	NA	Copper	CHN (38%), CHL (8%), JPN (6%)
	Cobalt	CHN (65%), FIN (10%), BEL (5%)	Copper	CHN (38%), CHL (8%), JPN (6%)	Aluminium	CHN (57%), RUS (6%), CAN (5%)
	Nickel	CHN (35%), IDN (15%), JPN (8%)	Rare earth	CHN (90%)	Polysilicon	CHN (81%), GER (8%), KOR (3%)
	Manganese	CHN (93%)				
	Graphite (natural)	CHN (close to 100%)				
Component production	Cathode (CR7)	CHN (53%), JPN (21%), KOR (20%)	Nacelle	CHN (58%), USA (10%), IND (10%)	Wafer	CHN (53%), JPN (21%), KOR (20%)
	Anode	CHN (78%), JPN (16%), KOR (4%)	Blades	CHN (59%), IND (12%), USA (5%)	Cell	CHN (78%), JPN (16%), KOR (4%)
	Separator	CHN (66%), KOR (16%), JPN (12%)	Towers	CHN (49%), ESP (10%), USA (8%)		
	Electrolyte	CHN (62%), KOR (14%), JPN (11%)	Generators	CHN (38%), IND (10%), ESP (8%)		
			Gearbox	CHN (46%), GER (14%), ESP (12%)		
Assembly	Battery cell/pack	CHN (79%), USA (6%), HUN (4%)	Wind turbine	CHN (40%), USA (16%), GER (8%)	PV module	CHN (80%)
Recycling	Recycling	CHN (58%), GER (15%), FRA (7%)	Recycling	NA	Recycling	NA

Note: The list of components (e.g. raw critical minerals) mentioned in each the production stages is not exhaustive. The ones mentioned in this table are the most used. Information about the largest producers of zinc for wind turbines is missing.
Source: (OECD, 2023[56]).

The globalized nature of the production of clean energy technologies is considered beneficial for the net-zero transition for example, by enhancing the economic viability of a product, reducing the costs of clean energy solutions, generating dynamic efficiency gains and innovation by fostering knowledge connectedness across borders (Ambos et al., 2021[58]), strengthening the resilience of the production processes of renewables (Thakur-Weigold and Miroudot, 2024[59]), and providing companies with broad access to outside options (Ossa, 2023[60]).[61]

[61] The option to switch suppliers from one country to another, for example, has been found to reduce exchange rate risks (Kogut and Kulatilaka, 1994[81]), labour cost risks (Belderbos and Zou, 2007[82]), and business cycle risks (Chung and Chan, 2010[83]) of multinational firms.

Despite the benefits of the globalised nature of the production of clean energy technologies, in a context of hyper-specialisation and geographical concentration of production, where a single country dominates the global production in a key value chain segment and where substitutes are hard to find, there is a risk that countries will be unable to ensure sufficient access to essential inputs for needed EGs.

The GVCs of clean energy technologies are susceptible to potential chokepoints. A small number of countries or firms located in specific countries control a large share of the critical mineral reserves, processing operations, and manufacturing activities that are indispensable for renewable technologies and difficult to substitute (Hayes and McCullough, 2018[61]) (OECD, 2023[56])) (Yi et al., 2024[62]). For instance, China accounts for almost 90% of the global rare earth element mine-to-metal refining and refines more than 60% of the world's cobalt, nickel, and lithium. Around 70% of battery components and battery cells are also made in China.

For these reasons, there is growing concern that geopolitical tensions or export restrictions by countries that are sources of critical inputs could lead to frictions or blockages in clean energy supply chains, with implications for the Net Zero transition. Indeed, OECD work has shown that export restrictions on CRMs have increased fivefold since 2009 (Kowalski and Legendre, 2023[63]). The May 2023 G7 Leaders' Statement on Economic Resilience and Economic Security reflects the intention of global leaders to minimise these risks by addressing chokepoints in clean energy supply chains.[62] A number of countries have also taken measures in relation to ensuring supply of CRMs.[63] While geographical concentration, as well as export restrictions, can impede access to CRMs important for the production of EGs, other non-tariff measures along supply chains can also impede access to inputs for EGs. These are discussed in below.

5.2. Non-tariff measures affecting CRMs for selected EGs

Supply of many CRMs is highly concentrated, with a few countries being hubs for their extraction and processing (Table 1). This section explores NTMs that could affect trade in CRMs.

For this purpose, the frequency index and coverage ratio are explained in Section 4 to identify the share of CRMs in the value chains of selected EGs and the share of trade affected by at least one NTM. For the identification of CRMs relevant to specific supply chains, the classification from Kowalski and Legendre (2023[63]) and Bobba et al. (2020[64]) is employed (Annex Table B.8). Similar minerals are used in the production processes of

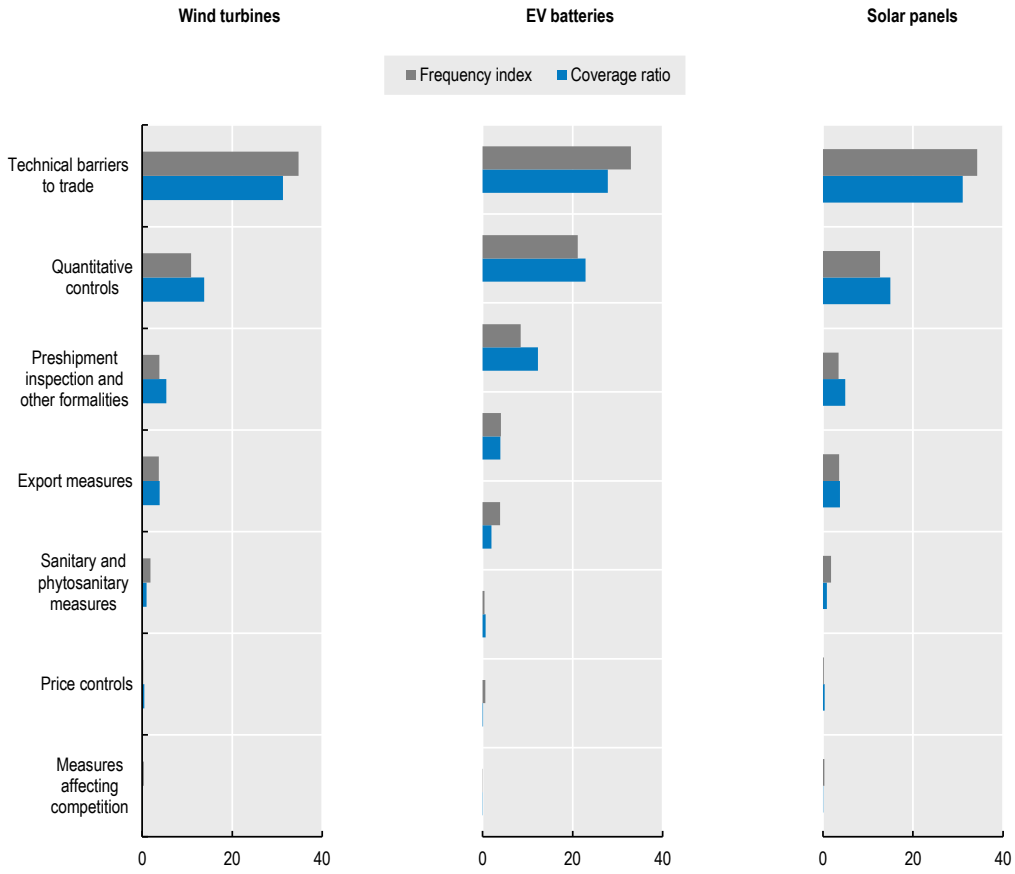
[62] G7 Leaders' Statement on Economic Resilience and Economic Security | The White House

[63] See, for example, Canada's Critical Minerals Strategy, which is designed in part to reduce the country's dependence on foreign-mined and foreign-processed critical minerals by, among other things, allocating USD 1.5 billion to support critical minerals projects related to advanced manufacturing, processing, and recycling applications. Similarly, the European Union's (EU) 2023 provisional agreement on the Critical Raw Material Act (CRMA) aims to ensure a sustainable and secure supply of 34 critical minerals, of which 17 are designated strategic because of their importance for the clean and digital transition and global market imbalances. The CRMA sets out targets related to the EU's annual consumption of strategic raw materials is to be achieved by 2030 and aims to reduce the EU's dependence on third countries for the raw materials needed to engineer its net-zero transition (European Commission, 2023). Finally, to reduce the high US dependence on raw material processing, component production, and assembly from China in electrical vehicle supply chains, the US Inflation Reduction Act requires that the final assembly of electrical vehicles take place in North America and that EVs meet critical minerals sourcing requirements (minimum thresholds of lithium, cobalt, and nickel extraction or processing in the United States or a country with which the United States has a free trade agreement) and battery component requirements.

the three EGs, with some small differences, in particular for wind turbines. Wind turbines, whether located on or offshore, are predominantly constructed using concrete for onshore installations and steel for offshore structures. As they comprise sizable components, including nacelles, blades, and towers, the supply chains for wind turbines are often centralised in specific regions. Given that the production of components for solar panels and EV batteries is more geographically spread, it is expected that the number of NTMs imposed on materials used uniquely for wind turbines could be lower compared to solar panels or EV batteries.

Results in Figure 18 show that most CRMs that are important in the supply chains for the selected EGs, and most of trade amounts in those CRMs, are affected by TBTs. Compared to EGs in general (see analysis in Section 4), the share of CRMs subject to at least one NTM and the amount of trade in CRMs affected by those NTMs compared to all traded CRMs used in selected EGs is lower. In other words, around 40% of trade in CRMs used as in inputs in selected EGs is affected by at least one NTM, whereas this number reached 80% for EGs in general. TBTs are the most prevalent measures affecting CRMs. When comparing the frequency index with the coverage ratio, findings show that the share of CRMs affected by TBTs for all three EGs supply chains, is high, compared to the actual amount of *traded* CRMs that are subject to TBT measures. That is, TBTs are imposed towards many traded CRMs, but the amount of trade concerned by TBTs is lower. Equally, quantitative measures are the second most prevalent category of measures both in terms of the number of affected CRMs and of volume of trade. They reach almost 20% of CRMs subject to an NTM and amount of trade in CRMs, in particular with respect to EV batteries. PSI measures are also more common for EV battery components, which is expected given that EV batteries contain more CRMs compared to the other goods (i.e. reflecting a higher probability to have more products affected by NTMs). Other measures applied to the three groups of products are SPS and PCs, but to a lower extent.

Figure 18. NTM prevalence on CRMs in the supply chains for selected EGs



Note: Authors' computation.
Source: OECD (2023[56]) and TRAINS, UNCTAD.

6. The way forward and trade facilitation for EGs

Non-tariff measures and technical barriers to trade in particular have been on the rise (Section 4). While these measures are generally non-discriminatory and do not have, on the face of it, a protectionist intent, they can still impede trade through different avenues. Heterogeneous standards and associated procedural requirements that are untransparent, divergent, or unduly burdensome can significantly increase trade costs for environmental goods. Cutting-edge endeavours to address mounting environmental concerns can also generate costs both in the short run and over time. Adaptation by producers, importers and exporters to new regulations will require navigating through and demonstrating compliance with novel and complex environmental requirements or standards (OECD et al., 2024[65]). Control of compliance at the border will also raise challenges for border authorities.

Specific trade concerns at the WTO reveal that procedural obstacles at the border rank high among the practical challenges encountered in goods trade, including EGs trade (Bellmann, 2021[66]) (Yamaguchi, 2022[67]). In addition to more generally applicable obstacles such as complex control procedures, insufficient automation, or excessive delays, the trade of environmental goods may be further impeded by insufficient EG-related expertise within border agencies. Divergent EG-related regulations across jurisdictions, particularly in the areas of health and safety, could complicate their enforcement, in particular at the border.

