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TRADING TOWARDS SUSTAINABILITY

The Role of Trade Policies in Indonesia's Green Transformation

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ABBREVIATIONS AND ACRONYMS

AFOLU	Agriculture, Forestry, and Other Land Use
ALDFG	Abandoned, Lost, or Discarded Fishing Gear
APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
AVE	Ad valorem Equivalent
BPS	*Badan Pusat Statistik* (Statistics Indonesia)
CBAM	Carbon Border Adjustment Mechanism
CCDR	Country Climate Development Report
DGCE	Directorate General of Customs and Excise
EAP	East-Asia Pacific
ECETCCS	Efficient Consumption of Energy Technologies and Carbon Capture and Storage
EFTA	The European Free Trade Association
EG	Environmental Good
EGA	Environmental Goods Agreement
EMDE	Emerging market and developing country
EPP	Environmentally Preferable Product
EPS	Environmental Policy Stringency
EU	European Union
EUDR	European Union Deforestation-Free Regulation
EV	Electric Vehicles
FDI	Foreign Direct Investment
FFSR	Fossil Fuel Subsidy Reform
FLEGT	Forest Law Enforcement, Governance, and Trade
FTA	Free Trade Agreement
GCI	Green Complexity Index
GHG	Greenhouse Gas
GSIM	Global Simulation Analysis Model
GTN	Green Transition Navigator
GVC	Global Value Chains
HICs	High Income Countries
HS	Harmonized Standard
IDP	Informal Dialogue on Plastics Pollution and Sustainable Plastics Trade
INSP	Pre-shipment Inspections and Other Related Measures
LCR	Local Content Requirements
MFN	Most Favored Nation
MoEF	Ministry of Environment and Forestry
NDC	Nationally Determined Contribution
NTM	Non-Tariff Measures
OECD	Organisation for Economic Co-operation and Development
OTH	Other Related Measures
PC	Price-Control Measures
PCI	Product Complexity Index
PoE	Port-of-Entry
PSI	Pre-shipment Inspection
PTA	Preferential Trade Agreements
QC	Quality-Control Measures
RCA	Revealed Comparative Advantage
RCEP	Regional Comprehensive Economic Partnership
SEZ	Special Economic Zones
SNI	*Standar Nasional Indonesia* (Indonesian National Standard)
SPS	Sanitary or Phytosanitary Measures
TESSD	Trade and Environmental Sustainability Structured Discussions
TBT	Technical Barriers to Trade
UNCTAD	United Nations Conference on Trade and Development
WITS	World Integrated Trade Solution
WTO	World Trade Organization

FOREWORD

The necessity for eco-friendly efforts in business and industry to be given top priority has been increasingly apparent to the world community in recent years. As one of the leading exporters in Southeast Asia, Indonesia has recognized the need for environmentally friendly trade and made significant progress in this area.

To combat climate change, both environmentally friendly products and trade policy play a vital role in ensuring sustainable development in Indonesia. Given its wealth of natural resources and biodiversity, Indonesia has simultaneously addressed the challenges of economic expansion and been mitigating the effects of climate change. We are aware that promoting green trade in Indonesia is essential to tackling environmental issues and promoting sustainable development. Nevertheless, Indonesia needs to balance environmental preservation and economic growth. Adopting green trade practices presents a calculated chance by encouraging trade that is socially, ecologically, and economically sustainable.

This new World Bank report on *Trading Towards Sustainability: The Role of Trade Policies in Indonesia's Green Transformation* could offer insights to guide the transition and to assist policy makers in creating effective policies on green trade. We can infer from the report that trade policy must balance the promotion of trade liberalization with the protection of environmental concerns. Properly crafted regulations have potential to foster a favorable climate for green trade, promote the manufacturing and exchange of eco-friendly products, as well as support worldwide sustainability objectives.

Furthermore, the report finds that governments, international organizations, corporations, and other stakeholders need to work together to address NTMs in the context of green trade to foster sustainable practices and make it easier for environmentally friendly goods to be traded internationally. There are some approaches that can be further considered to deal with NTMs associated with green trade, such as: (i) the promotion of international environmental standard harmonization; (ii) the facilitation of mutual recognition arrangements (MRAs) on environmental standards, certifications, and labels; (iii) the simplification of administrative processes for the certification and verification of green products; (iv) the provision of technical assistance and capacity-building programs, particularly aimed at developing countries; (v) encouragement on cooperation between governments and private sectors to develop guidelines, standards, and best practices for green trade; (vi) the implementation of trade promotion programs on increasing awareness of green products; and (vii) the implementation of trade facilitation measures tailored for green products through among others, streamlined customs procedures, less paperwork, and expedited processing procedures.

Notwithstanding the possible advantages of green trade, difficulties still exist. Indonesia frequently faces obstacles such as lack of funding, outdated technology, and inadequate institutional frameworks. To overcome these challenges, Indonesia may need financial commitments, supportive policies, international cooperation, and creative solutions that are designed to this country's particular conditions. It is impossible to underestimate the contribution of developing countries to the global movement of sustainability. The commitment to achieving a balance between economic expansion and environmental conservation should come from all to provide stronger and sustainable trade in the future.

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EXECUTIVE SUMMARY

Climate change–and efforts to mitigate and adapt to it–will affect global flows of trade and Indonesia's ability to transition to a more environmentally sustainable economy on its path to become a high-income economy is, therefore, interlinked with trade policy. Regulatory initiatives on climate and the environment by Indonesia and its trading partners will impact trade significantly. Green policies in emerging markets and developing countries (EMDEs) have been found to improve export duration–especially when trading with high-income countries.[1] While Indonesia has put in place policies such as on deforestation, moving towards sustainable palm oil, curtailing plastic waste, and carbon pricing instruments, more needs to be done to position itself in the global transition to a low-carbon economy. The carbon intensity of Indonesia's trade flows has seen a significant decline over the years–more than halving since 2005, but Indonesia has a high share of exports that have a high intensity of CO_2 emissions. About 60 percent of CO_2 emissions embedded in exports stem from agriculture (including mining and quarrying), manufacturing, and coal and petroleum products (refined and plastic).

Environmental policy stringency (EPS) is increasing around the globe–a crucial challenge lies in harmonizing these with sustained economic growth, yet both goals can be reached. EPS has been increasing over time across countries of all income groups in the last 20 years (Figure ES.1). The World Bank Climate Change and Development Report (CCDR) indicates that a balance between environmental goals and economic growth is attainable (World Bank 2023). This can be done by enacting reforms that simultaneously address short-term environmental concerns and contribute to the nation's long-term sustainable development–fostering a transition towards a greener, economically prosperous future. This includes making trade greener, as a larger portion of environmentally stringent countries record above–average green export survival rates than those below the overall mean EPS index value.

Although trade flows facilitate emissions, they are also a critical part of the solution, including through trade in environmental goods (EGs) and plastic substitutes–with important economic spillovers. First, trade can shift production towards cleaner

[1] Türkcan et al. forthcoming.

production techniques. Second, EGs and services necessary for transitioning to low-carbon production can be distributed and third, countries can access critical goods and services after being affected by extreme weather events (Brenton and Chemutai 2021). The presence of green products in trade reduces a country's ecological footprint (Can et al. 2021b) and increases environmental quality (Sauvage 2014). Plastic substitutes could also cut global plastic waste by about 17 percent by 2040, and can foster growth, increase exports, reduce pollution and emissions, as well as create higher-value employment opportunities (United Nations Conference on Trade and Development–UNCTAD 2023). As EGs serve various environmental sustainability roles, more trade in these products would also have important spillover effects in making domestic production cleaner and therefore broader exports, greener.

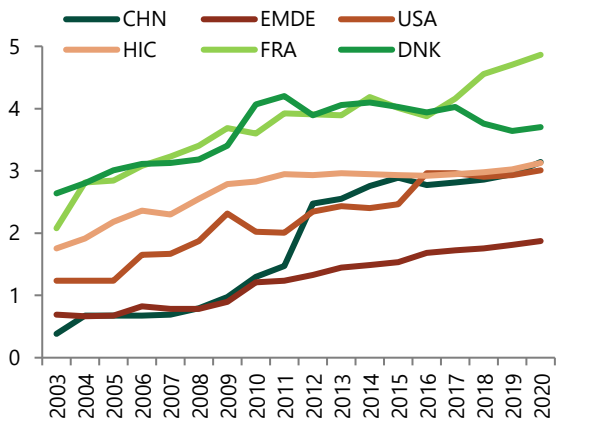
This report provides a detailed analysis of the role of trade and trade policy on EGs and plastic substitutes in Indonesia's green transition. Chapter One describes the need for, and urgency of, this transition, by looking at the carbon intensity of Indonesia's trade, the impacts of environmental policies of Indonesia and key trading partners, and the roles of EGs. Chapter Two examines where Indonesia stands on the level of trade in EGs and plastic substitutes and the competitiveness of EGs trade. Chapter Three explores trade agreements and tariffs and simulates potential impacts of tariff reforms–including through multilateral actions. Chapter Four examines what non-tariff measures (NTMs) apply on these products including inputs of firms exporting EGs and assesses which NTMs may be costly. Finally, Chapter Five concludes with policy recommendations. While comprehensive, the report recognizes that other factors besides trade play a crucial role in climate change, and that an increase in trade in EGs and plastic substitutes is likely to have distributional effects which are not studied in this report.

To analyze trade in EGs, this report refers to a list of products defined by the Green Transition Navigator (GTN), while plastic substitutes refer to the list by UNCTAD. The GTN compilation of EGs is based on classifications from the Asia-Pacific Economic Cooperation (APEC), the Organization for Economic Co-operation and Development (OECD), and the World Trade Organization (WTO) that use six-digit Harmonized System (HS) codes. The terms green trade and trade in EGs are used interchangeably. This includes 19 categories that have varying climate mitigation, adaptation, and broader environmental roles. UNCTAD (2023) published a list of 282 6-digit HS codes as a reference for raw materials and products categorized as environmentally sustainable plastic substitutes.

Finding 1: Indonesia's green competitiveness has declined in recent years but Indonesia has untapped potential in exports of EGs and plastic substitutes and the private sector, especially firms involved in global value chains, will be key to realizing Indonesia's potential in green trade.

Indonesia has untapped potential in exports of EGs and plastic substitutes. Indonesia's potential to diversify into green, technologically sophisticated products, measured by its Green Complexity Potential (GCP), ranks relatively higher than other countries and was steadily improving until 2015 before it started declining again. While Indonesia is lagging in EG exports (Figure ES.2), EG imports (Figure ES.3) are at par with global and regional averages and represent an important source of access and transmission of new green technologies–underscored by the fact that Indonesia's EG imports are more technology-intensive than exports. The extent to which Indonesia can competitively export green, technologically sophisticated products is still low relative to other countries, however, its potential to diversify into these products is relatively high. Indonesia is a net exporter of plastic substitutes. While Indonesia is in the world's top 20 traders of plastic substitutes (Figure ES.4), the levels have remained relatively static over time.

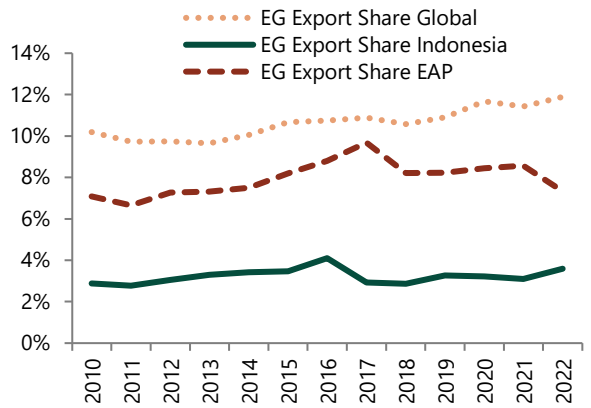
Figure ES.1: Trends in EPS index values of selected countries between 2003 and 2020



Source: OECD Stat database.
Note: HIC= selected High-income Countries; EMDEs: Selected emerging and developing economies.

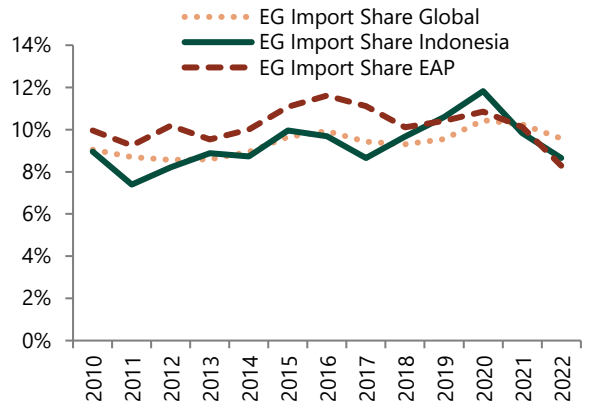
The private sector, especially firms involved in global value chains, will be key to realizing Indonesia's potential in trade in EGs and plastic substitutes. The number of firms involved in EGs trade increased between 2014 and 2018 but dropped as a share of all Indonesian firms trading internationally. The report shows that the degree of involvement of Indonesian firms in international trade matters in trade of EGs–especially for exports. Two-way traders–firms that both export and import–export more green products, trade in higher-technology EGs, and have higher survival rates in export markets of EGs (Figure ES.5). As over 90 percent of these products are intermediate and capital goods products, and have relatively higher technological intensity, firms stand to benefit from technological spillovers and tools to facilitate greener production practices.

Figure ES.2: Indonesia has a low share of EGs in its exports…



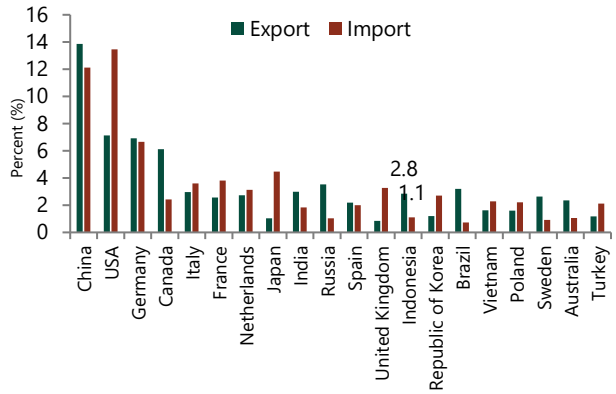
Source: World Bank staff calculations from BPS[2] and World Integrated Trade Solution (WITS) data.

Figure ES.3: …while the EG share in imports broadly aligns with the global average



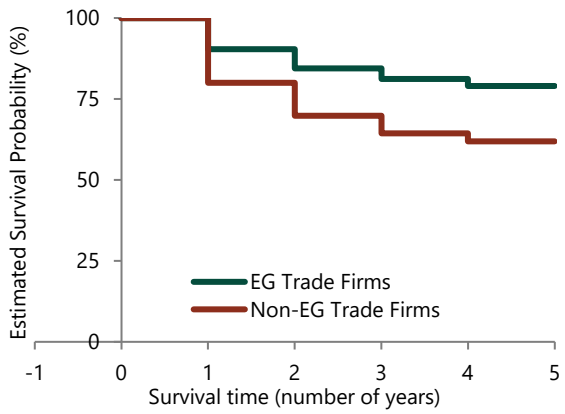
Source: World Bank staff calculations BPS and WITS data.

Figure ES.4: Indonesia is in the top 20 traders of plastic substitutes… (2021)



Source: World Bank staff calculations from WITS data.

Figure ES.5: Indonesian two-way traders in EGs have higher survival rates than non-EG traders (percent)



Source: World Bank staff calculations from Directorate General of Customs and Excise (DGCE) data.

[2] Statistics Indonesia (*Badan Pusat Statistik*: BPS) is a non-departmental government institute of Indonesia that is responsible for conducting statistical surveys. Its main customer is the government, but statistical data is also available to the public.

Finding 2: While Indonesia committed to reducing tariffs on some EGs and took steps to ensure more environmentally sustainable palm oil and timber exports, Indonesia does not participate in most multilateral initiatives and environmental provisions in trade agreements are weakly enforceable in most cases.

While Indonesia committed to reducing tariffs on some EGs, the country does not participate in most multilateral initiatives and environmental provisions in trade agreements are weakly enforceable. In the early stages, Indonesia was one of the signatories of the APEC agreement in 2012 committing to limit tariffs on 54 EGs to a maximum of 5 percent. Indonesia is not, however, one of the 46 members of the World Trade Organization (WTO) engaged in plurilateral negotiations seeking to eliminate tariffs on EGs under the Environmental Goods Agreement (EGA). Indonesia also does not participate in the three multilateral initiatives aimed at tackling issues at the nexus between trade policy and climate change–namely the Trade and Environmental Sustainability Structured Discussions (TESSD), the Informal Dialogue on Plastics Pollution and Sustainable Plastics Trade (IDP), and the Fossil Fuel Subsidy Reform (FFSR). Among Indonesia's 14 trade agreements analyzed at the time of writing, only six contain environmental provisions–of which only one (Indonesia EFTA) is strongly legally enforceable.

Finding 3: Average tariffs are low, but Indonesia's MFN tariffs on EG imports remain high. Tariff reductions and the regional liberalization of tariffs on EGs trade among APEC countries and under the WTO EGA would create important "trade creation" effects, boost Indonesia's EG trade and facilitate firm entry into EG markets.

While average tariffs are low, Indonesia's Most Favored Nation (MFN) tariffs on EG imports remain high (7.2 percent), and tariff reductions would have positive effects on trade in EGs. At an average of 2 percent in 2021, Indonesia's tariffs on EGs are generally low. Indonesia's MFN regime has several product lines with tariff peaks of above 25 percent. Results of simulations using a partial equilibrium trade model at the product level suggest that the unilateral, regional, and multilateral liberalization of tariffs on EGs trade would have previously untapped benefits for Indonesia. First, unilateral liberalization of tariffs would boost the private sector's access to cheaper and cutting-edge EGs and technologies. Second, regional liberalization of tariffs on EGs trade among APEC countries would create important "trade creation" effects with other participating countries and would benefit Indonesian exporters of EGs such as Energy Efficiency; Resources and Pollution Management; and Water Supply (Figure ES.6). Third, liberalizing tariffs on EGs under the umbrella of the WTO EGA is estimated to boost Indonesia's EG exports by 1.1 percent (US$99 million) and green imports by 1.2 percent (US$214 million) (Figure ES.7). Tariffs on imports of EGs also reduce the probability of firm entry, as a one percentage point increase in tariffs reduces the probability of firms starting to trade in EGs by 9.3 percent. In addition, a tariff increase in imported inputs for EG exports reduces the export value of EGs.

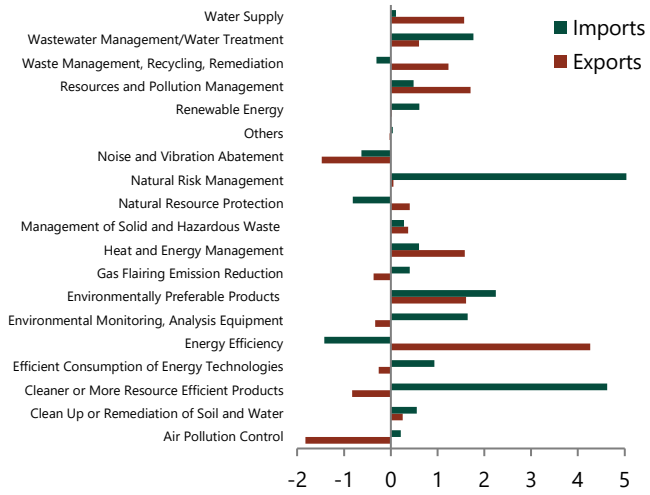
Finding 4: Estimates suggest that some NTMs impose significant costs–equivalent to up to a 30 percent tariff for some EGs and plastic substitutes, and some measures negatively affect firms. In addition, local content requirements (LCR) aimed at creating local manufacturing capacity could also be a deterrent to growth.

NTMs are regulations such as packaging or licensing requirements, price controls, and import quotas that aim to fulfill public policy objectives but can also affect the flow of goods and services. Some of these measures are necessary–for example, to ensure the compliance with health and safety standards, while others result in costly trade without achieving their primary policy objective.

Estimates suggest that some NTMs impose significant costs–equivalent to up to a 30 percent tariff for some EGs and plastic substitutes, and some measures deter firm entry. This leads to lower participation rates of firms in import and export markets of EGs. NTMs affect the inputs into the production of EGs and can lower the number of firms trading those goods and the export value of EGs. Between 2014 and 2018, on average, 92.4 percent of all exported EGs used imported inputs that were exposed to NTMs (Figure ES.8). In 2018 for example, NTMs affected inputs of 7,421 products out of 7,801 total exported products. Survey results also show that firms trading in EGs indeed consider some NTMs to pose a challenge–including the lack of harmonization on standards (Figure ES.9). Among NTMs, compliance with national standards (*Standar Nasional Indonesia*: SNI), the requirement to pass through a specific port of customs, and pre-shipment inspections (PSI) are more costly than the same measures on EGs in other ASEAN countries (Figure ES.10). Several NTMs also increase the cost of imported plastic substitutes and reforming them would potentially allow cheaper access (Figure ES.11).

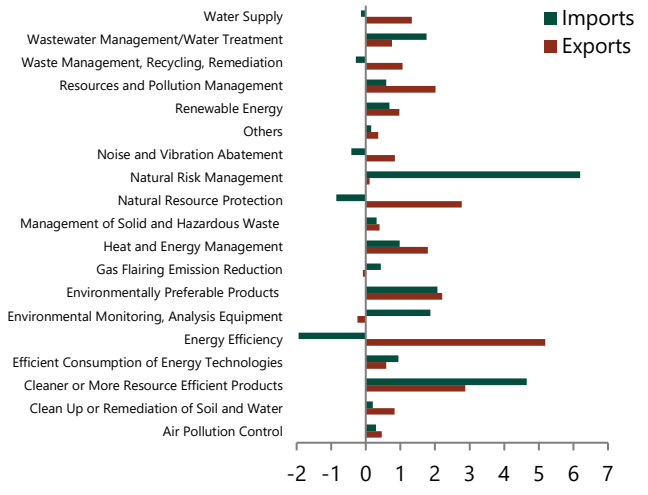
In addition, without the right conditions, LCR aimed at creating local manufacturing capacity could also be a deterrent to growth. Indonesia has set LCRs on solar panels but the realization of the LCR of solar modules currently does not reach the set minimum. LCRs also apply to the electric vehicle (EV) industry in Indonesia, compensated by generous incentives to attract investors. For two- and three-wheeled EVs, a minimum local content of 40 percent and for four-wheeled EVs a minimum 35 percent local content is required. LCRs act as barriers to international public procurement and, therefore, reduce the attractiveness of major renewable energy sector public procurement projects. LCRs applied in other countries for the purposes of developing domestic productive capability of renewables have mostly led to increased costs.[3] LCRs are far more likely to succeed if the market size is large and the market's demand is stable. Small or unstable markets may prevent firms from taking advantage of economies of scale, exacerbating the rise in production costs that result from LCR policy implementation.

Figure ES.6: The impact of regional liberalization of EGs trade among APEC countries (percent change)



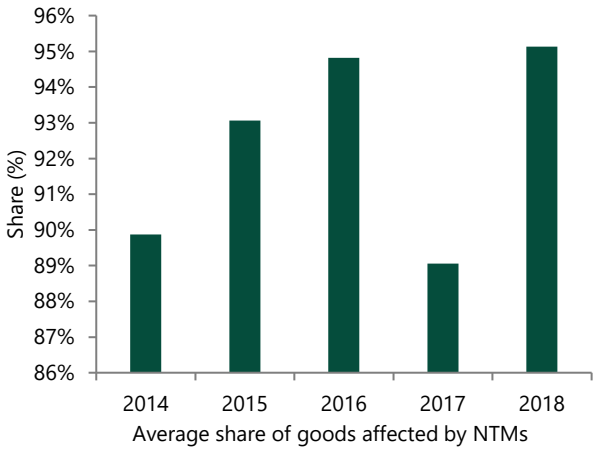
Source: World Bank staff calculations from DGCE data.

Figure ES.7: The impact of the WTO EGA with Indonesia on EGs trade (percent change)



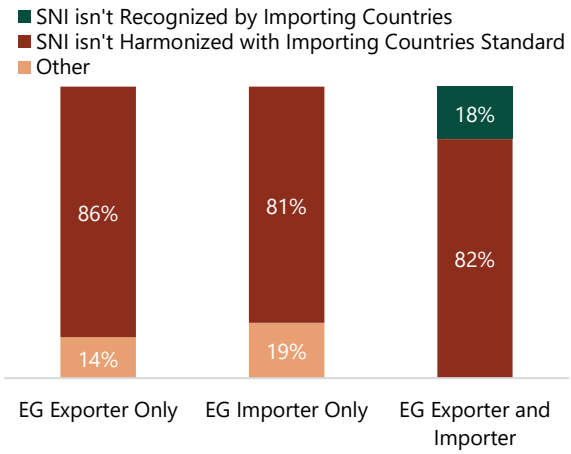
Source: World Bank staff calculations from DGCE data.

Figure ES.8: Average share of goods affected by NTMs



Source: World Bank staff calculations from DGCE data.

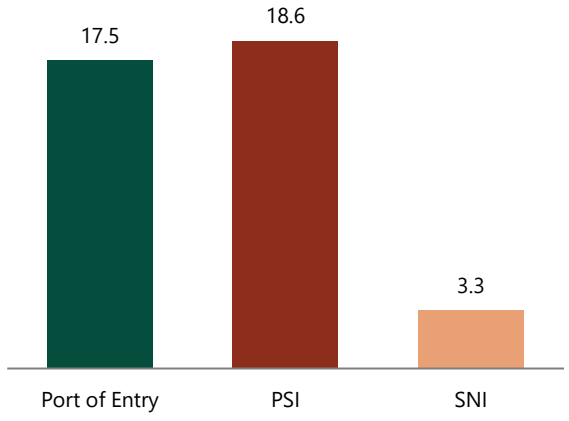
Figure ES.9: Challenges with product standards remain



Source: World Bank staff calculations from DGCE data.

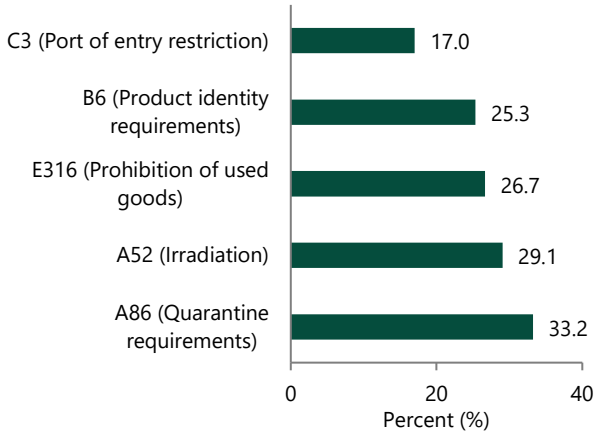
[3] For example, in Brazil, India, and South Africa as discussed in Bazilian et al. (2020).

Figure ES.10: Tariff equivalent of most problematic NTMs on EGs are relatively more costly compared to EAP (Ad Valorem Equivalent: AVE difference)



Source: World Bank staff calculations from WITS data.

Figure ES.11: NTMs increase the cost of imported plastic substitutes



Source: World Bank staff calculations from WITS data.

Finding 5: LCRs and nine out of nearly 90 non-tariff trade measures–including their estimated tariff equivalents, cost relative to ASEAN countries, overall incidence and a survey of firms trading in EGs–are suggested for review and possible reform.

The recommendations emerging from these findings are as follows:

Recommendation One: Reduce remaining tariffs on imports of EGs and plastic substitutes–including through multilateral participation. Reducing import tariffs on EGs will lower their price, boost access to lower-cost, more energy-efficient technologies and incentivize the use of environmentally friendly alternatives. This is particularly important for industries that must comply with climate change mitigation policies. Unilateral, regional, and multilateral liberalization of tariffs on EGs trade would have previously untapped benefits for Indonesia and facilitate firm entry into trading of EGs.

Recommendation Two: Streamline NTMs on EGs and plastic substitutes and conduct a systematic and periodic review of trade regulations. Given that there are many different NTMs by different government ministries and agencies, identifying which policies and measures warrant a closer look for reform is key. To that end, we triangulate the results on both the cost and the incidence of NTMs to narrow down measures that could be improved or relaxed for EGs and plastic substitutes. The recommendations also account for feedback from the survey of firms such as on standards and previous work the World Bank has conducted on specific non-tariff trade measures that may be burdensome. These are presented in Table ES.1. A responsible government agency that conducts such holistic reviews on NTMs would be an important first step in this regard.

Table ES.1: NTM recommendations based on findings in the report

NTMs for Potential Reform	EGs	Plastic Substitutes
Authorization requirement for SPS reasons for importing certain products (A14)	Renewable Energy	
Traceability requirements (A85)	Renewable Energy	
Quarantine requirement (A86)		Plastic Substitutes
Certifications complying to national standards (SNI, B7)#	All EGs*	
Authorization requirements for importing certain products (B14)	Management of Solid and Hazardous Waste and Recycling Systems; Waste Management, Recycling and Remediation	
Authorization requirements for importers (B15)	Waste Management, Recycling and Remediation	
Traceability requirements (B85)	Waste Management, Recycling and Remediation	
Pre-shipment Inspections (C1)#	All EGs*	
Requirement to pass through specified port of customs (C3)	All EGs*	Plastic Substitutes

Source: World Bank staff calculations from BPS and World Bank NTM Database based on 2008-21 sample years.
Note: Color codes: Orange affects some categories of EGs; Red affects all EG categories.
*AVEs for all EGs are in relation to AVEs for ASEAN countries applying the same measures on the same products.
While PSI measures were dropped in 2021, they have historically been high and new post-border and pre-border inspection changes yet to be implemented will likely increase this share. SNI measures are included due to high cost and recurrent concerns from the private sector including those trading in EGs.

Recommendation Three: Work toward a harmonization of product standards across markets, mutual recognition, as well as coordination on climate policies that are likely to affect trade to better enable the private sector. Harmonization of standards and mutual recognition could be a supportive policy to encourage imports of EGs, exports in new export markets with comparable standards, and facilitate product upgrading for firms. There is a need to harmonize existing local standards with international ones and develop new standards that are aligned with international standards and practices. Improving the coordination of climate-related policies would also reduce policy fragmentation and compliance costs for firms from administrative difficulties and potential complexities.

Recommendation Four: Review and relax local content requirements (LCRs) to accelerate renewable energy (RE) sector growth through strengthening domestic supply chain and establishing demand for RE and RE enabling projects. Given progress by, and lessons from, other countries, Indonesia may consider reducing minimum requirements on LCRs and allow the market to first develop to a point where domestic production could achieve the economies of scale required to keep prices affordable. There may be scope for countries to agree to cooperate on green industrial policies (procurement, subsidies, LCRs, investment, technology transfer, and IP).

Recommendation Five: Include enforceable environmental provisions in trade agreements and participate in plurilateral and multilateral trade policy initiatives on EGs. On the one hand, environmental provisions and commitments will need to become more detailed in terms of scope and ambition. On the other hand, direct participation in multilateral and plurilateral environment-related trade policy initiatives would not only allow Indonesian exporters to benefit from improved market access in destination markets but would also give Indonesia a seat at the table to shape the content and course of discussions.

Recommendation Six: Strengthen the complementarity between trade and climate policies. This includes more systematically integrating trade policies and trade facilitation measures as part of broader climate strategies–including in Nationally Determined Contributions (NDCs).

These policies will need to ensure equity and will have broader economy-wide effects that will need to be analyzed further. As trade in EGs and plastic substitutes increases, possible impacts on jobs and the labor market for various industries, as well as impacts on other macroeconomic outcomes is expected. Climate-related trade policy instruments also need to ensure non-discrimination and be administratively feasible. These aspects are beyond the scope of this report but will be taken on in the next phase.

CHAPTER 1.
INTRODUCTION

CHAPTER 1. INTRODUCTION

Indonesia has made progress on some aspects of trade, climate, and environmental policies, but climate action and trade-related policies are yet to be explicitly aligned. Although trade flows facilitate carbon emissions, they are also a critical part of the solution–including through trade in environmental goods (EGs) and plastic substitutes. This is crucial both for Indonesia's own Nationally Determined Contribution (NDC) and because global regulatory initiatives on climate and the environment by trading partners will impact trade significantly. Identifying key trade policies to boost trade in EGs and plastic substitutes would be a step forward to environmentally sustainable and climate friendly domestic production processes and international trade–on Indonesia's path to becoming a high-income country.

Indonesia has made significant strides in climate adaptation and mitigation efforts, but a crucial challenge lies in harmonizing these with sustained economic growth on its path to becoming a high-income nation. The World Bank Climate Change and Development Report (CCDR) indicates that a balance between these two objectives is attainable (World Bank 2023). Both goals can be reached by enacting reforms that simultaneously address short-term environmental concerns and contribute to the nation's long-term sustainable development–fostering a transition towards a greener, economically prosperous future.

Although Indonesia's economy has diversified over past decades, commodities and natural resource extraction remain key for both the domestic economy as well as international trade. Exports of primary products and resource-based manufactures make up over 60 percent of total exports. Indonesia is a large exporter of fossil fuels and the world's largest palm oil exporter–with a 55 percent share in total global exports (International Monetary Fund 2021). Coal made up 11 percent of exports, followed by palm oil (8 percent), and petroleum gas (4 percent) in 2019. Over 60 percent of total coal production was exported in 2019–making Indonesia the world's largest coal exporter (International Energy Agency 2021). The government receives royalties from oil, gas, and coal mining that are equivalent to 7.5 percent of total government revenue.[4]

[4] Oil, gas, and coal mining royalties were 4.3 percent, 1.9 percent, and 1.3 percent of total revenue, respectively, in 2019 (IMF 2021a).

Indonesia is among the world's ten largest GHG emitters but is also highly vulnerable to climate change–requiring that climate mitigation and adaptation efforts go hand in hand. Indonesia's total GHG emissions have increased from about 1,000 to 1,800 $MtCO_2eq$ during the 2000-19 period, more than one-half of which were contributed by the agriculture, forestry, and other land use (AFOLU) sectors. From 2000 to 2020, Indonesia lost almost 8.49 million hectares of forest cover (MoEF 2022) and registered one of the highest rates of species decline worldwide. Agriculture and forestry activities were the primary drivers of land cover change, notably export-oriented timber extraction, pulp and paper plantations and oil palm–particularly on the islands of Sumatra and Kalimantan. At the same time, Indonesia is highly vulnerable to weather and climate stresses. Estimates suggest that rising temperatures and changing rainfall patterns will significantly reduce yields across almost all key crops–rice, maize, other cereals, sugar, oil crops, pulses, fruit, and vegetables.

