The Technology-Trade Nexus: A Key Enabling Force for Tackling Air Pollution and Delivering upon the Sustainable Development Goals

The Growing Threat of Air Pollution

Air pollution is the world's greatest environmental threat to health. Every year, around 6.5 million people across the world die prematurely from exposure to indoor and outdoor air pollution, and nine out of ten people breathe outdoor air polluted beyond levels acceptable according to World Health Organization.[1] Moreover, air pollution is closely connected to climate change – polluted air contributes to rising temperatures as particles in the air trap heat in the atmosphere. Likewise, a warmer climate exacerbates air pollution as ozone particles, which are contained in smog, form faster at higher temperatures.[2]

Through the use of fossil fuels, industry and electricity production are major contributors to both air pollution and global warming. The choice of cleaner and more efficient technologies for production processes and electricity generation is therefore a decisive factor in reducing air pollution, advancing human well being, and protecting the health of the planet. Beyond raising awareness and garnering political will for fossil fuel subsidy reform, among other divisive issues, *access* to new technologies that are cleaner and more efficient remains a key factor in this transition. Trade can facilitate access to less polluting technologies and thus plays an essential role in their uptake.

The Increasing Role of Trade in Technology

In recent years, the nexus of technology and trade has gained increasing importance at the global-level. The multilateral trading system has witnessed an amplified volume of trade in technology, particularly "brown" technology, which has vast environmental implications. *Technology transfer*, defined as the broad set of processes covering the flows of technology-related know-how, experience and equipment amongst different stakeholders such as governments, private sector entities, financial institutions, NGOs and research/educational institutions, arguably encompasses *trade in technology*. Technology transfer comprises the process of learning to understand, utilize and replicate the technology, including the capacity to choose it and adapt it to local conditions, integrating with indigenous technologies. Trade in technology can furthermore be seen as a market-based mechanism governed by international trade rules, facilitating technology dissemination. Such lexical differences are important to understand in the larger policy landscape, given their explicit reference in guiding frameworks and agreements.

Trade and technological development can have important reciprocal effects, enabling each other if properly designed. New and advanced technology has played a central role in facilitating trade flows, by allowing the streamlining and simplifying of customs procedures and record keeping through more efficient transportation and logistics systems. At the same time trade itself has

[1] World Health Organization (2017): http://www.who.int/airpollution/en/
[2] Live Science (2017): https://www.livescience.com/57913-climate-change-will-increase-air-pollution.html

been a precondition for development, diffusion and large-scale adoption of new technologies in many parts of the world.

In light of a changing climate and increased environmental degradation, an imperative arises to reduce the environmental impact of trade patterns and to stimulate change in technologies traded from "brown" to "green" through a range of incentives. Environmental regulation paired with market forces have encouraged industry to produce cleaner and more environmentally sound technologies, and consequently, trade in these technologies has increased.

Environmentally Sound Technologies are technologies that protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes in an environmentally-friendly manner. Such technologies are also referred to as "clean" technologies. These technologies, such as solar photovoltaic, small-scale hydro, geothermal and wind energy, to name a few examples, can replace "brown" technologies and thereby reduce the use of fossil fuels and abate air

Environmentally sound technologies are a subset of environmental goods, the market of which currently amounts to USD 1 trillion,[3] and is projected to grow to USD 2 trillion by 2020.[4] With the successful implementation of international measures such as the Environmental Goods Agreement, the negotiations of which are currently stalled, projections would be even higher. While there is no single internationally agreed-upon definition of environmental goods, three prominent lists developed by the Asia-Pacific Economic Cooperation (APEC), the Organisation for Economic Co-operation and Development (OECD) and the World Bank serve as benchmarks. The APEC list,[5] agreed upon in 2012, put forward 54 product categories of environmental goods, most of which are environmentally sound technologies, and served as the basis for goods that were considered within the Environmental Goods Agreement.

Opportunities to Address Air Pollution at the Nexus of Technology and Trade

Increasing the uptake of environmentally sound technologies can result in several benefits for the environment, ranging from reduced air pollution to improved energy efficiency. **Access to cost-effective technologies through trade** can help to both operationalize the green economy and to achieve global sustainable development objectives. For instance, imports of solar panels contribute to the generation of cleaner energy production, thereby reducing air pollution.