Many recent trade agreements place as much emphasis on aligning national standards and regulations as they do on reducing traditional tariff barriers (Ederington and Ruta, 2016[48]). Moreover, the highly technical nature of some of the criteria for identifying EGs may call for particular expertise in implementing and enforcing control regulations at the border, especially in relation to dual-use products and implementation of ex-outs.[64]

International co-operation upstream can help minimise such obstacles. It can focus on the improvement, strengthening and interoperability of standards and practices for sustainably produced EGs and on the recognition of equivalence of relevant domestic policies and measures (see, for instance, the relevant commitments in ACCTS' Chapter 2 on Trade in Environmental Goods). It can also take the form of mutual recognition agreements or other forms of regulatory co-operation for environmental certifications, facilitating market entry for environmentally friendly products.[65] Finally, it could expand to areas of technical and financial assistance, EGs production infrastructure investments, and technology acquisition, including in the form of public-private partnerships to support developing countries' involvement in EGs supply chains. Capacity building programmes could also be provided to help small- and medium-sized enterprises (SMEs) understand and comply with environmental standards in export markets.

For instance, enhancing regulatory co-operation on matters such as making embedded emissions accounting systems interoperable and mutually recognising "low-emissions" certification schemes can help reduce information asymmetries and facilitate the development of low-emission cross-border supply chains. An example is the Clean Hydrogen Declaration of Intent, launched at COP28 to mutually recognise clean hydrogen certificates (COP28 UAE, 2023[68]), (IRENA, 2024[69]). In this context, while approaches are expected to vary depending on the national circumstances of each country, certifying the emissions intensity of hydrogen production based on a shared understanding of the methodology applied ushers a minimum level of regulatory interoperability, enables mutual recognition, and minimises market fragmentation (IEA, 2024[70]).

Another example of instruments to facilitate trade in EGs are collaborations aimed at achieving mutual environmental and industrial benefits by structurally changing shared value chains, termed by Aishbett et al. (2023[71]) as International Green Economy Collaborations (IGECs).[66] IGECs may contain information sharing mechanisms (such as the case of the 2021 EU-US Joint Statement on Steel and Aluminium, which establishes joint task forces, working groups or committees), technology collaboration (such as The Japan-Australia Partnership on Decarbonization through Technology and Germany-Australia Hydrogen Supply Chain Project), regulatory collaboration (e.g. co-ordinated development of product embedded emissions accounting, certification schemes), or market co-ordination through joint feasibility and costing studies for green supply chains (e.g. the 2020 Australia-Japan Co-operation Agreement on Hydrogen and Fuel Cells).

A further step to reduce costs stemming from the diversity of domestic regulations or lack of clarity around them are trade facilitation measures promoting transparency, or

[64] Expertise and resource sufficiency challenges faced by Customs authorities in implementing and enforcing control regulations on hazardous waste are also relevant in relation to EGs. See also United Nations Environment Programme (2022[75]).

[65] Empirical estimates indicate that MRAs help increase the value of exports, as well as facilitate the diversification of supply chains to new products and new markets (Cernat, 2022[84]).

[66] Some examples include the Indonesian Just Energy Transition Partnership, the Australia-Singapore Green Economy Agreement, the proposed U.S.-EU Carbon-Based Sectoral Arrangement on Steel and Aluminium Trade, or the Africa-EU Energy Partnership.

streamlining of the processes that products must undergo to enter a market, as well as the use of digital systems. While NTMs may imply customs valuation, inspection, and quarantine procedures that add time and costs to the trade process, several trade facilitation measures can play an important role in helping to meet regulatory requirements, including those related to sustainability. In particular, the WTO Trade Facilitation Agreement (TFA)[67] can provide relevant directives that are useful for the enforcement of environmental rules and regulations that are efficient and facilitate the trade of EGs.

Transparency measures that would help promote EG trade and iron out some of the complexities of compliance control include establishing online information portals that provide clear and up-to-date information on environmental regulations and procedures or developing standardised templates and guidance documents to help traders meet reporting and verification requirements (Duval, Lee and Kim, 2024[72]). Enabling technical interoperability by establishing common guidelines on data attributes—such as specific data fields, formats, and numerical classifications—also ensures consistency in information exchange across various sustainability-related requirements (Lopez-Gonzalez and Sorescu, Forthcoming 2025[73]). Enhanced private sector involvement, including business-led ecolabelling schemes, multi-stakeholder sustainability initiatives, or due diligence mechanisms, can help navigate some of the complexities of life-cycle-based criteria for EGs.

Transparency and predictability tools, such as advance rulings (ARs), disciplines on fees and charges, and effective appeal procedures, can mitigate the cost impact of the differences in regulatory frameworks and operational practices across countries (Moïsé and Sorescu, 2015[74]). For instance, ARs on the tariff classification of a product could reduce a trader's uncertainty as to whether specific products would be classified as EGs and the tariff treatment they would enjoy as a result. If, in addition, concerned countries used the possibility in TFA Article 3.8 to publicize tariff classification ARs concerning EGs more widely, they would gradually enhance the predictability and consistency of their EG-related policies, thus removing procedural disincentives to EG trade. Full transparency and proportionality of the fees and charges applied to operations meant to identify the nature of a given product as an EG would likewise reduce uncertainty in EG trade.

The automation of trade-related documents and processes can also help demonstrate compliance with environmental regulations in a more seamless way. Border agency co-operation in accordance with TFA Art. 8.2 – for instance through joint controls with national authorities in charge of implementing environmental policies, or the alignment of procedures and formalities, including the development of joint monitoring and enforcement strategies (United Nations Environment Programme, 2022[75])- can further alleviate the technical challenges raised by the enforcement of EG-related provisions. These trade facilitation tools could make expedited customs clearance procedures for EGs possible under certain circumstances, thereby reducing delays and costs associated with border crossings.

Further developments in facilitating trade in EGs would complement efforts towards the liberalisation of trade in such goods. For example, work is ongoing at the OECD on the development of a Green Trade Facilitation Indicator (TFI), a horizontal indicator aimed at

[67] The WTO TFA was concluded in 2013 and entered into force in 2017. It contains provisions for expediting the movement, release and clearance of goods, including goods in transit. The TFA also sets out measures for effective co-operation between customs and other appropriate authorities on trade facilitation and customs compliance issues and provisions for technical assistance and capacity building in this area.

capturing the trade facilitation policies for goods which can support environmental sustainability objectives.

7. Conclusion

The shift towards net-zero emissions has gained considerable momentum in the past decade, requiring a substantial change in production processes, through the use of low-emission inputs and final consumption products. Despite their importance in the energy transition and for reaching climate change objectives, EGs still only represent a small part in the GDP of many countries (Jondeau et al., 2023[76]). Hence, accelerating their development and diffusion through trade becomes crucial.

Despite the important role of trade in EGs, negotiations on liberalisation have not concluded, mainly due to disagreements on the definition and scope of EGs included in different negotiating lists. With renewed attention at the WTO TESSD, revisiting the taxonomy of EGs can help policymakers identify consistent definitions that would be useful to both domestic reform and possible future negotiations.

While tariffs on EGs are low (WTO, 2022[1]) for developed economies and require further liberalisation in developing countries, domestic reforms and trade liberalisation endeavours affecting EGs need to go beyond tariffs. Enhanced understanding of NTMs that can impact trade in EGs can help identify chokepoints for the production and deployment of EGs, as well as for the technologies that use EGs in their production. Moreover, the identification of NTMs along the supply chains for EGs can prompt countries to think about how best to reform NTMs to promote trade in EGs needed for the green transition.

This analysis shows an increasing trend in the adoption of NTMs on EGs. Most of NTM categories have seen an increase, in particular TBTs such as technical regulations and conformity assessment procedures. Specific trade concerns raised by countries at the WTO SPS and TBT Committees, reveal cases when NTMs can become more trade-restrictive than necessary. The greatest number of concerns were raised on TBTs and quantitative restrictions, particularly related to Renewable Energy Products (REP) and Clean and Renewable Energy (CRE) products. Analysis reveals that use of trade defence measures such as anti-dumping, countervailing and safeguard measures has also been increasing.

TBTs also appear to be the most prevalent NTM MAST category according to the TRAINS data, confirming that a significant portion of international trade is subject to some form of technical barrier regulation. Additionally, non-automatic licensing, quotas, and other quantitative controls, cover a high number of EGs, followed by SPS and export measures. As for goods trade in general, high-income countries implement most of the NTMs on EGs, affecting mainly trade in cleaner or more resource efficient goods (CRE) and goods for renewable energy plants (REP). This is the case for all categories of NTMs, with the exception of financial measures which are mostly applied by low and low-middle income economies.

As revealed by the frequency index, on average almost half of traded EGs is subject to at least one NTM. This share is even more important for traded EGs among OECD countries. Similar results are revealed by the coverage ratio: TBT and quantitative measures in particular, are applied to almost half of traded EGs, with TBT being present in almost 80% of traded EGs by OECD countries.

A review of selected EGs essential for the clean energy transition, such as wind turbines, solar panels and EV batteries confirms these findings. By applying a supply chain perspective (i.e. revisiting NTMs applied along the supply chains of specific EGs), results

show that TBTs are the most prevalent NTM category targeting raw materials critical in the production of these goods.

Trade facilitation measures can play a crucial role in reducing costs associated with diverse domestic regulations or unclear guidelines originating from a range of NTMs. By simplifying the procedures that products must follow to enter a market, these measures help businesses ensure compliance with regulatory requirements, including those related to sustainability. Greater private sector engagement—through business-driven ecolabelling schemes or multi-stakeholder sustainability initiatives—can contribute to addressing the complexities associated with life-cycle-based criteria for EGs.

Establishing mutual recognition agreements or other forms of regulatory collaboration for environmental certifications can simplify market access for environmentally friendly products. With the emergence of new sustainability requirements, enhancing regulatory co-operation and technical interoperability can enable clarity in the reporting standards, as well as efficient exchange of data at the border and lower compliance costs. This could be accomplished by providing clear and up-to-date information on environmental regulations and procedures or by developing standardised guidance documents, as well as by establishing common guidelines on data attributes to help traders meet reporting and verification requirements.