While forestry and land use persist as a critical issue for Indonesia's climate action, Indonesia has already made noteworthy progress in reducing emissions or preserving forest land. In 2022 Indonesia enhanced the NDC, raising the emission reduction target to 31.89 percent unconditionally and 43.2 percent conditionally (Republic of Indonesia 2022). To achieve carbon neutrality by 2050, Indonesia formulated the Long-Term Strategy for Low Carbon and Climate Resilience (2021), launched the Low Carbon Development Initiative and increased targets on renewable energy. Deforestation in Indonesia has slowed over time, decreasing from an average of 1.08 million hectares (ha) per year during 2000-2007, to an average of 0.48 million ha per year during 2014-2021 partly due to the permanent moratorium on clearing of primary forests and peatlands. Large peatland rewetting and restoration projects aim to restore 2.7 million hectares of peatland by 2030 while, at the same time, the government aims to rehabilitate 5.3 million hectares of degraded forest land (World Bank 2023).

Indonesia also aspires to curtail marine plastic waste by 70 percent before 2025.[5] The annual production of 7.8 million tons of plastic waste–the majority of which ultimately finds its way into rivers and oceans–leads to detrimental effects on marine life and ecosystems (World Bank 2021). In 2016, the Government of Indonesia through the Ministry of Environment and Forestry (MoEF) (Circular Letter Number 1230/2016) introduced supplementary charges for plastic bags with each retail purchase. Ongoing efforts to address plastic waste persist, with the implementation of MoEF Regulation No. 75/2019 serving as one such initiative. The regulation mandates that the manufacturing, food and beverage, and retail sectors follow a national roadmap to achieve a 30 percent plastic waste reduction by 2029. The prescribed implementation strategies encompass the adoption of biodegradable items, the utilization of recyclable materials at various stages of production, and the promotion of reusable waste management practices.

Climate change–and efforts to mitigate it both globally and in Indonesia–will affect global flows of trade, just as climate-related events will affect productive capacities. World Bank analysis shows that demand is expected to decline for fossil fuels and energy-intensive exports while rising for relatively low energy-intensity products such as electronics or select services sectors (Brenton et al. forthcoming). Mitigation policies could lead to a decline in world trade, with a drop of up to 5 percent in low- and middle-income countries and declines of 2 percent in advanced economies. Improving carbon competitiveness of existing Global Value Chains (GVCs), will drive the overall trade performance. Heavy agricultural exporters like Indonesia will see their yields decline in several sectors and productive capacities affected due to climate shocks. At the same time, tightened environmental laws within exporting countries increase their specialization in green products, improving their survival rates in international markets (Koźluk and Timiliotis 2016; Sauvage 2014).

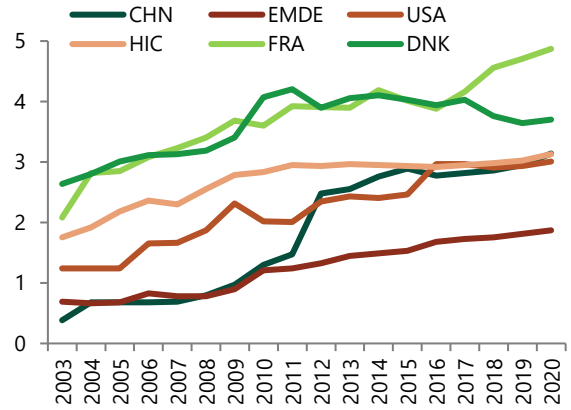
Environmental policy stringency (EPS) has been increasing across countries of all income groups in the years between 2003 and 2020. Although on average, high-income countries (HICs) enforced more stringent environmental policies than middle-income countries (Figure 1.1), the increase is observed among low-, middle-, and high-income countries, with Indonesia ranking 37th of the 40 countries sampled (Figure 1.2). One example is the Carbon Border Adjustment Mechanism (CBAM) of the European Union (EU) which is expected to impact sectors like iron and

[5] The National Plastic Action Partnership (NPAP) initiative brings together multiple public and private sector stakeholders in Indonesia. Source: https://wri-indonesia.org/en/initiatives/indonesia-national-plastic-action-partnership-npap

steel. While worldwide NDCs have a larger impact on Indonesia, if similar mechanisms to the EU CBAM are implemented by other countries, it will significantly affect aggregate real income, output, and trade as demand shifts away from more carbon-intensive sectors to green industries (Box 1.1). Other examples are the European Union Deforestation-Free Regulation (EUDR) which will likely affect exports of palm oil, one of Indonesia's main export commodities (European Commission 2023), the EU Critical Raw Materials Act, the US Inflation Reduction Act, and the EU Supply Chain Diligence, among others.

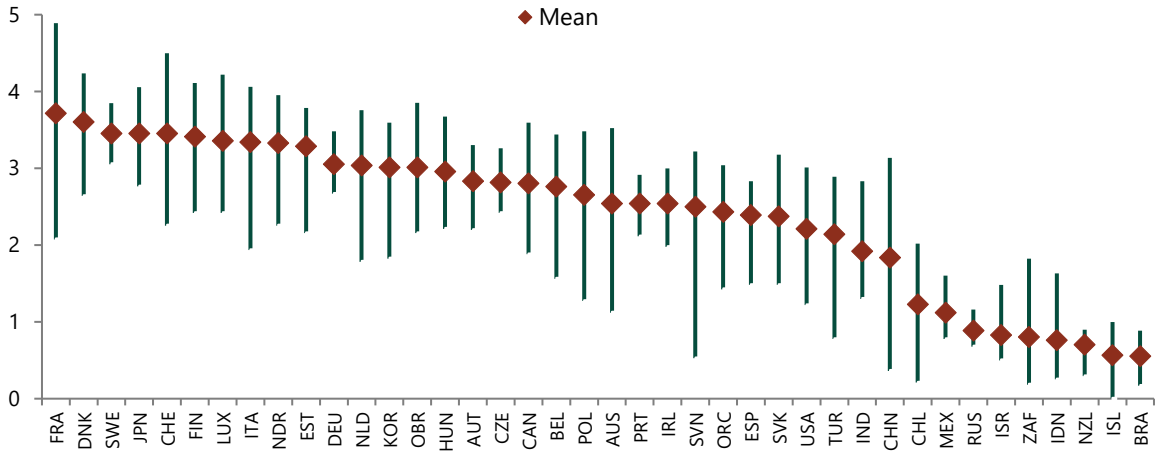
While Indonesia has put in place policies in response, such as on deforestation, more needs to be done to position itself in the global transition to a low-carbon economy. Partly in response to the EUDR, Indonesia established the Timber Sustainability and Legality Verification System, which was implemented as a response to the EU deforestation act. The system helps to ensure sustainable practices in timber production and is the first system worldwide that is recognized by the EU. Developments such as the trade agreement with the European Free Trade Association (EFTA) states will strengthen systems for trade of sustainable palm oil. Indonesia could further adapt to new sources of international demand, adjust its existing productive capabilities, and cultivate new green industries. Indonesia has an untapped potential for exports of environmental goods (EGs).[6] With exports of EGs of US$10.4 billion (3.6 percent of total goods exports) in 2022, Indonesia is far below the global and East Asia and Pacific (EAP) average at 12 percent and 7.3 percent, respectively.

Figure 1.1: Trends in EPS index values of selected countries (2003-20)



Source: Türkcan et al. (forthcoming)-calculations from OECD Stat database.

Figure 1.2: EPS index values for the sample (2003-20)



Source: Türkcan et al. (forthcoming)-calculations from OECD Stat database.

[6] EGs are defined by the environmental benefits they provide rather than their carbon content. The term EGs and environmental goods (EGs) are used interchangeably.

Indonesia's ability to diversify away from primary products, reduce carbon emissions, adapt to climate change, and transition to a more environmentally sustainable economy is, therefore, interlinked with trade and trade policy. Despite the declining importance of trade for Indonesia's economy after the Asian Financial Crisis (trade openness more than halved from 72 percent in 2000 to 33 percent in 2020 before increasing to 45 percent in 2022), trade and trade policies could play a crucial role in climate adaptation and mitigation efforts. First, trade shifts production towards cleaner production techniques. Second, EGs and services necessary for transitioning to low-carbon production are distributed and third, countries can access critical goods and services after being affected by extreme weather events (Brenton and Chemutai 2021).

The carbon intensity of Indonesia's trade flows has seen a significant decline over the years–more than halving since 2005, but Indonesia has a high share of exports that have a high intensity of CO_2 emissions. While imports and exports in goods and services each more than doubled–from under US$100 billion in 2005 to over US$250 billion in 2021, CO_2 emissions embedded in Indonesia's trade flows have only increased by 17 percent (Figure 1.3). This overall decline in CO_2 intensity can be attributed to a modest decrease in the carbon intensity of exports which fell slightly over the same period (Figure 1.4). Overall, CO_2 emissions embedded in Indonesia's trade flows add up to 131 and 126 metric tons of CO_2 for every US$1 million of exports and imports, respectively. This is lower than the carbon intensity of exports of Thailand, but higher than that of the Philippines and Malaysia. Indonesia is among countries with a more than 20 percent share of exports that would be impacted by measures that target producers with emission intensities at the upper end of the distribution at over 34 percent of exports (Brenton forthcoming). This is a higher percentage than countries such as Thailand (18 percent), Vietnam (31 percent), or Malaysia (19 percent).

CO_2 emissions embedded in Indonesia's exports are mainly sourced domestically rather than imported, while imported CO_2 emissions are mainly consumed, rather than re-exported. An estimated 84 percent of exported CO_2 emissions originate from domestic sources (Figure 1.5), suggesting that international green competitiveness will require making changes in domestic production. This signals that there is room for greening inputs through imports and domestic reform for firms to change processes. On the other hand, and consistent with this observation, imported CO_2 is mainly consumed (86 percent) and only a small share is re-exported (Figure 1.6). In terms of global ranking, this puts Indonesia's carbon content of trade at the 19th and 20th rank for exports and imports respectively.[7] Among peer countries in the EAP region, however, Indonesia remains at the top–with the highest CO_2 emissions embedded in trade.

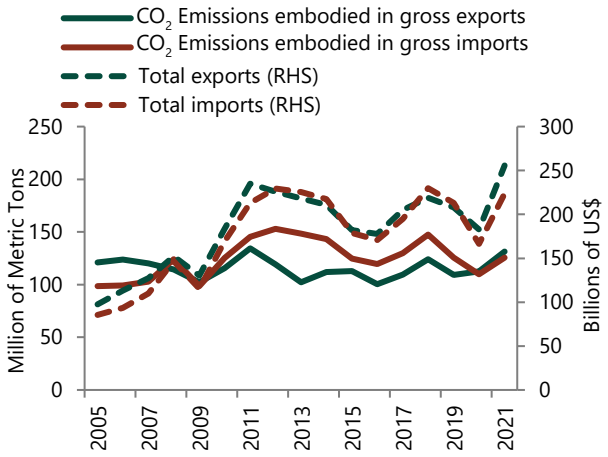
About 60 percent of CO_2 emissions embedded in exports stem from agriculture (including mining and quarrying), manufacturing, and coal and petroleum products (refined and plastic). During the 2005-18 period, nearly one-half of the emissions embedded in exports were accounted for by other manufacturing such as food, textiles, wood, and paper products at 25 percent and agriculture, mining, and quarrying at 21 percent. An additional 14 percent was embedded in exports of coal and petroleum while transport and storage made up 12 percent. There has been a notable increase in export CO_2 emissions stemming from transport and storage and basic metals (Figure A.1 in Appendix Three).

Nearly one-half of CO_2 emissions embedded in imports are from transport (including storage), basic metals, and coal and petroleum products that account for the largest sectoral shares. During the 2005-18 period, emissions embedded in imports of transport and storage (17 percent), basic metals (15 percent), and coal and petroleum products (refined and plastic) (13 percent) accounted for nearly one-half of all emissions, while other manufacturing (at 12 percent) is also significant. Unlike exports, CO_2 emissions in transport and storage imports have declined over time, while emissions in basic metals and computer and other electrical equipment have increased (Figure A.2 in Appendix Three). There is, therefore, room to ensure trade policy supports greener imports, which would also play a role in greening domestic production and exports, in addition to greener local raw materials.[8]

[7] IMF Climate Change Dashboard based on 2019 prorated data.

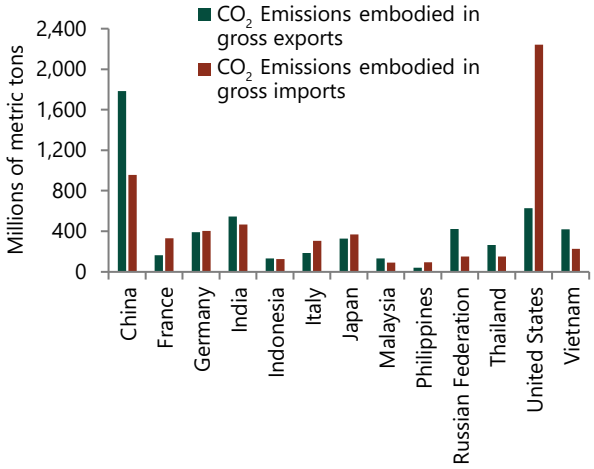
[8] See Chapter Three and Four which discusses in more detail the role of trade policy in greening trade in Indonesia.

Figure 1.3: CO_2 emissions embodied in Indonesia's exports and imports increased less than exports and imports



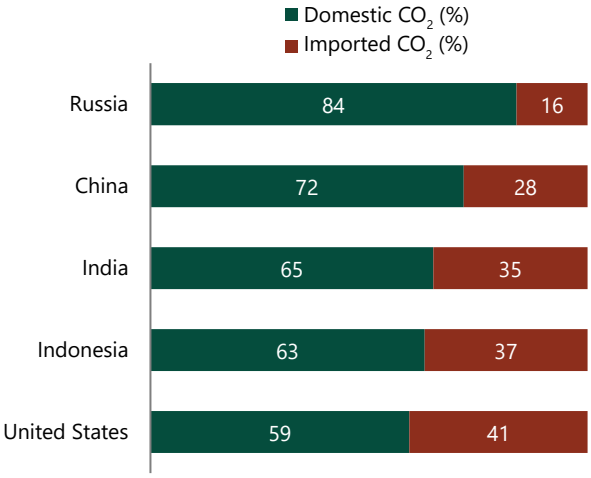
Source: World Bank staff calculations based on International Monetary Fund (IMF Climate Change Indicators Dashboard).[9]

Figure 1.4: CO_2 emissions in trade 2021: Indonesia lies above the Philippines and Malaysia (millions of metric tons)



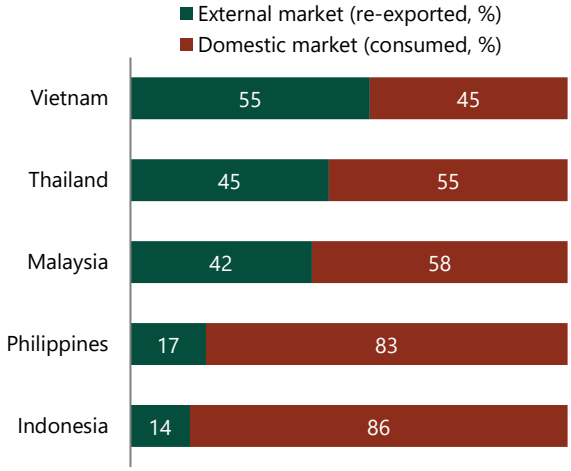
Source: World Bank staff calculations from Organisation for Economic Co-operation and Development (OECD) data 2021.

Figure 1.5: The source of exported CO_2 (%) in 2018 is largely domestic



Source: World Bank staff calculations from OECD data.

Figure 1.6: Use of CO_2 contained in imports (%) in 2018 is largely due to consumption



Source: World Bank staff calculations from OECD data.

Although trade flows facilitate carbon emissions, they are also a critical part of the solution—including through trade in EGs and plastic substitutes. EG trade plays a key role in achieving carbon neutrality targets. The presence of green products in trade reduces a country's ecological footprint (Can et al. 2021a) by reducing CO_2 emissions (Zugravu-Soilita 2018).[10] A reduction in tariffs and NTMs of energy-related EGs and environmentally preferable products (EPPs) leads to: (i) an increase in exports of those goods; (ii) a modest increase in GDP due to falling tariffs, NTMs, and increased energy efficiency; and (iii) a slightly lower level of global emissions (Bacchetta et al. 2022).[11] On the other hand, SO_2 emissions seem to increase following a tariff reduction on non-environmental goods (De Alwis 2014). Increased trade in environmental products can also increase environmental quality (Sauvage 2014). Finally, plastic substitutes could cut global plastic waste by around 17 percent or about 63 million tonnes by 2040–the equivalent of 3.5 million fewer trucks–and

[9] https://climatedata.imf.org/

[10] But increases water pollution. The reduction of CO_2 emissions results mainly from an indirect income effect that imposes dominating harmful scale-composition effects.

[11] Lower tariffs can result in higher economic activity, imposing higher emissions (Hu et al. 2020). Nimubona (2012) finds that pollution taxes end up being less stringent due to trade liberalization of EGs that can then increase pollution levels. These caveats, therefore, need to be accounted for when liberalizing EGs.

can foster growth, increase exports, reduce pollution and emissions, and create higher-value employment opportunities (UNCTAD 2023).

Indonesia has made progress on some aspects of trade policies, but climate action and trade-related policies are yet to be explicitly aligned–including to further facilitate the transition with local production. In 2021, as part of the implementing regulations for the Omnibus Law on Job Creation, several regulations were enacted that reduced the number of trade-related regulations from 164 in 2020 to 122 in 2021. These included a reduction in import-related regulations from 147 in 2020 to 116 in 2021, while export regulations decreased from 30 in 2020 to 18 in 2021.[12] Nevertheless, the share of products covered, including EGs increased in 2021 (more in Chapter Four) and other measures have been implemented since. Trade policies have not been integrated in Indonesia's NDCs and broader climate action as yet. As EGs serve various environmental sustainability roles and as over 90 percent of these products are intermediate and capital goods products and have relatively higher technological intensity, more trade in these products would also have important spillover effects to domestic production.

As such, identifying key trade policies to boost EG trade and trade in plastic substitutes would be a step forward to environmentally sustainable and climate-friendly international trade. This report provides a detailed analysis of the role of trade and trade policy on EGs and plastic substitutes in Indonesia. Chapter One describes the need for, and urgency of, this transition, including by looking at the carbon intensity of Indonesia's international trade, the policies of key trading partners and demonstrates the interlinkages between trade, trade policy, climate, and the environment. Chapter Two examines where Indonesia stands on the levels of trade in EGs and plastic substitutes and the competitiveness of EGs trade at the country level and firm level. Chapter Three explores trade agreements and tariffs and simulates potential impacts of tariff reforms–including through unilateral and multilateral actions. Chapter Four examines what NTMs apply on these products–including inputs of firms exporting these products–and assesses which NTMs may be costly and potentially need reform. Finally, Chapter Five draws the conclusions and provides some suggested recommendations.

While comprehensive, the report recognizes that other factors play a crucial role in climate change–including Indonesia's policies on exports of raw materials and agriculture products. Some examples are: (i) structural reform agendas (OECD, World Bank, and United Nations 2012); (ii) international trade law and agreements (Holzer 2015; Balogh et al. 2021; Brandi 2017; Aichele and Felbermayr 2015); (iii) carbon tariffs (Weber et al. 2009); (iv) emission inventories (Fernandez-Amador et al. 2016); and (v) renewable energy subsidy mechanisms (ADB 2020). Indonesia's policies on palm oil exports may also have an impact on greening trade (Bappenas 2023). The palm oil sector and its impact on the environment in Indonesia has been extensively studied (Murphy et al. 2021; Voora et al. 2023; Sylvia et al. 2020; Lam et al. 2019; and Sylvia et al. 2022). The nickel export ban to incentivize downstreaming targets the expansion of nickel smelting capacities which are generally emission-intensive and, therefore, have a potentially negative impact on the environment–including through negative effects on landscape, water resources, and air quality (WTO 2022). The downstreaming policies in the mining sector are being analyzed as part of an ongoing separate growth diagnosis for Indonesia by the World Bank.

As such, the report's focus on EGs and plastic substitutes trade provides an important channel through which trade and trade policy can be more integrated with environmental and climate policy–complementing other ongoing efforts and providing granular policy options. To analyze trade in EGs, this report refers to a list of products defined by the Green Transition Navigator (GTN), while plastic substitutes refer to the list by the United Nations Conference on Trade and Development (UNCTAD). The GTN compilation of EGs is based on classifications from the Asia-Pacific Economic Cooperation (APEC), the Organization for Economic Co-operation and Development (OECD), and the World Trade Organization (WTO) that use six-digit Harmonized System (HS) codes. This includes 19 categories further described in the next chapter. UNCTAD (2023) published a list of 282 6-digit HS codes as a reference for raw materials and products categorized as environmentally sustainable plastic substitutes. These are the two lists used in this report and their environmental benefits are further elaborated.

[12] Based on NTM data on Indonesia. These regulations were key to the changes: Ministry of Trade Regulation No. 18/2021 on Export and Import Prohibition); Ministry of Trade Regulation No. 19/2021 on Export Measures and Export Commodity Balance); and Ministry of Trade Regulation No. 20/2021 on Import Measures and Import Commodity Balance.

Box 1.1: The impact of the EU CBAM and worldwide environmental actions on Indonesia

The Carbon Border Adjustment Mechanism (CBAM) of the EU is scheduled to become operational on January 1, 2026, following a transition phase that commenced in October 2023. Its primary objective is to prevent "carbon leakage"[13] and establish a justifiable cost for emissions linked to the production of specific high-carbon intensity commodities such as steel, aluminum, cement, fertilizer, and electricity. These goods necessitate CBAM certificates which outline their associated carbon emissions. This will impact nations like Indonesia, which are exporting these goods to the EU.

The CBAM Exposure Index[14] assists in determining the impact of the EU CBAM on different nations. The calculation involves an analysis of a country's carbon emissions and its export volume to the EU. The index then computes the additional expenses exporters would incur for CBAM certificates compared to EU manufacturers–thereby conveying the changes in competitiveness.

Indonesia's iron and steel sector is expected to bear the brunt of this impact. Iron and steel are important export products for Indonesia–with the EU representing a vital market. In the year 2022, exports of iron and steel totaled US$29.6 billion–accounting for approximately 10 percent of all exports.[15] Of these iron and steel exports, 8.1 percent were exported to the EU. In comparison with regional peer countries like Vietnam, Thailand, the Philippines, and Malaysia, Indonesia has the second-highest relative CBAM exposure index[16] for iron and steel (Figure 1.7)–meaning that the sector experiences a relatively larger impact on its production costs and, therefore, competitiveness.

While the export value of aluminum is lower compared to iron and steel exports (amounting to US$890 million or 0.3 percent of all exports in 2022), and only 2 percent of these exports are destined for the EU, the carbon intensity of this sector surpasses that of its peer nations–with a ratio of 0.69 kg/US$1.00 as opposed to an average of 0.04 kg/US$1.00. Consequently, the CBAM exposure index value for aluminum in Indonesia is notably higher than that of other countries in the region (Figure 1.7). These countries generally exhibit negative index values, indicating that comparatively cleaner exporters may enhance their competitiveness within the EU market.

The Aggregate CBAM Exposure Index takes into account all sectors and identifies countries that are highly exposed to the CBAM–using emission intensity and exports to the EU. With a US$100/ton carbon price, it measures added certificate costs for exporters versus the EU average producer–adjusted by EU export share. The index considers EU market changes–allowing cleaner exporters to stay competitive despite certificate needs. The aggregate index shows trade-weighted exposure across all CBAM products. When considering all relevant sectors, Indonesia possesses an aggregate relative CBAM exposure index of 0.0017–higher than Malaysia, Thailand, and the Philippines but lower than Vietnam (Figure 1.8).

The estimated impacts of the EU CBAM on most countries' aggregate real income, output, and trade in 2030 are small. Estimations show that when both NDCs and the EU CBAM are implemented, Indonesia's real income decreases by 0.5 percent relative to the baseline in 2030 (Figure 1.9). The reduction is the result of the NDCs–while the effect of the EU CBAM is negligible. Aggregate imports and exports are also negatively impacted, with larger reductions in imports than exports. Given its high emission intensity, coal is the sector with the highest decline in total exports of 11.6 percent. Consequently, the share of coal in Indonesia's total exports declines by 1.7 percent relative to the baseline (Figure 1.10).

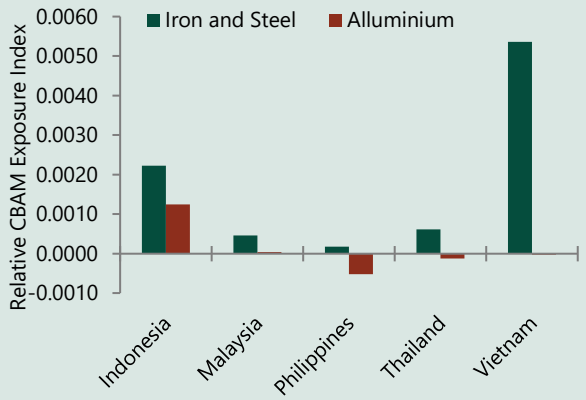
Some sectors see a relatively small increase of exports due to a redistribution of resources away from high emission intensity sectors. This is a result of resource allocation to sectors with relatively lower emissions. Estimates suggest that a larger portion of environmentally stringent countries record above-average green export survival

[13] Carbon leakage occurs when EU-based companies start producing their carbon-intensive goods abroad to avoid stringent climate policies in their domestic country.
[14] https://blogs.worldbank.org/trade/how-developing-countries-can-measure-exposure-eus-carbon-border-adjustment-mechanism
[15] Source: BPS.
[16] https://www.worldbank.org/en/data/interactive/2023/06/15/relative-cbam-exposure-index#3

rates than those below the overall mean EPS index value. Specifically, a 1-unit rise in its EPS index value decreased its EG export hazard rate by approximately 1.03 percent and green policies in exporting EMDEs improved their EG survival rates–especially when trading with HICs (Türkcan et al, forthcoming).

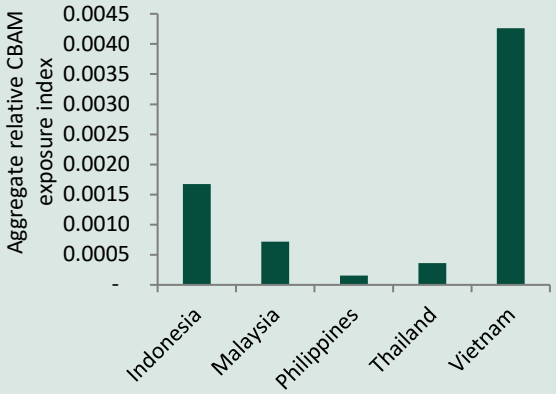
Notably, despite limited macro impacts of the EU CBAM initially, other countries are likely to introduce similar mechanisms with expanded reach as consumer demand shifts toward cleaner products and firms implement changes in their production processes to remain competitive. The CBAM exposure, therefore, informs the need to implement policies that could further accelerate transitioning towards green production and lower carbon exports for Indonesia–including by using green technologies.

Figure 1.7: Indonesia's iron and steel and aluminum products have a high CBAM exposure



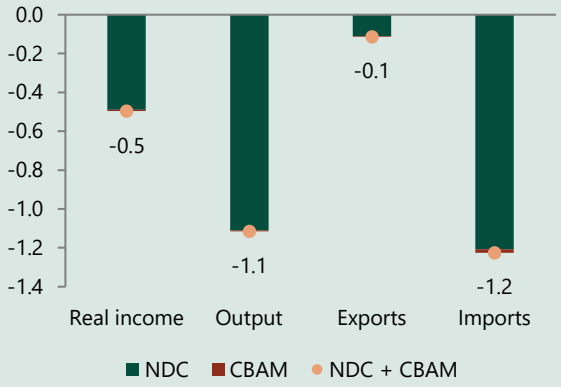
Source: Maliszewska et al. (2023).

Figure 1.8: The overall CBAM exposure of Indonesia is comparatively high



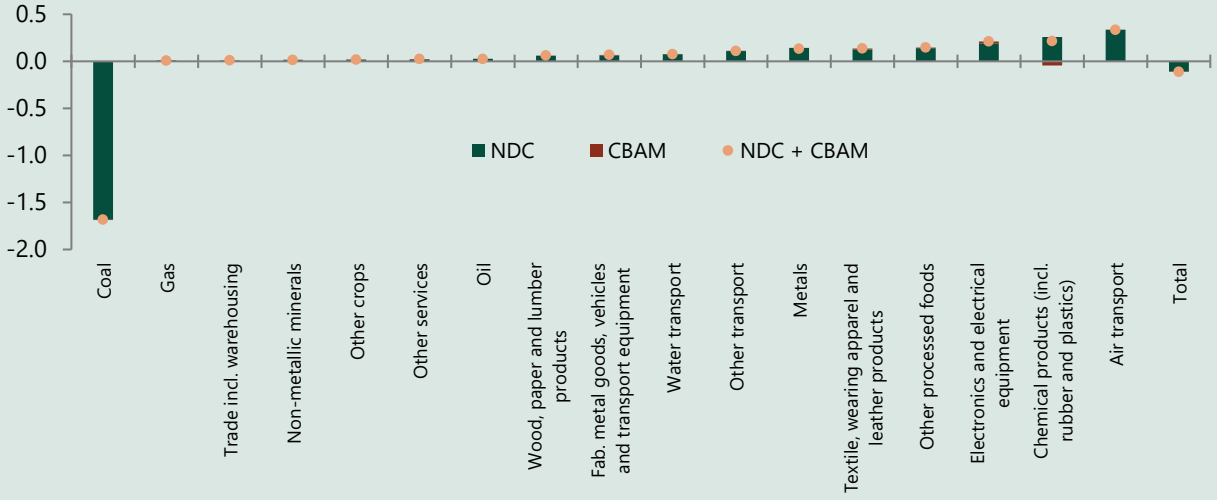
Source: Maliszewska et al. (2023).

Figure 1.9: Impact of NDCs and CBAM on aggregate macro indicators (percentage change in 2030 relative to baseline)



Source: Brenton et al. (forthcoming).

Figure 1.10: Indonesia: Impact of NDCs and CBAM on volume of total exports by sector (percentage change in 2030 relative to baseline)



Source: Brenton et al. (forthcoming).
Note: Showing selected industries with more than 0.00 percent change in export share.

CHAPTER 2.

INDONESIA'S TRADE IN EGs AND PLASTIC SUBSTITUTES: TRENDS AND STYLIZED FACTS

CHAPTER 2. INDONESIA'S TRADE IN EGs AND PLASTIC SUBSTITUTES: TRENDS AND STYLIZED FACTS

Indonesia's green competitiveness has declined in recent years, but Indonesia has untapped potential in exports of EGs and plastic substitutes. The share of plastic substitutes trade has stagnated and there is potential for greater participation in the global market. The number of firms involved in the EGs trade has increased. EGs can facilitate cleaner domestic production, as over 90 percent of these products are intermediate and capital goods products and have relatively higher technological intensity. Firms that both export and import (GVC firms) account for a larger share of EGs traders and trade, are more likely to export, and overall EGs trading firms have a higher survival rate in export and import markets than non-EG traders. The private sector, especially firms involved in GVCs, will be key to realizing Indonesia's potential in trade in EGs.

2.1. Defining EGs and Plastic Substitutes

There have been several attempts to develop lists of products with environmental benefits. The OECD has put together indicative lists of products ranging across several environmental categories such as air pollution control; wastewater management; renewable energy; and environmental monitoring, analysis, and assessment (OECD 1999), while the WTO and APEC lists were created specifically for trade negotiation purposes. The WTO lists were created through a process of product submission from member countries following the Doha Declaration mandate (WTO 2001). The APEC list includes a set of EGs on which the 21 APEC member states agreed to reduce applied tariff rates to 5 percent or less by the end of 2015 (APEC 2012). While these were non-binding commitments, there are now 19 APEC member economies that are fully compliant (APEC 2021).

The EGs referred to in this report are based on the list of green products defined by the GTN–a compilation of the APEC, OECD, and WTO green goods classifications. The GTN of green products–or products with environmental benefits–lists and collates these into a single dataset totaling 543 products

classified at the six-digit level of the 1992 version of the HS. The list is also inclusive of green technologies in the World Bank's (2007) *International Trade and Climate Change: Economic, Legal, and Institutional Perspectives* report. The compilation and agreement on an equivalent list on environmental services and data on trade in such services is still challenging. WTO commitments on environmental services remain even more modest compared to commitments of green/environmental goods. The discussion in this report, therefore, focuses on the EGs trade. Examples of EGs can be found in Box 2.1 and Table A.1 in Appendix One.

Box 2.1: Examples of EGs and their climate and environmental roles

The EGs are divided into 19 categories (Table 2.1) based on their environmental benefits. Table A.1 in Appendix One provides detailed examples of each category of EGs used in this analysis. It should be noted that these products are defined as EGs based on their use in mitigating and adapting to climate change–not on how cleanly they were produced. The EGs can be specifically attributed to mitigating climate change (such as through the energy transition, agriculture and land use transition or waste management)–adapting to climate change or to help with broader environmental protection. Table 2.1 also lists the 19 categories and the climate change role of each.

Air pollution control products, for instance, aim to control and reduce air pollution–which supports the energy transition and, therefore, climate change mitigation. Products needed to build air handling equipment or machines to extract polluted air include parts of vacuum pumps, compressors, fans, and blowers. They also include electric vehicles or parts thereof.

EPPs based on end-use or disposal characteristics support the production of biodegradable fiber alternatives from renewable resources. This requires products such as plant fibers, flooring, and gas turbines. These goods contribute to broader environmental protection.