Beyond broader policy objectives, a sectoral-level analysis reveals a multitude of opportunities at the nexus of technology and trade. In the transport sector, **new technologies have the potential to revolutionize logistics and transportation systems**. It is predicted that future CO_2 savings in

[3] UN Environment (2016): http://web.unep.org/greeneconomy/sites/unep.org.greeneconomy/files/publications/getopsynthesisreport_web_0.pdf
[4] German Institute for Economic Research (2009): http://www.diw.de/documents/publikationen/73/diw_01.c.334079.de/diw_wr_2009-20.pdf
[5] The full APEC list can be found here.

road transport will result directly from more efficient petroleum-powered vehicles and greater market penetration of alternative, low-carbon vehicles – both of which illustrate a need for trade in clean technologies as a mechanism to reduce air pollution. Patenting rates in clean technologies have risen by 20% per year since 1997, outpacing traditional energy technologies and depicting their vast potential. Additionally, in 2015, global investment in renewable energy capacity more than doubled financial allocations to new coal and gas generation.

Manufacturing is a principal contributor to air pollution and can contribute to environmental degradation. However, it also holds the potential to contribute to environmental protection through the production of innovative, environmentally sound technologies. **Trade can help facilitate access to energy efficiency technologies for manufacturing** to reduce the enormous energy consumption of the sector, expected to account for nearly 30% of total final energy consumption by 2035. Lastly, through its role in diffusing and spreading innovation, trade has the potential to accelerate the overall greening of the manufacturing sector, reducing environmental impact while strengthening its role in environmental protection. Furthermore, growth in the renewable energy sector creates sustainable jobs.

Challenges to Tackling Air Pollution at the Nexus of Technology and Trade

In a frictionless global economic system with no barriers to trade, an integrated market would accelerate the diffusion of, and access to, technology. It is estimated that elimination of both tariffs and non-tariff barriers to environmentally sound technologies could result in a 14% increase in their volume of trade. Yet barriers that hamper trade in technology, and thus its diffusion, inhibit the free flow of technologies.

Tariffs, or taxes imposed on imported goods and services that seek to restrict trade, raise the price of imported goods relative to domestic goods and generate revenue for the government. In some countries, tariffs on environmental goods remain very high, ranging from 10-14% on average, inhibiting trade and serving as a major barrier for exporters of environmentally sound technologies in accessing markets. For example, Cameroon and Gabon levy applied tariffs on solar panels of 10%; meanwhile Tanzania, Zambia and Zimbabwe apply tariffs of 20% on solar lamps.[6] Tariffs on environmentally sound technologies, intermediate products, and related services – a sector far less liberalized than goods trade, yet of critical importance to the solar industry, for example – can hinder access to, and affordability of, innovative technologies. In part, tariffs remain in place due to concerns regarding domestic industry and employment, and potential future capacity to compete with liberalized goods. Meanwhile import tariffs may also undermine a country's integration into globalized production chains of these technologies.

The impact of **non-tariff barriers** on trade in technology is increasingly important, given that tariff barriers to trade in environmental goods have gradually reduced in many regions. According to the OECD, "non-tariff barriers refer to all barriers to trade that are not tariffs. Examples of these include countervailing and anti-dumping duties, *voluntary* export restraints, subsidies which sustain in operation loss making enterprises, technical barriers to trade, and obstacles to the

[6] International Centre for Trade and Sustainable Development (2014): https://www.ictsd.org/about-us/media/ictsd-in-the-news/negotiating-a-cheaper-clean-energy-deal-for-all

establishment and provision of services." Additionally, customs procedures and local content requirements are frequently cited as non-tariff barriers.

Technological innovation has occurred largely in economies with ample human and financial capital. Developing countries, tending to lack such capacity, lag behind the innovation curve, illustrating the unequal innovation and unequal access to technology present at the global-level. This consequential exclusion creates a mandate for trade in technology, particularly in light of the Sustainable Development Goals (SDGs) and their focus on *inclusion*. Yet, developing countries have raised concerns surrounding **access to technology**, especially in regards to "green protectionism" and restrictions by the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). In theory, a functioning intellectual property regime should facilitate the transfer of technology via foreign direct investment, joint ventures and licensing, though international property rights often hamper affordability and access.