References

Aisbett, E. et al. (2023), "International green economy collaborations: Chasing mutual gains in the energy transition", *Energy Research & Social Science*, Vol. 104, p. 103249, https://doi.org/10.1016/j.erss.2023.103249. [71]

Ambos, B. et al. (2021), "The nature of innovation in global value chains", *Journal of World Business*, Vol. 56/4, p. 101221, https://doi.org/10.1016/j.jwb.2021.101221. [58]

Antweiler, W., B. Copeland and M. Taylor (2001), "Is free trade good for the environment?", *American Economic Review*, Vol. 91/4, pp. 877-908. [87]

Antweiler, W., B. Copeland and M. Taylor (2001), "Is Free Trade Good for the Environment?", *American Economic Review*, Vol. 91/4, pp. 877-908, https://doi.org/10.1257/aer.91.4.877. [7]

Bacchetta, M. et al. (2025), "The potential impact of environmental goods trade liberalization on trade and emissions", *Energy Economics*, Vol. 141, p. 108051, https://doi.org/10.1016/j.eneco.2024.108051. [13]

Belderbos, R. and J. Zou (2007), "On the growth of foreign affiliates: multinational plant networks, joint ventures, and flexibility", *Journal of International Business Studies*, Vol. 38/7, pp. 1095-1112, https://doi.org/10.1057/palgrave.jibs.8400319. [82]

Bellmann, C. (2021), *The Circular Economy and International Trade: Options for the World Trade Organization*. [66]

Bobba, S. et al. (2020), *Critical Raw Materials for Strategic Technologies and Sectors in the EU –A Foresight Study, Publications Office of the European Union*. [64]

Cernat, L. (2022), *How Important are Mutual Recognition Agreements for Trade Faciltation ?*, https://ecipe.org/publications/mutual-recognition-agreements-and-trade-facilitation/. [84]

Chung, H. and W. Chan (2010), "Impact of credit spreads, monetary policy and convergence trading on swap spreads", *International Review of Financial Analysis*, Vol. 19/2, pp. 118-126, https://doi.org/10.1016/j.irfa.2010.01.004. [83]

Conrad, C. (2011), *Processes and Production Methods (PPMs) in WTO Law*, Cambridge University Press, https://doi.org/10.1017/cbo9780511807398. [39]

COP28 UAE (2023), *"COP28 Declaration of Intent - Mutual Recognition of Certification Schemes for Renewable and Low-Carbon Hydrogen and Hydrogen Derivates*. [68]

Copeland, B. and M. Taylor (2004), "Trade, growth, and the environment", *Journal of Economic literature*, Vol. 42/1, pp. 7-71. [85]

Copeland, B. and M. Taylor (2004), "Trade, Growth, and the Environment", *Journal of Economic Literature*, Vol. 42/1, pp. 7-71, https://doi.org/10.1257/002205104773558047. [6]

Cottier, T. (2016), "The Role of PPMs in Extractive Industries", *E15Initiative, International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum, Geneva.*. [32]

Cottier, T. (2014), "CO2 Levies and Tariffs on Imported Electricity: Assessing the Compatibility of Options with WTO Law, EU Law and the Free Trade Agreement Switzerland-EEC", *Legal Opinion submitted to the Swiss Federal Financial Administratio*. [36]

Cottier, T., O. Nartova and S. Anirudh (2014), "The Potential of Tariff Policy for Climate Change Mitigation: Legal and Economic Analysis", *48(5) Journal of World Trade 1007.*. [35]

CSIS (2021), *Environmental Goods Agreement: A New Frontier or an Old Stalemate?*. [3]

De Melo, J. and A. Nicita (2018), "Non-tariff measures: Data and quantitative tools of analysis.", *FERDI Working paper*.. [55]

de Melo, J. and J. Solleder (2020), "Barriers to trade in environmental goods: How important they are and what should developing countries expect from their removal", *World Development*, Vol. 130, p. 104910, https://doi.org/10.1016/j.worlddev.2020.104910. [4]

de Melo, J. and J. Solleder (2019), "The role of an Environmental Goods Agreement in the quest to improve the regime complex for Climate Change", *Robert Schuman Centre for Advanced Studies Research Paper No. RSCAS, 55.*. [77]

de Melo, J. and J. Solleder (2019), "The role of an Environmental Goods Agreement in the quest to improve the regime complex for Climate Change.", *Robert Schuman Centre for Advanced Studies Research Paper No. RSCAS, 55*. [15]

Deconinck, K., M. Jansen and C. Barisone (2023), "Fast and furious: the rise of environmental impact reporting in food systems", *European Review of Agricultural Economics*, Vol. 50/4, pp. 1310-1337, https://doi.org/10.1093/erae/jbad018. [40]

Disdier, A. and M. Fugazza (2020), *A practical guide to the economic analysis of non-tariff measures*. [54]

Duval, Y., Y. Lee and K. Kim (2024), *Pioneering green trade facilitation: A new conceptual framework*, https://www.unescap.org/blog/pioneering-green-trade-facilitation-new-conceptual-framework. [72]

Ederington, J. and M. Ruta (2016), *Nontariff Measures and the World Trading System*, Elsevier, https://doi.org/10.1016/bs.hescop.2016.04.010. [48]

Espa, I. and B. Imeli (2022), *Switzerland-based private sustainability standards and WTO law*. [38]

European Commission (2021b), *Understanding product environmental footprint and organisation environmental footprint methods*, https://data.europa.eu/doi/10.2760/11564. [88]

Farrell, H. and A. Newman (2019), *Weaponized interdependence: How global economic networks shape state coercion.*. [78]

Farrell, H. and A. Newman (2019), "Weaponized Interdependence: How Global Economic Networks Shape State Coercion", *International Security*, Vol. 44/1, pp. 42-79, https://doi.org/10.1162/isec_a_00351. [57]

Fiorini, M. et al. (2025, forthcoming), *Services trade and Environmental Sustainability: Conceptual linkages and Empirical Patterns*. [94]

Garsous, G. (2019), "Trends in policy indicators on trade and environment", *OECD Trade and Environment Working Papers*, No. 2019/01, OECD Publishing, Paris, https://doi.org/10.1787/b8d2bcac-en. [42]

Ghodsi, M., J. Gruebler and R. Stehrer (2016), "Estimating importer-specific ad valorem equivalents of non-tariff measures", *(No. 129). wiiw Working Paper* (No. 129). [51]

Gisselman, F., E. Merkus and N. Norell (2025), "Boosting trade in environmental goods. Evidence from provisions in free trade agreements", *World Development Sustainability*, Vol. 6, p. 100195, https://doi.org/10.1016/j.wds.2024.100195. [16]

Gourdon, J. (2014), "CEPII NTM-MAP: A tool for assessing the economic impact of non-tariff measures", *CEPII*, Vol. No. 2014-24. [47]

Grossman, G. and A. Krueger (1995), "Economic growth and the environment", *The quarterly journal of economics*, Vol. 110/2, pp. 353-377. [86]

Grossman, G. and A. Krueger (1995), "Economic Growth and the Environment", *The Quarterly Journal of Economics*, Vol. 110/2, pp. 353-377, https://doi.org/10.2307/2118443. [5]

Hayes, S. and E. McCullough (2018), "Critical minerals: A review of elemental trends in comprehensive criticality studies", *Resources Policy*, Vol. 59, pp. 192-199, https://doi.org/10.1016/j.resourpol.2018.06.015. [61]

Holzer, K. (2014), *Carbon-related Border Adjustment and WTO Law*, Edward Elgar Publishing. [31]

Howse, R. and P. van Bork (2006), "Options for Liberalising Trade in Environmental Goods in the Doha Round.", *Geneva: International Centre for Trade and Sustainable Development.*. [27]

IEA (2024), *Global Hydrogen Review 2024*. [70]

IEA (2024), *Renewables 2023. Analysis and forecasts to 2028*. [89]

ILA (2018), *Interim Report on Sustainable Development and the Green Economy*. [29]

Ing, L., O. Cadot and J. Walz (2017), "Transparency in non-tariff measures: An international comparison", *The World Economy*, Vol. 41/3, pp. 884-912, https://doi.org/10.1111/twec.12552. [46]

IRENA (2024), *International Cooperation to Accelerate Green Hydrogen Deployment*. [69]

Jansen, M. (2024), *TESS*, https://tessforum.org/latest/greening-supply-chains-sleepwalking-into-a-new-era-of-trade-policy. [33]

Jondeau, E. et al. (2023), *Environmental Subsidies to Mitigate Net-Zero Transition Costs.*. [76]

Kim, J. (2007), "Issues of Dual Use and Reviews Product Coverage of Environmental Goods", *COM/ENV/TD(2006)30FINAL.*. [24]

Kogut, B. and N. Kulatilaka (1994), "Operating Flexibility, Global Manufacturing, and the Option Value of a Multinational Network", *Management Science*, Vol. 40/1, pp. 123-139, https://doi.org/10.1287/mnsc.40.1.123. [81]

Kowalski, P. and C. Legendre (2023), *Raw materials critical for the green transition: Production, international trade and export restrictions.*. [63]

Lopez-Gonzalez, J. and S. Sorescu (Forthcoming 2025), *The digitalisation of trade documents and processes – Going paperless today, going paperless tomorrow*. [73]

Moïsé, E. and S. Sorescu (2015), "Contribution of Trade Facilitation Measures to the Operation of Supply Chains", *OECD Trade Policy Papers*, No. 181, OECD Publishing, Paris, https://doi.org/10.1787/5js0bslh9m25-en. [74]

Moïsé, E. and R. Steenblik (2011), "Trade-Related Measures Based on Processes and Production Methods in the Context of Climate-Change Mitigation", *OECD Trade and Environment Working Papers*, No. 2011/4, OECD Publishing, Paris, https://doi.org/10.1787/5kg6xssz26jg-en. [30]

Nicita, A. and J. Gourdon (2013), "A preliminary analysis on newly collected data on non-tariff measures.", *UN*. [44]

OECD (2025), "Government Support in the Solar and Wind Value Chains", *OECD Trade Policy Papers*, No. 288, OECD Publishing, Paris, https://doi.org/10.1787/d82881fd-en. [52]

OECD (2023), *Strengthening clean energy supply chains for decarbonisation and economic security. OECD Report for the G7 Finance Ministers and Central Bank Governors*. [56]

OECD (2015), *Overcoming Barriers to International Investment in Clean Energy*, Green Finance and Investment, OECD Publishing, Paris, https://doi.org/10.1787/9789264227064-en. [53]

OECD (2006), *Environmental and Energy Products: The Benefits of Liberalising Trade.*. [80]

OECD/IEA (2006), *Environmental and Energy Products: The Benefits of Liberalising Trade*, OECD Trade Policy Studies, OECD Publishing, Paris, https://doi.org/10.1787/9789264024823-en. [90]

OECD/ITC (2024), *Understanding Sustainability Initiatives: A Typology Framework*, OECD Publishing, Paris, https://doi.org/10.1787/8f8a3d7f-en. [18]

OECD et al. (2024), *Working Together for Better Climate Action: Carbon Pricing, Policy Spillovers, and Global Climate Goals*, OECD Publishing, Paris, https://doi.org/10.1787/2b90fa2c-en. [65]

OECD and Eurostat (1999), *The Environmental Goods and Services Industry: Manual for Data Collection and Analysis*. [19]

Ossa, R. (2023), *Pillar of economic security.*, https://www.imf.org/en/Publications/fandd/issues/2023/06/pillar-of-economic-security-ralph-ossa. [60]

Pauwelyn, J. (2024), "21st Century Customs Fraud: How to Effectively Enforce Sustainability Requirements on Imports?", *SSRN Electronic Journal*, https://doi.org/10.2139/ssrn.4727779. [34]

Regan, D. (2009), *How to think about PPMs (and climate change).*, Cambridge Univ. Press. [37]

Sauvage, J. (2014), "The Stringency of Environmental Regulations and Trade in Environmental Goods", *OECD Trade and Environment Working Papers*, No. 2014/3, OECD Publishing, Paris, https://doi.org/10.1787/5jxrjn7xsnmq-en. [41]

Sorgho, Z. and E. al. (2018), *Trade and Global Warming: Do Environmental Goods (EGs) Matter in Climate Change Mitigation*, mimeo. [9]

Steenblik, R. (2020), *Code Shift: The environmental significance of the 2022 amendments to the Harmonized System*. [43]

Steenblik, R. (2005), "Environmental goods: A comparison of the APEC and OECD lists", *OECD Publishing*. [22]

Steenblik, R. (2005), "Liberalising trade in'environmental goods': Some practical considerations", *OECD Trade and Environment Working Papers, 2005/05, OECD Publishing*. [26]

Tamini, L. and Z. Sorgho (2018), "Trade in environmental goods: evidences from an analysis using elasticities of trade costs", *Environmental and Resource Economics*, pp. 70, 53-75. [8]

Tamini, L. and Z. Sorgho (2017), "Trade in Environmental Goods: Evidences from an Analysis Using Elasticities of Trade Costs", *Environmental and Resource Economics*, Vol. 70/1, pp. 53-75, https://doi.org/10.1007/s10640-017-0110-2. [12]