Products in the Gas Flaring Emission Reduction category are used to destroy solid and hazardous waste and, therefore, support the energy transition and climate mitigation. Catalytic incinerators are designed to destroy pollutants by heating polluted air and oxidizing organic components. This requires products such as industrial furnaces, ovens, and filtering/purifying equipment.

An example of an EG category that helps adaptation to climate change is natural risk management. This category includes surveying instruments that provide environmental benefits by enabling monitoring of the ozone layer. These instruments also support the prediction of natural disasters like earthquakes, cyclones, and tsunamis–allowing communities to better prepare for and adapt to such events.

Table 2.1: 19 EGs categories and their climate change role

Product Category	Energy Transition (Mitigation)	Agriculture And Land Use Transition/NRM (Mitigation)	Waste Management (Mitigation)	Adapta-tion	Broader Environmental Protection
Air Pollution Control	*				
Clean Up or Remediation of Soil and Water		*		*	
Cleaner or More Resource Efficient Technologies and Products	*				
Efficient Consumption of Energy Technologies and Carbon Capture and Storage	*				
Energy Efficiency	*				
Environmental Monitoring, Analysis, and Assessment Equipment					*
EPPs based on End-Use or Disposal Characteristics					*

Gas Flaring Emission Reduction	*				
Heat and Energy Management	*				
Management of Solid and Hazardous Waste and Recycling Systems			*		
Natural Resource Protection		*			
Natural Risk Management				*	
Noise and Vibration Abatement					*
Renewable Energy	*				
Resources and Pollution Management		*			
Waste Management, Recycling, and Remediation			*		
Wastewater Management and Potable Water Treatment					*
Water Supply		*			*
Others					*

Source: World Bank staff calibrations.

UNCTAD (2023) published a list of 282 6-digit HS codes as a reference for raw materials and products categorized as plastic substitutes. This compilation encompasses natural materials, minerals, plants, and materials of marine or animal origin that are characterized by their biodegradability, erodibility, minimal environmental impact, and non-harmful property towards living organisms. The list does not include materials of fossil origin. Furthermore, UNCTAD classifies plastic substitutes into three main categories, namely: (i) natural fibers; (ii) minerals (aluminum); and (iii) abandoned, lost, or discarded fishing gear (ALDFG). Although the HS code's universal implementation has constraints in various countries given the varying details in tariff lines, it still retains significant importance due to its role in shaping policy development and monitoring trade patterns. Given the list, Indonesia can refine its initiatives to address the issue of plastic pollution more effectively. This report includes some illustrations on trade in plastic substitutes, as this is a new and potentially productive area, but the core focus of this report is on the aforementioned EGs trade.

2.2. Green Competitiveness and Trade in Environmental Goods and Plastic Substitutes

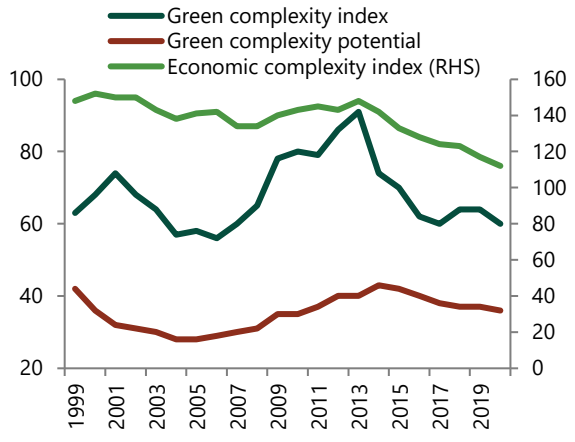
Green Competitiveness Potential

To assess the status quo, the green complexity index (GCI) and the green complexity potential (GCP) index are important metrics. GCI assesses the technological sophistication of a product (Product Complexity Index: PCI)[17] and combines this with the number of EG exports. This combination of quantity together with the complexity of the product measures a country's green competitiveness. With more complex green products, the competitiveness of the country increases which, in turn, benefits the terms of trade of EGs. The GCP measures how much potential a country has to diversify into green, complex products in the future based on the proximity (how likely a country has a comparative advantage in the production of two different goods) and complexity of products it is not yet competitive in.

Indonesia's GCI is still low relative to other countries, while the GCP is more promising. The GCI has sharply declined since 2014 (Figure 2.1).[18] Indonesia currently ranks 60th on the GCI,[19] much lower than income peer countries in the region–Thailand and Malaysia at number 39 and 42, respectively (Figure 2.2). On the GCP, Indonesia's potential to diversify into green, technologically sophisticated products, measured by its GCP, ranks relatively higher than other countries and was steadily improving until 2015 before it started declining again. With respect to GCP, Indonesia ranks 36th–higher than Malaysia and Vietnam but lower than Thailand (28th). Indonesia's performance on the GCI and GCP is strongly interlinked with its economic complexity. The Economic Complexity Index (ECI) ranks countries as high if the country has competitive strengths that are similar to other countries with a high ECI. On this, Indonesia also performs relatively poorly, ranked 112th–much lower than Malaysia and Thailand at number 22 and 34, respectively (Figure 2.2).

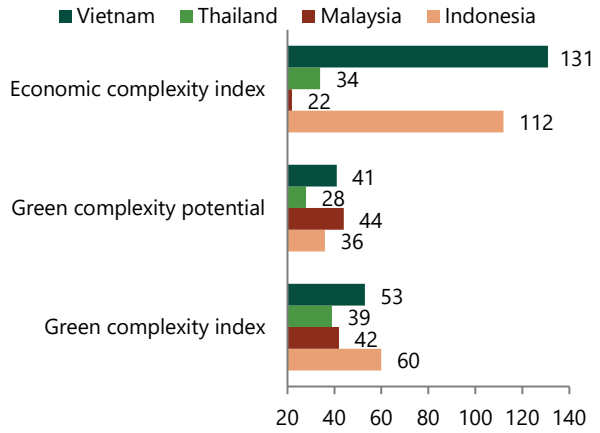
Indonesia has a high potential of developing future competitiveness in green products with lower product complexity, as green products closest to current capabilities are those with lower product complexity and technologies. Proximity measures the product's alignment with the country's productive capabilities and identifies green diversification opportunities that are closely related to their existing production capabilities, as this would allow them to take advantage of skills, infrastructure, and know-how that they already possess. Green products with the closest proximity to Indonesia's current production capabilities are Waste Management, Recycling, and Remediation; EPPs; and Natural Resource Protection (Figure 2.3).

Figure 2.1: Indonesia's green competitiveness ranking is declining



Source: World Bank staff calculations from GTN data.

Figure 2.2: In regional comparison, Indonesia has low complexity but performs relatively well in terms of its potential



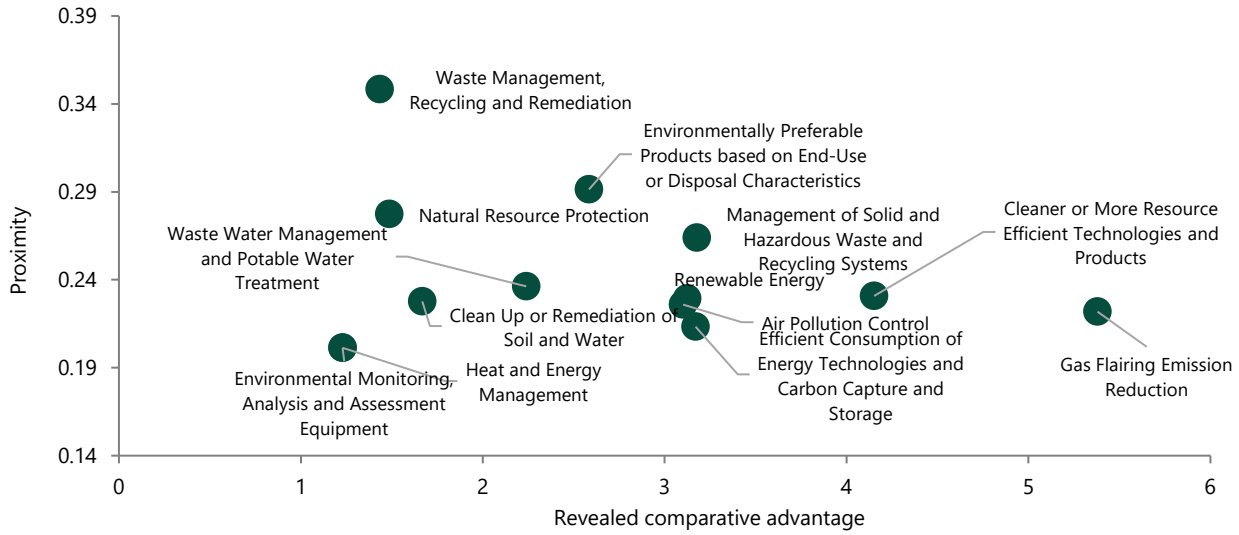
Source: World Bank staff calculations from GTN data, 2016-2020.

[17] The PCI ranks products according to the similarity of the countries that export them competitively. The PCI is often used as a proxy for the technological sophistication of a product.

[18] For details on these metrics, see Andres and Mealy (2021). Retrieved from www.green-transition-navigator.org

[19] The GCI aims to capture the extent to which countries can competitively export green, technologically sophisticated products.

Figure 2.3: Indonesia's RCA is high for gas flaring emission reduction



Source: World Bank staff calculations from GTN data (2016-20).

Product categories with the highest Revealed Comparative Advantage (RCA)[20] are Gas Flaring Emission Reduction; and Cleaner or More Resource Efficient Technologies and Products[21] (Figure 2.3)– making them ideal potential export growth areas. Among these, bicycle hubs and free-wheel sprocket wheels, primary cells and batteries, and machinery for liquifying air and other gases are shown to be at the intersection of products with high potential and high RCA. This may be because Indonesia's productive know-how is more closely focused on extracting fossil fuel resources. Conversely, green products with the lowest proximity to Indonesia's current production possibilities are Environmental Monitoring, Analysis and Assessment Equipment; Heat and Energy Management; and Efficient Consumption of Energy Technologies and Carbon Capture and Storage.

Furthermore, Indonesia's potential to diversify into products the country is not yet competitive in is promising. Countries with higher GCP scores are significantly more likely to have greater future increases in their GCI, green export ratio, and the number of green products they can export competitively. Indonesia's potential increased until 2015 but has since worsened slightly and stagnated in recent years (Figure 2.1). Access to green technologies through trade could play a key role in realizing this potential.

While the GTN provides useful RCA metrics to assess countries' green trade potentials, the methodology has some limitations. As production and trade in EGs expand exponentially, the tool's predictive capacity may decrease for complex GVCs. In addition, the underlying RCA index incorporates countries' overall trade volumes, not just sectoral competitiveness. As demonstrated by Shepherd (2021), differences in productivity only account for a small amount of the observed variation in RCA estimates and other factors such as market size and trade costs are more determining of the RCA estimations. Thus, while the GTN delivers valuable high-level insights, its quantitative outputs should be interpreted carefully alongside qualitative assessments of countries' environmental policy contexts. These are further explored below.

Trade in EGs

The levels of trade complement the competitiveness findings that Indonesia has significant untapped potential in exports of EGs and technologies, while imports are at par with global and regional averages. EGs amounted to US$10.4 billion or 3.6 percent of total goods exports in 2022, far below the global and EAP average of 12 percent and 7.3 percent, respectively (Figure 2.4). Conversely, with imports of EGs at about 9 percent of total goods imports (Figure

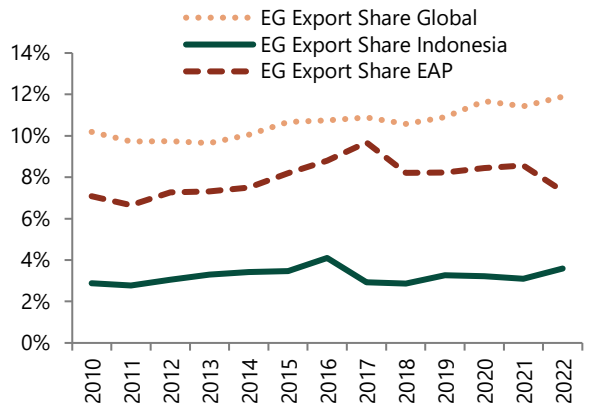
[20] "RCA is based on Ricardian trade theory, which posits that patterns of trade among countries are governed by their relative differences in productivity." https://unctad-stat.unctad.org/datacentre/reportInfo/US.RCA. Last accessed: 11.14.2023.
[21] For examples of products within each category, see Table A.1 and Box 1.2.

2.5) or US$20.5 billion (Figure 2.6), Indonesia's imports of EGs are relatively higher compared to EAP regional peers–at an average of 8 percent. The number of green products imported (extensive margin) had a historically higher import share than the share in terms of values (intensive margin), at an average of 10.5 percent of all products imported during 2017-22–compared to about 9.8 percent of value of imports for the same period.

Major destination markets for Indonesia's exports of EGs are Singapore, the United States, and Japan, while the main import source countries are China and Japan (Figure 2.7). As such, main destination and source markets are well aligned with that of aggregate goods exports and imports. In terms of exports, more than one-half of Indonesia's exports of EGs in 2022 were destined to markets in the EAP and South Asia region–to Singapore (20 percent), Japan (8 percent), Thailand (6 percent), Republic of Korea (6 percent), Philippines (5 percent), India (4 percent), Taiwan, China (4 percent), and Malaysia (4 percent). In turn, imports of EGs are much more concentrated from a few source countries: China accounts for 43 percent of Indonesia's imports of EGs, followed by Japan with 12 percent. Outside of the EAP region, the United States and Germany are also important trading partners. The United States accounts for 16 percent of Indonesia's exports of EGs and about 5 percent of imports of EGs, while Germany accounts for 4 percent of imports.

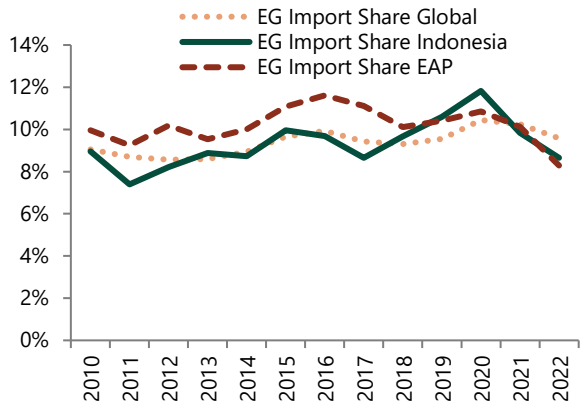
Exports of Cleaner or More Resource Efficient Technologies and Products represent significant export potential for Indonesia. This category of EGs accounted for almost 15 percent of Indonesia's exports of EGs between 2017-22 and has also been growing (Figure 2.8). Renewable Energy Plants and Cleaner or More Resource Efficient Technologies and Products made up the largest share with almost 30 percent of total EG exports in 2022. In turn, the fastest growing EG export categories were products for Natural Resource Protection and Heat and Energy Management–growing by 101 percent and 86 percent during the 2017-22 period, respectively.

Figure 2.4: Indonesia's EG exports as a percentage of all exports is low...



Source: World Bank staff calculations from BPS[22] and WITS data.

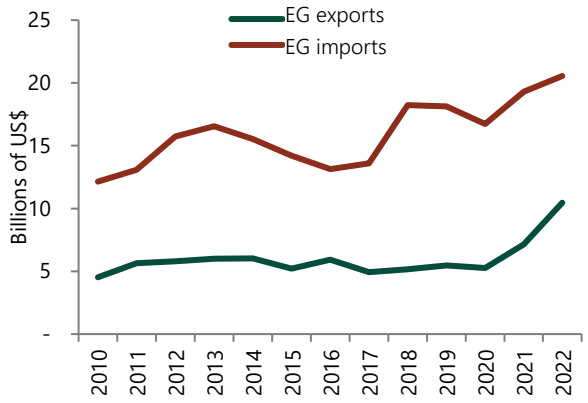
Figure 2.5: ... while Indonesia's EG imports as a percentage of all imports is around the global average



Source: World Bank staff calculations from BPS and WITS data.

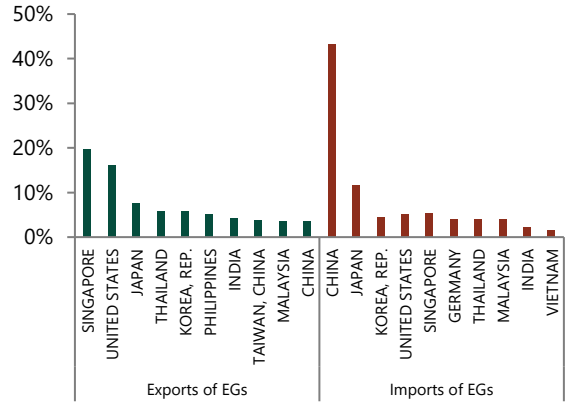
[22] Statistics Indonesia (*Badan Pusat Statistik*: BPS) is a non-departmental government institute of Indonesia that is responsible for conducting statistical surveys. Its main customer is the government, but statistical data is also available to the public.

Figure 2.6: EGs trade in Indonesia is increasing in absolute numbers



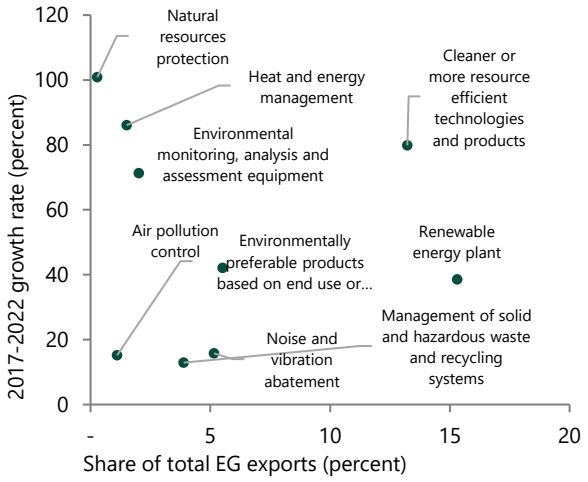
Source: World Bank staff calculations from BPS and WITS data.

Figure 2.7: Major trading partners for EGs are Singapore and China



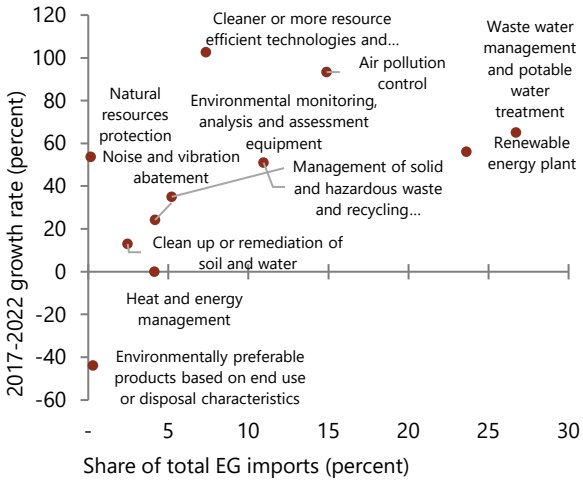
Source: World Bank staff calculations from BPS and WITS data.

Figure 2.8: Cleaner or more resource efficient technology products are growing and make up a high share of exports...



Source: World Bank staff calculations from BPS and WITS data.

Figure 2.9: ...while waste water management and potable water treatment dominate imports



Source: World Bank staff calculations from BPS and WITS data.

Note: EGs do not include all EGs categories for Figures 2.4-2.9 and in Figure 2.8 two categories were omitted due to being extreme outliers (Clean up or Remediation of Soil and Water, and Waste Water Management and Potable Water Treatment).

In terms of products, solar panels and electric vehicles (EVs) are included in these EG categories. Solar panels made up only about 1 percent of products included in the EG category of Efficient Consumption of Energy Technologies and Carbon Capture and Storage as well as 2.3 percent of Renewable Energy products. EVs accounted for 3 percent of Air Pollution Control, 3.5 percent of Cleaner or More Resource Efficient Technologies and Products, and 2.4 percent of Renewable Energy products.

The values of both EVs and solar panel exports have increased in recent years. The top destinations for exports of solar panels in 2022 were the US (33 percent), Singapore (19 percent), France (14 percent), and Japan (17 percent-2021 data). For EVs it was the US (50 percent) with Canada and Singapore at 9 percent and 8 percent, respectively. While the value of trade in solar panels has increased in recent years (Figure 2.10), they remained the same in terms of share of exports (0.3 percent). EV exports increased drastically in 2022, partly following the completion of a manufacturing plant in 2021[23] (Figure 2.11). Other top export

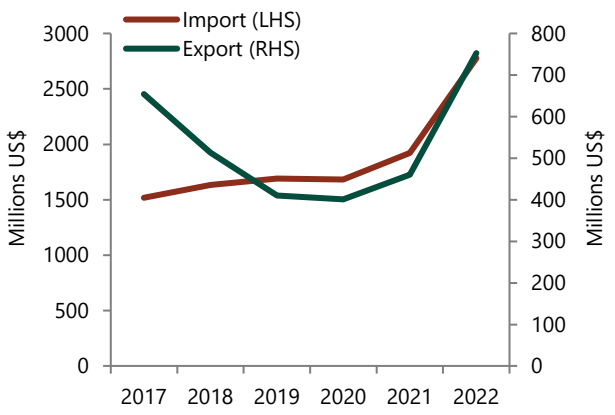
[23] https://www.thejakartapost.com/news/2019/11/26/asean-korea-summit-hyundai-motor-clinches-15b-deal-with-indonesia-to-build-automotive-plant.html

products included exports of electrical machines and apparatus (Waste Water Management and Potable Water Treatment), electrical static converters inverters (Renewable Energy plant) and parts of engines (Air Pollution Control, Noise and Vibration Abatement) (see list in Appendix One Table A.1).

On the imports side, the fastest growing imported EGs categories between 2017-22 were Cleaner or More Resource Efficient Technologies and Products (103 percent), Air Pollution Control (93 percent), and Wastewater Management and Potable Water Treatment products (65 percent) (Figure 2.9). In addition to Wastewater Management and Potable Water Treatment products (27 percent) and Renewable Energy Plants (24 percent); Management of Solid and Hazardous Waste and Recycling Systems; and Air Pollution Control also make up notable shares (11 and 15 percent respectively). Top imported products were water taps (Wastewater Management and Potable Water Treatment), electrical static converters (Renewable Energy Plant), machinery, plant, and laboratory equipment (Renewable Energy Plant, Wastewater Management and Potable Water Treatment), motorcycle brakes (Cleaner or More Resource Efficient Technologies and Products), and plastic (Wastewater Management and Potable Water Treatment). The value of imports of both solar panels and EVs has also increased in recent years, both reaching an all-time high in 2022 (Figures 2.10 and 2.11). Similar to exports, the share of imports has remained relatively the same over time at about 1.0 percent for solar panels and 0.02 percent for EVs.

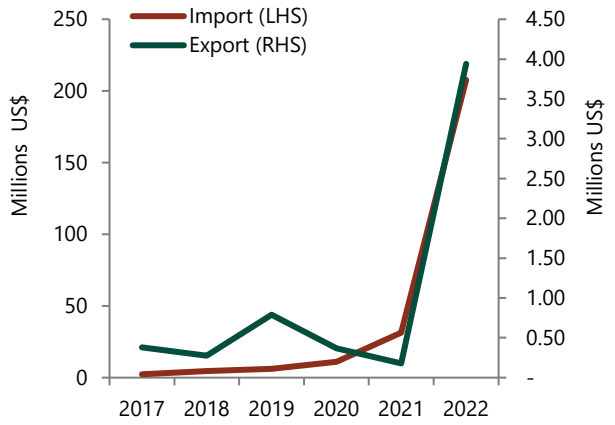
EG imports represent an important source of access and transmission of new green technologies for Indonesia, underscored also by the fact that EG imports are more intensive in medium and high-tech products than exports. Exports of EGs include 64 percent of medium and high-tech products, compared to imports with 73 percent. EG exports' intensity in medium and high-tech products has increased significantly–from 56 percent in 2008 to 64 percent in 2020. In addition, Indonesia's EG trade has higher technology-intensity than Indonesia's overall trade in goods. Access to these technologies through imports will help Indonesia to not only improve productivity and allocate resources more efficiently but also to lower production costs and improve international competitiveness. Furthermore, access to new technologies might also generate new tasks and jobs in Indonesia–new job categories that emerge when more sophisticated technology is introduced might lead to a higher demand for highly skilled labor.

Figure 2.10: Increasing imports and exports of solar panels



Source: World Bank staff calculations from BPS data.

Figure 2.11: Increasing imports and exports of EVs



Source: World Bank staff calculations from BPS data.

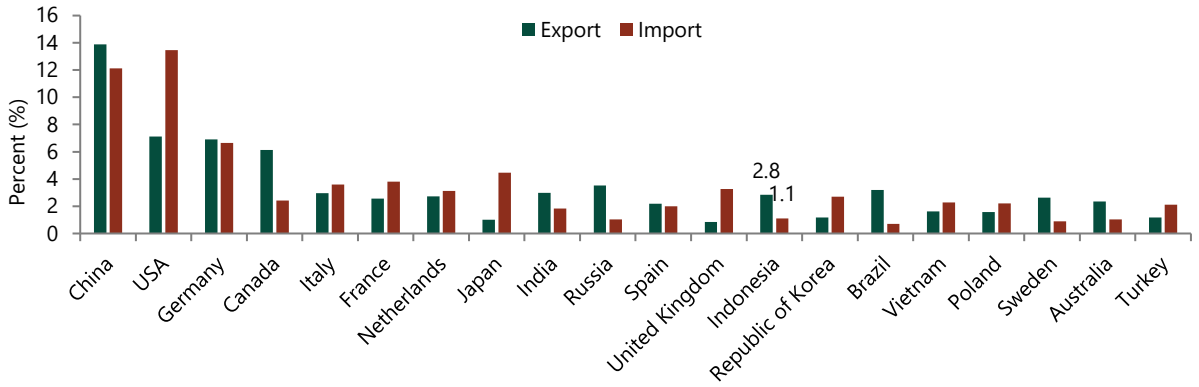
Trade in Plastic Substitutes

In 2021, Indonesia's total imports and exports of plastic substitutes accounted for 2.8 percent and 1.1 percent of global trade. Indonesia's trade in plastic substitutes still significantly lags the world's top performers in this field–namely China, United States, and Germany (Figure 2.12). Moreover, Indonesia's participation in the international markets has remained stagnant over the past decade, specifically since 2013, with its share of global trade consistently hovering about the 3 percent mark for exports and 1.1 percent for imports (Figure 2.13). Indonesia's ambition to diminish plastic waste could be better supported by mitigation efforts through the trade lens. Over the six years to 2022, a declining trend can be seen in Indonesia's share of global exports and imports of plastic substitutes. Exports of plastic substitutes experienced a decrease of 1.58 percent, while imports saw a decline of 0.74 percent during the 2017-22 period (Figure 2.14).

The trade of plastic substitutes in Indonesia involves many international partners. In 2022, Indonesia's primary trade partners for plastic substitutes consisted of China, Japan, and the United States as exporters, and Australia, Brazil, and India as importers (Table A.10 in Appendix Three). These countries hold top five positions among trading partners in plastic substitutes for Indonesia–particularly for wood pulp and cotton as the top exported and imported products, respectively.

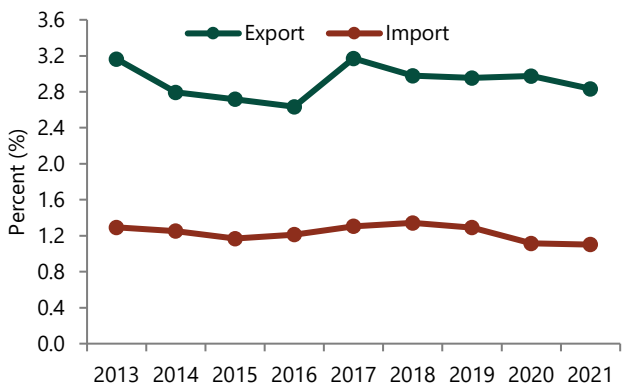
For both imports (74 percent) and exports (89 percent), most of the trade is in natural fibers and minerals. Natural fibers constitute 48 percent of imports and 78 percent of exports, Minerals 25 percent of imports and 10 percent of exports, while ALDFG just 1 percent of both imports and exports. The total trade of Indonesia and trade flow pattern suggest that there is considerable untapped potential for greater participation in the global market of plastic substitutes.

Figure 2.12: Measured by the share of global trade of plastic substitutes, Indonesia belongs to the top 20 countries (2021)



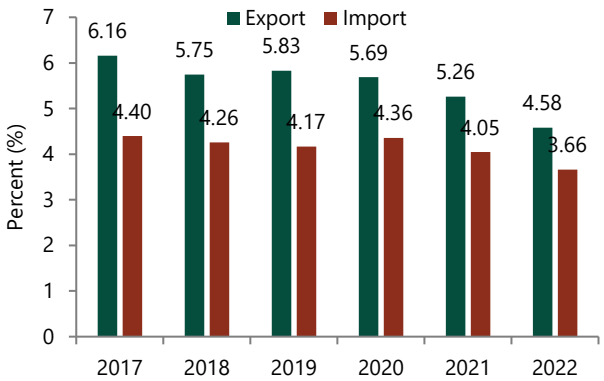
Source: World Bank staff calculations from BPS data.

Figure 2.13: But Indonesia's share of global trade in plastic substitutes is stagnating



Source: World Bank staff calculations from WITS data.

Figure 2.14: Share of Indonesia's plastic substitutes trade is declining



Source: World Bank staff calculations from WITS data.

2.3 Indonesia's Trade in Environmental Goods – Firm level

Firm Characteristics in Green Trade

The number of firms involved in EGs trade has increased in Indonesia, with a larger share of firms importing EGs than exporting, thereby signaling the role of trade in accessing green technologies (Figure 2.15). The number of firms trading EGs reached 12,534 pure importing firms, 2,561 pure exporting firms and 9,275 importer-exporters in 2018, up from 8,879 pure importers, 2,885 pure exporters and 8,066 importer-exporters in 2014.[24] Between 2014-18, an average of 43 percent of all pure exporters were traders of EGs while 73 percent of pure importers and 83 percent of importer-exporters traded EGs. The share of firms trading EGs remained broadly stable between 2014-18 as has the share of EGs per firm (Figure 2.16).

Figure 2.15: The share of EGs trading firms remained stable while absolute numbers increased: number (LHS) and percent (RHS) of total

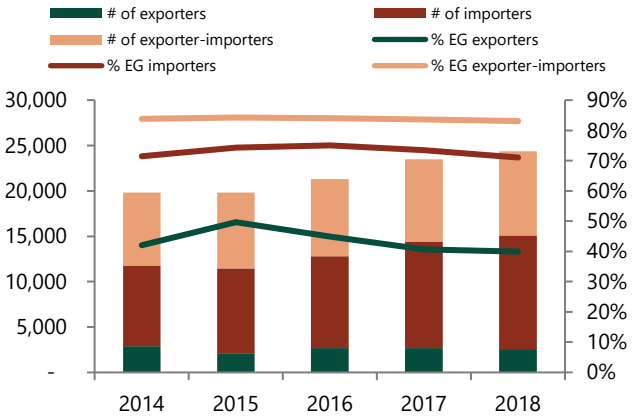
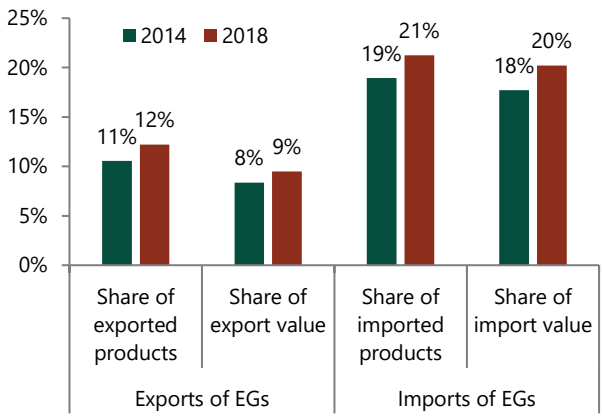


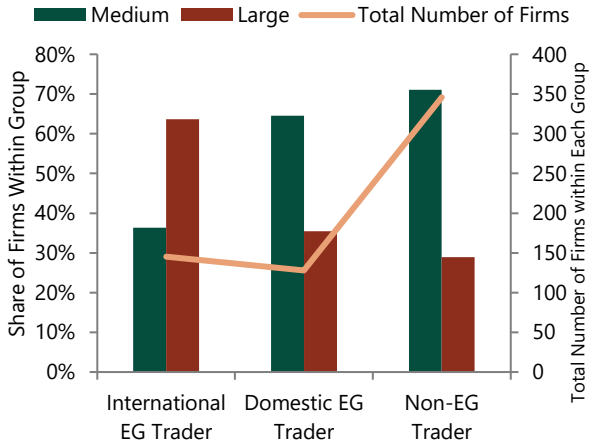
Figure 2.16: The share of EGs per firm remained broadly stable (percent)



Source: Figures 2.15 and 2.16: World Bank staff calculations using DGCE data and EGs list from GTN.

Most EG firms trading internationally are large and have relatively higher foreign ownership relative to domestic EG traders and non-EG traders, signaling the role of Foreign Direct Investment (FDI). In a 2022 World Bank survey, 621 firms were asked about their green manufacturing practices and whether they traded in EGs in the last fiscal year. Of these, about 22 percent were international traders of EGs, of which, about 30 percent reported to be importers only, 31 percent were exporter-only firms and 39 percent were both importers and exporters.[25] This is consistent with data from Indonesia's manufacturing plants where firms in EGs have an average of 22 percent foreign ownership compared to 12 percent for non-EG firms in the 2008-15 period.[26] Of the interviewed firms, 21 percent of the 621 were domestic traders of EGs. Some 67 percent of international EG traders are large firms and 33 percent are medium-sized firms, while there are no small firms (Figure 2.17). Nearly 30 percent are foreign owned (Figure 2.18).

Figure 2.17: International EG traders are large firms while domestic traders are medium size (survey results)



Source: World Bank 2022 CCDR Survey.