The Enabling Environment

To tackle air pollution at both the domestic and international levels, policy needs to adapt in order to facilitate trade in environmentally sound technologies and to deliver upon global objectives captured in the SDGs and the Paris Agreement. **Policy action is required to eliminate trade barriers, including both tariff and non-tariff barriers**. Additionally, a strong regulatory framework conducive to environmental protection can facilitate successful trade in environmentally sound technologies and their diffusion.

> Initially proposed in early 2014 by a group of countries at the World Economic Forum in Davos, **the Environmental Goods Agreement (EGA)** was launched later that year as a means to promote trade in several key environmental products. While the EGA negotiations are currently stalled, they aimed to eliminate tariffs on a list of goods of particular importance for environmental protection and climate action, and were intended to be expanded to environmental services and non-tariff trade barriers. The current EGA membership includes 18 WTO Members that account for 85-90% of trade in environmental goods. The EGA holds the potential to provide cheaper access to clean technologies worldwide through tariff elimination and would provide a mechanism to also address air pollution. According to projections, the EGA has the potential to reduce $C0_2$ emissions by almost 10 million tonnes by 2030 – if successfully concluded – highlighting a clear opportunity to abate air pollution.[7]

In addition to the removal of tariffs, a need persists for the **harmonization of standards** for technology across markets in order to improve value chain integration. The World Trade Organization (WTO) Technical Barriers to Trade Agreement promotes harmonization and includes the Code of Good Practice to encourage its implementation. In this context,

[7] European Commission, Trade Sustainability Impact Assessment on the Environmental Goods Agreement, 2016.

EGA countries include: Australia, Canada, China, Costa Rica, European Union, Hong Kong (China), Iceland, Israel, Japan, Korea, New Zealand, Norway, Singapore, Switzerland, Liechtenstein, Chinese Taipei, Turkey, and the United States.

harmonization is defined as bilaterally shared standards among an importing-exporting country pair for clean technologies.

At the **United Nations Framework Convention on Climate Change (UNFCCC)** level, the climate plans, so called **Nationally Determined Contributions (NDCs), captured in the Paris Agreement,** could serve as another policy mechanism to tackle air pollution, providing a roadmap for technology and enhancing or stimulating collaboration on research, development and dissemination. In order to achieve the NDCs, an array of policy measures merit further consideration.

- In terms of macroeconomic policy, **direct financial support** through subsidies or the provision of equipment or services could facilitate trade in environmentally sound technologies by overcoming issues related to lack of access to capital, high import duties, and investment risk, among others.

- **Public-private partnerships** provide another avenue to address challenges related to lack of capacity found in developing countries by facilitating collaboration on research and development and overcoming inadequate science and educational infrastructure.

- **Public procurement standards** are increasingly used to attain environmental objectives and serve as an example for the private sector while simultaneously stimulating the marketplace. Public procurement policies hold the potential to boost the uptake of clean technologies and to accelerate diffusion.

The Global Policy Landscape

At the level of global policy, several developments in recent years have changed the framework for trade in clean technologies. Alongside the 2030 Agenda for Sustainable Development and the SDGs, the corresponding Addis Ababa Action Agenda on Financing for Development and the Paris Agreement on Climate Change play a key role in shaping the technology-trade nexus.

In the context of the **2030 Agenda for Sustainable Development and its SDGs**, trade and technology serve as key means of implementation to address global issues, including air pollution. Adopted in September 2015, the SDGs are a set of 17 goals with 169 targets and 304 indicators. Implementation of the goals and targets presents an opportunity to shape national and economic development strategies, plans, policies and actions by governments, civil society and international organizations towards greater sustainability. While the nexus of air pollution, technology and trade cuts across several SDGs and their targets, trade is most visibly addressed in Goal 17 (Strengthen the Means of Implementation and Revitalize the Global Partnership for Sustainable Development), technology in Goals 7 (Ensure Access to Affordable, Reliable, Sustainable and Modern Energy for All, via technological upgrades) and 9 (Build Resilient Infrastructure, Promote Sustainable Industrialization and Foster Innovation), and air pollution in Goals 3 (Ensure Healthy Lives and Promote Well-being for all at All Ages) and 11 (Make Cities and Human Settlements Inclusive, Safe, Resilient and Sustainable).