Thakur-Weigold, B. and S. Miroudot (2024), "Supply chain myths in the resilience and deglobalization narrative: consequences for policy.", *Journal of International Business Policy, 1-13*. [59]

Tothova, M. (2005), "Liberalisation of Trade in Environmentally Preferable Products", *OECD Trade and Environment Working Papers*, No. 2005/6, OECD Publishing, Paris, https://doi.org/10.1787/240712186425. [20]

Tothova, M. (2005), *Liberalisation of trade in environmentally preferable products.*, https://doi.org/10.1787/240712186425. [91]

UNCTAD (2023), *Guidelines for the collection of data on official non-tariff measures*. [49]

UNCTAD (2023), *Metadata for non-tariff measures bulk download database: Variables in the "Researcher file"*. [50]

UNCTAD (2019), *International classification of non-tariff measures*. [45]

UNCTAD (1995), *Environmentally Preferable Products (EPPs) as a Trade Opportunity for Developing Countries*. [28]

UNCTAD and The World Bank (2018), "The unseen impact of non-tariff measures: Insights from a new database" (UNCTAD/DITC/TAB/2018/2), p. United Nations Conference on Trade and Development & The World Bank. [14]

UNEP and WTO (2018), "Making trade work for the environment, propsperity and resilience.", *Geneva: World Trade Organization; United Nations Environment Programme.*, https://www.wto.org/english/res_e/publications_e/unereport2018_e.pdf . [2]

United Nations Environment Programme (2022), *Green Customs guide to Multilateral Environmental Agreements*, https://www.greencustoms.org/sites/default/files/2023-05/Green_customs_guide-english.pdf. [75]

Vaca Eyzaguirre, C. and C. Deere Birkbeck (2022), "Plastic pollution and trade across the life cycle of plastics: options for amending the harmonized system to improve transparency.", *Forum on Trade, Environment & the SDGs (TESS).*. [25]

Vossenaar, R. (2014), "Identifying products with climate and development benefits for an environmental goods agreement.", *Environment.*. [23]

Vossenaar, R. (2014), "Identifying products with climate and development benefits for an environmental goods agreement.", *Environment.*. [79]

WTO (2022), *World Trade Report, Climate change and international trade*. [1]

WTO (2022), *World Trade Report, Climate change and International Trade*. [92]

WTO (2001), *Ministerial Declaration, Fourth Session, Doha*. [93]

WTO (2021a), *Trade and Environmental Sustainability Structured Discussions (TESSD): Ministerial Statement on Trade and Environmental Sustainability, WT/MIN(21)/6/Rev. 2*. [21]

Yamaguchi, S. (2022), "Securing reverse supply chains for a resource efficient and circular economy", *OECD Trade and Environment Working Papers*, No. 2022/02, OECD Publishing, Paris, https://doi.org/10.1787/6ab6bb39-en. [67]

Yamaguchi, S. and C. van der Ven (2025, forthcoming), *Exploring synergies between environmental labelling and standards, and promoting trade in environmental goods and services*. [17]

Yi, J. et al. (2024), "How does digital economy development affect renewable energy innovation?", *Renewable and Sustainable Energy Reviews*, Vol. 192, p. 114221, https://doi.org/10.1016/j.rser.2023.114221. [62]

Zugravu-Soilita, N. (2019), "Trade in environmental goods and air pollution: a mediation analysis to estimate total, direct and indirect effects.", *Environmental and Resource Economics,*, pp. 74(3), 1125-1162. [11]

Zugravu-Soilita, N. (2018), "The impact of trade in environmental goods on pollution: what are we learning from the transition economies' experience?", *Environmental Economics and Policy Studies*, pp. , 20(4), 785-827. [10]

Annex A. List of Environmental Goods

Table A A.1. Combined List of Environmental Goods

hs6_2022	hs6_2017	Description_hs2022	Medium code
840410	840410	Boilers; auxiliary plant, for use with boilers of heading no. 8402 or 8403 (e.g. economisers, super-heaters, soot removers, gas recoverers)	APC
841410	841410	Pumps; vacuum	APC
842139	842139	Machinery; for filtering or purifying gases, other than intake air filters, catalytic converters or particulate filters for internal combustion engines	APC
841430	841430	Compressors; of a kind used in refrigerating equipment	APC
840420	840420	Boilers; condensers, for steam or other vapour power units	APC
841490	841490	Pumps and compressors; parts, of air or vacuum pumps, air or other gas compressors and fans, ventilating or recycling hoods incorporating a fan	APC
841459	841459	Fans; n.e.c. in item no. 8414.51	APC
841960	841960	Machinery; for liquefying air or gas, not used for domestic purposes	APC
840490	840490	Boilers; parts of auxiliary plant, for use with boilers of heading no. 8402 and 8403 and parts of condensers for steam or other vapour power units	APC
842132	842139	Machinery; catalytic converters or particulate filters, whether or not combined, for purifying or filtering exhaust gases from internal combustion engines	APC
841440	841440	Compressors; air compressors mounted on a wheeled chassis for towing	APC
840510	840510	Generators; producer gas, water gas, acetylene gas and similar water process gas generators, with or without their purifiers	APC
841480	841480	Pumps and compressors; for air, vacuum or gas, n.e.c. in heading no. 8414	APC
732111	732111	Cooking appliances and plate warmers; for gas fuel or for both gas and other fuels, of iron or steel	CRE
860711	860711	Railway or tramway locomotives or rolling stock; parts, driving bogies and bissel-bogies	CRE
871492	871492	Cycles; parts thereof, wheel rims and spokes	CRE
860791	860791	Railway or tramway locomotives; parts n.e.c. in heading no. 8607	CRE
871496	871496	Cycles; parts, pedals and crank-gear, and parts thereof	CRE
860500	860500	Railway or tramway coaches; passenger coaches, luggage vans, post office coaches and other special purpose railway or tramway coaches, not self-propelled (excluding those of heading no. 8604)	CRE
860721	860721	Railway or tramway locomotives or rolling stock; parts, air brakes and parts thereof	CRE
840790	840790	Reciprocating piston engines of a kind used for the propulsion of vehicles of chapter 87; other engines	CRE
730230	730230	Iron or steel, railway or tramway track construction material; switch blades, crossing frogs, point rods and other crossing pieces	CRE
870380	870380	Vehicles; with only electric motor for propulsion	CRE
853010	853010	Signalling, safety or traffic control equipment; for railways or tramways (excluding those of heading no. 8608)	CRE
853090	853090	Signalling apparatus; parts of safety, traffic control equipment for railways, tramways, roads, inland waterways, airfields, parking facilities, port instalments (excluding those of heading no. 8608)	CRE
860120	860120	Rail locomotives; powered by electric accumulators	CRE
860290	860290	Rail locomotives and locomotive tenders; other than diesel-electric powered	CRE
840734	840734	Reciprocating piston engines of a kind used for the propulsion of vehicles of chapter 87; of a cylinder capacity exceeding 1000 cc	CRE
860310	860310	Railway or tramway coaches, vans and trucks; self-propelled, powered from an external source of electricity (excluding those of heading no. 8604)	CRE
871495	871495	Cycles; parts thereof, saddles	CRE

hs6_2022	hs6_2017	Description_hs2022	Medium code
860712	860712	Railway or tramway locomotives or rolling stock; parts, bogies and bissel-bogies (excluding driving bogies and bissel-bogies)	CRE
281420	281420	Ammonia in aqueous solution	CRE
870370	870370	Vehicles; with both compression-ignition internal combustion piston engine (diesel or semi-diesel) and electric motor for propulsion, capable of being charged by plugging to external source of electric power	CRE
840733	840733	Reciprocating piston engines of a kind used for the propulsion of vehicles of chapter 87; of a cylinder capacity exceeding 250 cc but not exceeding 1000 cc	CRE
860110	860110	Rail locomotives; powered from an external source of electricity	CRE
870360	870360	Vehicles; with both spark-ignition internal combustion piston engine and electric motor for propulsion, capable of being charged by plugging to external source of electric power	CRE
860630	860630	Railway or tramway goods vans and wagons; self-discharging, not self-propelled, excluding those of item no. 8606.10	CRE
860699	860699	Railway or tramway goods vans and wagons; n.e.c. in heading no. 8606, not self-propelled	CRE
860800	860800	Railway or tramway track fixtures and fittings; mechanical (including electro-mechanical) signalling, safety or traffic control equipment for railways, tramways, roads, inland waterways, parking facilities, port installations or airfields; parts thereof	CRE
730240	730240	Iron or steel, railway or tramway track construction material; fish-plates and sole plates	CRE
860729	860729	Railway or tramway locomotives or rolling stock; parts, brakes (other than air brakes) and parts thereof	CRE
871499	871499	Cycles; parts thereof, n.e.c. in item no. 8714.9	CRE
860390	860390	Railway or tramway coaches, vans and trucks; self-propelled, powered other than from an external source of electricity (excluding those of heading no. 8604)	CRE
731100	731100	Aluminium containers for compressed or liquefied gas, of iron or steel	CRE
860730	860730	Railway or tramway locomotives or rolling stock; parts, hooks and other coupling devices, buffers and parts thereof	CRE
850980	850980	Electro-mechanical domestic appliances; with self-contained electric motor, other than vacuum cleaners of heading 85.08, n.e.c. in heading no. 8509	CRE
870230	870230	Vehicles; public transport type (carries 10 or more persons, including driver), with both compression-ignition internal combustion piston engine (diesel or semi-diesel) and electric motor for propulsion, new or used	CRE
871491	871491	Cycles; frames and forks, and parts thereof	CRE
730290	730290	Iron or steel, railway or tramway track construction material; n.e.c. in heading no. 7302	CRE
730210	730210	Iron or steel, railway or tramway track construction material; rails	CRE
860719	860719	Railway or tramway locomotives or rolling stock; parts, axles and wheels, and parts thereof	CRE
401150	401150	New pneumatic tyres, of rubber; of a kind used on bicycles	CRE
871493	871493	Cycles; parts thereof, hubs (other than coaster braking hubs and hub brakes) and free-wheel sprocket-wheels	CRE
860610	860610	Railway or tramway goods vans and wagons; tank wagons and the like, not self-propelled	CRE
860692	860692	Railway or tramway goods vans and wagons; open, with non-removable sides of a height exceeding 60cm, not self-propelled	CRE
840732	840732	Reciprocating piston engines of a kind used for the propulsion of vehicles of chapter 87; of a cylinder capacity exceeding 50 cc but not exceeding 110 cc	CRE
860400	860400	Railway or tramway maintenance or service vehicles; whether or not self-propelled (e.g. workshops, cranes, ballast tampers, trackliners, testing coaches and track inspection vehicles)	CRE
853080	853080	Signalling, safety or traffic control equipment; for roads, inland waterways, parking facilities, port installations or airfields (excluding those of heading no. 8608)	CRE
280410	280410	Hydrogen	CRE