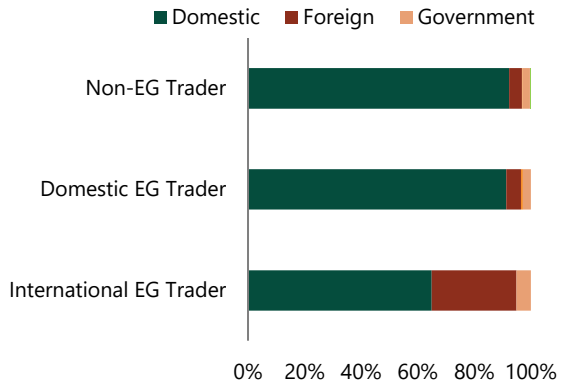
[24] Exporter or importer is defined as a firm that imported or exported at least one EG in the time period. This is obtained from customs data sourced from the Indonesian Directorate General of Customs and Excise (DGCE).
[25] Since the survey only asks about trade in the last year while the customs data considers trade in a period of five years, the lower shares are to be expected. Moreover, the customs data covers the universe of traders in Indonesia, while the survey is from a limited sample but provides us with more updated information. Values are weighted averages of the responses.
[26] The data is based on the Indonesian survey of manufacturing plants (*Statistik Industri:* SI) administered by BPS. The coverage of the survey is extensive, and it is very close to a census. Plants are grouped into five digits industries following the definition in the *Klasifikasi Baku Lapangan Usaha Indonesia*–a classification mostly compatible with ISIC coding. This coding is used to merge with the HS-10 products that identify EGs.

Overall, firms that are trading internationally are more likely to be involved in EGs than those trading domestically-further signaling the important role for trade in mitigating and adapting to climate change. Among firms that are in business activities that also involve EGs, an average of 34 percent do not trade internationally while for other types of products, this share is higher, at 45 percent based on Indonesia's manufacturing census. According to the 2022 survey, domestic EG traders' characteristics are similar to non-EG traders, with the majority being medium-sized and only 5 percent being foreign-owned (Figure 2.18). Interestingly, 8 percent of international EG traders reported to be government owned–a higher share than for both non-EG traders and domestic EG traders.

EG exporters are also more likely to trade in environmental services (ES) compared to importers, but information on ES trade remains limited. Environmental services are often challenging to distinguish. They may involve construction of a geothermal power plant to the installation, repair, or maintenance of a facility critical to mitigation and adaptation to climate change. Generally, they are services crucial to the delivery and proper functioning of environmental equipment (Sauvage and Timiliotis 2017). Among the surveyed firms, only 3.6 percent of importer-only firms participated in ES trade. In contrast, 14.6 percent and 17.0 percent of exporter-only firms and two-way EG traders (firms that both import and export) respectively reported participating in ES trade. The average among all EG traders that were also involved in ES trade was only 6.3 percent (about 20 firms).

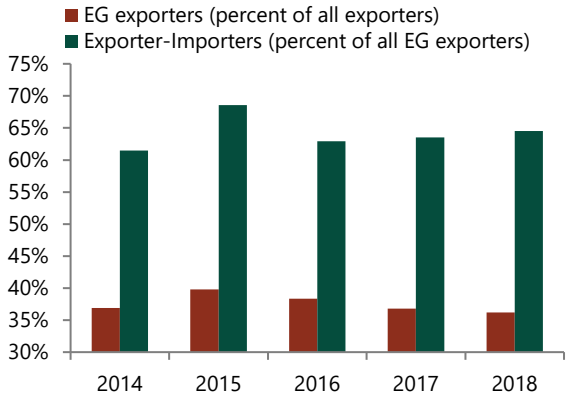
Firms that both export and import (GVC firms) account for a larger share of EGs traders and trade–especially exports. GVC firms are more likely to export than import EGs and make up a large share of the firms that export EGs in Indonesia (64 percent) but a smaller share (about one-third) among importers (Figures 2.19 and 2.20). Similarly, among the surveyed firms, there is a slightly higher number of two-way traders among firms in international EGs trade (41 percent of all EG traders) compared to importer-only or exporter-only firms (both making up 7 percent). This is further confirmed from Indonesia's manufacturing census–within business sectors that trade EGs, 20 percent are GVC firms compared to 14 percent for non-EG sectors. This is consistent with broader characteristics of trading firms in Indonesia where 73 percent of exporters and 40 percent of importers are two-way traders and with the stylized fact that over two-thirds of export value in Indonesia is generated by two-way traders (Cali et al. 2022).

Figure 2.18: Nearly 30 percent of international EG traders are foreign owned (survey results)



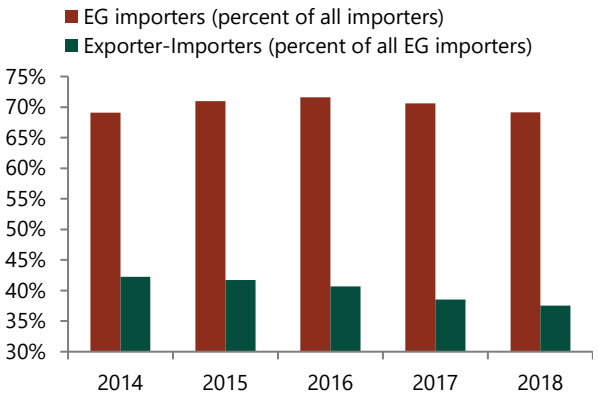
Source: World Bank 2022 CCDR Survey.

Figure 2.19: Two-way traders are more likely to export EGs (percent)



Source: World Bank staff calculations using DGCE data and EGs list from GTN.

Figure 2.20: ...But less likely to import (percent)



Source: World Bank staff calculations using DGCE data and EGs list from GTN.

Firms trading in EGs are not specialized in such trade as EGs make up a small share of the export and import baskets of firms–although this has increased slightly between 2014 and 2018. In both value terms and the number of products traded, imports of EGs have a larger share in the firms' basket of traded goods compared to exports, although both are very low overall. On average, EGs made up about 12 percent of the number of products exported and 9 percent of value in 2018 (Figure 2.16). Firms trading EGs are, therefore, rarely specialized in such trade, and mostly trade in non-EGs. Conversely, imports of EGs accounted for about 21 and 20 percent of the number and value of imports, respectively in 2018. Apart from a slight recent increase, these shares have been broadly stable between 2014-18.

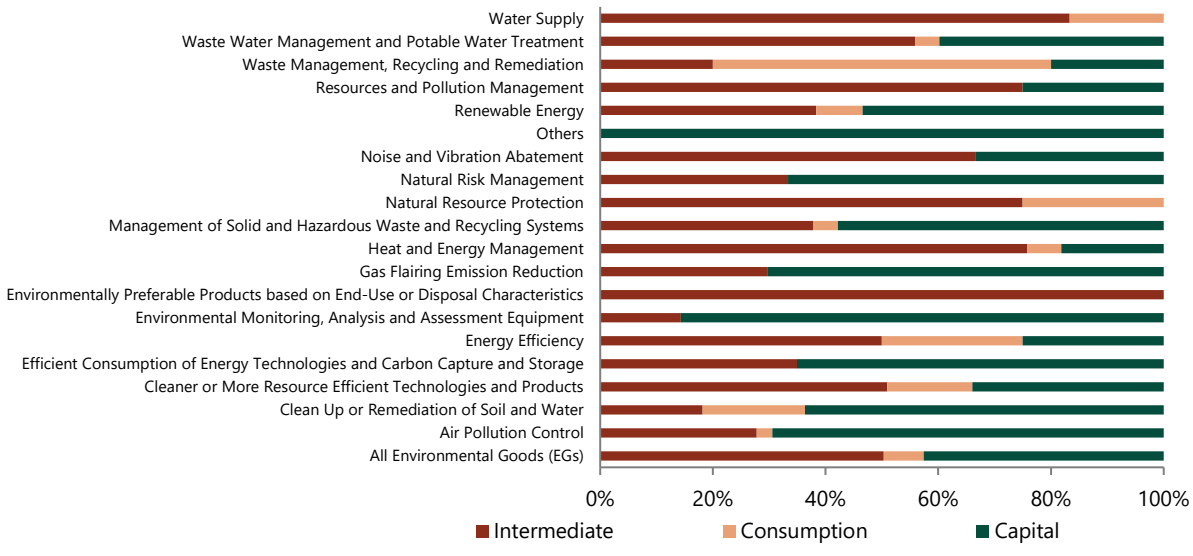
Indonesia's exports and imports of EGs are quite geographically concentrated among trade partners. EGs exporters have only one-half the number of trading partner countries as exporters of non-EGs. The average number of partner countries per firm is three for EGs exporters, compared to six for non-EGs exporters. In terms of source countries, the difference is smaller: non-EGs are imported from an average of four countries per firm, compared to three for importers of EGs. These numbers have not changed much in recent years.

EGs trade is highly concentrated among firms and, of the biggest Indonesian firms, the top 5 percent account for more than two-thirds of EGs trade. Conversely, the bottom 75 percent made up only 6 percent of exports and 8 percent of imports of EGs in 2018. The concentration of EGs traders is slightly higher than the concentration of all trading firms. For non-EGs, the top 5 percent of firms make up about 5 percentage points lower share than EG imports and 10 percentage points for exports generated by the top 5 percent. Import concentration is higher than for exports of EGs. Nearly 70 percent of imports and about 65 percent of export value is generated by the top 5 percent of firms, while the top 1 percent generate an average of 44 percent of imports and 30 percent of exports in EGs

Products Traded by Firms in EG Trade

EGs mainly consist of intermediate products (50 percent) and capital goods (43 percent) and only a small share of consumption products (7 percent) (Figure 2.21). By category, Waste Management, Recycling, and Remediation products have the largest share of consumption goods (60 percent), followed by Natural Resource Protection and Energy Efficiency (25 percent each). These categories contain some goods that are purposed for end use. Nevertheless, the bulk

Figure 2.21: EGs mainly consist of intermediate products (based on end-use classification and function, % share within each category)

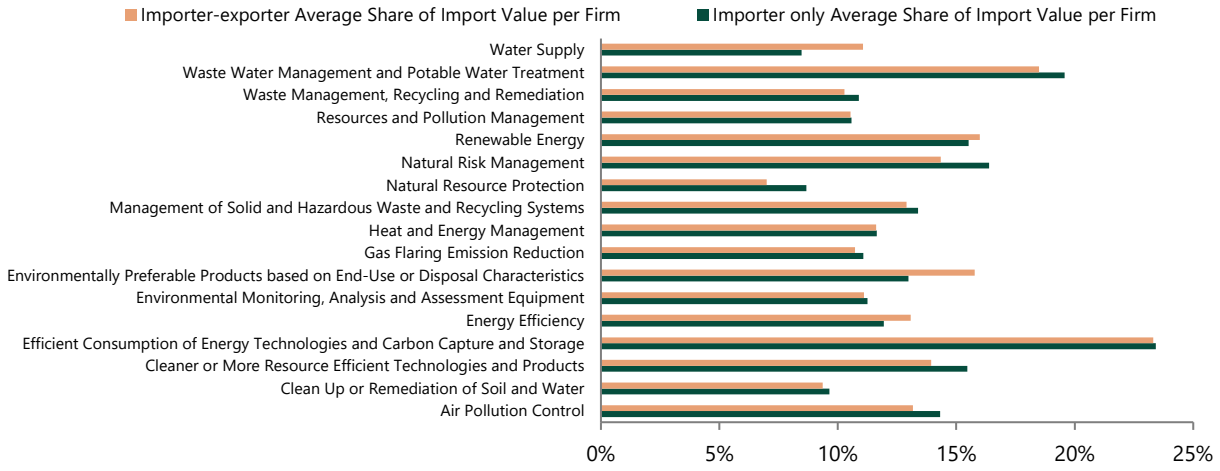


Source: World Bank staff calculations from GTN list. Capital, intermediate and consumption goods are categorized using UNSTAT concordance of System of National Accounts.

of EGs are used for production of other goods. Table A.2 in Appendix One provides the top traded EGs and their environmental categories.

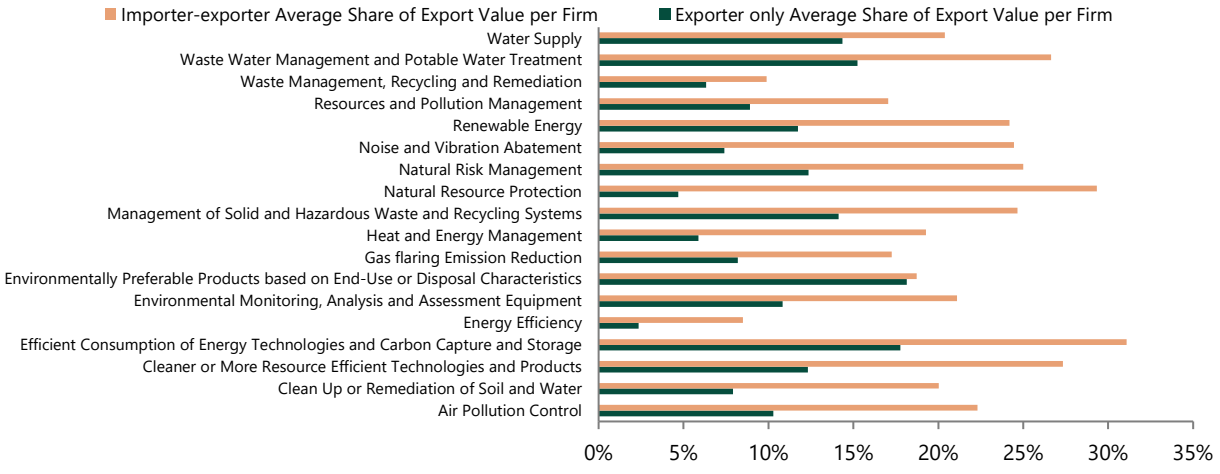
The main category of EGs imported or exported by two-way traders is Efficient Consumption of Energy Technologies and Carbon Capture and Storage (ECETCCS) (Figures 2.22 and 2.23) which mainly consist of capital and intermediate products. Among ECETCCS HS-10 products, 53 percent are intermediate products and 47 percent are capital products. This indicates that these imports are used as inputs for production and exports. This is followed by Natural Resource Protection Products, of which 75 percent are intermediate products, and Cleaner or More Resource Efficient Technologies and Products. Conversely, export-only firms are engaged in the exports of EPPs followed by ECETCCS goods. Two-way traders have higher shares in the exports of all types of EGs relative to export-only firms. Each firm exports an average of one to three EGs–with ECETCCSs having the largest number of distinct exported products per firm.

Figure 2.22: Average share of imports by EG category and firm type (2014-18)



Source: World Bank staff calculations from DGCE data.

Figure 2.23: Average share of exports by EG category and firm type (2014-18)



Source: World Bank staff calculations from DGCE data.

Overall, there has been an increase in the average value of exported EGs per firm–driven mostly by two-way traders. With the exception of Waste Management, Recycling, and Remediation, and Energy Efficiency Products, there has been an increase in the average firm-level value shares of EGs. For instance, the value of exports of Gas Flaring Emission Reduction and Cleaner or More Resource Efficient Technologies Products each increased by 6 percentage points between 2014-18. On the other hand, there have been slight declines or stagnations–with minimal growth in the EG exports of exporter-only firms.

ECETCCS products are also the most imported EGs by all firms by value, followed by Wastewater Management and Potable Water. This is closely followed by Renewable Energy and EPPs–each averaging 16 percent of import value for two-way traders (Figure 2.22).[27] For importer-only firms, Natural Risk Management products made up a larger share than EPPs based on end use, followed by Cleaner or More Resource Efficient Technologies products. Among importer-only firms, Natural Resource Protection, Cleaner or More Resource Efficient Technologies, and Natural Risk Management products had an increase in average firm-level shares between 2014-18 based on end use. Conversely, Water Supply products declined in the shares of both firm types and EPPs dropped in the firm-level share of two-way traders.

There is more variation in the distinct number of imported EGs compared to exports. The number of imported products varies between one and six products on average per firm. Once again, ECETCCS make up the highest number of products imported per firm (an average of five products between 2014-18 for both two-way traders and importer-only firms). There are also heterogeneities in the concentration of firms across different types of EGs. For instance, the export concentration of firms in the Renewable Energy and Cleaner or More Resource Efficient Technologies products is higher than the average–with 79 percent and 82 percent of value accounted for by the top 5 percent of firms. Within the subset of energy efficiency products, the share of the top 5 percent of firms is only 42 percent of exports and 50 percent of imports.

Technology Intensity of Firm-Level Trade in EGs

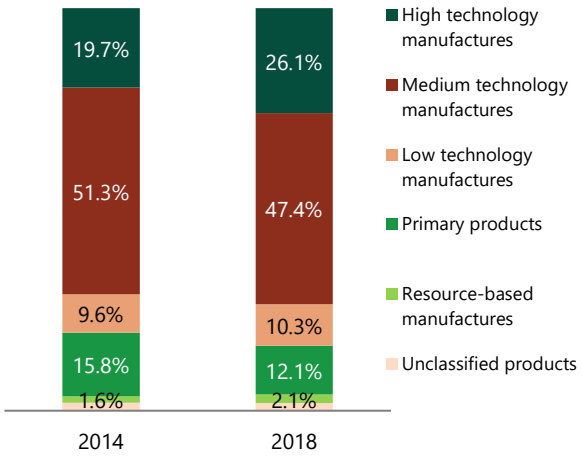
A country's ability to compete in high-technology markets is important to its overall competitiveness in the global market. This is even more critical in a decarbonizing global economy and the role of trade in technology spillovers. Imported technology has the potential to further restructure the Indonesian economy–not only from resource-based but also to a greener trading economy. Furthermore, imports are one of the channels for technological spillover from trade.

The EGs imported by two-way traders have a higher technology-intensity than average trade.[28] Importer-exporters imported, on average, 9 percent of high-technology goods in 2018 but 26 percent of high-technology EGs (Figure 2.24).[29] The share of high-technology EG imports by two-way traders is also slightly higher than the high-technology EG imports of importer-only firms (19 percent). Notably, the share of high-technology EG imports has increased over time for both two-way traders (by 6.4 percentage points between 2014 and 2018) and importer-only firms (by 5 percentage points).

Similarly, exports of EGs by two-way traders have relatively high technology embodied in them.[30] The EG exports of two-way traders included, on average, 20.2 percent of high-technology goods in 2018 (Figure 2.25). This is lower than the high-technology imports share but slightly higher than the high-technology exports of exporter-only firms (18 percent) and much higher than the share in non-EG exports of these firms (3 percent). Reflecting the nature of the Indonesian economy and relative comparative advantages, the share of resource-based manufactures is higher in the exports of EGs by two-way traders (13.2 percent), compared to their imports (2.1 percent). Similarly, the share of low-technology exports is much higher (12.9 percent) than their imports (10.3 percent). There are a few products where exporter-only firms trade in higher technology goods. Heat and Energy Management; Wastewater Management and Potable Water Treatment; and Clean up or Remediation of Soil and Water are the three products that have higher technology intensity in the exports of exporter-only firms compared to two-way firms.

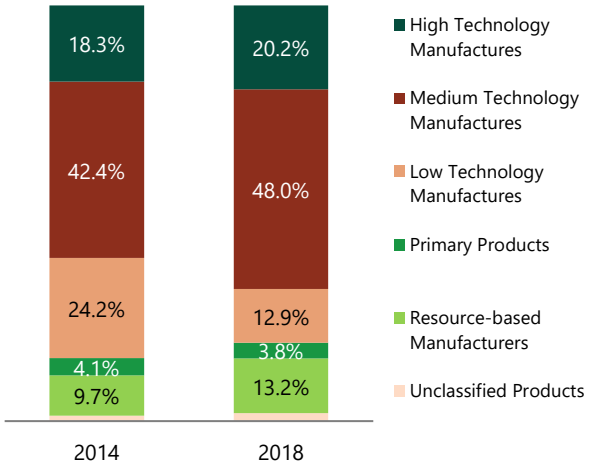
[27] The discussion focuses on EGs most closely linked to climate change. Statistically, the second most imported product by value was Wastewater Management and Potable Water Treatment with an average 18 percent share per firm.
[28] Technology intensity is categorized using the Lall classification.
[29] All averages are for the 2014-18 period. Most EGs are usually machinery and other equipment so this result is unsurprising.
[30] Lall (2000) defines high-tech goods as those characterized by advanced and rapidly changing technologies in the manufacturing process, accompanied by high investments in research and development, with a primary emphasis on product design.

Figure 2.24: The share of high technology intensity of EG imports for importer-exporters is increasing...



Source: World Bank staff calculations.

Figure 2.25: ...and so is the share of high technology intensity of EG exports for importer-exporters



Source: World Bank staff calculations.

How Competitive is EGs Trade for Firms in Indonesia?

Understanding trends in the entry/exit and the survival of firms trading EGs is essential to understanding the competitiveness of trade in EGs and for the design of a policy environment that enables firms not only to export but also to stay active in trading. Firm entry into, exit from, and survival in foreign markets can be a signal of the external environment (favorable or unfavorable) such as government regulations or macroeconomic uncertainty. Entry into export markets involves substantial sunk costs and a firm's decision to enter depends on the expected demand and future returns from exporting. Free market entry and conditions that enable firms to operate are essential for the development of new ideas. Firms tend to persist in exporting once they begin to export to recoup sunk costs but may exit if they were initially overly optimistic about the market's demand or risks faced in the foreign market (Dixit 1989). Firm exit can also be a key to transferring resources to more productive uses and, thereby, achieving, over time, structural shifts in the economy.

In Indonesia, the share of firms entering EGs export markets is lower than the share of firms entering non-EGs export markets–suggesting that expected returns remain relatively low. Entry rates into non-EG exports are twice as high as for EGs–averaging about 10 percent higher and 1,272 firms a year between 2015 and 2018.[31] Although entry rates of importer-exporter firms into EG exports have been relatively stable (Figure 2.26), overall entry of all firms has slightly decreased over time–mostly driven by exporter-only firms (Figure 2.27). Conversely, entry into the importing of EGs is higher than exports by 8 percentage points. Firm differences are not as pronounced for imports of EGs, where entry rates are only 4 percentage points lower than non-EG imports, and there is little difference between the entry rates of importer-only firms and two-way traders.

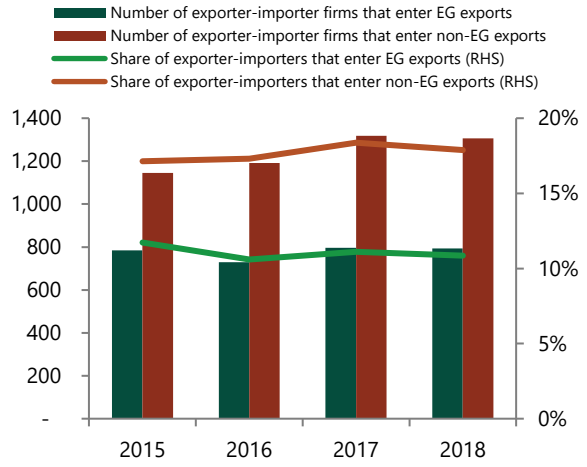
The number of two-way trader firms entering export markets for EGs was relatively stable between 2015 and 2018, while these traders have higher entry rates relative to exporter-only firms. The entry rate into green exports is slightly higher for two-way traders, at about 11 percent or an average of over 776 firms a year between 2015 and 2018–over 1.5 times that of exporter-only firms. Exporter-only firms have also been declining in their entry rates and in the numbers. On the other hand, exporter-only firms have slightly higher entry rates into non-EG trade (22 percent) compared to two-way traders. This suggests that being more internationally exposed, these GVC firms or two-way traders can leverage existing relationships and learn more from their trading activities to enable them to take advantage of market access opportunities.

Exit rates from both import and export markets are also lower in EGs than in non-EGs–suggesting more firms continue EGs trade than non-EGs trade–but the proportion of EG traders has not changed

[31] Entry is defined as if a firm was not trading EGs but starts trading EGs in the following year. Such a firm is defined as entering in the following year into trade in that particular good.

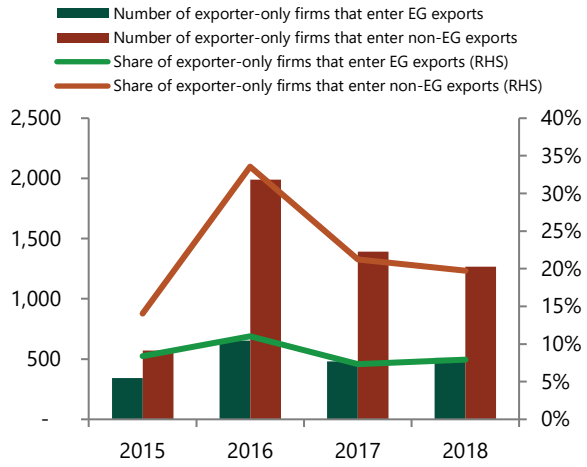
over the 2015-18 period. Using firm-level trade data, firms' decisions to stop trading in EGs is examined.[32] The results show that exit rates from importing and exporting EGs are lower than non-EGs for all firm types (Figures 2.28 and 2.29). For two-way traders, the average exit rates between 2015 and 2018 were 12 percent for EG imports and 15 percent for other imports. For exports, the gap is larger at 10 percent for EGs and 15 percent for other products. The percentage point differences in EGs and other goods exit rates are similar for importer-only or exporter-only firms. As average entry and exit rates are broadly the same, this explains the broadly unchanged share of traders in EGs in the time period (see Figure 2.15).

Figure 2.26: Two-way traders' entry rates have been broadly stable...



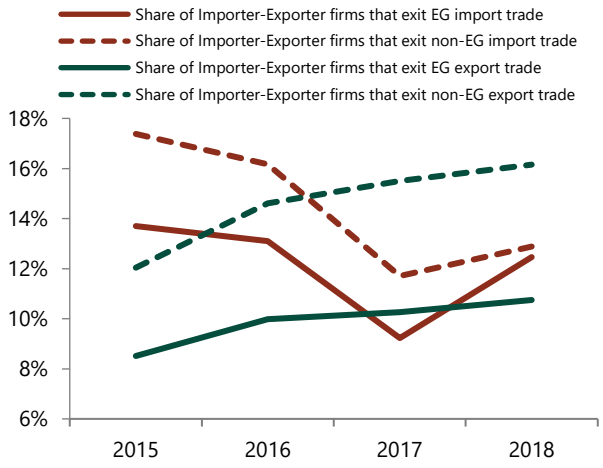
Source: World Bank staff calculations.

Figure 2.27: ...but exporter-only firms' entry rates decreased



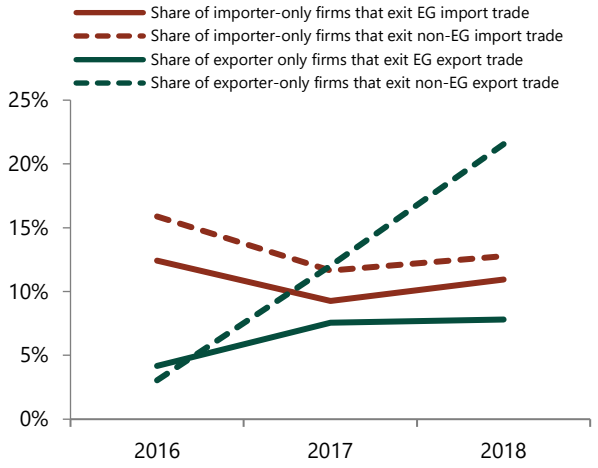
Source: World Bank staff calculations.

Figure 2.28: Two-way traders exit rates are lower for EGs...



Source: World Bank staff calculations.

Figure 2.29: ...as are the exit rates for importer-only/ exporter-only



Source: World Bank staff calculations.

[32] Exit is defined as if a firm was trading EGs but stops trading EGs in the following year. Such a firm is defined as exited in the following year from trade in that particular good.

EGs trading firms have a higher survival rate in export and import markets (Figures 2.30-2.32). Independent of whether the firm only imports or only exports, firms that are involved with EGs trade survive longer in the respective markets. Importer-exporter firms have the highest survival probability. Over 75 percent of EGs importer-exporter firms survive longer than the observed time period of five years (Figure 2.32). EGs trading firms that only export have a lower survival rate than firms that only import. Nevertheless, over 50 percent of the firms that export EGs survive the observed maximum time period of five years, compared to non-EGs exporting firms where less than 50 percent survive (Figure 2.31). The difference is even more pronounced when looking at purely importing firms, where almost 75 percent of EG importers stay in the market longer than five years while for non-EG importers more than one-half leave the market within the five years (Figure 2.30).

It is recommended to monitor and analyze the entry, exit, and survival rates of firms, implement policies promoting the growth and sustainability of the sector, and the ability for technological absorption. The EGs trade in Indonesia is concentrated among a few firms. The top 5 percent account for most of the trade–potentially limiting competition and leading to monopolistic practices. Entry rates for EG exports are lower than for non-EGs–indicating lower expected returns and potential challenges in finding profitable markets. About one-half of EGs exporting firms survive, while about 75 percent of importers remain in the market for over five years, reflecting the higher technological intensity of imported EGs. The share of firms trading EGs remained stable from 2014 to 2018, suggesting potential risks of limited growth and innovation in the sector. It is recommended to monitor and analyze the entry, exit, and survival rates of firms, implement policies promoting the growth and sustainability of the sector, and encourage more firms to engage in EGs trade. The higher technology-intensity of EGs indicates the need to improve capacity for technological absorption to maximize spillovers and productivity gains from global trade in EGs.

Figure 2.30: The firm survival rate is higher for importing-only firms

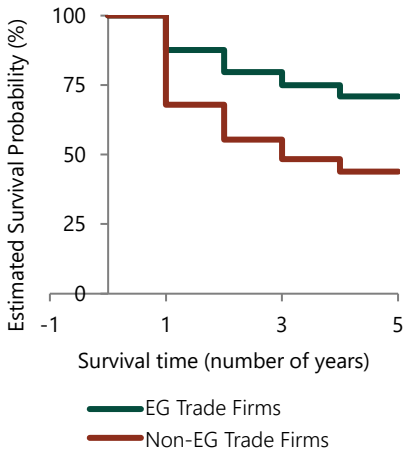


Figure 2.31: ...as well as for exporting-only firms...

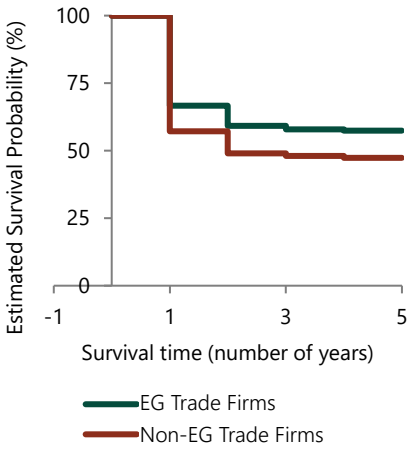
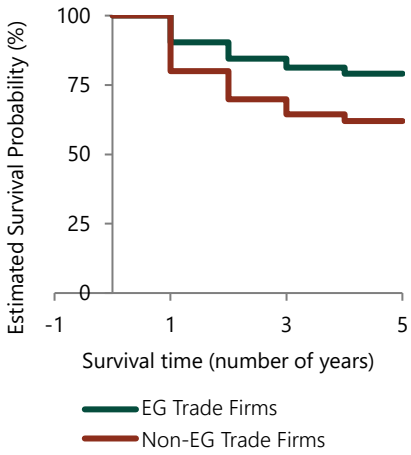


Figure 2.32: ...and two-way trader firms



Source: World Bank staff calculations from DGCE Data.

CHAPTER 3.

TRADE AGREEMENTS AND TARIFFS ON EGs

3.1. Environmental Provisions in Indonesia's Trade Agreements

3.2. Tariffs on EGs

3.3. Simulating the Impacts of Tariff Reforms and Multilateral Actions

CHAPTER 3. TRADE AGREEMENTS AND TARIFFS ON EGs

Indonesia was one of the signatories of the APEC agreement in 2012 committing to limit tariffs on 54 EGs to a maximum of 5 percent. Average tariffs on EGs are, therefore, low, but MFN tariffs are relatively high. Indonesia does not participate in most ongoing multilateral initiatives on these issues. Among Indonesia's 14 trade agreements analyzed at the time of writing, only six contain environmental provisions–of which only one (Indonesia EFTA) is strongly legally enforceable. Simulations indicate that unilateral, regional, and multilateral tariff liberalization, including joining the WTO Environmental Goods Agreement (EGA), could bring untapped benefits by boosting trade ties, exports, and imports of EGs–with potential positive impacts on Indonesia's economy and environmental sustainability.

3.1. Environmental Provisions in Indonesia's Trade Agreements

The inclusion of environmental provisions in preferential trade agreements (PTAs) is not a recent or an uncommon phenomenon–close to 90 percent of trade agreements currently in force include some form of commitments concerning the environment. Prior to the 1990s, however, environmental provisions in PTAs did not establish any binding obligations for environmental protection. Rather, these provisions took the form of environmental exception clauses to trade policy commitments–such as those to protect the conservation of natural resources. This progressively changed in the 1990s and, with much stronger emphasis, in the late 2000s when PTAs increasingly included commitments to environmental protection.

While Indonesia committed to reducing tariffs on some EGs in the early stages, the country does not participate in most multilateral initiatives in this area. In the early stages, Indonesia was one of the signatories of the APEC agreement in 2012 committing to limit tariffs on 54 EGs to a maximum of 5 percent.[33] Indonesia is not, however, one of the 46 members of the World Trade Organization (WTO) engaged in plurilateral negotiations seeking to eliminate tariffs

[33] APEC countries are Australia; Brunei Darussalam; Canada; Chile; China; Hong Kong SAR, China; Indonesia; Japan; Republic of Korea; Malaysia; Mexico; New Zealand; Papua New Guinea; Peru; the Philippines; the Russian Federation; Singapore; Taiwan, China; Thailand; the United States of America; and Vietnam.

on EGs under the EGA. Indonesia also does not participate in the three multilateral initiatives aimed at tackling issues at the nexus between trade policy and climate change, namely the Trade and Environmental Sustainability Structured Discussions (TESSD), the Informal Dialogue on Plastics Pollution and Sustainable Plastics Trade (IDP), and the Fossil Fuel Subsidy Reform (FFSR).