Figure 1: Key SDGs related to Technology, Trade and Air Pollution

SDG target	Description
SDG 2.a	Increase investment, including through **enhanced international cooperation** in **technology development** in order to enhance agricultural productive capacity in developing countries.
SDG 3.9	Substantially **reduce the number of deaths and illnesses** from hazardous chemicals and **air, water and soil pollution** and contamination.
SDG 3.b	Support the **research and development of vaccines and medicines**, provide access to affordable essential medicines and vaccines, in accordance with the **Doha Declaration on the TRIPS Agreement and Public Health**, which affirms the right of developing countries to use to the full the provisions in the **Agreement on Trade-Related Aspects of Intellectual Property Rights** regarding flexibilities to protect public health, and, in particular, provide access to medicines for all.
SDG 7.a	Enhance **international cooperation** to facilitate **access to clean energy research and technology**, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.
SDG 7.b	Expand infrastructure and **upgrade technology for supplying modern and sustainable energy services** for all in developing countries, in particular Least Developed Countries Landlocked Developing Countries and Small Island Developing States
SDG 9.b	Support domestic **technology development**, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and **value addition to commodities.**
SDG 11.6	Reduce the adverse per capita environmental impact of cities, including by paying special attention to **air quality** and municipal and other waste management.
SDG 13.a	Implement the commitment undertaken by developed-country parties to the **United Nations Framework Convention on Climate Change** to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible.
SDG 17.6	Enhance North-South, South-South and triangular regional and **international cooperation on and access to science, technology and innovation**, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a **global technology facilitation mechanism.**
SDG 17.7	Promote the **development, transfer, dissemination and diffusion of environmentally sound technologies** to developing countries on favourable terms, including on **concessional and preferential terms**, as mutually agreed.
SDG 17.8	Fully **operationalize the technology bank and science, technology and innovation capacity-building mechanism** for Least Developed Countries by 2017 and **enhance the use of enabling technology**, in particular information and communications technology.
SDG 17.10	Promote a universal, rules-based, open, non-discriminatory and **equitable multilateral trading system** under the World Trade Organization (WTO), including through the **conclusion of negotiations under its Doha Development Agenda.**

Beyond the SDGs, the technology-trade nexus is highly relevant to **the UN's Financing for Development mandate. The Addis Ababa Action Agenda**, stemming from the third annual conference on Financing for Development and endorsed by the UN General Assembly in July 2015, promotes the development and use of information-communications technology and capacity building in Least Developed Countries, Landlocked Developing Countries and Small Island Developing States. Worldwide, a "digital divide" pervades, underlining the uneven innovative capacity, connectivity and access to technology *within* and *between* countries. This gap often serves as a determinant of Least Developed Countries' structural deficiencies. The Agenda encourages the development, dissemination, diffusion and transfer of clean technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed.

Embodied in Article 4.5 of the **UNFCCC,** the transfer of environmentally sound technologies, including technologies for climate change mitigation and adaptation, is mandated through an inclusive approach. Article 4.5 stipulates that developed countries "shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties." Technology transfer has the capability to play a vital role in the global response to the challenges inherent in climate change and related air pollution by accelerating access to pioneering technologies. **The Paris Agreement**, resulting from UNFCCC's 21st Conference of the Parties in December 2015, further outlines the role of technology development and transfer in improving resilience to climate change and in reducing greenhouse gas emissions, as well as the contributions of each UNFCCC member.