hs6_2022	hs6_2017	Description_hs2022	Medium code
961700	961700	Vacuum flasks and other vacuum vessels, complete with cases; parts thereof other than glass inners	CRE
870240	870240	Vehicles; public transport type (carries 10 or more persons, including driver), with only electric motor for propulsion, new or used	CRE
860799	860799	Railway or tramway rolling stock; parts n.e.c. in heading no. 8607	CRE
871420	871420	Carriages for disabled persons; parts and accessories thereof	CRE
871494	871494	Cycles; parts thereof, brakes, including coaster braking hubs and hub-brakes, and parts thereof	CRE
860691	860691	Railway or tramway goods vans and wagons; covered and closed, not self-propelled	CRE
871410	871410	Motorcycles (including mopeds); parts and accessories	CRE
871200	871200	Bicycles and other cycles; including delivery tricycles, not motorised	CRE
871639	871639	Trailers and semi-trailers; (other than tanker type)	CRE
870340	870340	Vehicles; with both spark-ignition internal combustion piston engine and electric motor for propulsion, incapable of being charged by plugging to external source of electric power	CRE
850680	850680	Cells and batteries; primary, (other than manganese dioxide, mercuric oxide, silver oxide, lithium or air-zinc)	CRE
732190	732190	Domestic appliances; non-electric, parts thereof, of iron or steel.	CRE
860210	860210	Rail locomotives; diesel-electric powered	CRE
870350	870350	Vehicles; with both compression-ignition internal combustion piston engine (diesel or semi-diesel) and electric motor for propulsion, incapable of being charged by plugging to external source of electric power	CRE
281410	281410	Anhydrous ammonia	CRE
840731	840731	Reciprocating piston engines of a kind used for the propulsion of vehicles of chapter 87; of a cylinder capacity not exceeding 50 cc	CRE
401320	401320	Inner tubes, of rubber; of a kind used on bicycles	CRE
441873	441873	Wood; assembled flooring panels, of bamboo or with at least the top layer (wear layer) of bamboo	EPP
840310	840310	Central heating boilers other than those of heading 84.02; boilers	EPP
530310	530310	Jute and other textile bast fibres; raw or retted, but not spun, (excluding flax, hemp (cannabis sativa L.), and ramie)	EPP
531010	531010	Woven fabrics of jute or of other textile bast fibres of heading 53.03; unbleached	EPP
840220	840220	Super-heated water boilers	EPP
840390	840390	Central heating boilers other than those of heading 84.02; parts	EPP
560790	560790	Twine, cordage, ropes, cables; of materials n.e.c. in heading no. 5607, whether or not plaited, braided or impregnated, coated, covered, or sheathed with rubber or plastics	EPP
630510	630510	Sacks and bags; of a kind used for the packing of goods, of jute or of other textile bast fibres of heading no. 5303	EPP
560721	560721	Twine; binder or baler twine, of sisal or other textile fibres of the genus agave	EPP
701914	701931	Glass fibres; (including glass wool), mechanically bonded mats	HEM
853931	853931	Lamps; discharge, (excluding ultra-violet), fluorescent, hot cathode	HEM
700800	700800	Glass; multiple-walled insulating units of glass	HEM
701969	701939	Glass fibres; fabrics n.e.c. in item no. 7019.6	HEM
392111	392111	Plastics; plates, sheets, film, foil and strip, of polymers of styrene, cellular	HEM
392062	392062	Other plates, sheets, film, foil and strip, of plastics, non- cellular and not reinforced, laminated, supported or similarly combined with other materials; of poly(ethylene terephthalate)	HEM
392091	392091	Other plates, sheets, film, foil and strip, of plastics, non- cellular and not reinforced, laminated, supported or similarly combined with other materials; of poly(vinyl butyral)	HEM
940541	940540	Luminaires and light fittings; electric, photovoltaic, designed for use solely with light-emitting diode (LED) light sources	HEM

hs6_2022	hs6_2017	Description_hs2022	Medium code
701980	701939	Glass fibres; glass wool and articles thereof	HEM
540500	540500	Monofilament, synthetic; of 67 decitex or more and of which no cross-sectional dimension exceeds 1mm, strip and the like (e.g. artificial straw), of synthetic textile materials with width not over 5mm	HEM
940519	940510	Chandeliers and electric ceiling or wall light fittings; (excluding those used for lighting public open spaces or thoroughfares), for use other than with light-emitting diode (LED) light sources	HEM
392030	392030	Plastics; of polymers of styrene, plates, sheets, film, foil and strip (not self-adhesive), non-cellular and not reinforced, laminated, supported or similarly combined with other materials	HEM
851310	851310	Lamps; portable, electric, designed to function by their own source of energy (excluding lighting equipment of heading no. 8512)	HEM
902830	902830	Meters; electricity supply or production meters, including calibrating meters thereof	HEM
680690	680690	Minerals; mixtures and articles of heat-insulating, sound-insulating or sound-absorbing mineral materials, other than those of heading no. 6811 or 6812 or of chapter 69	HEM
940542	940540	Luminaires and light fittings; electric, designed for use solely with light-emitting diode (LED) light sources	HEM
450490	450490	Cork; articles of agglomerated cork (with or without a binding substance), n.e.c. in heading no. 4504	HEM
940529	940520	Luminaires and light fittings; electric, table, desk, bedside or floor-standing, for other than use solely with light-emitting diode (LED) light sources	HEM
701990	701939	Glass fibres; n.e.c. in heading no. 7019	HEM
940511	940510	Luminaires and light fittings; chandeliers and electric ceiling or wall light fittings; (excluding those used for lighting public open spaces or thoroughfares), for use solely with light-emitting diode (LED) light sources	HEM
701915	701931	Glass fibres; (including glass wool), chemically bonded mats	HEM
681519	681510	Carbon fibres; articles of carbon fibres for non- electrical uses; other articles of graphite or other carbon for non- electrical uses; other	HEM
681019	681019	Cement, concrete or artificial stone; tiles, flagstones and similar, (excluding building blocks and bricks) whether or not reinforced	HEM
841950	841950	Heat exchange units; not used for domestic purposes	HEM
902890	902890	Meters; parts and accessories of gas, liquid, electricity supply or production meters, including calibrating meters thereof	HEM
450410	450410	Cork; blocks, plates, sheets and strip, tiles of any shape, solid cylinders (including discs), of agglomerated cork (with or without a binding substance)	HEM
681091	681091	Cement, concrete or artificial stone; prefabricated structural components for building or civil engineering, whether or not reinforced	HEM
392190	392190	Other plates, sheets, film, foil and strip, of plastics; other	HEM
853952	853950	Lamps; light-emitting diode (LED) light sources, light-emitting diode (LED) lamps	HEM
940549	940540	Luminaires and light fittings; electric, designed for other than use solely with light-emitting diode (LED) light sources	HEM
853932	853932	Lamps; discharge, (excluding ultra-violet), mercury or sodium vapour lamps, metal halide lamps	HEM
701973	701939	Glass fibres; chemically bonded fabrics, open fabrics n.e.c. in heading 7019	HEM
392113	392113	Plastics; plates, sheets, film, foil and strip, of polyurethanes, cellular	HEM
853951	940510	Lamps; light-emitting diode (LED) light sources, light-emitting diode (LED) modules	HEM
853921	853921	Lamps; filament, (excluding ultra-violet or infra-red), tungsten halogen	HEM
940561	940560	Luminaires; illuminated signs, illuminated name-plates and the like, designed for use solely with light-emitting diode (LED) light sources	HEM
701962	701939	Glass fibres; non-woven mechanically bonded fabrics and closed fabrics of rovings	HEM
701972	701939	Glass fibres; chemically bonded fabrics, closed fabrics n.e.c. in heading 7019	HEM
390940	390940	Phenolic resins; in primary forms	HEM

hs6_2022	hs6_2017	Description_hs2022	Medium code
680800	680800	Panels, boards, tiles, blocks and the like; of vegetable fibre, of straw, shavings, chips, particles, sawdust or other waste, of wood, agglomerated with cement, plaster or other mineral binders	HEM
940531	940530	Luminaires and light fittings; electric, lighting strings of a kind used for Christmas trees, for use solely with light-emitting diode (LED) light sources	HEM
681099	681099	Articles of cement, of concrete or of artificial stone, whether or not reinforced; other	HEM
681011	681011	Cement, concrete or artificial stone; building blocks or bricks, whether or not reinforced	HEM
701919	701931	Glass fibres; (including glass wool), threads and mats	HEM
940521	940520	Luminaires and light fittings; electric, table, desk, bedside or floor-standing, for use solely with light-emitting diode (LED) light sources	HEM
680610	680610	Slag wool, rock wool and similar mineral wools (including intermixtures thereof), in bulk, sheets or rolls	HEM
901540	901540	Surveying equipment; photogrammetrical surveying instruments and appliances	MON
903082	903082	Hydrometers and similar floating instruments, thermometers, pyrometers, barometers, hygrometers and psychrometers, recording or not, and any combination of these instruments; parts and accessories.	MON
903090	903090	Instruments, apparatus for measuring, checking electrical quantities, not meters of heading no. 9028; parts and accessories, for measuring or detecting alpha, beta, gamma, x-ray, cosmic and other radiations	MON
900580	900580	Monoculars; other optical telescopes and astronomical instruments, excluding instruments for radio-astronomy	MON
902810	902810	Meters; gas, supply or production meters, including calibrating meters thereof	MON
902610	902610	Instruments and apparatus; for measuring or checking the flow or level of liquids	MON
903031	903031	Multimeters; for measuring or checking voltage, current, resistance or power (other than those for measuring or checking semiconductor wafer or devices), without a recording device	MON
903020	903020	Oscilloscopes and oscillographs	MON
902790	902790	Microtomes and parts and accessories thereof	MON
903190	903190	Instruments, appliances and machines; parts and accessories for those measuring or checking devices of heading no. 9031	MON
903010	903010	Monitoring instruments: Instruments and apparatus; for measuring or detecting ionising radiations	MON
903290	903290	Regulating or controlling instruments and apparatus; automatic, parts and accessories	MON
903033	903033	Instruments and apparatus; for measuring or checking voltage, current, resistance or power, without a recording device (excluding multimeters)	MON
903120	903120	Test benches	MON
902620	902620	Instruments and apparatus; for measuring or checking pressure	MON
903300	903300	Machines and appliances, instruments or apparatus of chapter 90; parts and accessories n.e.c. in chapter 90	MON
903220	903220	Regulating or controlling instruments and apparatus; automatic, manostats	MON
903089	903089	Instruments and apparatus; n.e.c. in heading no. 9030, without a recording device	MON
903032	903032	Multimeters; for measuring or checking voltage, current, resistance or power, with a recording device	MON
903149	903149	Optical instruments and appliances; for measuring or checking, n.e.c. in chapter 90	MON
903084	903084	Instruments and apparatus; n.e.c. in heading no. 9030, with a recording device	MON
902511	902511	Thermometers and pyrometers; liquid filled, for direct reading, not combined with other instruments	MON
902750	902750	Instruments and apparatus; using optical radiations (UV, visible, IR), (other than spectrometers, spectrophotometers and spectrographs)	MON
903281	903281	Regulating or controlling instruments and apparatus; automatic, hydraulic or pneumatic	MON