In contrast to global trends, among Indonesia's 14 trade agreements analyzed at the time of writing, only six contain environmental provisions–of which only one is strongly legally enforceable. The ASEAN-Japan, ASEAN-Republic of Korea, Indonesia-Japan, and Indonesia-Chile trade agreements, and the Regional Comprehensive Economic Partnership (RCEP) all include some form of environmental provisions, however, these are only weakly enforceable (Table 3.1). For example, in the Indonesia-Chile trade agreement that went into effect in August 2019, the two countries commit to "effectively enforce environmental laws and not weaken or reduce levels of environmental protection with the sole intention to encourage investment or to seek or to enhance a competitive trade advantage." In addition, the parties commit to ensure that "environmental laws, regulations and policies not be used for trade protectionist purposes" and that they will cooperate to "prevent or reduce the contamination, and degradation of ecosystems and natural resources through developing and endorsing special programs and projects for the transfer of knowledge and technology."[34]

Recent developments such as the trade agreement with the EFTA states that strengthen its certification and monitoring, reporting, and verification systems for trade of sustainable palm oil suggest there may be progress. It is a mechanism through which the implicit carbon pricing from EFTA tariffs on Indonesian palm oil varies according to the carbon intensity of Indonesian palm oil production–as captured by the certification system. In the agreement, EFTA countries will then use this information to vary their tariff rate on palm oil imported from Indonesia. This agreement presents a possible solution for carbon pricing for land uses. Although a very small market for Indonesia (for instance Switzerland has less than 0.5 percent share of each of Indonesia's imports and exports), the design could scale. There is evidence that trade agreements with environmental provisions do indeed mitigate negative environmental externalities such as deforestation (Box 3.1). In the past, similar policies such as the EU's Forest Law Enforcement, Governance and Trade (FLEGT) worked well, as Indonesia was the first country to export "verified legal" timber to the EU through this licensing system for the certification of wood.

Table 3.1: Environmental provisions in Indonesia's trade agreements

Agreement	Environmental provision is covered?	Legal enforceability?
ASEAN Free Trade Area – 1992	No	n.a.
ASEAN Free Trade Area – 2021	No	n.a.
ASEAN – China 2005	No	n.a.
ASEAN – Japan 2008	Yes	Weak
ASEAN – Australia – New Zealand 2010	No	n.a.
ASEAN – India 2010	No	n.a.
ASEAN – Republic of Korea 2010	Yes	Weak
ASEAN – Hong Kong, China 2019	No	n.a.
Indonesia – Japan 2008	Yes	Weak
Indonesia – Pakistan 2013	No	n.a.
Indonesia – Chile 2019	Yes	Weak
Indonesia – Australia 2020	No	n.a.
RCEP 2021	Yes	Weak
EFTA	Yes	Strong
Total Share	**43%**	

Source: World Bank Deep Trade Agreements Dataset.

[34] Indonesia-Chile Comprehensive Economic Association Agreement.

Box 3.1: Trade agreements with environmental provisions mitigate deforestation

Deforestation is one of the most pressing environmental challenges of the modern era and very relevant for Indonesia given that the largest share of carbon emissions originates from changes in land use.[35] The extent of global forest loss over the past 30 years has been unprecedented: the world lost an approximately net 178 million hectares of forest area between 1990 and 2020, which also implies a huge biodiversity loss (FAO 2020).

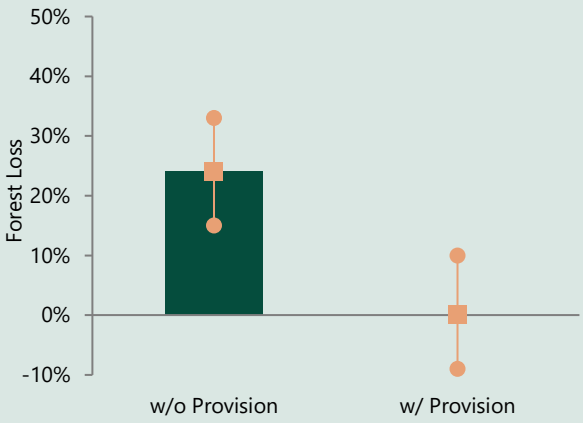
This box details the findings of Abman et al. (2021) who provide new causal evidence that environmental provisions included in PTAs are effective in limiting deforestation (see also Abman 2020). The authors exploit high-resolution, satellite-derived estimates of deforestation and identify the content of environmental provisions in PTAs using a new World Bank Deep Trade Agreements database (Mattoo et al. 2020).

Results show that there are large and significant net increases in annual forest loss following the entry into force of PTAs without environmental provisions (23 percent). Results, however, also show that the inclusion of environmental provisions entirely offsets the rise in forest loss (Figure 3.1). The mitigating effect of environmental provisions on deforestation is largely driven by changes to forest loss in tropical, developing countries with high levels of biodiversity–the locations where deforestation is of greatest concern.

The study also investigates the mechanisms through which forestry and biodiversity provisions in PTAs mitigate environmental damage. It is found that PTAs without these environmental provisions lead to an average 5 percent increase in the annual land area harvested, while there is no evidence of an increase in agricultural extensification following PTAs that include these provisions. Trade liberalization also leads to increases in agricultural output (as measured in tons harvested) that is partially, but not completely, offset by the inclusion of forestry and biodiversity provisions (Figure 3.2). This suggests that environmental provisions may limit agricultural land expansion, but not intensification. Net increases in agricultural exports are also lower in PTAs with environmental provisions, but not entirely offset.

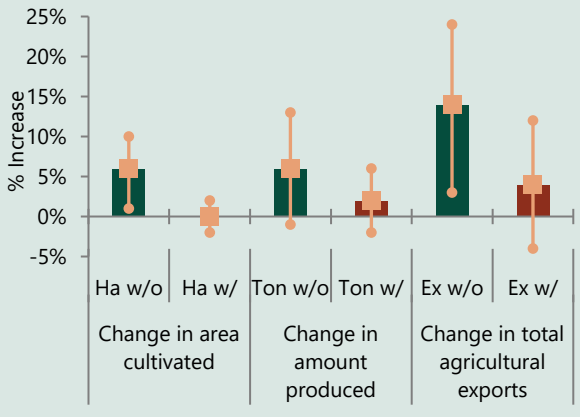
The effectiveness of forest-related PTA provisions at limiting deforestation arising from trade liberalization is also evaluated. It is found that there are no changes in net annual deforestation following implementation of agreements that include provisions aimed at protecting forests and/or biodiversity. On the other hand, agreements without these provisions see substantial increases in net forest loss–that is, provisions reduce forest loss relative to PTAs that do not include them. Rough calculations indicate that the forest and biodiversity provisions prevented approximately 7,500 square kilometers of deforestation from 2003–14–which is greater than the entire forested area of countries like Belgium or Ireland.

Figure 3.1: Inclusion of environmental provisions entirely offsets the rise in forest loss



Source: World Bank staff calculations.

Figure 3.2: Inclusion of forestry and biodiversity provisions partly offset increases in agricultural output from trade liberalization



Source: World Bank staff calculations.

[35] Its emissions stem from deforestation and peatland megafires and, to a lesser extent, the burning of fossil fuels for energy. From 2000 to 2015, Indonesia lost an average of 498,000 hectares of forest each year–making it the world's second biggest deforester after Brazil (https://www.carbonbrief.org/the-carbon-brief-profile-indonesia).

The findings suggest that these types of environmental provisions provide a mechanism to defray the environmental costs that can arise from international trade integration. While on the one hand the inclusion of such provisions may incur some bargaining costs in the negotiation phases of trade agreements, they appear to provide an institutional framework that allows member countries to commit to policies that encourage more sustainable patterns of trade integration and economic growth.

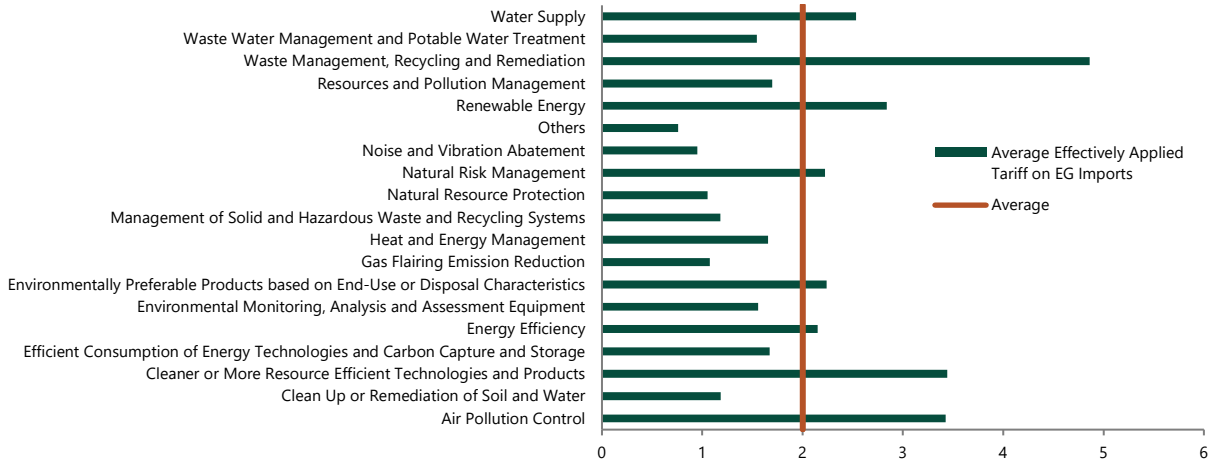
3.2. Tariffs on EGs

At an average of 2 percent in 2021,[36] Indonesia's tariffs on EGs are generally low. These low tariffs on EGs are mostly a result of EGs liberalization under the APEC agreement. As such, Indonesia's tariffs on EGs are consistent with global trends–with average tariffs on EGs being about the same as average aggregate tariffs. For example, while on the one hand imports of green products for Noise and Vibration Abatement benefit from close to zero average import tariffs (Figure 3.3), higher than average tariffs are applied on EG categories such as Waste Management, Recycling, and Remediation (4.9 percent), Air Pollution Control (3.4 percent), and Cleaner or More Resource Efficient Technologies and Products (3.4 percent). There are also more than 20 product lines with applied tariffs of more than 5 percent, among which the highest apply to imports of motor vehicles, and plaiting materials with tariffs above 20 percent.

Indonesia's Most Favored Nation (MFN) tariffs[37] on EG imports remain high (on average 7.2 percent), and there are several product lines with tariff peaks of above 25 percent. MFN tariffs are the highest on EG categories such as Waste Management, Recycling, and Remediation (17.3 percent), Cleaner or More Resource Efficient Technologies and Products (11.3 percent), and Air Pollution Control (11.1 percent) (Figure 3.5). There are several tariff peaks that apply to imports of products such as motor vehicles, and bicycles (including tricycles) with tariffs of 35-40 percent and over 25 percent, respectively. Participation in the WTO EGA would allow Indonesia to reduce these MFN tariffs and benefit from increased market access for exports to other participating countries.[38]

In terms of market access, Indonesia also faces relatively low average tariffs (1.2 percent) on its exports of EGs to destination markets. Among EG categories, Cleaner or More Resource Efficient Technologies and Products (2.5 percent) and Noise and Vibration Abatement (2.4 percent) are among the highest (Figure 3.4). There are also high tariffs of above 10 percent applied to Indonesia's exports of products such as motor vehicles, sodium hydroxide, heaters, cement, and monoculars. Overall, however, tariffs on Indonesia's exports to major destination markets (EU, China, Japan, United States) are generally low but high tariffs reduce Indonesia's exports to Pakistan, Argentina, and Brazil (Figure 3.6).[39]

Figure 3.3: Indonesia's average tariff on EG imports is around 2 percent (2021)



[36] All tariffs reported in this report were calculated using trade weighted averages.
[37] MFN tariffs are tariffs imposed on imports from other members of the WTO, unless the country is part of a preferential trade agreement.
[38] For a list of adaptation and mitigation categorization of the EGs, see Table 2.1.
[39] In December 2021, Indonesia and MERCOSUR countries (Argentina, Brazil, Uruguay, and Paraguay) launched negotiations for a Comprehensive Economic Partnership Agreement which could potentially cover the trade liberalization of EGs.

Figure 3.4: Indonesia faces low average tariffs on exports of EGs (2021)

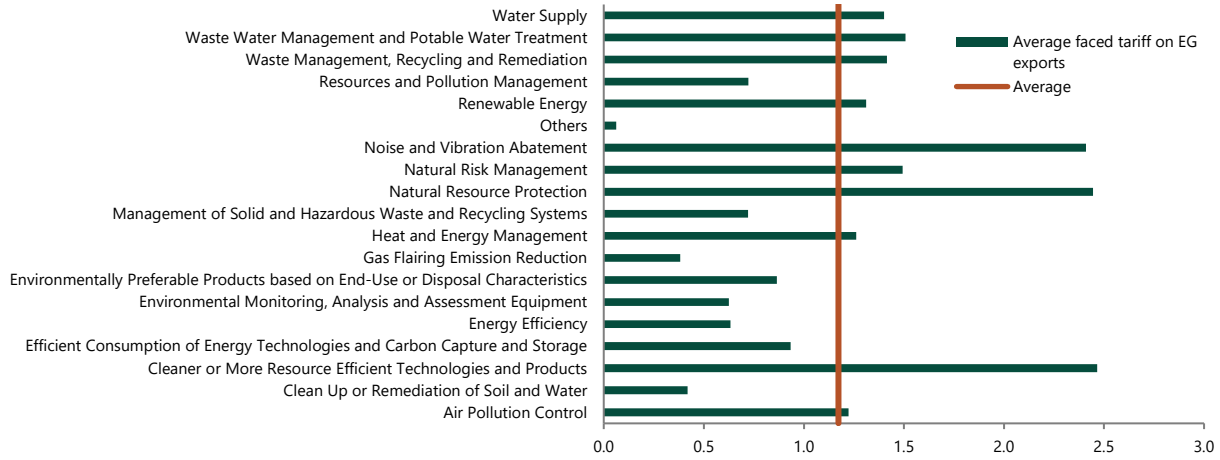


Figure 3.5: Indonesia's MFN tariffs on EG imports remain high (2021)

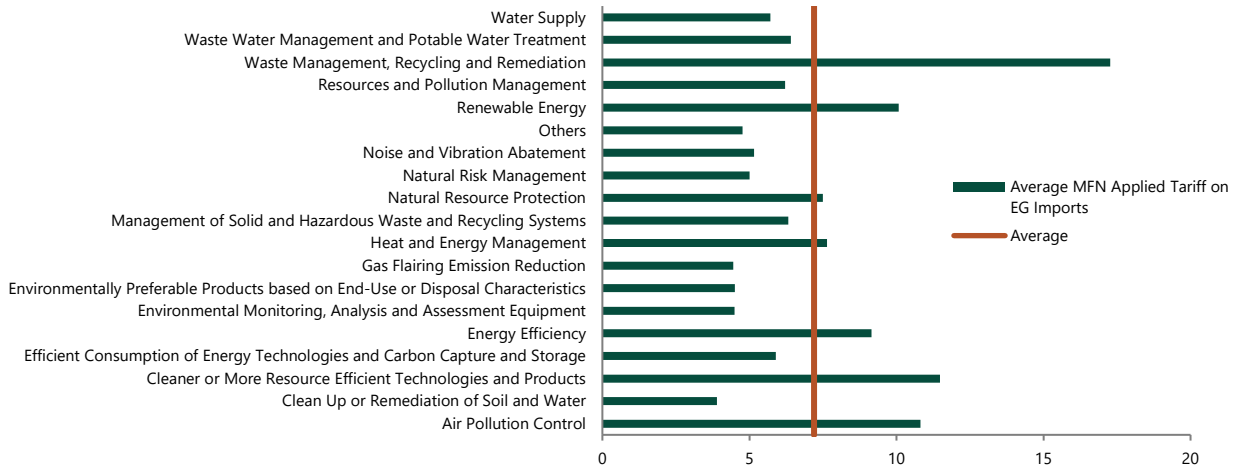
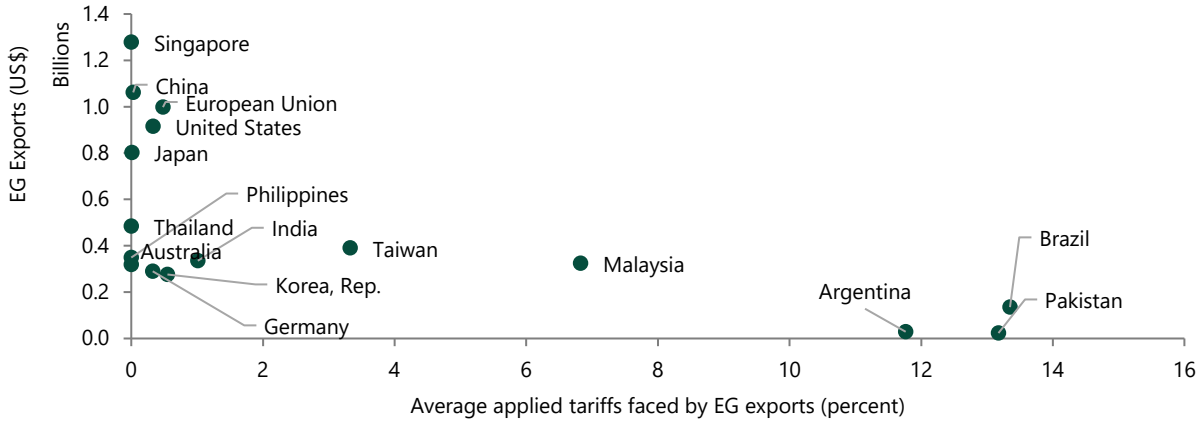


Figure 3.6: Average tariffs faced by Indonesian EGs in major export markets are low (2021)



Source for Figure 3.3-3.6: World Bank staff calculations based on the World Bank WITS database.
Note: All graphs are produced using import weighted averages.

3.3. Simulating the Impacts of Tariff Reforms and Multilateral Actions

The limited number of trade agreements that include environmental provisions have focused predominantly on tariffs. We first focus, therefore, on the impact of Indonesia's involvement in these agreements by considering different tariff liberalization scenarios.

To estimate the effects of potential liberalization scenarios of tariffs on EGs trade for Indonesia, a partial equilibrium trade model is used (for detailed methodology see Appendix Two). The modeling framework underlying the simulations is a modified version of the Global Simulation Analysis Model (GSIM) (Francois and Hall 2009). The model is calibrated on EGs trade data at the HS6 product level for all bilateral country pairs, explicitly representing global export and import flows for 358 HS6 level green products–with more than 401,000 observations. The model is specified based on the assumption of national product differentiation–that is, Armington (1969) preferences, according to which goods produced by different countries are imperfect substitutes, and thereby allowing for two-way trade between countries exporting the same goods. The elasticity of substitution is held equal and constant across products from different sources, while the elasticity of demand in aggregate is also constant. Import demand and export supply equations are cleared by a market price that is directly affected by tariffs.

Four increasingly more ambitious scenarios are considered, representing Indonesia's unilateral, regional, and multilateral liberalization of tariffs on EGs trade. Scenario One assumes the full unilateral liberalization of tariffs on EG imports by Indonesia; Scenario Two represents the full regional liberalization of tariffs on EGs among APEC countries; Scenario Three depicts the implementation of the WTO EGA without Indonesia's participation; finally, Scenario Four assumes the full liberalization of tariffs on EGs under the WTO EGA with Indonesia's participation.

Unilateral liberalization of tariffs on EGs by Indonesia (Scenario One) would boost the competitiveness of Indonesian firms that already use these as inputs into their production by boosting a firm's access to cheaper environmental technologies. This could, in turn, incentivize the private sector's transition to the use of green technologies. Imports of EGs are estimated to increase by 3 percent or US$521 million. The overall effects are muted as Indonesia already applies low tariffs on imports of EGs. Imports of Cleaner or More Resource Efficient Technologies and Natural Risk Management are estimated to increase the most–by 8 percent and 7.4 percent, respectively (Figure 3.7). On the one hand, this unilateral liberalization would boost Indonesia's trade with important partners such as the United States (by 42 percent); Taiwan, China (49 percent); and India (22 percent), while at the same time slightly reduce imports from countries with already low tariffs on EGs such as Japan, China, Singapore, and others in the EAP region.

Full regional liberalization of tariffs on EGs trade among APEC countries (Scenario Two) is estimated to boost Indonesia's exports of EGs by 0.2 percent or US$15 million and imports by 1.2 percent or US$214 million. While the increase in imports under this scenario is more muted than under unilateral liberalization, regional APEC liberalization of EGs trade would not only ensure Indonesia's access to lower prices and quality imported environmental technologies but also improved market access for its exports. Indonesian exporters of EGs such as for Energy Efficiency; Resources and Pollution Management; and Water Supply are estimated to benefit the most, with an increase in exports by 4.3 percent, 1.7 percent, and 1.6 percent, respectively (Figure 3.8). Conversely, imports of Natural Risk Management and Cleaner or More Resource Efficient products increase the most. Regional liberalization would benefit trade with the United States; Hong Kong SAR, China; Canada; and Mexico the most.

The implementation of the WTO EGA without Indonesia's participation (Scenario Three) would hurt not only Indonesian exporters but also importers of EGs. Due to trade diversion effects, Indonesia's exports and imports of EGs decline by 0.3 percent (US$29 million) and 0.8 percent (US$129 million), respectively. Except for exports of EGs for Water Supply; Noise and Vibration Abatement; Air Pollution Control; and Natural Risk Management, all of Indonesia's exports and imports are estimated to be hurt (Figure 3.9). Interestingly, results also show that, while Indonesia's trade with non-participating countries increases (for example, Thailand, Vietnam, and India), these increases are outweighed by the

contraction in trade with major trading partners such as the United States, Japan, and China.

By joining the WTO EGA (Scenario Four), exports would significantly expand the benefits of participation in a regional APEC liberalization and boost Indonesia's EG exports by 1.1 percent (US$99 million) and imports by 1.2 percent (US$214 million). On the one hand, eliminating remaining tariffs on EGs would boost imports of products categories such as Natural Risk Management; Cleaner or More Resource Efficient Products; and Environmentally Preferable Products by 6.2 percent, 4.6 percent, and 2 percent, respectively (Figure 3.10). Conversely, improved market access to participating countries' markets would benefit exporters of EGs such as Energy Efficiency; Cleaner or More Resource Efficient Products; and Natural Resource Protection.

There are additional benefits from freeing up trade in EGs and distributional implications that are not captured in this analysis. These additional effects include promoting competition and innovation within Indonesia. This analysis provides the impact of tariff liberalization using largely static and partial equilibrium assumptions. Additional benefits would accrue from freeing up trade not only through tariffs but also, crucially, NTMs on environmental products and technologies as demonstrated earlier.

Figure 3.7: The impact of unilateral liberalization of EG imports (percent change) (scenario one)

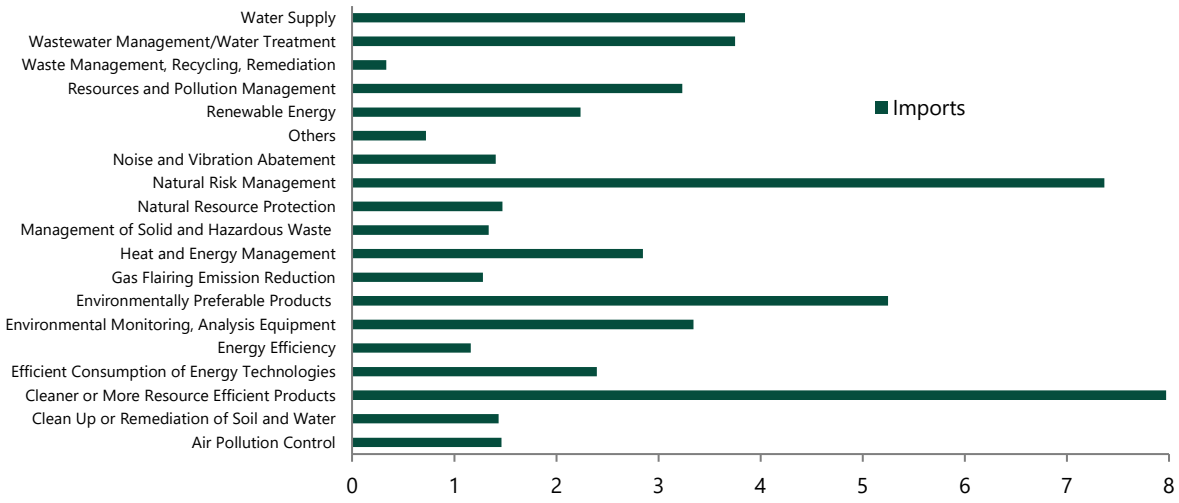


Figure 3.8: The impact of regional liberalization of EGs trade among APEC countries (percent change) (scenario two)

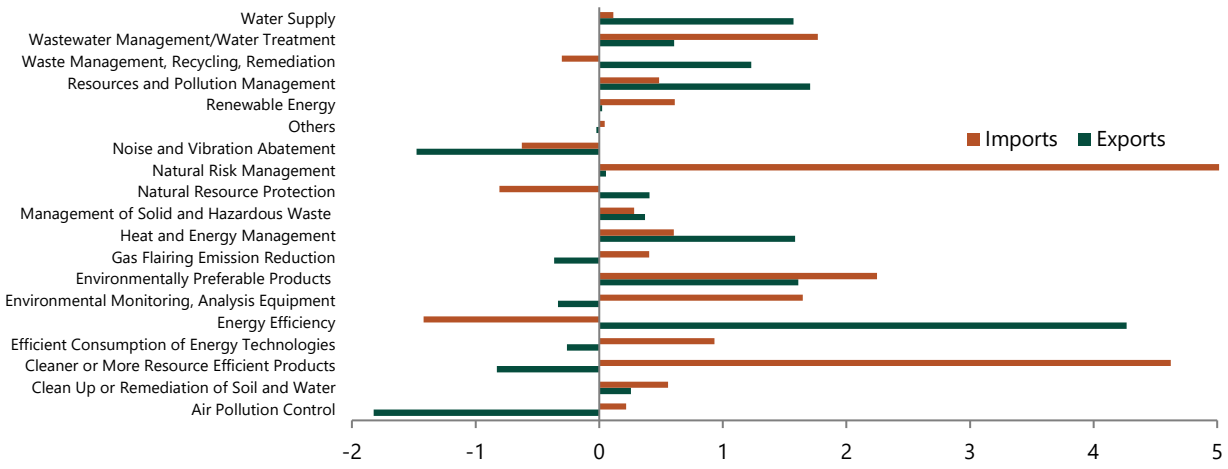


Figure 3.9: The impacts of the WTO EGA without Indonesia on EGs trade (percent change) (scenario three)

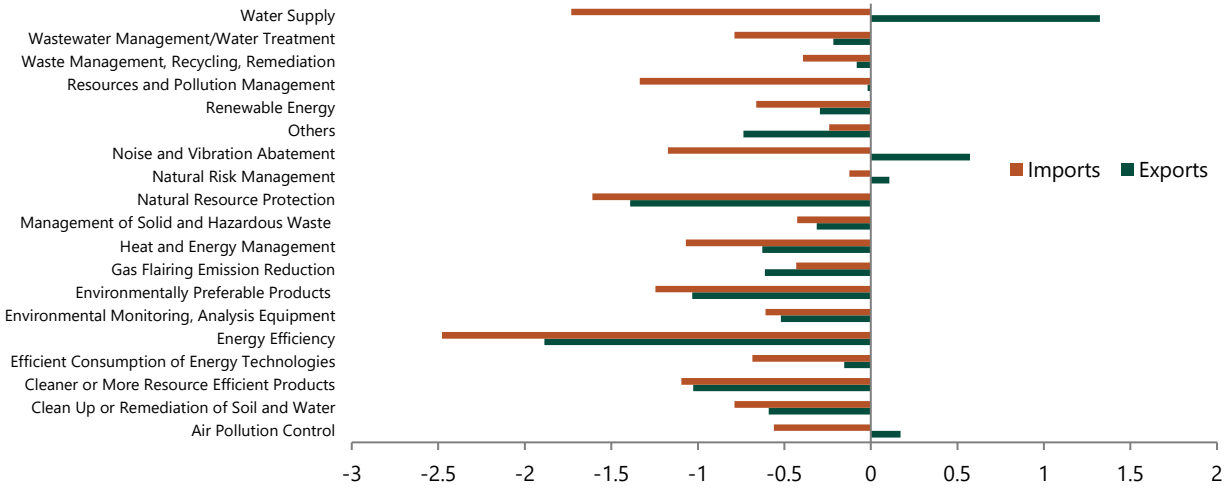
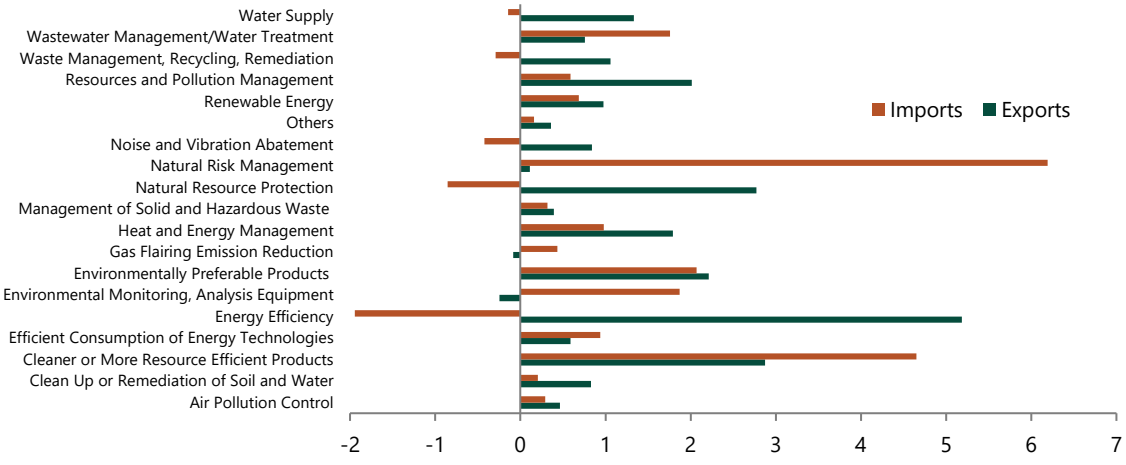


Figure 3.10: The impacts of the WTO EGA with Indonesia on EGs trade (percent change) (scenario four)



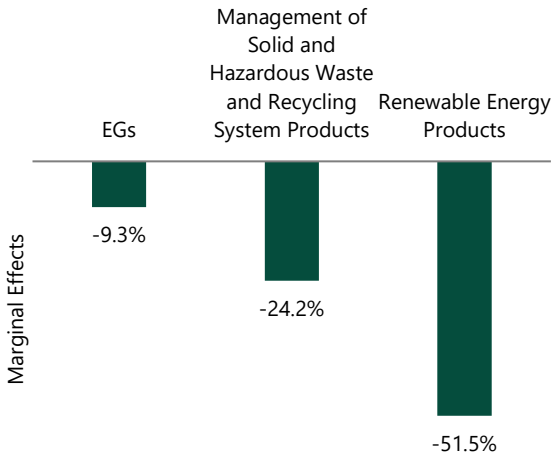
Source: Figures 3.7-3.10: World Bank staff calculations using WITS and GTN data.

Results of simulations suggest that unilateral, regional, and multilateral liberalization of tariffs on EGs trade would have previously untapped benefits for Indonesia. First, unilateral liberalization of tariffs would boost the private sector's access to cheaper and cutting-edge EGs and technologies, increase imports of EGs (especially of Cleaner or More Resource Efficient technologies and Natural Risk Management), and strengthen trade ties with important trading partners such as the United States; Taiwan, China; Hong Kong SAR, China; and India. Second, regional liberalization of tariffs on EGs trade among APEC countries would create important "trade creation" effects with other participating countries and would benefit Indonesian exporters of EGs such as Energy Efficiency; Resource and Pollution Management; and Water Supply. Third, results also show that the trade-related opportunity costs of not participating in the WTO EGA could be significant for Indonesia–not only in terms of lost export and import opportunities but also for being able to shape the content and course of negotiations in these different multilateral forums. Conversely, liberalizing tariffs on EGs under the umbrella of the WTO EGA is estimated to boost Indonesia's EG exports by 1.1 percent (US$99 million) and imports by 1.2 percent (US$214 million).

Finally, we also find that tariffs on imports of EGs reduce the probability of firm entry, and tariffs on inputs used by EG exporters reduce their EG export growth. Raising tariffs by one percentage point reduces the probability of firms starting to trade in EGs by 9.3 percent. The effect is even larger for certain categories of EGs such as Management of Solid and Hazardous Waste and Recycling System Products and Renewable Energy Products where the probability declines by 24.2 percent and 51.5 percent, respectively (Figure 3.11). In addition, a one percentage point tariff increase in imported inputs for EG exports, reduces the export value of EGs by US$6 million per year (Montfaucon et al. World Bank mimeo).

These results provide the import and export simulated effects of these policies, but economy-wide effects will need to be analyzed further. These include possible impacts on jobs and the labor market for various industries relatively more involved in trading these products, as well as impacts on other macroeconomic outcomes such as GDP, which are beyond the scope of this aspect of the analysis but in the next phase of this work.

Figure 3.11: Tariffs reduce the likelihood that firms start trading EGs



Source: World Bank staff calculations from DGCE data and World Bank NTM database.
Note: This figure shows the probabilities of starting to trade EGs, calculated by using the marginal effects following xtprobit regression. We only report the negative significant coefficients. All full regression tables as well as the methodology can be found in Appendix Two (Tables A.3-A.5 (Column 6)).

CHAPTER 4.

NON-TARIFF TRADE MEASURES ON EGs AND PLASTIC SUBSTITUTES

4.1. Incidence of Non-Tariff Measures (NTMs) on EGs and Plastic Substitutes

4.2. Assessing the Cost of NTMs

4.3. A Look at Local Content Requirements on Solar Panels and EVs

4.4. Which NTMs Matter the Most?

CHAPTER 4. NON-TARIFF TRADE MEASURES ON EGs AND PLASTIC SUBSTITUTES

While most Non-Tariff Measures (NTMs) are in place to address legitimate public policy concerns, estimates suggest that some NTMs impose significant costs–equivalent to up to a 30 percent tariff for some EGs and plastic substitutes. NTMs also affect firms' decision to enter the EG trade and are cited by firms already involved in EG trade as a challenge. Accounting for one or more of the following criteria: their estimated tariff equivalents, their cost relative to ASEAN countries, their overall incidence and survey of firms trading in EGs, nine out of nearly ninety non-tariff trade measures are suggested for review and possible reform. International evidence suggests high minimum local content requirements (LCR) can act as a deterrent to the growth of the industry and need to be reviewed as they can only succeed in certain conditions.