Furthermore, the global energy agenda, set by **the UN-mandated Sustainable Energy for All Initiative,** has particular implications for the technology-trade nexus. The past decades have witnessed unprecedented growth in global electricity demand, in part due to economic growth in emerging economies, underlining a growing need for energy security. With additional demand for energy, air pollution and its costs borne by society also increase. The International Energy Agency has indicated that it is both realistic and economical to pursue a clean energy agenda. However, in order to do so, a need persists to accelerate energy technology innovation, including through policy support and new market frameworks. The capacity for trade to facilitate the dissemination of renewable energy and energy efficiency technologies will become a critical component in delivering on these ambitions.

For enhanced international coordination of enabling policies and financing of technology development and trade, a suite of concrete platforms and mechanisms have been established.

Figure 2: Platforms and Mechanisms within the Global Policy Landscape

The Environment and Trade Hub	Launched by UN Environment in late 2015 at the WTO Ministerial Conference, the Environment and Trade Hub offers capacity building and related policy advice on sustainable trade tailored to local needs and circumstances. One of its principal focal areas centres on value chain integration and trade opportunities for clean

	technologies, and on addressing tariff and non-tariff barriers related to Environmental Goods and Services more broadly.
The Technology Facilitation Mechanism	Arising from the Addis Ababa Action Agenda, the Technology Facilitation Mechanism provides a platform that promotes science, technology and innovation (STI) to support the implementation of the SDGs. It is comprised of a United Nations inter-agency task team on STI, an annual multi-stakeholder forum, and an online platform as a gateway for information on existing STI initiatives and programs.
The Technology Bank for Least Developed Countries	Operationalized in 2017, the Technology Bank aims to help the Least Developed Countries build the STI capacity that they need to promote the structural transformation of their economies, eradicate poverty and foster sustainable development. In doing so, it aims to overcome the "digital divide" by enabling technology transfer and acquisition, acting as a supporting mechanism for science, innovation and technology, and facilitating networking and access for Least Developed Countries' researchers and scientists.
Technology Mechanism	Under the UNFCCC, the Technology Mechanism supports developing countries to develop and transfer climate technologies so that they can effectively reduce greenhouse gas emissions and adapt to the adverse effects of the changing climate.
Technology Needs Assessment	Implemented by UN Environment and funded by the Global Environmental Facility, the Technology Needs Assessment assists developing countries to determine their technological priorities with an aim to mitigate greenhouse gas emissions by supporting the development of national Technology Action Plans.
National Cleaner Production Centres	National Cleaner Production Centres exist in 47 countries and raise awareness of the benefits and advantages of resource efficient and cleaner production. The centres are jointly operated by UN Environment and the United Nations Industrial Development Organization and support the promotion of investment projects to facilitate the transfer of clean technologies to industries in developing countries.

If fully harnessed, each of these initiatives provides a unique value proposition to unlock trade in clean technologies to tackle air pollution.

Outcomes and Next Steps

At the heart of the technology-trade nexus lies untapped potential to tackle air pollution and to deliver upon the 2030 Agenda for Sustainable Development. With an aim to further the dissemination of environmentally sound technologies, particularly in a developing-country context, UN Environment provides policy advice and capacity building at the critical nexus of technology and trade. In this context, UN Environment's side event on "Unlocking Trade in Environmentally Sound Technologies to Tackle Air Pollution," held on the occasion of the third United Nations Environment Assembly, shed light upon opportunities deriving from trade in environmentally sound technologies to tackle air pollution, outlining next steps to contribute to a cleaner world.

The event built momentum and partnerships among public and private sector actors aiming to promote trade in environmentally sound technologies. The need to foster a dialogue and a positive narrative between trade and environment policymakers was asserted, highlighting scaled-up collaboration between the WTO and UN Environment as an immediate next step. Likewise, a forum for "friends of clean technologies for development" was proposed, which could provide evidence of the benefits for sustainable development that trade in environmentally sound technologies can provide, with an aim to bring other actors on board. Such forums will be critical in supporting pioneers and champions in long-term policy planning and in enabling a long-term investment horizon to transition to an "economy of the future." Illustrated by further proposals for national trade and environment committees or task forces, the event underscored the need for dialogue at the national-level and ultimately reenergized political will to reduce trade barriers for technological advancements, a precursor to a green economy and a pollution-free world.