hs6_2022	hs6_2017	Description_hs2022	Medium code
902290	902290	Apparatus based on the use of X- rays or of alpha, beta, gamma or other ionising radiations, whether	MON
902730	902730	Spectrometers, spectrophotometers and spectrographs; using optical radiations (UV, visible, IR)	MON
903210	903210	Regulating or controlling instruments and apparatus; automatic type, thermostats	MON
902781	902780	Instruments and apparatus; for physical or chemical analysis, for measuring or checking viscosity, porosity, expansion, surface tension or quantities of heat, sound or light, mass spectrometers	MON
902710	902710	Instruments and apparatus; gas or smoke analysis apparatus, for physical or chemical analysis	MON
902690	902690	Instruments and apparatus; parts and accessories for those measuring or checking the flow, level, pressure or other variables of liquids or gases (excluding those of heading no. 9014, 9015, 9028 or 9032)	MON
902720	902720	Chromatographs and electrophoresis instruments	MON
902789	902780	Instruments and apparatus; for physical or chemical analysis, for measuring or checking viscosity, porosity, expansion, surface tension or quantities of heat, sound or light, exposure meters	MON
902219	902219	Apparatus based on the use of X- rays, whether or not for medical, surgical, dental or veterinary uses, including radiography or radiotherapy apparatus; for other uses	MON
902820	902820	Meters; liquid supply or production meters, including calibrating meters thereof	MON
902519	902519	Thermometers and pyrometers; (other than liquid filled, for direct reading), not combined with other instruments	MON
901590	901590	Surveying equipment; parts and accessories for articles of heading no. 9015	MON
901580	901580	Surveying equipment; articles n.e.c. in heading no. 9015, including hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances (excluding compasses)	MON
903180	903180	Instruments, appliances and machines; for measuring or checking n.e.c. in chapter 90	MON
902680	902680	Instruments and apparatus; for measuring or checking variables of liquids or gases (excluding pressure or the flow and level of liquids and those of heading no. 9014, 9015, 9028 and 9032)	MON
901530	901530	Surveying equipment; levels	MON
903039	903039	Instruments and apparatus; for measuring or checking voltage, current, resistance or power, with a recording device (excluding multimeters)	MON
902590	902590	Hydrometers and similar floating instruments, thermometers, pyrometers, barometers, hygrometers and psychrometers, recording or not, and any combination of these instruments; parts and accessories	MON
560890	560890	Twine, cordage or rope; knotted netting, of other than man-made textiles	NRP
950720	950720	Fish-hooks; whether or not snelled	NRP
560811	560811	Twine, cordage or rope; fishing nets, made up, of man made textile materials	NRP
903110	903110	Machines; for balancing mechanical parts	NVA
840991	840991	Engines; parts, suitable for use solely or principally with spark-ignition internal combustion piston engines (for other than aircraft)	NVA
840999	840999	Engines; parts for internal combustion piston engines (excluding spark-ignition)	NVA
848210	848210	Ball bearings	REP
850172	850133	Electric generators; photovoltaic DC generators, of an output exceeding 50W	REP
850220	850220	Electric generating sets; with spark-ignition internal combustion piston engines	REP
850760	850760	Electric accumulators, including separators therefor, whether or not rectangular (including square); lithium-ion	REP
850433	850433	Transformers; n.e.c. in item no. 8504.2, having a power handling capacity exceeding 16kVA but not exceeding 500kVA	REP

hs6_2022	hs6_2017	Description_hs2022	Medium code
850431	850431	Electrical transformers; n.e.c. in item no. 8504.2, having a power handling capacity not exceeding 1kVA	REP
848610	848610	Machines and apparatus of a kind used solely or principally for the manufacture of semiconductor boules or wafers	REP
848620	848620	Machines and apparatus for the manufacture of semiconductor devices or of electronic integrated circuits	REP
841510	841510	Air conditioning machines, comprising a motor-driven fan and elements for changing the temperature and humidity, including those machines in which the humidity cannot be separately regulated; of a kind designed to be fixed to a window, wall, ceiling or floor, self- contained or "split-system"	REP
850163	850163	Electric generators; AC generators, (alternators), other than photovoltaic generators, of an output exceeding 375kVA but not exceeding 750kVA	REP
850660	850660	Primary cells and primary batteries: - air-zinc	REP
850161	850161	Generators; AC generators, (alternators), other than photovoltaic generators, of an output not exceeding 75kVA	REP
848340	848340	Gears and gearing; (not toothed wheels, chain sprockets and other transmission elements presented separately); ball or roller screws; gear boxes and other speed changers, including torque converters	REP
840681	840681	Turbines; steam and other vapour turbines, (for other than marine propulsion), of an output exceeding 40MW	REP
841280	841280	Engines; pneumatic power engines and motors, n.e.c. in heading no. 8412	REP
848360	848360	Clutches and shaft couplings (including universal joints)	REP
850450	850450	Other inductors	REP
700719	700719	Glass; safety glass, toughened (tempered), (not of a size and shape suitable for incorporation in vehicles, aircraft, spacecraft or vessels)	REP
841012	841012	Turbines; hydraulic turbines and water wheels, of a power exceeding 1000kW but not exceeding 10000kW	REP
841011	841011	Turbines; hydraulic turbines and water wheels, of a power not exceeding 1000kW	REP
840682	840682	Turbines; steam and other vapour turbines, (for other than marine propulsion), of an output not exceeding 40MW	REP
841919	841919	Heaters; instantaneous or storage water heaters, non-electric, (other than instantaneous gas or solar water heaters)	REP
841583	841583	Air conditioning machines, comprising a motor-driven fan and elements for changing the temperature and humidity, including those machines in which the humidity cannot be separately regulated; other; not incorporating a refrigerating unit	REP
841990	841990	Machinery, plant and laboratory equipment; parts of equipment for treating materials by a process involving a change of temperature	REP
854141	854140	Electrical apparatus; photosensitive semiconductor devices, light emitting diodes (LED)	REP
850750	850750	Electric accumulators; nickel-metal hydride, including separators, whether or not rectangular (including square)	REP
841013	841013	Turbines; hydraulic turbines and water wheels, of a power exceeding 10000kW	REP
732189	732189	Domestic appliances; non-electric, (other than cookers and plate warmers), for solid fuel and fuels other than gas or liquid, of iron or steel.	REP
841861	841861	Heat pumps; other than air conditioning machines of heading no. 8415	REP
841090	841090	Turbines; parts of hydraulic turbines and water wheels, including regulators	REP
850423	850423	Electrical transformers; liquid dielectric, having a power handling capacity exceeding 10,000kVA	REP

hs6_2022	hs6_2017	Description_hs2022	Medium code
761090	761090	Aluminium; structures (excluding prefabricated buildings of heading no. 9406) and parts of structures, n.e.c. in heading no. 7610, plates, rods, profiles, tubes and the like	REP
850171	850131	Electric generators; photovoltaic DC generators, of an output not exceeding 50W	REP
850440	850440	Electrical static converters	REP
900290	900290	Optical elements; n.e.c. in heading no. 9002 (e.g. prisms and mirrors), mounted, being parts or fittings for instruments or apparatus, of any material (excluding elements of glass not optically worked)	REP
850239	850239	Electric generating sets; (excluding those with spark-ignition or compression-ignition internal combustion piston engines), other than wind powered	REP
700991	700991	Glass mirrors; unframed, excluding rear-view mirrors for vehicles	REP
761300	761300	Aluminium; containers for compressed or liquefied gas.	REP
854142	854140	Electrical apparatus; photosensitive semiconductor devices, photovoltaic cells not assembled in modules or made up into panels	REP
850710	850710	Electric accumulators, including separators therefor, whether or not rectangular (including square): - Lead-acid, of a kind used for starting piston engines:	REP
732119	732119	Cooking appliances and plate warmers; for solid fuel and fuels other than gas or liquid, of iron or steel	REP
850180	850162	Electric generators; (excluding generating sets), photovoltaic AC generators (alternators)	REP
850133	850133	Other DC motors; DC generators, other than photovoltaic generators; of an output exceeding 75 kW but not exceeding 375 kW	REP
850650	850650	Cells and batteries; primary, lithium	REP
830630	830630	Photograph, picture or similar frames, mirrors; of base metal	REP
730820	730820	Iron or steel; structures and parts thereof, towers and lattice masts	REP
681512	681599	Stone or other mineral substances not elsewhere specified or included; fabrics of carbon fibres for non-electrical uses	REP
850610	850610	Primary cells and primary batteries: - Manganese dioxide	REP
850432	850432	Transformers; n.e.c. in item no. 8504.2, having a power handling capacity exceeding 1kVA but not exceeding 16kVA	REP
381800	381800	Chemical elements; doped for use in electronics, in the form of discs, wafers or similar forms; chemical	REP
850490	850490	Electrical transformers, static converters and inductors; parts thereof	REP
841181	841181	Turbines; gas-turbines (excluding turbo-jets and turbo-propellers), of a power not exceeding 5000kW	REP
840212	840212	Boilers; watertube boilers with a steam production not exceeding 45t per hour	REP
700992	700992	Glass mirrors; framed, excluding rear-view mirrors for vehicles	REP
901390	901390	Optical appliances and instruments; parts and accessories for articles of heading no. 9013	REP
841581	841581	Air conditioning machines; containing a motor driven fan, other than window or wall types, incorporating a refrigerating unit and a valve for reversal of the cooling/heat cycle (reversible heat pumps)	REP
392510	392510	Plastics; builders' ware, reservoirs, tanks, vats and similar containers of a capacity exceeding 300 litres	REP
901380	901380	Optical devices, appliances and instruments; n.e.c. in heading no. 9013	REP
850790	850790	Electric accumulators; parts n.e.c. in heading no. 8507	REP
854330	854330	Machines and apparatus for electroplating, electrolysis and electrophoresis:	REP
840690	840690	Turbines; parts of steam and other vapour turbines	REP

hs6_2022	hs6_2017	Description_hs2022	Medium code
850720	850720	Electric accumulators; lead-acid, (other than for starting piston engines), including separators, whether or not rectangular (including square)	REP
903289	903289	Regulating or controlling instruments and apparatus; automatic, other than hydraulic or pneumatic	REP
840211	840211	Boilers; watertube boilers with a steam production exceeding 45t per hour	REP
841590	841590	Air conditioning machines, comprising a motor-driven fan and elements for changing the temperature and humidity, including those machines in which the humidity cannot be separately regulated; parts	REP
841869	841869	Refrigerating or freezing equipment; n.e.c. in heading no. 8418	REP
841182	841182	Turbines; gas-turbines (excluding turbo-jets and turbo-propellers), of a power exceeding 5000kW	REP
850231	850231	Electric generating sets; wind-powered, (excluding those with spark-ignition or compression-ignition internal combustion piston engines)	REP
850421	850421	Electrical transformers; liquid dielectric, having a power handling capacity not exceeding 650kVA	REP
848690	848690	Parts and accessories of 8486	REP
761100	761100	Aluminium; reservoirs, tanks, vats and similar containers, for material (not compressed or liquefied gas), of a capacity over 300l, whether or not lined, not fitted with mechanical/thermal equipment	REP
850422	850422	Electrical transformers; liquid dielectric, having a power handling capacity exceeding 650kVA but not exceeding 10,000kVA	REP
900190	900190	Optical elements; lenses n.e.c. in heading no. 9001, prisms, mirrors and other optical elements, unmounted, of any material (excluding elements of glass not optically worked)	REP
850300	850300	Electric motors and generators; parts suitable for use solely or principally with the machines of heading no. 8501 or 8502	REP
853710	853710	Boards, panels, consoles, desks and other bases; for electric control or the distribution of electricity, (other than switching apparatus of heading no. 8517), for a voltage not exceeding 1000 volts	REP
841199	841199	Turbines; parts of gas turbines (excluding turbo-jets and turbo-propellers)	REP
850780	850740	Electric accumulators, including separators therefor, whether or not rectangular (including square); nickel-metal hydride	REP
854149	854140	Electrical apparatus; photosensitive semiconductor devices, diodes other than light emitting diodes and photovoltaic cells whether or not assembled in modules or made up into panels	REP
841290	841290	Engines; parts, for engines and motors of heading no. 8412	REP
850730	850730	Electric accumulators; nickel-cadmium, including separators, whether or not rectangular (including square)	REP
854143	854140	Electrical apparatus; photosensitive semiconductor devices, photovoltaic cells assembled in modules or made up into panels	REP
841582	841582	Air conditioning machines, comprising a motor-driven fan and elements for changing the temperature and humidity, including those machines in which the humidity cannot be separately regulated; other; other, incorporating a refrigerating unit	REP
850434	850434	Transformers; n.e.c. in item no. 8504.2, having a power handling capacity exceeding 500kVA	REP
850162	850162	Electric generators; AC generators, (alternators), other than photovoltaic generators, of an output exceeding 75kVA but not exceeding 375kVA	REP
841912	841919	Heaters; solar water heaters, non-electric	REP
700510	700510	Glass; float glass and surface ground or polished glass, in sheets, non-wired, having an absorbent reflecting or non-reflecting layer	REP