4.1. Incidence of Non-Tariff Measures (NTMs) on EGs and Plastic Substitutes

NTMs on EGs

NTMs are regulations such as packaging or licensing requirements, price controls, and import quotas that can affect the flow of goods and services across borders. Some of these measures are necessary–for example, to ensure the compliance with health and safety standards, while others result in costly barriers to trade without achieving their primary policy objective. Analysis of NTM data is, therefore, very important for understanding and improving trade policy. The data used to analyze the impact of these NTMs is a panel dataset collected by the World Bank based on data collected by UNCTAD and Economic Research Institute for ASEAN and East Asia (ERIA) in 2015 and 2018 for Indonesia.[40] The World Bank data backdates and updates this data and creates a panel of nearly 90 measures and more than 650 regulations, spanning from 2008-2021 and covering all import and export measures across all traded products. The dataset can, therefore, be used to highlight the specific NTMs applied on different EGs and plastic substitutes.

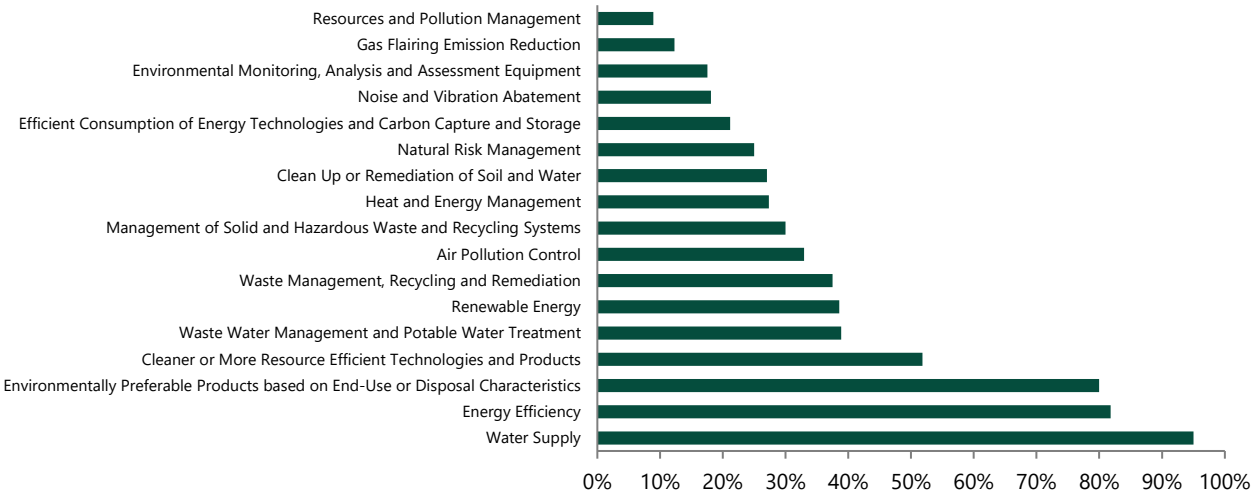
Despite low tariffs, a high incidence of NTMs on imports of EGs and technologies prevails in Indonesia. These NTMs affect a high share of trade and many products. Among the most affected by NTMs are Water Supply Products; Energy Efficiency Products; and

[40] https://datacatalog.worldbank.org/int/search/dataset/0063543/indonesia_nontariff_measures

Environmentally Preferable Products based on End-use or Disposal Characteristics (Figure 4.1). In most cases, various NTMs are applied to the same products at the same time, compounding compliance cost. For example, 95 percent of all Water Supply Products are affected by at least one NTM while 82 percent of all Energy Efficiency Products are impacted by at least one NTM.

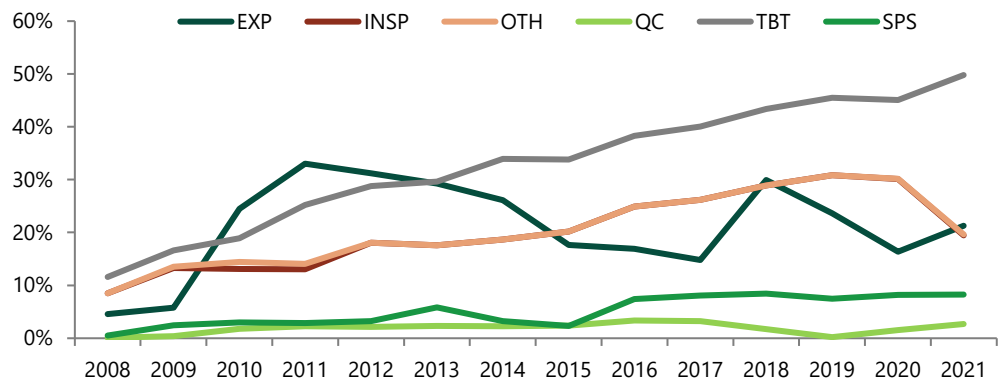
Further analysis reveals that technical barriers to trade (TBT) affect the highest share of products (50 percent in 2021)[41] (Figure 4.2).[42] All categories of NTMs applied to imports of EGs have increased in terms of their coverage since 2008. The more pronounced increase in TBT measures may be associated with an increasing preference for quality products as a country's income rises (Munadi 2019). More generally, however, the increase in NTMs applied on EGs is consistent with Indonesia's increasing incidence of NTMs applied to all imports (Cali and Montfaucon 2021). The measure which affects the highest share of EG imports is authorization requirements for importers (a TBT measure), affecting 43 percent of imports in 2021, followed by traceability requirements and authorization requirements for importing certain products (37 percent each) (Figure 4.3).

Figure 4.1: NTMs affect up to 95 percent of EG products in each EG category in 2021 (frequency ratio)



Source: World Bank staff calculations from World Bank NTM Database.
Note: Figure 4.1 only shows categories where at least one good was affected by at least one NTM.

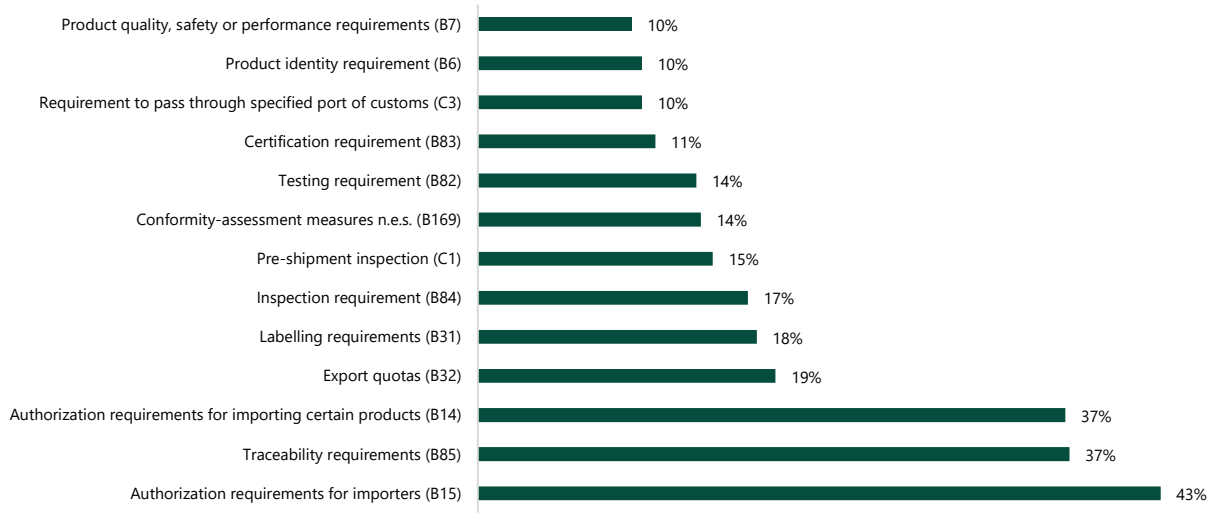
Figure 4.2: The share of affected trade (coverage ratio) of green products varies between different NTM groups...



Source: World Bank staff calculations from World Bank NTM Database.

[41] These are measures referring to technical regulations, and procedures for assessment of conformity with technical regulations and standards.
[42] These are measures that are applied to protect human/animal life from risks arising from additives, contaminants, toxins, or disease-causing organisms in their food; to protect human life from plant- or animal-carried diseases; to protect animal or plant life from pests, diseases, or disease-causing organisms; to prevent or limit other damage to a country from the entry, establishment or spread of pests; and to protect biodiversity. These include measures taken to protect the health of fish and wild fauna, as well as of forests and wild flora. Note that measures for environmental protection (other than as defined above), to protect consumer interests, or for the welfare of animals are not covered by SPS.

Figure 4.3: .....and between different specific NTMs (coverage ratio, 2021)



Source: World Bank staff calculations from World Bank NTM Database.

A substantial number of internationally trading firms in Indonesia encounter various NTMs, and a significant proportion of these firms engage in trade of EGs. Among the diverse NTM categories, TBTs have an effect on the largest number of firms. A total of 23,029 or 80 percent of firms engaged in imports (both exclusive importers and exporting importers) in the year 2018 were subjected to TBT measures (Table 4.1). Among these firms, approximately 80.6 percent are involved in trading EGs. Measures like pre-shipment inspections and other related measures (INSP), such as the obligation to pass through specific customs ports, are also highly prevalent among importing firms. In most instances, a significant majority of firms affected by these NTMs are also engaged in trading EGs. The lowest percentage for firms trading in EGs is 74.9 percent out of a total of 7,112 importing firms that face SPS measures on their imports. On the other hand, the incidence of export NTMs is notably lower in terms of the proportion of firms affected, with 62.5 percent of these impacted exporting firms being involved in trading EGs.

Nearly 90 percent of EGs trading firms encounter NTMs (Figure 4.4). Importer-exporters, in particular, bear a greater burden of these NTMs–experiencing a more pronounced impact. Among the various NTM categories, TBT and INSP stand out as the most significant impact, with 85 percent and 75 percent of firms affected respectively. NTMs linked to exports affect approximately 35 percent of all firms engaged in the trading of EGs. This interplay between trading practices and the influence of NTMs underscores the complex relationship between trade dynamics and regulatory measures in the context of green trade. In the next section, we formally assess to what extent these NTMs may be creating barriers to trade in EGs for Indonesian firms.

NTMs not only affect green products but also the inputs that are used in the production of these EGs–which has significant implications for Indonesia's potential for green exports. Between 2014 and 2018, an average of 92.4 percent of all exported EGs used inputs that were exposed to NTMs. In 2018 for example, NTMs affected inputs of 7,421 products[43] out of a total of 7,801 exported products (95.1 percent) (Figure 4.5). This affected about 96.5 percent of all EGs exporting firms in the sample (6,152 firms out of 6,376 EGs exporting firms over the sample period). Almost all categories of EG exports face a significantly high share of NTMs on their inputs. The most affected EG categories include Energy Efficiency; Environmentally Preferable Products based on End-Use or Disposal Characteristics; Natural Resource Protection; Natural Risk Management; Noise and Vibration Abatement; Waste Management, Recycling, and Remediation; and Water Supply–all of which face NTMs on their inputs. Even the least affected category–Cleaner or More Resource Efficient Technologies and Products–faces NTMs on as many as 88 percent of the products (Figure 4.6). These NTMs may hinder firms' ability to produce and export more EGs in Indonesia.

Looking at specific EGs within an EG category–for example, Renewable Energy–reveals which products are most impacted by NTMs on its inputs. Some 99 percent of inputs into the production of regulating

[43] Products are classified at HS6 digits.

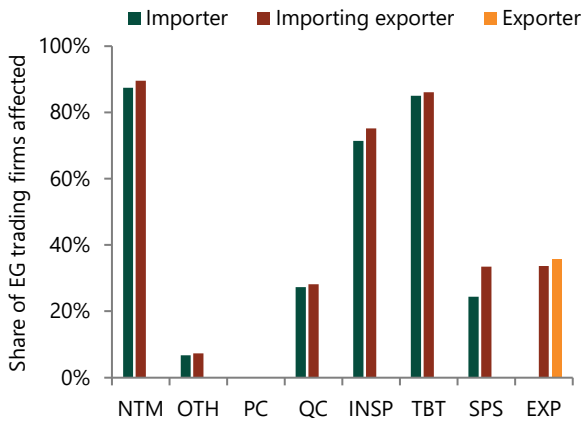
or controlling instruments and apparatus are subject to NTMs (Figure 4.7). This exposure comes from approximately 25 different NTMs that place a burden on the production of renewable energy products. Another example is cells and batteries which are needed in the production of renewable energy products. On average, 93 percent of imported inputs into the production of these cells and batteries are subject to NTMs. Overall, this involves 11 different NTMs.

Table 4.1: Share of firms affected by NTM groups in 2018

	Importing Firms				Importing-Exporter Firms			
	Number of Firms	Share affected	Non-EG Trading	EG Trading	Number of Firms	Share affected	Non-EG Trading	EG Trading
Other measures (OTH)	1,716	6.0%	14.7%	85.3%	769	6.9%	11.4%	88.6%
Quality-control measures (QC)	6,529	22.7%	8.7%	91.3%	2,798	25.1%	6.8%	93.2%
Pre-shipment inspections and other related measures (INSP)	19,204	66.7%	18.9%	81.1%	8,151	73.0%	14.4%	85.6%
Technical barriers to trade (TBT)	23,029	80.0%	19.4%	80.6%	9,351	83.7%	14.6%	85.4%
Sanitary and phytosanitary measures (SPS)	7,112	24.7%	25.1%	74.9%	3,818	34.2%	18.6%	81.4%
	Exporting Firms				Importing-Exporter Firms			
	Number of Firms	Share affected	Non-EG Trading	EG Trading	Number of Firms	Share affected	Non-EG Trading	EG Trading
Export-related measures	6,775	38.5%	37.5%	62.5%	3,683	33.0%	15.3%	84.7%

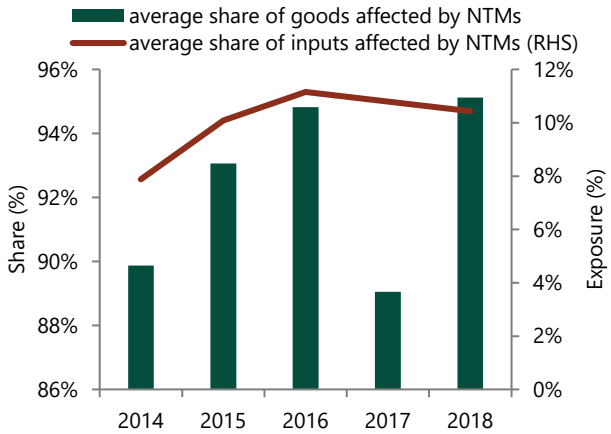
Note: A firm is defined as trading EG if at any point in our dataset (2010-2018) a firm traded at least one EG.

Figure 4.4: Firms that trade in EGs are mostly affected by TBT and INSP measures in 2018



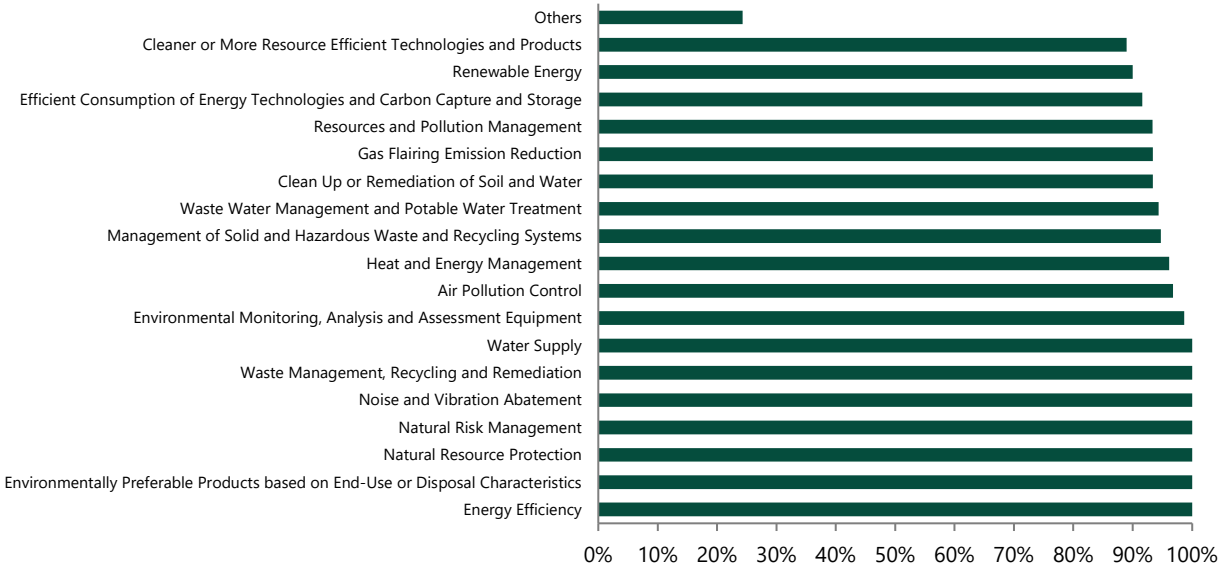
Source: World Bank staff calculations.
Note: The graph shows the share of EGs trading firms that are affected by each measure. EXP = Export-related measures; OTH = Others; PC = price-control measures; QC = Quality-control measures; INSP = Pre-shipment inspections and other related measures; TBT = Technical barriers to trade; SPS = Sanitary and Phytosanitary Measures. A firm is defined as trading in EGs if at any point in our dataset (2010-2018) it traded at least one EG.

Figure 4.5: A high share of exported EG Products are affected by NTMs on their inputs



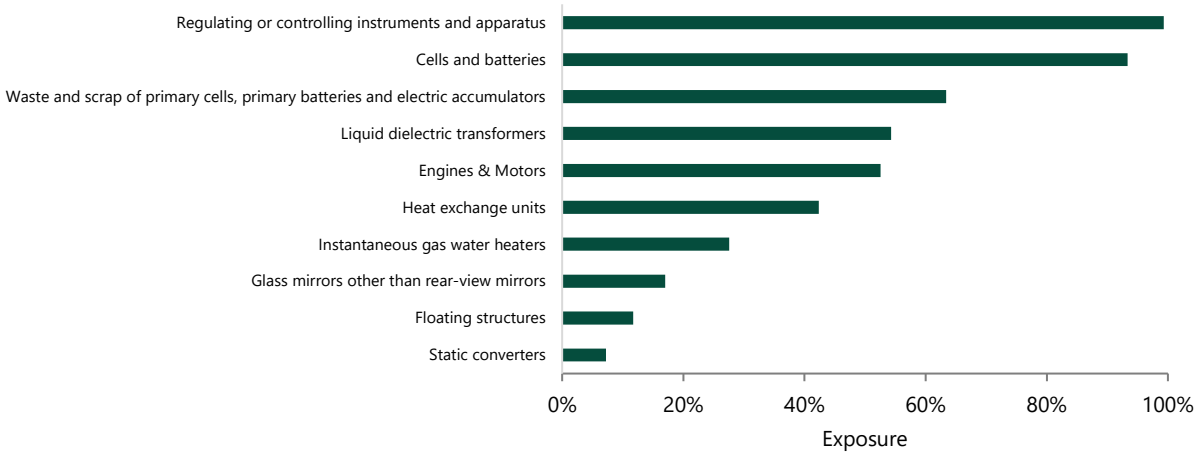
Source: World Bank staff calculations from DGCE data.

Figure 4.6: Most inputs in the production of EGs face NTMs in 2018



Source: World Bank staff calculations from DGCE data.

Figure 4.7: Products within the renewable energy group most affected by NTMs on their inputs in 2018



Source: World Bank staff calculations from DGCE data.

Box 4.1: Survey results on challenges firms face in green trade

We examine some of the underlying challenges firms face in trading EGs which may provide insights into competitiveness constraints and firm entry and exit rates. Using a survey of firms conducted as part of the Indonesia CCDR (World Bank 2023), we examine challenges reported by firms trading in EGs in Indonesia. A total of 145 of the surveyed firms trade in EGs internationally while 128 trade domestically–for a total of 273 of the 621 firms that were interviewed. A total of 101 firms responded to questions on import challenges and 104 on export challenges related to trading in EGs.

Some 72 percent of firms reported facing challenges to importing EGs, while 70 percent reported facing export challenges–with each firm facing multiple trade-related challenges. The challenges identified included trade regulations including tariffs and NTMs. Among these, NTMs such as customs procedures and compliance with Indonesian national standards were cited, as well as destination markets' LCR rules among others. LCRs are prevalent for products such as solar panels and electric motors and vehicles.

Despite tariffs on EGs being relatively low, import tariffs were reported by the majority to be an obstacle or the main obstacle to importing EGs. Among import challenges listed, 23 percent identified import tariffs, the most significant of any single obstacle (Figure 4.8). There may be several reasons why firms reported this. First, tariffs are straightforward and easier to estimate in terms of costs. Second, firms trading in EGs are importing not only EGs and this response may refer to other products outside of the EGs list.[44] Notably, products outside the EGs list may be used as inputs in the production of EGs and tariffs on those may still be high. Finally, further analysis shows that tariffs on a limited number of EGs remain high.[45]

Among NTM-related obstacles, customs procedures (18 percent),[46] and SNI compliance (13 percent), were highlighted as key hindrances to importing EGs. Import customs procedures include both documentary and border compliance requirements–contributing to the increase in the number of hours and days at the border. SNI compliance was further singled out as an important obstacle. SNI compliance is mandatory in Indonesia for thousands of intermediate and capital goods (which most EGs are, including domestically produced ones). As certification requires a visit to the factory premises by an Indonesian certifying agency, the cost is considerably higher for imported goods. The monetary cost is compounded by the uncertain duration of the process and World Bank research has found this procedure to negatively impact firms in Indonesia.[47]

Other challenges to importing included the lack of information for importing (10 percent), port-of-entry (PoE) restrictions (7 percent), government procurement (5 percent), and LCRs (5 percent). The survey revealed that firms face multiple trade-related challenges in importing EGs and, while this is a limited sample, the results are in line with previous findings about some of the most problematic NTMs that traders face in Indonesia. The survey reveals that these same measures also affect the greening of Indonesia's production and exports.

The main challenge identified in exporting EGs were standards in export markets (25 percent) and the lack of harmonization between Indonesia's standards and international ones, followed by export approvals (15 percent) (Figure 4.9). Other export challenges identified were the lack of information on market access (13 percent), the high costs of imported inputs (11 percent), and customs procedures both in Indonesia and destination markets (11 percent). High production cost due to the high cost of imported inputs is unsurprising given the prevalence of NTMs affecting intermediate goods imports. Customs procedures in both Indonesia and destination markets can also be challenging, and these are usually compounded due to the documentary requirements of export approvals domestically, and standard certifications. This relates to the lack of information on foreign markets and further resonates with the finding that more internationally exposed firms (two-way traders) dominate EGs trade, especially exports (see Figure 2.19).

[44] The survey did not have information on which specific products firms were referring to when they reported the challenges. Rather the question was: "What are the main challenges this company faces when importing EGs" with a list of options.
[45] See Part C on the tariff schedule on the full list of EGs.
[46] The survey did not elaborate which specific customs procedures.
[47] SNI certification is also a recurrent cost as the certification must be renewed every year against a fee and the certification process must be carried out again every three or four years depending on the product (see Cali and Montfaucon 2021).

Firms exporting EGs face challenges in meeting product standards in destination markets. This is consistent with Indonesia's low harmonization with international standards as 80 percent of firms surveyed reported that the harmonization of Indonesian standards in foreign markets is a key obstacle (Figure 4.10). For exporter-importers of EGs, 100 percent of surveyed firms reported that a lack of recognition of SNIs by importing countries or harmonization with that of trading partners were key obstacles. This also relates to reported challenges with obtaining export approvals from Indonesian authorities which can be cumbersome when some of the documents and restrictions apply.

Despite these challenges, 41 percent of importers and 32 percent of exporters reported benefiting from duty-free or special permits or subsidies when trading EGs (Figure 4.11). This suggests that there may be efforts to stimulate such trade or these traders are taking advantage of policies that affect these goods–even if the policies may not necessarily be of environmental benefit.[48] Unfortunately, more in-depth information on these was unavailable at the time of writing this report.

As for environmental services trade, the main identified challenges have to do with businesses being unable to access critical foreign skills (Figure 4.12). The main challenges faced by firms have to do with getting working visas and permits for foreign workers (13 percent), restrictions on the number of foreign workers (11 percent), and requirements for workers to be local or native (9 percent). These contribute to shortages of needed skills for firms.[49]

Figure 4.8: Import tariffs are the biggest import challenge...

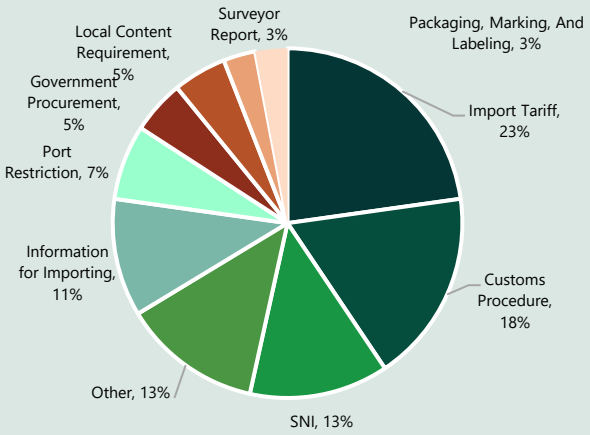


Figure 4.9: ... while ISO in destination countries is the biggest export challenge

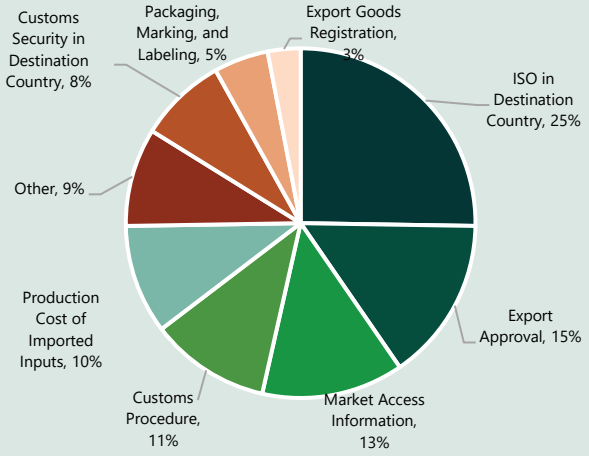


Figure 4.10: Challenges with product standards remain

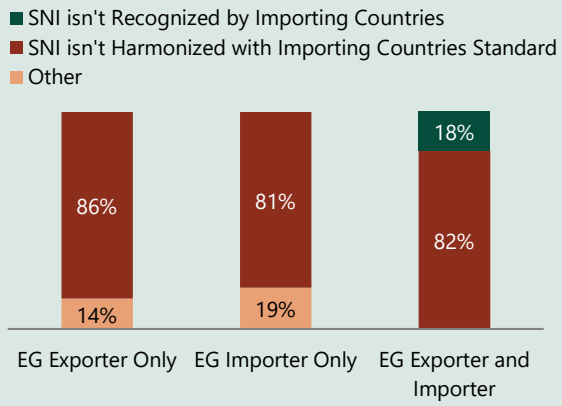
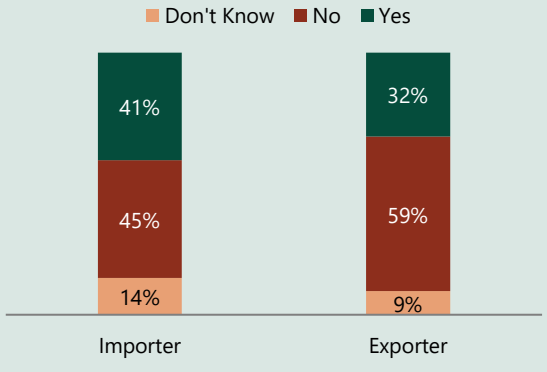


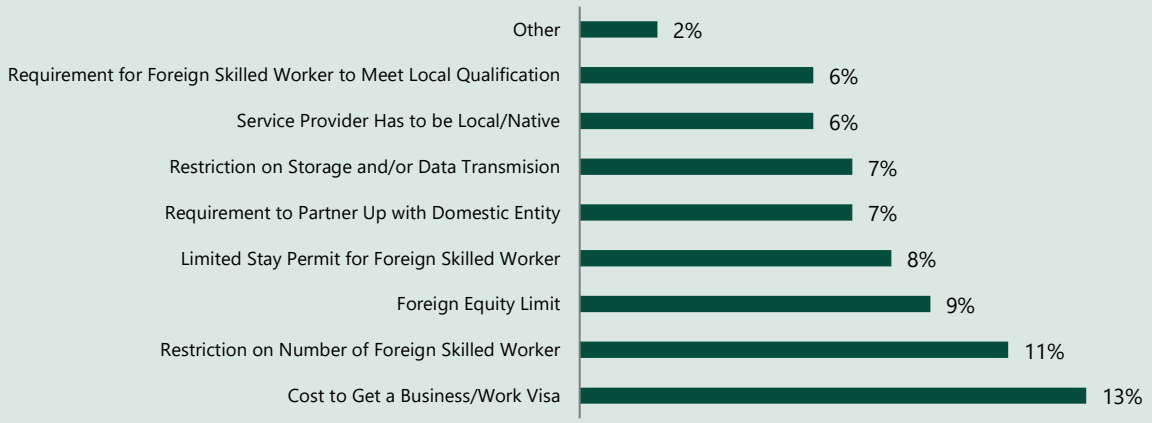
Figure 4.11: Duty-free or special permits or subsidies for trading EG are common when trading EGs



[48] The survey does not provide more details of the type of benefits and subsidies that are most prevalent, and this is an area of follow-up research.

[49] Until recently, Indonesia operated a highly restrictive work permit system that involved a limited set of occupations eligible for work permits and a cumbersome approval process. This included the approval of the Expatriate Manpower Employment Plan and the issuance of the Expatriate Manpower Employment License by the Ministry of Manpower. Any work permit needed for a position outside the eligible ones required the approval of the line ministries related to the specific sector and occupation. The restrictiveness of the work permit system effectively prevented businesses from accessing foreign talent–unlike the case in most other countries in the region.

Figure 4.12: Access to critical foreign skills remains a challenge related to international trade of environmental services



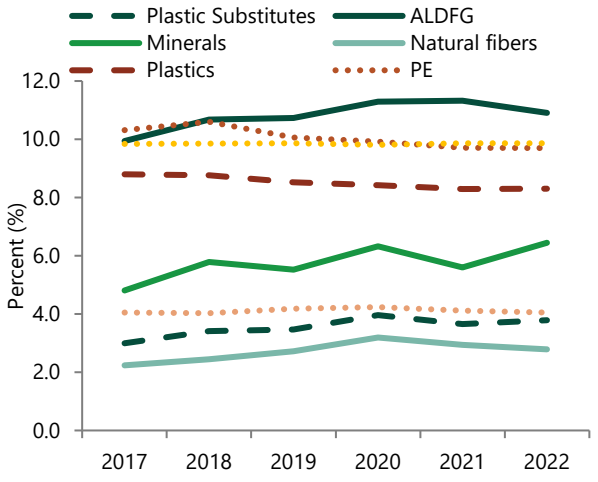
Source: Figures 4.8-4.12: Authors calculations based on the World Bank 2022 CCDR Firm Survey.

NTMs on Plastic Substitutes

Considering efforts to reduce plastic waste in Indonesia, trade policies such as import tariffs and NTMs could play a pivotal role in shaping the nation's path in the global marketplace. Throughout the period from 2019-22, Indonesia has in some cases maintained lower tariff rates for plastic substitutes compared to conventional plastic products (Figure 4.13). Average tariffs for abandoned, lost, or discarded fishing gear (ALDFGs) are, however, consistently higher than those of plastic and have been less competitive in recent years when compared to conventional plastic.[50]

Globally, approximately 40 percent of imported plastic substitutes need to adhere to at least one NTM while, for Indonesia, this has been above 60 percent since 2015. At the same time, the global average coverage ratio currently sits at about 80 percent, and Indonesia has maintained this identical figure since 2015 (Figure 4.14). Meanwhile, nearly one-third of exported plastic substitutes have to comply with NTMs globally compared to nearly one-half of all exports. UNCTAD (2023) also identifies clusters and types of NTMs–with natural fibers, dedicated crops, and agricultural by-products being the most regulated imports. TBT and quantity control measures were the most common for imports (65 and 50 percent of world imports respectively), while SPS measures were found to primarily affect food and agriculture products. SPS measures are characterized by their high prevalence score, with each imported product needing to comply with an average of six SPS measures, compared to three for TBT measures.

Figure 4.13: Weighted average import tariff on plastic substitutes are lower than plastic products in Indonesia



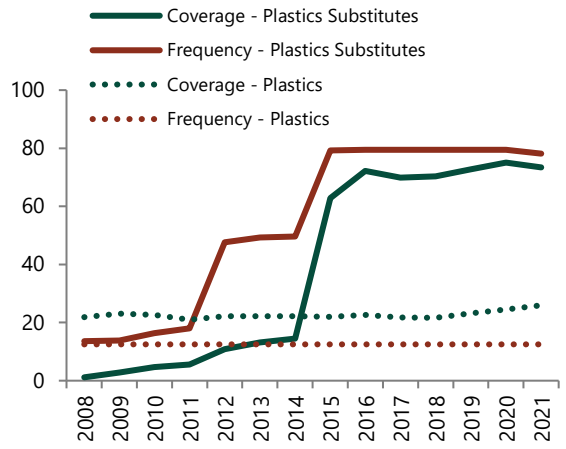
Source: World Bank staff calculations from BPS data.
Note: ALDFG, minerals (aluminum), and natural fibers are sub-categories of plastic substitutes. Polyethylene (PE), polypropylene (PP), polyoxyethylene methyl phosphonate (POM), and polycarbonates (PC).