hs6_2022	hs6_2017	Description_hs2022	Medium code
850164	850164	Electric generators; AC generators, (alternators), other than photovoltaic generators, of an output exceeding 750kVA	REP
730890	730890	Iron or steel; structures and parts thereof, n.e.c. in heading 7308	REP
853720	853720	Boards, panels, consoles, desks and other bases; for electric control or the distribution of electricity, (other than switching apparatus of heading no. 8517), for a voltage exceeding 1000 volts	REP
850132	850132	Other DC motors; DC generators, other than photovoltaic generators; of an output exceeding 750 W and not exceeding 75 kW	REP
850690	850690	Primary cells and primary batteries; parts	REP
846596	846596	Machine-tools; for working wood, cork, bone, hard rubber, hard plastics or similar hard materials; splitting, slicing or paring machines	SWM
846694	846694	Machine-tools; parts and accessories, for the machines of heading no. 8462 or 8463, n.e.c. in heading no. 8466	SWM
851420	851420	Furnaces and ovens; electric, for industrial or laboratory use, functioning by induction or dielectric loss	SWM
847990	847990	Machines and mechanical appliances; parts, of those having individual functions	SWM
761290	761290	Aluminium; casks, drums, cans, boxes and the like for any material (not compressed or liquefied gas), 300l capacity or less, whether or not lined or heat-insulated, no mechanical or thermal equipment	SWM
851431	851430	Furnaces and ovens; electric, for industrial or laboratory use, other than those functioning by induction, dielectric loss or resistance heated, electron beam furnaces	SWM
852499	851410	Flat panel display modules, whether or not incorporating touch-sensitive screens; of other than liquid crystals or organic light-emitting diodes (OLED), with drivers or control circuits	SWM
840219	840219	Boilers; vapour generating boilers, including hybrid boilers n.e.c. in heading no. 8402	SWM
841382	841382	Other pumps, liquid elevators; liquid elevators	SWM
852419	851410	Flat panel display modules, whether or not incorporating touch-sensitive screens; of other than liquid crystals or organic light-emitting diodes (OLED), without drivers or control circuits	SWM
841780	841780	Furnaces and ovens; including incinerators, non-electric, for industrial or laboratory use, n.e.c. in heading no. 8417	SWM
851419	851410	Furnaces and ovens; electric, for industrial or laboratory use, resistance heated; other than hot isostatic presses, for the manufacture of semiconductor devices on semiconductor wafers	SWM
846290	846291	Machine-tools; (including presses) for working metal by forging, hammering or die-forging, for bending, folding, straightening, flattening, shearing, punching, notching or nibbling metal, n.e.c. in heading 8462	SWM
846261	846291	Machine-tools; cold metal working presses, hydraulic presses	SWM
846599	846599	Machine-tools; for working wood, cork, bone, hard rubber, hard plastics or similar hard materials; n.e.c. in heading no. 8465	SWM
847420	847420	Machines; for crushing or grinding earth, stone, ores or other mineral substances	SWM
852491	851410	Flat panel display modules, whether or not incorporating touch-sensitive screens; of liquid crystals, with drivers or control circuits	SWM
851411	851410	Furnaces and ovens; electric, for industrial or laboratory use, resistance heated; hot isostatic presses	SWM
840290	840290	Boilers; parts of steam or other vapour generating boilers	SWM
852492	851410	Flat panel display modules, whether or not incorporating touch-sensitive screens; of organic light-emitting diodes (OLED), with drivers or control circuits	SWM
851490	851490	Furnaces, ovens and heating equipment; parts of the industrial or laboratory equipment of heading no. 8514	SWM
842833	842833	Elevators and conveyors; continuous-action, for goods or materials, belt type, n.e.c. in item no. 8428.20 or 8428.31	SWM

hs6_2022	hs6_2017	Description_hs2022	Medium code
392010	392010	Plastics; plates, sheets, film, foil and strip (not self-adhesive), of polymers of ethylene, non-cellular and not reinforced, laminated, supported or similarly combined with other materials	SWM
851439	851430	Furnaces and ovens; electric, for industrial or laboratory use, other than those functioning by induction, dielectric loss or resistance heated, other than electron beam, plasma or vacuum arc furnaces	SWM
841940	841940	Distilling or rectifying plant; not used for domestic purposes	SWM
842220	842220	Machinery; for cleaning or drying bottles or other containers	SWM
852990	851410	Reception and transmission apparatus; for use with the apparatus of heading no. 8524 to 8528, excluding aerials and aerial reflectors	SWM
842940	842940	Tamping machines and road rollers; self-propelled	SWM
841319	841319	Pumps fitted or designed to be fitted with a measuring device; other	SWM
841790	841790	Furnaces and ovens; parts of non-electric furnaces and ovens (including incinerators), of industrial or laboratory use	SWM
851432	851430	Furnaces and ovens; electric, for industrial or laboratory use, other than those functioning by induction, dielectric loss or resistance heated, plasma and vacuum arc furnaces	SWM
847989	847989	Machines and mechanical appliances; having individual functions, n.e.c. or included in this chapter	SWM
852412	851410	Flat panel display modules, whether or not incorporating touch-sensitive screens; of organic light-emitting diodes (OLED), without drivers or control circuits	SWM
847982	847982	Machines; for mixing, kneading, crushing, grinding, screening, sifting, homogenising, emulsifying or stirring	SWM
842290	842290	Machinery; parts of machinery of heading no. 8422	SWM
852411	851410	Flat panel display modules, whether or not incorporating touch-sensitive screens; of liquid crystals, without drivers or control circuits	SWM
850590	850590	Magnets; electro-magnets, holding devices and parts n.e.c. in heading no. 8505	SWM
400259	400259	Rubber; synthetic, acrylonitrile-butadiene rubber (NBR), (other than latex), in primary forms or in plates, sheets or strip	SWM
842191	842191	Centrifuges; parts thereof, including parts for centrifugal dryers	SWR
842119	842119	Centrifuges; n.e.c. in heading no. 8421, including centrifugal dryers (but not clothes-dryers)	SWR
851629	851629	Heating apparatus; electric soil heating apparatus and space heating apparatus (excluding storage heating radiators)	SWR
890790	890790	Floating structures; tanks, coffer-dams, landing stages, buoys and beacons	SWR
730900	730900	Reservoirs, tanks, vats and similar containers; for any material (excluding compressed or liquefied gas), of iron or steel, capacity exceeding 300l, whether or not lined or heat insulated	WAT
732690	732690	Iron or steel; articles n.e.c. in heading 7326	WAT
730630	730630	Iron or non-alloy steel (excluding cast iron); tubes and pipes (not seamless), welded, of circular cross-section, n.e.c. in chapter 73	WAT
848130	848130	Valves; check (nonreturn) valves, for pipes, boiler shells, tanks, vats or the like	WAT
732510	732510	Iron; articles of non-malleable cast iron	WAT
730490	730490	Iron or steel (excluding cast iron); seamless, tubes, pipes and hollow profiles, seamless, n.e.c. in heading no. 7304	WAT
848140	848140	Valves; safety or relief valves, for pipes, boiler shells, tanks, vats or the like	WAT
391400	391400	Ion-exchangers based on polymers of headings 39.01 to 39.13, in primary forms	WAT
841350	841350	Pumps; reciprocating positive displacement pumps, n.e.c. in heading no. 8413, for liquids	WAT
560314	560314	Nonwovens; whether or not impregnated, coated, covered or laminated, of man-made filaments, (weighing more than 150g/m2)	WAT
732490	732490	Iron or steel; sanitary ware and parts thereof, excluding sinks, wash basins and baths	WAT
730300	730300	Cast iron; tubes, pipes and hollow profiles	WAT
842199	842199	Machinery; parts for filtering or purifying liquids or gases	WAT

hs6_2022	hs6_2017	Description_hs2022	Medium code
848110	848110	Valves; pressure reducing, for pipes, boiler shells, tanks, vats or the like	WAT
380210	380210	Carbon; activated	WAT
848190	848190	Taps, cocks, valves and similar appliances; parts thereof	WAT
854390	854390	Electrical machines and apparatus; parts of the electrical goods of heading no. 8543	WAT
841989	841989	Machinery, plant and laboratory equipment; for treating materials by change of temperature, other than for making hot drinks or cooking or heating food	WAT
560394	560394	Nonwovens, whether or not impregnated, coated, covered or laminated; other; weighing more than 150 g/m2	WAT
841360	841360	Pumps; rotary positive displacement pumps, n.e.c. in heading no. 8413, for liquids	WAT
730690	730690	Iron or steel (excluding cast iron); tubes, pipes and hollow profiles (not seamless), n.e.c. in chapter 73	WAT
731029	731029	Tanks, casks, drums, boxes and similar containers for any material (excluding compressed or liquefied gas) less than 50l capacity, n.e.c. in item no. 7310.2, of iron or steel	WAT
842121	842121	Machinery; for filtering or purifying water	WAT
841381	841381	Pumps and liquid elevators; n.e.c. in heading no. 8413	WAT
854370	854370	Electrical machines and apparatus; having individual functions, not specified or included elsewhere in this chapter, n.e.c. in heading no. 8543	WAT
848180	848180	Taps, cocks, valves and similar appliances; for pipes, boiler shells, tanks, vats or the like, including thermostatically controlled valves	WAT
842129	842129	Machinery; for filtering or purifying liquids, n.e.c. in item no. 8421.2	WAT
731010	731010	Tanks, casks, drums, cans, boxes and similar containers, for any material (excluding compressed or liquefied gas), 50l or more capacity but not exceeding 300l	WAT
691010	691010	Ceramic sinks, wash basins, wash basin pedestals, baths, bidets, water closet pans, flushing cisterns, urinals and similar sanitary fixtures; of porcelain or china	WAT
841939	841939	Dryers; for products n.e.c. in heading no. 8419, not used for domestic purposes	WAT
730431	730431	Iron or non-alloy steel (excluding cast iron); seamless, cold-drawn or cold-rolled, tubes, pipes and hollow profiles of circular cross-section	WAT
841370	841370	Pumps; centrifugal, n.e.c. in heading no. 8413, for liquids	WAT
841320	841320	Pumps; hand, fitted or designed to be fitted with a measuring device, for liquids, other than those of item no. 8413.11 or 8413.19	WAT

Note: A version of this list with explanations about the environmental purpose and possible ex-outs exists upon request and will be available on the OECD website. The environmental mediums are: APC = Air pollution control; CRE = Cleaner or more resource efficient technologies and products; EPP = Environmentally preferable products based on end use or disposal characteristics; HEM = Heat and energy management; MON = Environmental monitoring, analysis and assessment equipment; NRP = Natural resources protection; NVA = Noise and vibration abatement; REP =Renewable energy plant; SWM = Management of solid and hazardous waste and recycling systems; SWR = Clean up or remediation of soil and water; WAT = Waste water management and potable water treatment.