Despite plastic substitutes having a lower tariff rate in comparison to conventional plastic, the disparities in both coverage and frequency ratios of NTMs are notably substantial. The coverage ratio

[50] Conventional plastic products are defined by HS headings: 3901 – polyethylene (PE); 3902 – polypropylene (PP); 3907 - polyoxyethylene methylphosphonate (POM) and polycarbonates (PC).

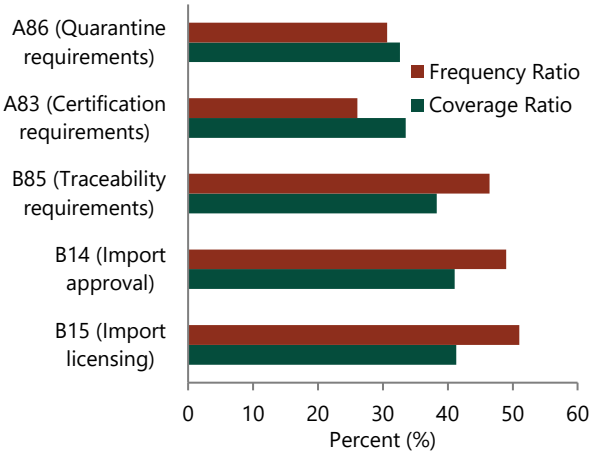
exhibits a significant difference of nearly 50 percentage points since 2016, while the frequency ratio illustrates an even more pronounced difference, exceeding 60 percentage points. These considerable gaps underline the significant disparities between the two types of plastic in terms of their NTM implementation aspects. Among NTMs applied on imports in Indonesia, as of 2021, five NTMs exceeded 30 percent of import value, with licensing requirements for imports (B15) being the highest at 41.3 percent (Figure 4.15). Of the 282 plastic substitutes, nearly one-half are subject to import approvals and more than one-half are subject to import licensing measures.

Figure 4.14: Coverage and frequency ratios of import NTM for plastic substitutes in Indonesia are higher than for plastic products



Source: World Bank staff calculations from BPS and World Bank NTM Database.

Figure 4.15: Licensing requirements for imports has the highest coverage and frequency ratio for plastic substitutes in indonesia



Source: World Bank staff calculations from BPS and World Bank NTM Database.

4.2. Assessing the Cost of NTMs

Not all NTMs are problematic and require reform, rather the key is identifying measures which impose an unnecessary burden, and negatively impact green trade. The focus is on measures that fulfill the three conditions underlying the breach of a key principle of WTO rules: (i) they discriminate against imports; (ii) they are not necessary to achieve a non-trade objective; and (iii) they are likely to impose significant costs on imports.

A systematic analysis of the effects of NTMs involves evaluating their tariff Ad Valorem Equivalent (AVE). AVEs of NTMs involve estimating the uniform tariff that will result in the same trade impacts on the import of a product due to the presence of the NTMs. The AVE of an NTM is often interpreted as measuring the distortion imposed by the NTM to the domestic economy. As some NTMs are, however, imposed to address market failures, the presence of externalities or public goods, means that simply interpreting AVEs as measuring distortions would be misleading. To draw meaningful insights, an in-depth review on whether the measures are justified on the products they affect is also needed. Additionally, while AVEs entail which NTMs are costly, they do not provide the non-trade effects of the trade regulations such as health and safety standards.

The report assesses the trade implications of NTMs in comparison to tariffs, and the effect of NTMs on EG trading firms to determine which NTMs may need closer attention and potential reform. These AVEs can then be applied in conjunction with trade elasticities to determine the overall impact. The specific equations for calculating these AVEs can be found in Appendix Two. The effect of NTMs on firms EGs trade is also estimated–including the effect of NTMs on exporting firms inputs into the production of EGs. The methodology details are in Appendix Two. These estimates will help narrow down specific trade policy that may need closer attention.

Estimates show that, in addition to their high incidence, NTMs on EGs have tariff equivalents that are high. For example, SPS authorization requirements increase the costs of renewable energy products by almost 10 percent while TBT authorization requirements increase the costs of Management of Solid and Hazardous Waste and Recycling Systems by 31 percent (Figure 4.16) and affect 26 percent of all products. The impact of certain NTMs is also worse in Indonesia compared to other countries in the region–suggesting lower implementation efficiency and higher compliance costs. Even when the same measures are applied to the same goods in different countries, the cost of the measures will differ, depending on how the measures are implemented–which translates to the compliance cost to traders. This compliance cost is captured through the tariff AVE of NTMs. Further analysis reveals that when the same NTM is applied in other countries, the cost of these measures in Indonesia is significantly higher for EGs. For example, the cost of PSIs of EGs are 18.6 percent higher in Indonesia and PoE restrictions up to 17.5 percent (Figure 4.17).

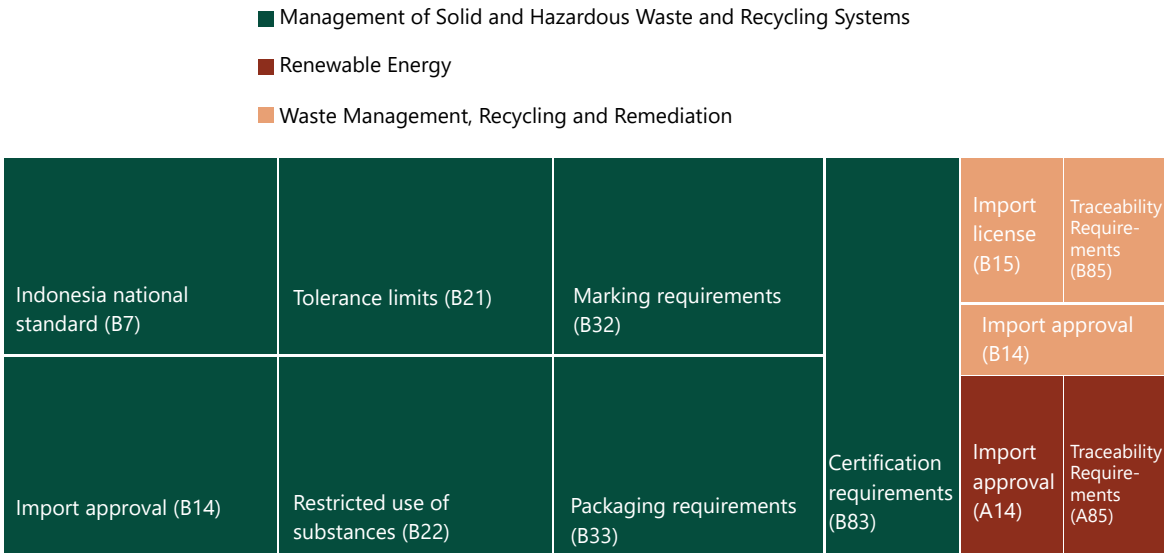
Several NTMs also increase the cost of imported plastic substitutes and reforming them would potentially allow cheaper access. For instance, the requirement to pass through a specified port of customs (C3) has an estimated tariff equivalent of 17 percent (Figure 4.18) and affected 25 percent of all imported products in 2021. These measures exceeded both average and median of plastic substitutes' tariffs at 5.2 percent and 5 percent, respectively.[51] As such, the evidence underscores the significant capability of NTM reform to enable access to environmentally friendly plastic substitutes in Indonesia.

Firms' participation in import and export markets for EGs is negatively affected by both import and export NTMs. While certain NTMs have a positive effect on firms' decisions to engage in trade in EGs, price controls (PCs) and SPS measures discourage importing firms from importing EGs. Similarly, export-related NTMs discourage the exports of EGs for exporting firms, however, the magnitude of these effects varies between different categories of EGs. For instance, PCs significantly reduce the likelihood of importing Renewable Energy products. In the case of Renewable Energy products, the additional imposition of marking requirements and tolerance limits for residues of, or contamination by, certain substances further contributes to the negative impact on firm entry (Figure 4.19).

When inputs for the production of EGs are exposed to NTMs the likelihood of firms exporting EGs is reduced. Results show that firms producing goods with those products being subject to NTMs are 2.8 percent less likely to start exporting EGs (Figure 4.20, methodology see Appendix Two). This highlights the fact that NTMs can be a significant obstacle for firms exporting EGs. In particular, PSIs and other measures have a negative impact, with the former reducing the probability of starting to export EGs by 4.0 percent and the latter by as high as 32.8 percent. NTMs on inputs into production of EGs can also negatively affect the export value of a firm. For example, a one percentage point increase in exposure to product quality, safety, or performance requirements (B7) reduces export value by US$2.2 million per year.[52]

[51] Based on Indonesian Customs Tariff Book 2022.
[52] Montfaucon, A.F., C. Lakatos, B. Agnimaruto, and J.M. Silberring. World Bank mimeo.

Figure 4.16: The tariff equivalent of specific NTMs on EGs



Source: World Bank staff calculations from World Bank NTM Database.
Note: AVE estimations are based on a sample from 2008-19.

Figure 4.17: Tariff equivalent of most problematic NTMs on EGs are relatively more costly compared to EAP (AVE difference)

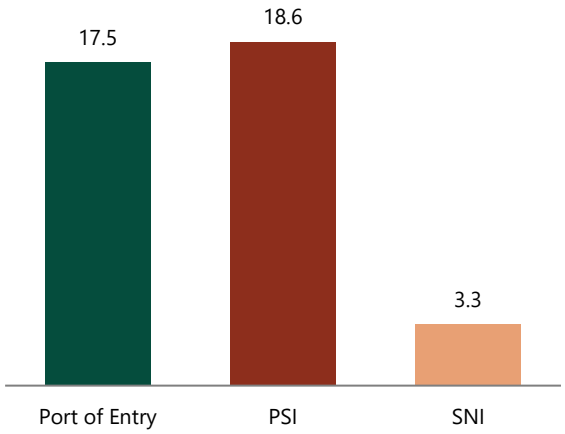
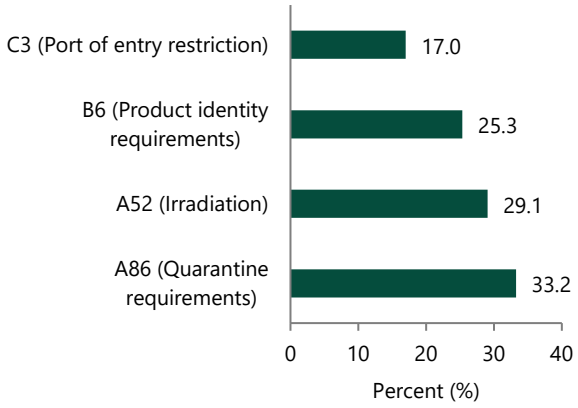
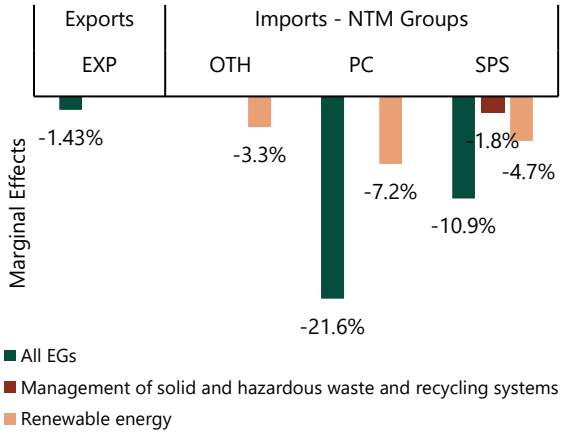


Figure 4.18: Estimated AVE of NTMs negatively affecting import of plastic substitutes



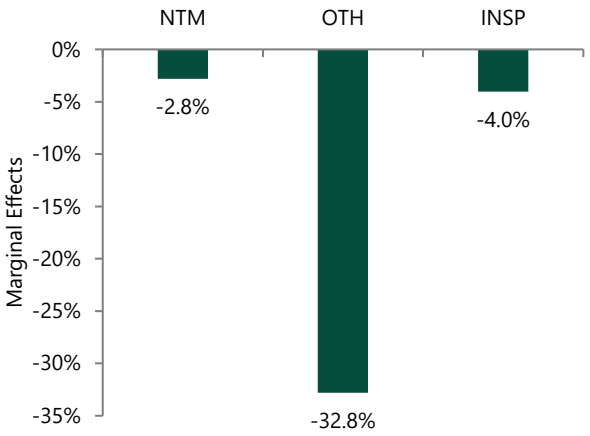
Source: World Bank staff calculations from UNCTAD TRAINS NTM Database and WITS.
Note: (i) Figure 4.17 plots the AVE for EGs for Indonesia relative to other EA countries. (ii) The SNI result is not statistically significant. (iii) Countries included: Brunei Darussalam, Cambodia, China, Indonesia, Republic of Korea, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, and Vietnam. (iv) See Appendix Two for methodology.

Figure 4.19: NTMs can negatively affect a firm's decision to import or export EGs



Source: World Bank staff calculations from DGCE data and World Bank NTM database.
Note: This figure shows the probabilities of starting to trade EGs, calculated by using the marginal effects following xtprobit regression. We only report the negative significant coefficients. All full regression tables as well as the methodology can be found in Appendix Two (Tables A.3 (Column 2 and 6) and A.4-A.5 (Column 6)). EXP = Export-related measures; OTH = Others; PC = Price-control measures; SPS = Sanitary and Phytosanitary Measures. The NTM variables are equal to one if an NTM of that category applies to EG. We control for tariffs. The specific NTMs were chosen based on those which once had positive AVEs at least in one year between 2019 and 2021. The results are robust when including year fixed effects.

Figure 4.20: Exposure to NTMs of inputs can also impact the export of EGs



Source: World Bank staff calculations from DGCE data and World Bank NTM database.
Note: This figure shows the probabilities of starting to trade EGs, calculated by using the marginal effects following xtprobit regression. We only report the negative significant coefficients. A full regression table as well as the methodology can be found in Appendix Two (Table A.6). OTH = Others; PC = Price-control measures; INSP = Pre-Shipment Inspections. The exposure is defined as the weighted share of inputs that are exposed to NTMs per product at a particular time. Controls include tariffs and sector fixed effects. Each firm is allocated to one of 21 HS section based on the highest export/import value of that firm.

4.3. A Look at Local Content Requirements on Solar Panels and EVs

LCRs or "localization rules" are imposed by governments with the objective of helping the development of local industries. LCRs require firms to use a certain percentage of domestically produced goods or services and are among the fastest growing NTM measures applied worldwide.[53] To comply with LCRs, firms are often required or incentivized to substitute imported inputs for what may be more expensive and lower quality domestically produced ones–leading to increases in costs, loss of efficiency and competitiveness (IESR 2021). LCRs are prohibited under WTO rules as they violate several WTO provisions–including the national treatment principle.

Indonesia has set LCRs on solar panels but the realization of the LCR of solar modules currently does not reach the set minimum. LCR regulations[54] set the level of domestic components for solar modules at 60 percent by 2025,[55] however, the realization of the LCR of solar modules currently only reaches 47.5 percent. This may be contributing to the underdevelopment of the local industry as domestically produced solar panels are more expensive and considered less efficient and technologically advanced than imported ones and local production of solar panels is highly reliant on imported parts and components. The price of imported solar modules from China ranges from US$0.25-0.37/Wp[56] while the average price of local solar modules is US$0.47/Wp (IESR 2019), implying that the competitiveness and efficiency of local solar modules may also be lower. In a further effort to encourage the local manufacturing industry, the government has banned the export of quartz sand and silica sand (key components in solar PV modules).

LCRs also apply to the EV industry in Indonesia, compensated by generous incentives to attract investors. For two- and three-wheeled EVs, a minimum

[53] https://www.oecd.org/trade/topics/local-content-requirements/
[54] MoEMR Regulation No. 49/2018 on the Utilization of Roof Top Solar PV by PT. Perusahaan Listrik Negara (PLN) and Ministry of Industry Regulation No. 23/2023.
[55] Ministry of Industry Regulation No. 23/2023 on Use of Domestic Products for Electricity Infrastructure Development: Requirement that the LCR for solar modules must increase from 40 percent to 60 percent by the beginning of 2025.
[56] The capacity of solar installation is measured in watt peak (Wp) which is the maximum electrical capacity a solar cell can yield under ideal circumstances.

local content of 40 percent and for four-wheeled EVs a minimum 35 percent local content is required. LCRs will be further raised to a minimum of 60 percent for two- or three-wheeled EVs produced between 2024 and 2025, and 80 percent for those manufactured after 2026. For four-wheeled or more EVs, the LCR will be raised to 40 percent if manufactured during 2022-23, 60 percent during 2024-29, and 80 percent from 2030 onwards. In addition to LCRs, the government also introduced incentives to attract investors and stimulate growth of the local industry.[57] For example, imports of parts and components are allowed if local suppliers do not have the capacity to produce these components. In addition, EV manufacturers who develop production facilities in Indonesia can import completely built-up EVs and are exempted from luxury goods tax.[58] These initiatives are expected to jump start sales of EVs in Indonesia.

While some have reached the EV thresholds, others choose not to comply as they are not mandatory. Some brands have achieved the government's LCR target of 40 percent in 2022 (IESR 2023), however, some EV industries could choose not to comply with the LCR assessment as it is not necessary for sales to customers. This also means that they miss out on incentives and other opportunities such as government procurement. Opportunities to enforce the LCR emerge with the recent government plans to conduct public procurement for government official vehicles and provide customer incentives through Presidential Instruction No. 7/2022. To benefit from these government programs, manufacturers need to comply with the LCR.

Overall, renewable energy industrial development in Indonesia is still at a budding stages and domestic manufacturers are not currently able to fulfil levels of projected demand or meet quality standards. International evidence suggests high minimum LCRs often act as a deterrent to the growth of the industry and can only succeed in certain conditions. When LCR rates are observed to be very high, they increase their trade-distorting impact and the inefficient allocation of resources (Kuntze and Moerenhout 2013). Indeed, LCRs applied in other countries for the purposes of developing domestic productive capability of renewables have mostly led to increased costs.[59] LCRs are far more likely to succeed if the market size is large and the market's demand is stable. Small or unstable markets may prevent firms from taking advantage of economies of scale, exacerbating the rise in production costs that result from LCR policy implementation (Kuntze and Moerenhout 2013).

4.4. Which NTMs Matter the Most?

Given that there are many different NTMs, identifying which policies and measures warrant a closer look for reform consideration is key. To that end, we triangulate the results on both the cost and the incidence of NTMs to narrow down measures that could be improved or relaxed for EGs and plastic substitutes. This is done by taking measures whose cost is 10 percent of a tariff equivalent or more and that affect at least 10 percent of imported products. Based on the discussions in Chapter Four, Table 4.2 provides the suggested measures and the key products they affect. The recommendations also account for feedback from the survey of firms such as on standards and previous work the World Bank has conducted on specific non-tariff trade measures that may be burdensome.

[57] Presidential Regulation No. 55/2019.
[58] Government Regulation No. 74/2021 and Ministry of Finance Regulation No. 141/PMK.010/2021.
[59] For example, in Brazil, India, and South Africa as discussed in Bazilian et al. (2020).

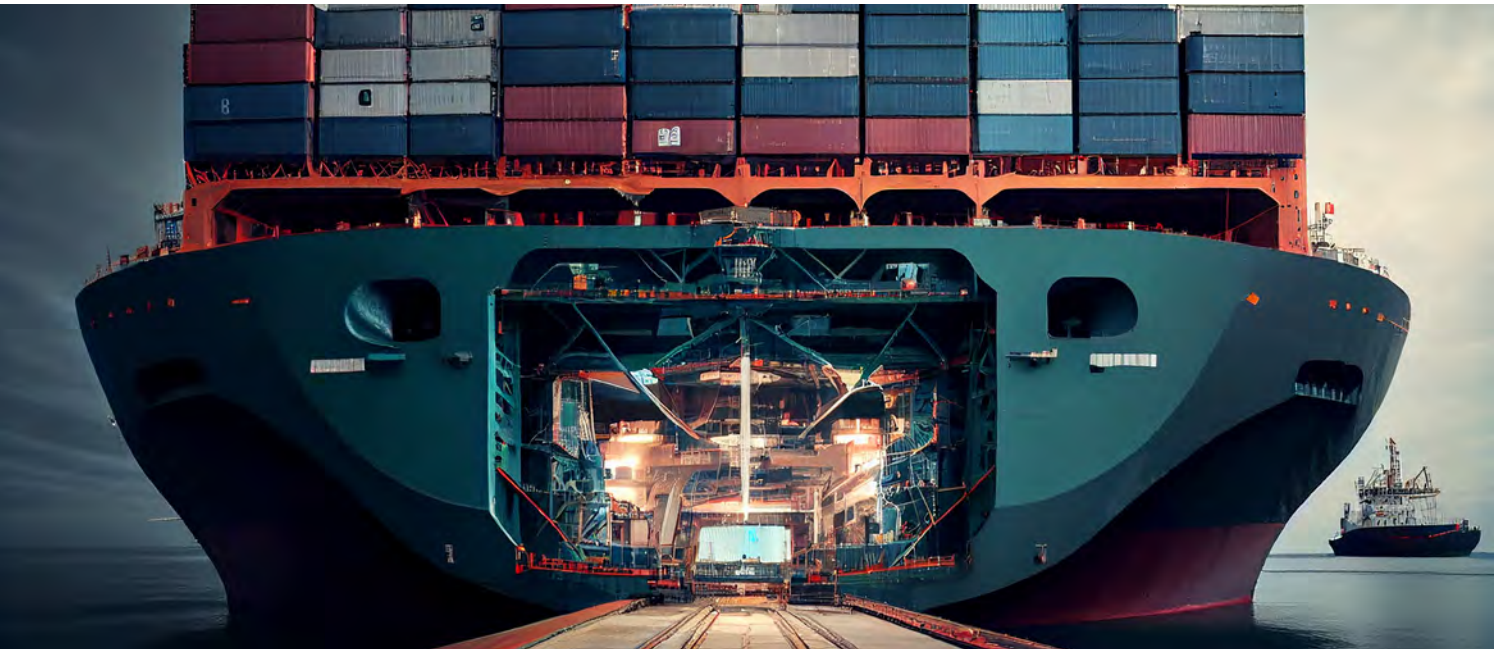
Table 4.2: Tariffs and NTMs for boosting green and environmentally sustainable trade

	EGs								Plastic Substitutes	
	Management of Solid and Hazardous Waste and Recycling Systems		Renewable Energy		Waste Management, Recycling and Remediation		All EGs*			
	AVE	FR	AVE	FR	AVE	FR	AVE	FR	AVE	FR
Authorization requirement for SPS reasons for importing certain products (A14)			10	9						
Traceability requirements (A85)			10	11						
Quarantine requirement (A86)									33	31
Certifications complying to national standards (SNI, B7)							3	7#		
Authorization requirements for importing certain products (B14)	31	26			8	13				
Authorization requirements for importers (B15)					8	13				
Traceability requirements (B85)					8	13				
Pre-shipment Inspections (C1)							19	5#		
Requirement to pass through specified port of customs (C3)							18	8	17	25
LCRs			n.a.*	n.a.*						

Source: World Bank staff calculations from BPS and World Bank NTM Database based on 2008-21 sample years.
Note: AVE estimations are based on a sample from 2008-19.
*AVEs for all EGs are in relation to AVEs for ASEAN countries applying the same measures on the same products. LCRs are not extensively analyzed but are key to EVs and solar development and need to be reviewed constantly.
While PSI measures dropped in 2021, they have historically been high (4 percent and new post border and pre border inspection changes yet to be implemented will likely increase this share). SNI measures are included due to high cost and recurrent concerns from the private sector including those trading in EGs.
FR is the share of the number of products within that category of goods affected by that trade measure. All figures are from 2021.

CHAPTER 5.

CONCLUSIONS AND KEY TAKEAWAYS



CHAPTER 5. CONCLUSIONS AND KEY TAKEAWAYS

The findings of the analysis suggest that NTMs pose significant costs on EGs and plastic substitutes while both NTM and tariff reforms could boost EG trade in Indonesia and grow importer and exporter firms. As NTMs are prevalent on EGs and plastic substitutes, addressing NTMs would stimulate existing exporters to export more and incentivize entry into the EGs trade. In addition to these behind the border steps, trade agreements, addressing challenges such as tariffs for products that still have high tariffs as well as unilateral, regional, and multilateral liberalization of tariffs on EGs trade would have previously untapped benefits for Indonesia. Keeping the costs of EGs and environmental services low–including access to critical skills and technologies could also make cleaner practices more accessible and widespread–including for domestic firms. An enabling environment for firms to import and export EGs and environmental services could benefit both domestic importers and exporters and non-traders.

The key recommendations emerging from the findings are as follows:

Recommendation One: Reduce remaining tariffs on imports of EGs and plastic substitutes–including through multilateral participation. Reducing import tariffs on EGs will lower their price, boost access to lower-cost, more energy-efficient technologies and incentivize the use of environmentally friendly alternatives. This is particularly important for industries that must comply with climate change mitigation policies. Unilateral, regional, and multilateral liberalization of tariffs on EGs trade would have previously untapped benefits for Indonesia and facilitate firm entry into trading of EGs.

Recommendation Two: Streamline NTMs on EGs and plastic substitutes and conduct a systematic and periodic review of trade regulations. Given that there are many different NTMs, identifying which policies and measures warrant a closer look for reform

consideration is key. To that end, we triangulate the results on both the cost and the incidence of NTMs to narrow down measures that could be improved or relaxed for EGs and plastic substitutes. The recommendations also account for feedback from the survey of firms such as on standards and previous work the World Bank has conducted on specific non-tariff trade measures that may be burdensome. These are Authorization requirement for SPS reasons for importing certain products (A14); Traceability requirements (A85); Quarantine requirement (A86); Certifications complying to national standards (SNI, B7); Authorization requirements for importing certain products (B14); Authorization requirements for importers (B15); Traceability requirements (B85); Pre-shipment Inspections (C1); and Requirement to pass through specified port of customs (C3) as listed in Table 5.1.

Table 5.1: NTM Recommendations based on findings in the report

NTMs for Potential Reform	EGs	Plastic Substitutes
Authorization requirement for SPS reasons for importing certain products (A14)	Renewable Energy	
Traceability requirements (A85)	Renewable Energy	
Quarantine requirement (A86)		Plastic Substitutes
Certifications complying to national standards (SNI, B7)#	All EGs*	
Authorization requirements for importing certain products (B14)	Management of Solid and Hazardous Waste and Recycling Systems; Waste Management, Recycling and Remediation	
Authorization requirements for importers (B15)	Waste Management, Recycling and Remediation	
Traceability requirements (B85)	Waste Management, Recycling and Remediation	
Pre-shipment Inspections (C1)#	All EGs*	
Requirement to pass through specified port of customs (C3)	All EGs*	Plastic Substitutes

Note: Color codes: Orange- affects some categories of EGs; Red affects all EG categories.
*AVEs for all EGs are in relation to AVEs for ASEAN countries applying the same measures on the same products.
While PSI measures dropped in 2021, they have historically been high and new post border and pre border inspection changes yet to be implemented will likely increase this share. SNI measures are included due to high cost and recurrent concerns from the private sector including those trading in EGs.

Recommendation Three: Work toward a harmonization of product standards across markets, mutual recognition, as well as coordination on climate policies that are likely to affect trade to better enable the private sector. Harmonization of standards and mutual recognition could be a supportive policy to encourage imports of EGs, exports in new export markets with comparable standards and facilitate product upgrading for firms. There is a need to harmonize existing local standards with international ones and develop new standards that are aligned with international standards and practices. Improving the coordination of climate-related policies would also reduce policy fragmentation and compliance costs for firms from administrative difficulties and potential complexities.

Recommendation Four: Review and relax local content requirements (LCRs) to accelerate renewable energy (RE) sector growth through strengthening domestic supply chain and establishing demand for RE and RE enabling projects. Given progress and lessons from other countries, Indonesia may consider reducing minimum requirements on LCRs and allow the market to first develop to a point where domestic production could achieve the economies of scale required to keep prices affordable. There may be scope for countries to agree to cooperate on green industrial policies (procurement, subsidies, LCRs, investment, technology transfer, and intellectual property).

Recommendation Five: Include enforceable environmental provisions in trade agreements. On the one hand, environmental provisions and commitments will need to become more detailed in terms of scope and ambition. On the other hand, direct participation in multilateral and plurilateral environment-related trade policy initiatives would not only allow Indonesian exporters to benefit from improved market access in destination markets but would also give Indonesia a seat at the table to shape the content and course of discussions.

Recommendation Six: Strengthen the complementarity between trade and climate policies. This includes more systematically integrating trade policies and trade facilitation measures as part of broader climate strategies–including in NDCs.

These policies will need to ensure equity and will have broader economy-wide effects that will need to be analyzed further. As trade in EGs and plastic substitutes increases, possible impacts on jobs and the labor market for various industries, as well as impacts on other macroeconomic outcomes is expected. Climate-related trade policy instruments also need to ensure non-discrimination and be administratively feasible. These aspects are beyond the scope of this report but will be taken on in the next phase.

APPENDIXES

Appendix 1

Table A.1: Top environmental goods, examples and climate change/environmental role

EG Description, Examples, and Climate Change Role	Top 10 Products in 2020 Exports	Rank
Air Pollution Control (Mitigation) For example: Parts of vacuum pumps, compressors, fans, blowers, hoods. Used for: (i) air handling equipment; (ii) transport or extraction of polluted air, corrosive gases, or dust; and (iii) transport or extraction of polluted air and corrosive gases or dust.	Compressors used for automotive air conditioners.	1
	Cylinder block; crank case for vehicle of Chapter 87, other than of heading 87.01 & 87.11.	2
	Part of vehicle of Chapter 87, other than carburretor, piston, cylinder, other than of heading 87.01 & 87.11.	3
	Cylinder liner with internal diameter <= 50mm or <= 155 mm for marine propulsion engine of a power > 22.38 kW.	4
	Parts of marine propulsion engine of a power > 22.38 kW, other than piston & cylinder.	5
	Compressor exclusively for refrigerating equip, air, gas in oil drill operation, automotive AC & sealed unit for AC machine.	6
	Other automatic service-vending machines, not electrically operated.	7
	Machinery, plant & equipment other than for making hot drink/cooking/heating food, electrically operated.	8
	Other automatic service-vending machines, electrically operated.	9
	Laminar airflow cabinets fitted with filters in horizontal side > 120 cm.	10
Clean Up or Remediation of Soil and Water (Mitigation, Adaptation) For example: Water filtering or purifying machinery or apparatus. Environmental benefit: Used to filter and purify water for a variety of environmental, industrial, and scientific applications, including water treatment plants and wastewater treatment facilities. Other Environmental categories: Efficient Consumption of Energy Technologies and Carbon Capture and Storage (ECETCCS): Wastewater Management and Potable Water Treatment.	Remote control apparatus, other than radio remote control apparatus.	1
	Other equipment/machine for removal of dust particles & curing material by UV light for manufacturing of printed circuit boards.	2
	Other floating structures.	3
	Smart cards.	4
	Filtering/purifying machine & apparatus, other than for medical/surgical/laboratory, sugar manufacture & oil drilling operation.	5
	Purifying machinery and apparatus of a capacity <= 500 l/hfor domestic use.	6
	Light-emitting diode (LED) lamps.	7
	Centrifuge machinery other than used for sugar manufacture.	8
	Filtering or purifying machinery and apparatus for water of a capacity > 500 l/h, electrically operated.	9
	Oil filter other than for medical/surgical/laboratory use, sugar manufacture & oil drilling operations.	10

Cleaner or More Resource Efficient Technologies and Products (Mitigation) For example: Railway/tramway rails, iron, or steel. Environmental benefit: Cleaner or more resource efficient technologies and products. Environmental categories: Cleaner or more resource-efficient technologies and products.	Other motorcycles (including mopeds).	1
	Primary cells and primary lithium batteries.	2
	Chain wheels and cranks; other parts for bicycles designed to be used by children.	3
	Other bicycles not motorized.	4
	Other primary cells and primary batteries not zinc-carbon, having an external volume > 300 cm3.	5
	Electrical machines, domestic other than vacuum cleaner, floor polisher, grinder, mixer, juice extractor, kitchen waste disposers.	6
	Other primary cells and primary batteries zinc-carbon, having an external volume <= 300 cm3.	7
	Railway/tramway passenger coach & other special purpose railway or tramway coaches not self-propelled.	8
	Brakes and parts thereof of motorcycles (incl mopeds).	9
	Self-propelled railway or tramway coaches, van, and truck powered from internal source of electricity.	10
Efficient Consumption of Energy Technologies and Carbon Capture and Storage (ECETCCS) (Mitigation) For example: Parts of gas turbine engines except turbojet/prop. Environmental benefit: Gas turbines for electrical power generation from recovered landfill gas, coal mine vent gas, or biogas (clean energy system). Other environmental categories: Renewable energy.	Static converters other than Uninterruptible Power Supply (UPS), battery chargers, inverters, and rectifiers.	1
	Part of other gas turbines.	2
	Cylinder block; crank case for vehicle of Chapter 87, other than of heading 87.01 & 87.11.	3
	Part of vehicle of Chapter 87, other than carburretor, piston & cylinder, excluding heading 87.01 & 87.11.	4
	Cylinder liner with <= 50 mm internal diameter <= 155 mm for marine propulsion engine of a power > 22.38 kW.	5
	Other parts undefined of gasoline engine for other vehicles of Chapter 87, other than 87.01 or 87.11.	6
	Liquid dielectric transformers, power capacity >30.000 kVA.	7
	UPS, not automatic data processing machines & units thereof, telecommunications apparatus.	8
	Parts of marine propulsion engine of a power > 22.38 kW, other than piston & cylinder.	9
	Other parts undefined of gasoline engine for vehicles of heading 87.11.	10
Energy Efficiency (Mitigation) For example: Electric lamps, lighting fittings. Environmental benefit: Compared with the conventional fluorescent or incandescent lamps, they are long life, low power consumption, energy saving and no toxic substance (mercury free). Other environmental categories: Heat and energy management.	Pilot lamp with fitting for electro-thermic domestic applications of heading 85.16.	1
	Other lighting fittings.	2
	Other fluorescent lamps and lighting fittings other than for operating rooms.	3
	Lamps of electric table, desk, bedside/ floor-standing lamps.	4
	Fluorescent lamps and lighting fittings.	5
	Other exterior lighting.	6
	Searchlights.	7
	Other electric lamps, of a kind used for lighting public open space/ thoroughfares.	8
	Other electric lamps of spotlights.	9
	AC machinery of cooling capacity >21.10kW & air flow rate >67.96m3/min, incorporating refrigerating & reversible heat pump, in marine.	10