Annex B. Additional tables and figures

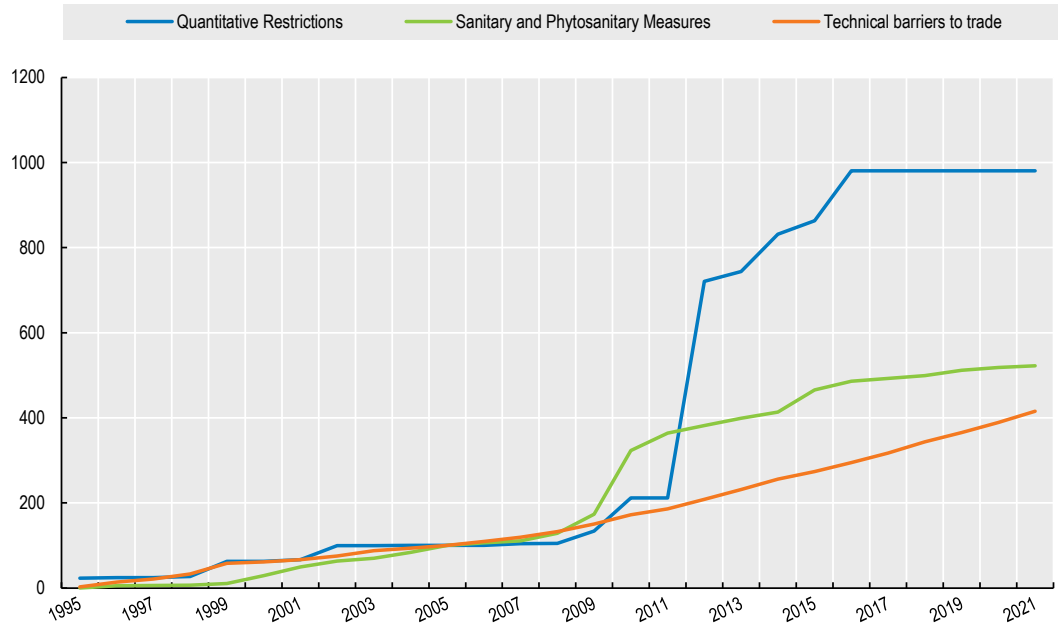
Table A B.1. Non-tariff measures per MAST chapter

		MAST chapter	Measures
Imports	Technical measures	A	Sanitary and phytosanitary measures (SPS)
		B	Technical barriers to trade (TBT)
		C	Preshipment inspection and other formalities (PSI)
	Non-technical measures	D	Contingent trade-protective measures
		E	Nonautomatic licensing, quotas, and other quantitative controls
		F	Price controls (PCs)
		G	Financial measures
		H	Measures affecting competition
		I	Trade-related investment measures
		J	Distribution restrictions
		K	Restrictions on postsales services
		L	Subsidies (excluding export subsidies under P7)
		M	Government procurement restrictions
		N	Intellectual property
		O	Rules of origin
Exports		P	Export-related measures

Source: TRAINS, UNCTAD.

Figure A B.1. Evolution of non-tariff measures

Base year 2005=100



Note: Authors' computation.
Source: Integrated Trade Intelligence Portal (I-TIP), WTO.

Table A B.2. Number of TBT decisions notified at the WTO and still in force in 2022, applied to EGs, per implementing country

Implementing country	Nb. of TBT decisions notified at the WTO since 2000 and still in force in 2022
Israel	351
China	342
United States	309
Brazil	180
Japan	141
Chinese Taipei	117
Ecuador	117
Thailand	112
Uganda	68
Kenya	54
South Africa	45
Mexico	43
Australia	35

Note: The table displays implementing countries that have the higher number of decisions on TBT measures. The same decision could affect more than one product and be implemented towards more than one trade partner.
Source: Integrated Trade Intelligence Portal (I-TIP), WTO.

Table A B.3. EGs regulated the most by TBT measures still in force (2000-2022)

HS code	Product description	Nb decisions
870390	Vehicles; for transport of persons (other than those of heading no. 8702) n.e.c. in heading no. 8703, including station wagons and racing cars	349
870290	Motor Vehicles For The Transport Of Ten Or More Persons, Others	235
853931	Lamps; discharge, (excluding ultra-violet), fluorescent, hot cathode	235
853921	Electric Filament Lamps Vehicles; public transport type (carries 10 or more persons, including driver), n.e.c. in heading 8702, new or used	203
853932	Lamps; discharge, (excluding ultra-violet), mercury or sodium vapour lamps, metal halide lamps	203
841581	Air conditioning machines; containing a motor driven fan, other than window or wall types, incorporating a refrigerating unit and a valve for reversal of the cooling/heat cycle (reversible heat pumps)	193
851629	Heating apparatus; electric soil heating apparatus and space heating apparatus (excluding storage heating radiators)	190
848180	Taps, Cocks, Valves And Similar Appliances For Pipes, Vats Or The Like, Including Thermostatically Controlled Valves, Others	190
850440	Electrical Static Converters; Power Supplies For Adp Machines Or Units Of 8471.	186

Note: The table displays the number of decisions on TBT measures mostly implemented on EGs. The same decision could affect more than one product and be implemented towards more than one trade partner.
Source: Integrated Trade Intelligence Portal (I-TIP), WTO.

Table A B.4. Illustrative TBT measures notified at the WTO

Measure description	Member imposing	Initiation year	HS6
National Standard of the P.R.C. - Fuel Consumption Limits for Passenger Cars	China	2014	870390
Technical requirements and measurement methods for emissions from light-duty hybrid electric vehicles.	China	2016	870390
Administration Regulation on the Access of New Energy Vehicle Manufactures and Products. This regulation specifies the requirements for the new energy vehicle manufacturers with regards to strengthening safety supervision and promoting, production conformity, etc.	China	2016	870390
National Standard of the P.R.C, Safety Specifications for Road Transportation Vehicle of Explosive Substance and Chemical Toxic Substance (…).The standard applies to road transportation vehicle and trailer of explosive substance and chemical toxic substance.	China	2017	870390
National Standard of the P.R.C., Electric Buses Safety Requirements.	China	2019	870390
Proposal for Amendments to Requirements on Minimum Energy Performance Standard and Energy Efficiency Rating Labeling and Inspection of Non-ducted Air Conditioning Machines.	China	2022	841581
Playpens for domestic use: Safety requirements SI 681 part 2 - (…) Playpen carriages - Safety requirements and test methods (SI 681 partie 3. Parcs à usage domestique.	Israel	2008	870390
Flat glass panels for use in buildings: Insulating glass units - Generalities, dimensional tolerance and rules for system description.	Israel	2022	700510
Partial Amendment to Safety Regulations for Road Vehicles, etc Amendments to the relevant regulations concerning headlamps, door latches and door retention components, passenger car braking, safety-belt, seats, etc.	Japan	2009	870390
Clarify that the exhaust pipe has to be piped so that there is little risk to injure passengers according to the exhaust gas enter the passenger compartment.	Japan	2017	870390
The Minister of Energy has proposed to create regulations to create a mandatory fuel economy labelling schemes for all vehicles under 3.5 tonnes. (…)	New Zealand	2007	870390
Draft Thai Industrial Standard for Positive Ignition Engined Vehicles: Safety Requirements; Emission from Engine (…).	Thailand	2011	870390
Intention to lay secondary legislation for electric vehicle smart charge points.	United Kingdom	2021	870390
Federal Motor Vehicle Safety Standards; Designated Seating Positions and Seat Belt Assembly Anchorages.	United States	2005	870390
Bus Testing; Phase-In of Brake Performance and Emissions Testing, and Program Updates.	United States	2008	870390
Vehicle Test Procedure Adjustments for Tier 3 Certification Test Fuel. The Environmental Protection Agency (EPA) is proposing to make adjustments to certain laboratory tailpipe emission testing procedures for automobiles, light trucks, and heavy-duty pickup trucks and vans(…).	United States	2020	870390
Energy Conservation Program: Test Procedure for Single Package Vertical Air Conditioners and Single Package Vertical Heat Pumps - The U.S. Department of Energy proposes to amend its test procedures for single package vertical air conditioners and single package vertical heat pumps.	United States	2022	841581

Note: The initiation data are the date of notification or publication of "draft and proposed" measures prior to their entry into force.
Source: Integrated Trade Intelligence Portal (I-TIP), WTO.

Table A B.5. Illustrative specific trade concerns on TBT measures notified at the WTO, for products mostly concerned by STC

Country/ Measure	Year	HS6	Product description
China - GB/T Information Security Technology -- Office Devices Security and YD/T. High spectrum efficiency and high throughput wireless LAN technical requirements. Voluntary standard that had not yet been issued.	2011	842119	Centrifuges; n.e.c. in heading no. 8421, including centrifugal dryers (but not clothes-dryers)
European Union - Draft Commission Regulation implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to eco-design requirements for air conditioners and comfort fans (ID 321) This draft Commission Regulation sets minimum energy performance, maximum sound power level and information requirements for air conditioners, as there exists a cost-effective potential to limit their energy consumption. (…)	2011	842119	Centrifuges; n.e.c. in heading no. 8421, including centrifugal dryers (but not clothes-dryers)
Ecuador - Energy efficiency. Clothes dryers. Labelling.	2014	842119	Centrifuges; n.e.c. in heading no. 8421, including centrifugal dryers (but not clothes-dryers)
Brazil - Toy Certification (…) It establishes the criteria to procedures to assess conformity and security, in order to be acquainted with the Conformity Assessment Program for Toys through the certification mechanism and provisions settled by the Technical Regulation aimed at preventing consumption accidents.	2015	950720	Fish-hooks; whether or not snelled
Kazakhstan, Russian Federation, Kyrgyz Republic - ? The amendments No. 2 to the Technical Regulation of the Customs Union on Safety of Toys.	2016	950720	Fish-hooks; whether or not snelled
China - GB/T Information Security Technology -- Office Devices Security and YD/T. High spectrum efficiency and high throughput wireless LAN technical requirements. Voluntary standard that had not yet been issued.	2011	841861	Heat pumps; other than air conditioning machines of heading no. 8415
European Union - Draft Commission Regulation implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to eco-design requirements for air conditioners and comfort fans (…).	2011	841861	Heat pumps; other than air conditioning machines of heading no. 8415
China - GB/T, Information Security Technology -- Office Devices Security and YD/T. High spectrum efficiency and high throughput wireless LAN technical requirements (ID 327) Voluntary standard that had not yet been issued.	2011	841581	Air conditioning machines; containing a motor driven fan, other than window or wall types, incorporating a refrigerating unit and a valve for reversal of the cooling/heat cycle (reversible heat pumps)
US - Energy Conservation Program for Consumer Products: various products (ID 384) US Department of Energy (DOE) measures to promote energy efficiency of appliances, lighting and other consumer products, under the Energy Policy and Conservation Act. (…) DOE set minimum energy requirements for products to be sold in the US market.	2013	841861	Heat pumps; other than air conditioning machines of heading no. 8415

Source: Integrated Trade Intelligence Portal (I-TIP), WTO.

Table A B.6. Countries included in the analysis using TRAINS, by income group

High and upper-middle income	Low and low-middle income
European Union	Pakistan
Algeria	Bolivia
Georgia	Nicaragua
Mexico	Kenya
Ecuador	El Salvador
Argentina	Honduras
Thailand	Côte d'Ivoire
Oman	Tunisia
United States	Indonesia
Armenia	Senegal
Guatemala	Morocco
Brazil	Burundi
Russia	Niger
Peru	Chad
Türkiye	Mozambique
Venezuela	Togo
Costa Rica	Guinea
Paraguay	
Colombia	
Cuba	
Qatar	
Canada	
New Zealand	
Panama	
Bahrain	
Saudi Arabia	
Switzerland	
Chile	
United Arab Emirates	
Norway	
Kuwait	

Note: Authors' elaboration based on World Bank classification.

Table A B.7. Minerals used in selected environmental goods

Material	Li-ion battery	Wind energy	Photo-voltaic
Aluminium	x	x	x
Copper	x	x	x
Iron ore	x	x	x
Borates		x	x
Germanium and other	x	x	x
Cobalt	x	x	
Rare earth elements	x	x	
Lead	x	x	x
Manganese	x	x	
Molybdenum		x	x
Nickel	x		x
Chromium		x	
Lithium	x		
Natural graphite	x		
Selenium	x		
Silver			x
Tin	x		x
Titanium	x		
Cadmium			x
Phosphorus	x		
Zinc			x
Zirconium			
Iron ore and steel products		x	x

Source: OECD (2023[56]).