Environmental Monitoring, analysis and assessment equipment (Broader Environmental Protection) For example: Monocular, telescopes. Environmental benefit: Applications in environmental monitoring, analysis and assessment equipment.	Other instruments & apparatus other than exposure meters, electrically operated.	1
	Other automatic regulating/controlling instruments & applications, not electrically operated.	2
	Other instruments, appliances and machines, other cable tester.	3
	Water meters.	4
	Thermometers & pyrometers, electrically operated, other temperature gauges for motor vehicles.	5
	Other optical instruments and appliances for other purposes.	6
	Microtomes, not electrically operated.	7
	Thermostats, electrically operated.	8
	Parts & accessories (not specified/incl elsewhere in this chapter) for machines, applications of Chapter 90 for electrically operated equipment.	9
	Thermometers & pyrometers, elect operated, temperature gauges for motor vehicles.	10
Environmentally Preferable Products based on End-Use or Disposal Characteristics (Broader Environmental Protection) For example: Vegetable fiber, processed not spun, tow & waste. Environmental benefit: More biodegradable than synthetic fiber alternatives and made from a renewable resource	Assembled flooring panels other than of bamboo or with at least the top layer (wear layer) of bamboo, multilayer.	1
	Other assembled flooring panels.	2
	Coconut fibers (coir) and abaca fibers, other coconut fibers.	3
	Gas turbines of a power > 5,000 kW.	4
	Coconut fibers (coir) and abaca fibers, coconut fibers, raw.	5
	Twine, cordage, ropes, cables, other than of jute/other textile bast fibers of head 53.03.	6
	Vegetable textile fibers other than 5305.00.10-23.	7
	Sacks and bags, of a kind used for the packing of goods, new, of other textile bast fibers of heading 53.03, excluding jute.	8
	Sisal & other textile fibers of the genus agave, tow & waste of these fibers.	9
	Gas turbines of a power <= 5,000 kW.	10
Gas Flaring Emission Reduction (Mitigation) For example: Industrial furnace, oven, incinerator non-electric. Environmental benefit: Used to destroy solid and hazardous wastes. Catalytic incinerators are designed for the destruction of pollutants by heating polluted air and oxidation of organic components. Other environmental categories: Several.	Other automatic regulating/controlling instruments & applications, not electrically operated.	1
	Machinery, plant & equipment, other than for making hot drink/cooking/ heating food, electrically operated.	2
	Thermostats, electrically operated.	3
	Parts & accessories (not specified/incl elsewhere in this chapter) for machines, appliances of Chapter 90 for electrically operated equipment.	4
	Filtering/purifying machinery & apparatus for gases.	5
	Instrument & apparatus other than automatic regulating voltage units (stabilizers), electrically operated.	6
	Part of evaporator/condenser for AC machine for motor vehicle with a cooling capacity <= 21.10 kW.	7
	Parts & accessories for electrically operated instruments & apparatus, measure/check the flow level, pressure.	8
	Part of filtering/purifying machinery & apparatus for liquid/gas of 8421.21.19-90,8421.29.10,8421.29.30-40,8421.29.90,8421.39.20.	9
	Other instruments/apparatus for measuring/checking the flow, level, pressure, electrically operated.	10

Heat and Energy Management (Mitigation) For example: Thermostats. Environmental benefit: Used to control the efficiency of air conditioning, refrigeration, or heating systems. Other environmental categories: ECETCCS; Environmental monitoring, analysis and assessment equipment; gas flaring	Pilot lamp with fitting for electro-thermic domestic application of heading 85.16.	1
	Water meters.	2
	Thermostats, electrically operated.	3
	Kilowatt hour meters (kwh).	4
	Phenolic resins, other than molding compounds, other than phenol formaldehyde.	5
	Slag wool, rock wool & similar mineral wools in bulk/sheets/rolls.	6
	Part of evaporator/condenser for AC machine for motor vehicle with a cooling capacity <= 21.10 kW.	7
	Flagstones, reinforced or not.	8
	Other lighting fittings.	9
	Acrylonitrile butadiene styrene (ABS) sheets of a kind used in the manufacture of refrigerators.	10
Management of Solid and Hazardous Waste and Recycling Systems (Mitigation) For example: Film not cellular/ reinforced polymers of ethylene. Environmental benefit: Membrane systems have multiple uses including: (i) to line landfills to prevent leachate (water run-off) from contaminating groundwater resources; (ii) to cover landfills and prevent methane from escaping into atmosphere; and (iii) for the reinforcement and protection of soil, including under oil refineries and gas stations.	Other electronic integrated circuits.	1
	Biaxially oriented polypropylene (BOPP) film.	2
	Processor & controller of electronics integrated circuits.	3
	Plates & sheets of polymers of ethylene, unreinforced, laminated, supported or similarly combined with other materials, unrigid.	4
	Plates & sheets, of polymers of propylene, unreinforced, laminated, supported or similarly combined with other materials.	5
	Film, foil and strip, of polymers of ethylene, unreinforced, laminated, supported or similarly combined with other materials.	6
	Other aluminum casks, drums, cans, boxes & containers for any material.	7
	Brooms consisting of twig/other vegetable materials bound together.	8
	Other automatic service-vending machines, not electrically operated.	9
	Film, foil & strip, of polymers of propylene, unreinforced, laminated, supported or similarly combined with other materials.	10
Natural Resource Protection (Mitigation) For example: Binder or baler twine, of sisal or agave. Environmental benefit: More biodegradable than synthetic fiber alternatives and made from a renewable resource. Other environmental categories: Environmentally preferable products.	Made up fishing nets of manmade textile materials.	1
	Fishhooks, whether/not snelled.	2
	Twine, cordage or rope, knotted netting, of other than man-made textiles, other than of net bags.	3
	Twine, cordage or rope, knotted netting, of other than man-made textiles, net bags.	4
	Twine, binder or baler twine, of sisal or other textile fibers of the genus agave	5
Natural Risk Management (Adaptation) For example: Surveying instruments Environmental benefit: Used for measuring the ozone layer and to monitor, measure and assist planning for natural risks such as earthquakes, cyclones, and tsunamis. Other environmental categories: ECETCCS; Environmental monitoring.	Other instruments & appliances other than radio sonde and radio wind apparatus.	1
	Parts & accessories of surveying instruments & appliances.	2
	Photogrammetrically surveying instruments and appliances.	3

Noise and Vibration Abatement (Broader Environmental Protection) For example: Locks, sheets, strip and tiles of agglomerated cork. Environmental benefit: Assists in the reduction of noise levels in buildings.	Cylinder block; crank case for vehicle of Chapter 87, other than of heading 87.01 & 87.11.	1
	Part of vehicle of Chapter 87, other than carburretor, piston & cylinder, excluding heading 87.01 & 87.11.	2
	Cylinder liner with <= 50mm internal diameter <= 155 mm for marine propulsion engine of a power > 22.38 kW.	3
	Other parts undefined of gasoline engine for other vehicle of Chapter 87, other than 8701 or 87.11.	4
	Parts of marine propulsion engine of a power > 22.38 kW, other than piston & cylinder.	5
	Other parts undefined of gasoline engine for vehicles of heading 87.11.	6
	Carburretors and parts of gasoline engines, for vehicles of Chapter 87, other than 87.01 or 87.11.	7
	Piston rings and gudgeon pins for other vehicles of Chapter 87, other than 87.01 or 87.11.	8
	Compressor excluding for refrigerating equipment, air, gas in oil drill operation, automotive AC & sealed unit for AC machine.	9
	Laminar airflow cabinets fitted with filters in horizontal side > 120 cm.	10
Others (Broader Environmental Protection) For example: Distilling or rectifying plant. Environmental benefit: Desalination plants remove salt from water and are important in conditions of water scarcity. Biogas refinement equipment "upgrades" biogas resulting from organic matter to give it the same properties as natural gas. Allows the recovery and reuse of solvents, (for example, solvents used in the printing, painting, or dry-cleaning industries). Other environmental categories: Several.	Machinery, plant & equipment, other than for making hot drink/cooking/ heating food, electrically operated.	1
	Machines for working by removal of material, by laser/other light/photon beam in the production of semiconductor wafers.	2
	Distilling or rectifying plant, electrically operated.	3
	Machines for bending, folding, and straightening semiconductor leads.	4
	Other laser cutters for cutting contacting tracks in semiconductor production by laser beam.	5
	Epitaxial deposition machines, spinners for coating photographic emulsions on semiconductor wafers.	6
	Spin dryers for semiconductor wafer processing.	7
	Grinding, polishing, and lapping machines for processing of semiconductor wafers.	8
	Resistance heated furnaces and ovens for the manufacture of semiconductor devices on semiconductor wafers.	9
	Machinery for processing material by heating, for the manufacture of PCB/ PWB/PCA, electrically operated.	10
Renewable Energy (Mitigation) For example: Heat exchange units, non-domestic, non-electric. Environmental benefit: Provide cooling effect to heat exchangers in solar collector or solar system controllers to avoid overheating. Some are specifically designed for use with renewable energy sources such as geothermal energy. Other environmental categories: ECETCCS; gas flaring emission reduction; Heat and energy management.	Primary cells and primary lithium batteries.	1
	Switchboard & control panels: use for other purposes.	2
	Other guardrails of iron or steel.	3
	Static converters other than UPS, battery chargers, inverters rectifiers.	4
	Part of other gas turbines.	5
	Other towers of iron or steel.	6
	Other primary cells and primary batteries not zinc-carbon, having an external volume > 300 cm3.	7
	Other board for electrical control for voltage <1,000 volts.	8
	Other primary cells and primary batteries zinc-carbon, having an external volume <= 300 cm3.	9
	Switchboard & control panels: use in distributed control systems.	10

Resources and Pollution Management (Mitigation) For example: Valves, safety or relief. Environmental benefit: Used for handling and transport of wastewater or slurries during treatment. Environmental categories: ECETCCS; Wastewater management and potable water treatment.	Swing check-valves, of cast iron, with an inlet of <=4cms, internal diameter =60 cm.	1
	Other fuel cut-off valves for vehicles of copper/alloy.	2
	Other manually operated gate valves of cast iron.	3
	Other taps, cocks, valves & similar appliances for pipes, boiler shells, tanks, vats, or the like.	4
	Other parts of housing for sluice or gate valves.	5
	Parts of table, floor, wall, window, ceiling/roof fans &explosion-proof air fans.	6
	Other swing check-valves, of cast iron, with an inlet of <=4cms, internal diameter =60 cms.	7
	Mixing taps and valves.	8
	Housings for sluice or gate valves with inlet or outlet of 50 mm, an internal diameter <=400 mm.	9
	Part of free piston generator, oil drilling gas/automotive AC/sealed unit AC compressor, electrically operated.	10
Waste Management, Recycling and Remediation (Broader Environmental Protection) For example: Mats, matting, and screens, vegetable plaiting material. Environmental benefit: Used for soil erosion as a soil cover, biodegradable from waste.	Mats, matting, and screens of vegetable materials of rattan.	1
	Mats, matting, and screens of vegetable materials other than bamboo and rattan.	2
	Parts for steam/other vapor-generating boilers, other than boiler bodies, shells or casings.	3
	Mats, matting, and screens of vegetable materials of bamboo.	4
	Boiler bodies, shells or casings, parts for steam or other vapor-generating boilers.	5
Wastewater Management and Potable Water Treatment (Mitigation, Broader Environmental Protection) For example: Porcelain bathroom, kitchen, & other sanitary fixtures. Environmental benefit: Waterless urinals and composting toilets minimize water use. Composting toilets also provide self-contained sewage treatment on site, with no need for sewers and treatment plants. These items also do not pollute ground or surface water or soil (unlike septic tanks or pit latrines) and produce safe, useful compost.	Anhydrous ammonia.	1
	Compressors used for automotive air conditioners.	2
	Babies' garments and clothing accessories, knitted or crocheted, of cotton.	3
	Remote control apparatus, other than radio remote control apparatus.	4
	Other women's or girls' protective work garments (excluding those used for protection from fire/chemical substances/radiation).	5
	Parts of other electrical machines and apparatus, having individual functions.	6
	Surgical masks.	7
	Other made-up articles excluding umbrella covers/surgical masks/safety harnesses/fans & handscreens/laces, shoes, boots, and corsets.	8
	Baby napkins and pads for incontinence, of paper, paper pulp, cellulose wadding, or webs of cellulose fibers.	9
	Other articles of plastic & other materials of headings 39.01 to 39.14. other than 3926.10.00-3926.90.92.	10

Water Supply For example: Mineral and aerated waters not sweetened or flavored. Environmental benefit: Potable water supply and distribution.	Naphthenic acids, their water insoluble salts and their esters.	1
	Other nucleic acids their salts, whether/not chemically defined, other heterocyclic components other than HS29341000-29349950.	2
	Biodiesel, not containing petroleum oil, coconut methyl ester (CME), with ester alkyl content 96.5% or more but <98%.	3
	Other acetone oil, chemical preparations containing monosodium glutamate (MSG), Other chemical preparation used in manufacturing of foodstuffs.	4
	Mineral waters.	5
	Biodiesel, not containing petroleum oil, coconut methyl ester (CME), with ester alkyl content exceeding 98%.	6
	In addition to biodiesel, containing petroleum oil.	7
	Peptones & their derivatives, other protein substances, not specified or included, hide powder, chromed or not.	8
	Carbides, whether or not chemically defined, other than of calcium & silicon.	9
	Oxadiazon, with a purity of 94% or more.	10

Source: World Bank staff calculation based on GTN list of EGs and BPS trade data.

Table A.2: Top EGs traded in 2020 (ranked by value)

No.	10-digit HS code	Description	EG Category (Climate Change/ Environmental Role)	Exports (2020) (millions of US$)	10-digit code	Description	EG Category (Climate Change Role)	Imports (2020) (millions of US$)
1	87141090	Other motorcycles (including mopeds)	Cleaner or more resource efficient technologies and products (mitigation)	438.9	38220090	Diagnostic/ laboratory reagents on a backing prepared diagnostic/ laboratory reagents	Wastewater management and potable water treatment (Broader Environmental Protection)	496.5
2	28141000	Anhydrous ammonia	Wastewater management and potable water treatment (Broader Environmental Protection)	386.9	84068100	Steam turbines and other vapor turbines. output > 40 MW, other than for marine propulsion	Renewable energy (mitigation)	472.6
3	85065000	Primary cells and primary batteries (lithium)	Cleaner or more resource efficient technologies and products (mitigation)	191.1	85423100	Processor & controller of electronics integrated circuits	Management of solid and hazardous waste and recycling systems (mitigation)	332.2
4	85423900	Other electronic integrated circuits	Management of solid and hazardous waste and recycling systems (mitigation)	151.1	85423900	Other electronic integrated circuits	Wastewater management and potable water treatment (Broader Environmental Protection)	322.8
5	85371099	Switchboard & control panels: use for other purposes	Renewable energy (mitigation)	145.4	85143090	Other furnaces and ovens	Air pollution control (mitigation)	310.5
6	73089099	Other guardrails of iron or steel	Renewable energy (mitigation)	135.5	84818099	Other fuel cut-off valves for vehicles of copper/alloy	Wastewater management and potable water treatment (Broader Environmental Protection)	288.0

7	85044090	Static converters other than UPS, battery chargers, inverters, rectifiers	Renewable energy (mitigation)	132.3	84798939	Other automatic service-vending machines, electrically operated	Air pollution control (mitigation)	273.2
8	87149994	Chain wheels and cranks; other parts for bicycles designed to be used by children	Cleaner or more resource efficient technologies and products (mitigation)	126.4	84118200	Gas turbines of a power > 5,000 kW	Environmentally preferable products based on end use or disposal characteristics (Broader Environmental Protection)	260.3
9	39202010	Biaxially oriented polypropylene (BOPP) film	Management of solid and hazardous waste and recycling systems (mitigation)	123.3	84178000	Furnace & oven including incinerators for laboratory, non-electric	Air pollution control (mitigation)	258.1
10	87120030	Other bicycles not motorized	Cleaner or more resource efficient technologies and products (mitigation)	112.1	85023939	Other generating sets other-powered of 10,000 kVA < output< 12,500 kVA	Renewable energy (mitigation)	243.3
11	84148042	Compressors used for automotive air conditioners	Air pollution control (mitigation)	110.2	87141090	Other of motorcycles (including mopeds)	Cleaner or more resource- efficient technologies and products (mitigation)	230.6
12	61112000	Babies garments and clothing accessories, knitted or crocheted, of cotton	Wastewater management and potable water treatment (Broader Environmental Protection)	107.6	73089099	Other guardrails of iron or steel	Renewable energy (mitigation)	222.6
13	85437020	Remote control apparatus, other radio remote controlled apparatus	Clean up or remediation of soil and water (mitigation, adaptation)	105.9	84798210	Mixing, kneading, crushing, grinding, screening, sifting, homogenizing, emulsifying/ stirring machines, electrically operated	Management of solid and hazardous waste and recycling systems (mitigation)	218.3
14	62105090	Other women's or girls' protective work garments (excluding those used for protection from fire/chemical substances/ radiation)	Wastewater management and potable water treatment (Broader Environmental Protection)	98.3	84069000	Part steam and other vapor turbines	Renewable energy (mitigation)	216.6
15	84119900	Part of other gas turbines	Renewable energy (mitigation)	89.9	29051100	Methanol (methyl alcohol)	Renewable energy (mitigation)	213.3

Appendix 2

Methodologies

Methodology for the estimation of AVE for NTMs on EGs

The AVEs of NTMs are estimated by comparing the trade effect of NTMs to the one from tariffs. Specifically, it is theorized that the total effect of NTMs is a product of trade elasticity and the AVEs. The following regression specification is then estimated using Indonesia's import data as follows:

$$lnV_{it} = \beta_1 ln(1 + tariff_{it}) + \beta_j NTM_{ijt} + \gamma_k NTM_{ikt} + \alpha_i + \alpha_t + \varepsilon_{it} \qquad (1)$$

Eq.1 is the first step to get the coefficients of NTM and tariff. They are β_j and β_1, respectively

- *lnV_it is* the log import value of commodity i (HS 10) at year t.
- *tariff_it* is the ad valorem tariff of commodity i at year t.
- *NTM_ijt* is a dummy that takes value of 1 if NTM of interest j affects commodity i at year t.
- *NTM_ikt* is a dummy that takes value of 1 for all other NTMs k that affect commodity i at year t.
- *α_i* is the product dummy
- that serves as a control for other product characteristics
- *α_t* is the year dummy that serve as a control for shocks to a given year
- *ε_it* is the error term.

$AVE_j = \beta_j / \beta_1 * 100 \qquad (2)$

Eq.2 is the second step that will give us the estimate of unique AVE for each NTM j. The AVE is defined as the ratio between estimated coefficient of NTM j and estimated coefficient of ad valorem tariff, both of which we already derived from Eq.1. Essentially, this allows turning NTMs into "tariff units" since NTMs are regulatory text which are represented by a dummy variable. The AVE from Eq.2 is only feasible and calculated if the estimated coefficient of β_j and β_1 are statistically significant. For product groups, the estimation is done at HS-10 product level if the product is within that product category or group (sub samples). Due to the differences in the NTM data used compared to previous studies, AVEs may be different from other existing estimates in the literature.

Methodology for the entry rate analysis

To analyze whether NTMs prohibit firms from entering the EGs trading market we adopt a probit model whereby the firm has a binary choice between entering the EGs market (entry equals 1) or not (entry equals 0).

The regression equation of the time series probit model can be expressed as follows:

$$\Phi^{-1}(P_{it}(gtnc_i = 1)) = \gamma_{it} \times NTM_{it} + \beta_{it} \times X_{it} + \epsilon \qquad (3)$$

where:

- Φ^{-1} (.) is the inverse cumulative distribution function of the standard normal distribution.
- P_{it} (*gtnc* = 1) is the probability of the dependent variable *gtnc* being equal to 1, meaning that the firm i trades in EGs at time t
- *NTM* is a dummy variable equal to 1 if the good is subject to any NTMs
- β_{it} is a vector of coefficients of the control variables including tariffs and sector fixed effects. Each firm is allocated to one sector based on the highest export/import value of that firm. Sectors are defined based on the 21 different HS sections.
- ε is the error term.

By calculating the marginal effects, we can interpret the coefficients at the sample means. For the time series probit model, the marginal effects are as follows:

$$\frac{\partial P_{it}(gtnc_{it}=1)}{\partial NTM_{it}} = \phi(\boldsymbol{NTM_i'}\gamma)\gamma_i \qquad (4)$$

Where P_{it} is the probability that the *ith* firm will choose to enter EGs trading at time t. NTM_{it} captures whether firm i at time t was affected by that NTM, while γ_i is the coefficient.

The data used is a panel data set at the monthly firm level. For this exercise, the data was aggregated to an annual level. A firm is identified as being impacted by NTM(s) if at least one NTM affects at least one of the goods that are being imported/exported by that firm (regardless of whether it is an EG or not). A firm is defined as trading in EGs in a particular year if at least one EG is imported/exported in that year by the firm. The data includes time invariant firm characteristics, which are used as control variables. Time fixed effects are included.

The equivalent methodology was applied when analyzing the entry rate to EGs market based on how exposed the production inputs are to NTMs. Hereby, we limit the sample to EGs and to exporting firms only. Again, the dependent variable was the dummy as explained above. The independent variable is a variable between 0 and 1 whereby 0 means that none of the inputs are subjected to NTMs while 1 means that all inputs are subject to NTMs.

Regression Results

Table A.3: The marginal effects of NTMs on exporting and importing firms and their decision to trade in EGs

NTM	(1)	(2)	(5)	(6)	(7)	(8)	(11)	(12)
	Exporter	Exporter	Importer NTM Groups	Importer NTM Groups	Exporter	Exporter	Importer NTM Groups	Importer NTM Groups
EXP	0.0829*** (0.00482)	-0.0143*** (0.00408)			0.0821*** (0.00484)	-0.0153*** (0.00410)		
Tariff	0.0726*** (0.0197)	0.0780*** (0.0189)	0.0746*** (0.0285)	-0.0926*** (0.0292)	0.0779*** (0.0199)	0.0825*** (0.0192)	0.0901*** (0.0287)	-0.0838*** (0.0295)
OTH			0.0687*** (0.00753)	0.0176** (0.00750)			0.0729*** (0.00752)	0.0237*** (0.00749)
PC			-0.118*** (0.0368)	-0.216*** (0.0331)			-0.104*** (0.0369)	-0.190*** (0.0338)
QC			0.289*** (0.00409)	0.292*** (0.00413)			0.289*** (0.00411)	0.290*** (0.00415)
INSP			0.105*** (0.00374)	0.103*** (0.00370)			0.101*** (0.00374)	0.0993*** (0.00370)
TBT			0.131*** (0.00410)	0.146*** (0.00405)			0.128*** (0.00409)	0.142*** (0.00404)
SPS			0.0519*** (0.00564)	-0.109*** (0.00474)			0.0447*** (0.00572)	-0.116*** (0.00475)
Sector FE	Yes	No	Yes	No	Yes	No	Yes	No
Year FE	No	No	No	No	Yes	Yes	Yes	Yes
Observations	64,088	64,145	110,030	110,086	64,088	64,145	110,030	110,086

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: This table shows the probabilities of entry into trade in EGs, calculated by using the marginal effects following probit regression. EXP = Export-related measures; OTH = Others; PC = Price-control measures; QC = Quality-control measures; INSP = Pre-shipment inspections; TBT = Technical barriers to trade; SPS = Sanitary and Phytosanitary Measures. Each firm is allocated to one sector based on the highest export/import value of that firm. Sectors are defined based on the 21 different HS sections.

Table A.4: The marginal effects of NTMs on exporting and importing firms and their decision to trade in management of solid and hazardous waste and recycling system products

NTM	(1)	(2)	(3)	(4)	(5)	(6)
	Exporter	Exporters	Importers All NTMs	Importers All NTMs	Importers NTM Groups	Importers NTM Groups
EXP	0.0447***	0.0142***				
	(0.00295)	(0.00221)				
Tariff	0.0273**	-0.00911	-0.0662**	-0.138***	-0.137***	-0.242***
	(0.0114)	(0.0130)	(0.0319)	(0.0309)	(0.0342)	(0.0333)
NTM			0.152***	0.141***		
			(0.00261)	(0.00265)		
OTH					0.0298***	0.0127**
					(0.00613)	(0.00574)
PC					0.0139	-0.0387
					(0.0348)	(0.0281)
QC					0.130***	0.125***
					(0.00384)	(0.00376)
INSP					0.138***	0.132***
					(0.00329)	(0.00319)
TBT					0.0521***	0.0636***
					(0.00382)	(0.00365)
SPS					0.0534***	-0.0176***
					(0.00471)	(0.00369)
Sector FE	Yes	No	Yes	No	Yes	No
Observations	64,076	64,145	110,030	110,086	110,030	110,086

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Note: This table shows the probabilities of entry into trade in EGs category 10, calculated by using the marginal effects following probit regression. EXP = Export-related measures; OTH = Others; PC = Price-control measures; QC = Quality-control measures; INSP = Pre-shipment inspections; TBT = Technical barriers to trade; SPS = Sanitary and Phytosanitary measures. Each firm is allocated to one sector based on the highest export/import value of that firm. Sectors are defined based on the 21 different HS sections.

Table A.5: The marginal effects of NTMs on exporting and importing firms and their decision to trade in renewable energy products

NTM	(1)	(2)	(3)	(4)	(5)	(6)
	Exporter	Exporters	Importers All NTMs	Importers All NTMs	Importers NTM Groups	Importers NTM Groups
EXP	0.0766***	0.0244***				
	(0.00367)	(0.00265)				
Tariff	0.0204	-0.0587***	-0.0986***	-0.345***	-0.182***	-0.515***
	(0.0150)	(0.0176)	(0.0349)	(0.0355)	(0.0368)	(0.0378)
NTM			0.197***	0.180***		
			(0.00268)	(0.00277)		
OTH					0.00795	-0.0328***
					(0.00631)	(0.00572)
PC					-0.0217	-0.0723**
					(0.0353)	(0.0287)
QC					0.126***	0.113***
					(0.00388)	(0.00383)
INSP					0.138***	0.136***
					(0.00337)	(0.00330)
TBT					0.106***	0.120***
					(0.00378)	(0.00365)
SPS					0.0534***	-0.0474***
					(0.00497)	(0.00387)
Sector FE	Yes	No	Yes	No	Yes	No
Observations	64,076	64,145	110,030	110,086	110,030	110,086

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Note: This table shows the probabilities of entry into trade in EGs category 15, calculated by using the marginal effects following probit regression. Only statistically significant coefficients are shown for the sake of brevity but regressions include the universe of NTMs to avoid omitted variable bias. The results for import prohibitions, while statistically significant coefficient, are also not reported. EXP = Export-related measures; OTH = Others; PC = Price-control measures; QC = Quality-control measures; INSP = Pre-shipment inspections; TBT = Technical barriers to trade; SPS = Sanitary and Phytosanitary measures. Each firm is allocated to one sector based on the highest export/import value of that firm. Sectors are defined based on the 21 different HS sections

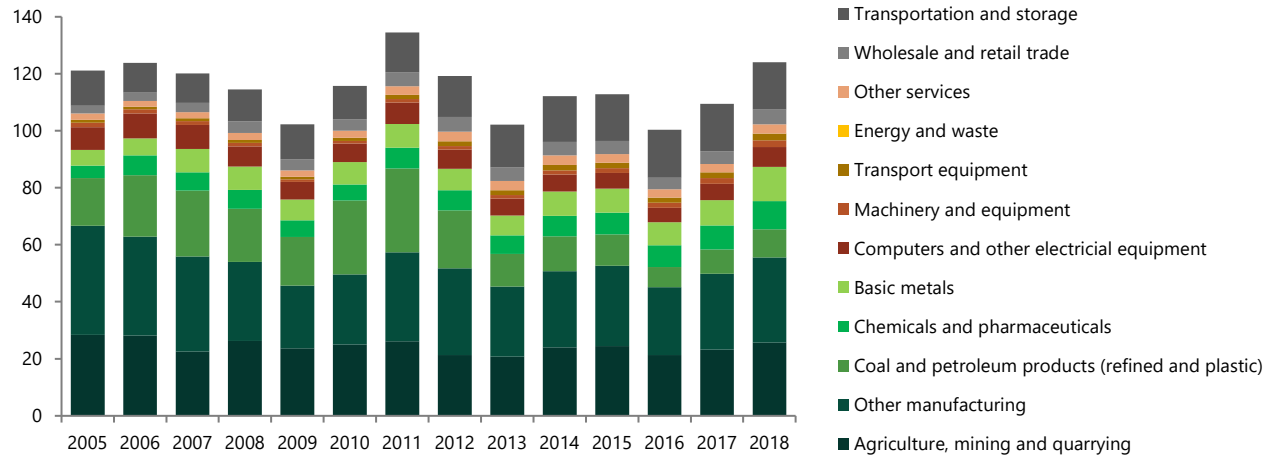
Table A.6: The marginal effects of input exposure to NTMs on exporting firms values their decision to trade in EGs

NTM	(1)	(2)	(3)	(4)	(5)	(6)
	All NTMs	All NTMs	All NTMs	NTMs Groups	NTM Groups	NTM Groups
Exposure OTH				-0.328***	-0.342***	-0.343***
				(0.0721)	(0.0695)	(0.0695)
Exposure INSP				-0.0401**	-0.0160	-0.0163
				(0.0184)	(0.0182)	(0.0182)
Exposure SPS				0.0208	0.0596***	0.0601***
				(0.0226)	(0.0225)	(0.0224)
Tariff	0.186***	0.0541		0.183***	0.0511	
	(0.0381)	(0.0357)		(0.0381)	(0.0358)	
Exposure NTM	-0.0281***	-0.0129	-0.0130			
	(0.00939)	(0.00921)	(0.00921)			
Sector FE	Yes	No	No	Yes	No	No
Observations	54,532	54,562	54,562	54,532	54,562	54,562

Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001
Note: This table shows the probabilities of entry into trade in EGs, calculated by using the marginal effects following probit regression. Only statistically significant coefficients are shown for the sake of brevity but regressions include the universe of NTMs to avoid omitted variable bias. The exposure is defined as the weighted share of inputs that are exposed to NTMs per product at a particular time. EXP = Export-related measures; OTH = Others; PC = Price-control measures; QC = Quality-control measures; INSP = Pre-shipment inspections; TBT = Technical barriers to trade; SPS = Sanitary and Phytosanitary measures. Each firm is allocated to one sector based on the highest export/import value of that firm. Sectors are defined based on the 21 different HS sections.

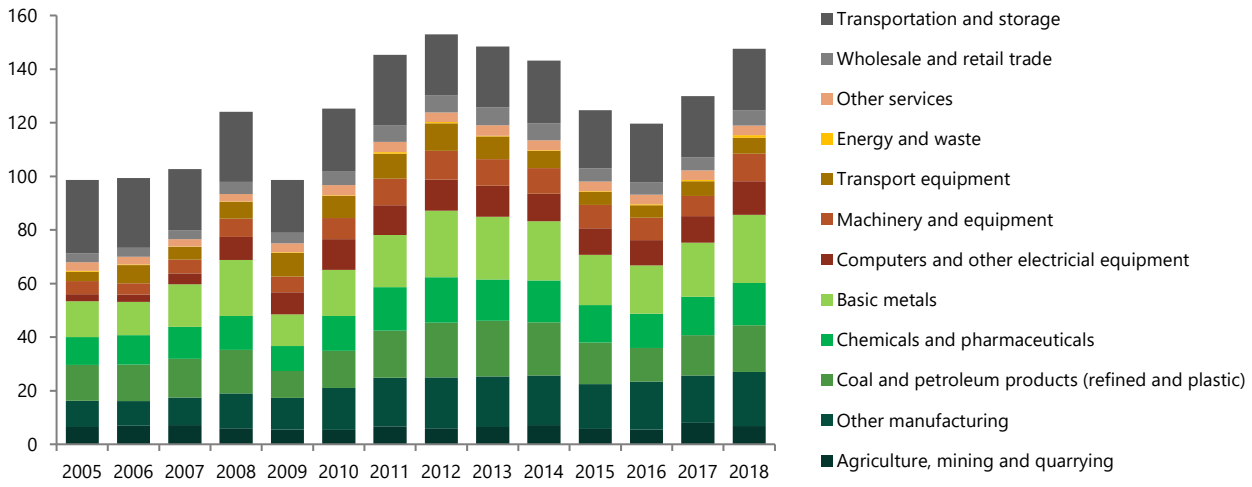
Appendix 3

Figure A.1: The Largest Share of CO_2 Emissions Embedded in Exports Stem from Agriculture and Manufacturing (millions of metric tons) (2005-18)



Source: World Bank staff calculations from OECD data.

Figure A.2: CO_2 Emissions Embedded in Imports are Mainly from Transport and Basic Metals (millions of metric tons) (2005-18)



Source: World Bank staff calculations from OECD data.

Table A.7: Top five trade partners for Indonesia in plastic substitutes

Flow	Country	HS2017	Description	Value (in million US$)	Rank
Export	CHINA	47032900	Chemical wood pulp, soda or sulphate other than dissolving grades	1831.78	1
	CHINA	47020000	Chemical wood pulp, dissolving grades	946.11	2
	JAPAN	40012220	Technically specified natural rubber (TSNR) 20	803.83	3
	UNITED STATES	40012220	Technically specified natural rubber (TSNR) 20	743.27	4
	JAPAN	14049091	Palm kernel shells	392.69	5
Import	AUSTRALIA	52010000	Cotton, not carded or combed	415.92	1
	BRAZIL	52010000	Cotton, not carded or combed	370.67	2
	INDIA	12024200	Groundnuts, not roasted or otherwise cooked	322.39	3
	UNITED STATES	23033000	Brewing or distilling dregs and waste	284.39	4
	UNITED STATES	52010000	Cotton, not carded or combed	255.97	5

Source: World Bank staff calculations from BPS data.

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