WORLD TRADE ORGANIZATION

WT/MIN(24)/11/Add.3

19 February 2024

(24-1499)

Page: 1/25

Ministerial Conference
Thirteenth Session
Abu Dhabi, 26-29 February 2024

Original: English

TRADE AND ENVIRONMENTAL SUSTAINABILITY STRUCTURED DISCUSSIONS (TESSD)

STATEMENT BY THE TESSD CO-CONVENORS

Addendum

This addendum includes the outcome document of the TESSD Informal Working Group on Environmental Goods and Services (EGS), accompanying the Statement by the TESSD Co-convenors circulated in document WT/MIN(24)/11.

INFORMAL WORKING GROUP ON ENVIRONMENTAL GOODS AND SERVICES

Analytical Summary[1]

Contents

[1] This analytical summary remains a living document that will be further updated based on discussions and contributions under the Working Group.

1 RENEWABLE ENERGY

1.1 Introduction

1.1. In the 2021 TESSD Ministerial Statement, Members agreed to explore opportunities and possible approaches for promoting and facilitating trade in environmental goods and services to meet environmental and climate goals, including through addressing supply chain, technical and regulatory elements. Members further agreed to identify and compile best practices, as well as explore opportunities for voluntary actions and partnerships to ensure that trade and trade policies contribute to promoting and facilitating access to environmental goods and services, including encouraging the global uptake of new and emerging low-emissions and other climate-friendly technologies.[2]

1.2. As foreseen by the TESSD Work Plan of February 2022, Members pursued more in-depth discussions in four informal working groups, including in the Working Group on Environmental Goods and Services. Following discussions on Members' priorities and the approach to be taken in the Working Group during 2022, Members supported the idea of pursuing an objective-based approach, where Members would examine sector-specific issues involved in the promotion and facilitation of trade in environmental goods and services towards achieving an environmental objective.[3] In 2023, the Working Group focused on the environmental goal of climate change mitigation and adaptation, and renewable energy as the first sector.

1.3. Renewable energy generation comprises solar energy, wind energy, hydropower, tidal and ocean energy, bioenergy and geothermal energy. According to projections for a net zero pathway by the International Energy Agency (IEA, 2021), two-thirds of total energy supply in 2050 would come from these sources. Also, the share of renewables in total electricity generation would increase from 29% in 2020 to over 60% in 2030 and to nearly 90% in 2050. To achieve this, solar photovoltaic (PV) capacity would increase 20-fold between 2019 and 2050, and wind power 11-fold.[4]

1.4. According to the International Renewable Energy Agency (IRENA, 2022), the share of renewables in total electricity supply would need to increase from 26.4% in 2019 to 65% in 2030 to achieve a 1.5°C scenario.[5] Installed generating capacity from renewables accounted for more than 2,500 GW in 2019, broken down as follows: hydropower (1,189 GW), solar (580 GW), onshore wind (594 GW), offshore wind (28 GW), bioenergy (123 GW), and geothermal energy (14 GW). The installed generation capacity of renewable power will need to expand four-fold to 10,770 GW by 2030, driven by growth in solar (more than 5,200 GW in 2030) and wind (more than 3,300 GW in 2030) capacities.

1.5. In meetings on 17 March, 10 May, 20 September, and 20 November 2023, the TESSD Working Group on Environmental Goods and Services discussed sector-specific issues related to solar energy, wind energy, and hydropower, as well as green hydrogen and biofuels. Discussions aimed at identifying relevant renewable energy goods and services that would allow these sectors to achieve climate change mitigation and adaptation objectives, barriers to their dissemination, challenges facing developing countries, as well as opportunities and approaches to promote and facilitate trade in these goods and services. This document provides an analytical summary of this work, and remains a living document that will be further updated based on discussions and contributions under the Working Group.

1.2 Services and renewable energy

1.2.1 Relevant services

1.6. The service industry and trade in services play a critical role in the successful development, installation, operation and maintenance, and decommissioning of renewable energy projects. In the renewable energy sector, openness to trade in services offers access to a greater variety of services

[2] TESSD Ministerial Statement – WT/MIN(21)/6/Rev.2.
[3] TESSD Summary Report 2022 – INF/TE/SSD/R/14; and Statement by the TESSD Co-convenors – INF/TE/SSD/W/21.
[4] https://www.iea.org/reports/net-zero-by-2050, pp. 18 and 73.
[5] https://www.irena.org/Publications/2022/Mar/World-Energy-Transitions-Outlook-2022, p. 60.

at a lower cost and increases the market size for service suppliers, thereby boosting the returns from innovation for those involved in the energy supply chain.

1.7. Services are often complementary to environmental goods and technologies in the renewable energy sector, as they contribute to the planning, design, sale, installation, maintenance, repair or any other operation linked to these goods and technologies. Poor market access conditions for trade in services can hinder the development of renewable energy projects.

1.8. Regarding the scoping of relevant services, renewable energy services could be considered as services that are embedded in the planning and development of renewable energy projects. While such services are aimed rather at producing energy, they are directly linked to technologies, methods and processes aimed at improving climate and environmental performance by reducing emissions. Since most of these services may also be used for non-environmental ends, one might need contextual evidence to define their relevance to renewable energy production.

1.9. A presentation by the WTO Secretariat on renewable energy services noted that current classifications for defining these services lack the granularity needed to identify how a service is used, and that a practical approach to understanding the relationship between services and renewable energy could be analyzed to identify the services supporting the renewable energy supply chain. Services supporting the renewable energy supply chain, *inter alia*, include: (i) research and development; scientific and technical consulting services; technical testing and analysis services; resource assessment; evaluation, planning or siting of renewable energy projects or facilities; and environmental surveying services and environmental impact analysis in upstream processes; (ii) design, construction, engineering, and installation services for renewable energy equipment and facilities; and operation, management, and monitoring of renewable energy projects or facilities during production processes; and (iii) transmission as well as distribution of electricity and heat produced through the use of renewable energy sources; sales and marketing; and after-sales service, maintenance and repair in downstream processes. In addition, different services also constitute necessary inputs in the manufacturing of renewable energy equipment and facilities, such as solar panels and wind turbines.

1.10. Renewable energy services can be traded through four modes of supply. The presentation by the Secretariat noted that establishment of a commercial presence by foreign investment is the dominant mode of supply for renewable energy services, while movement of natural persons is particularly important for the construction, installation, maintenance and repair of renewable energy facilities. Cross-border trade in services related to renewable energy, such as remote monitoring and diagnosis services for wind turbines, has been gaining importance due to technological advances. Renewable energy services are usually traded together with the sale of renewable energy equipment and facilities.

1.11. Table 1 below lists the services identified by Members in the Working Group as being important for the development, installation, operation and decommissioning of renewable energy projects. It should be noted that this is an indicative list and does not aim to be exhaustive. Table 9 in the Annex is an extension of Table 1 providing indicative Central Product Classification (CPC) 2.1 codes and descriptions for these services based on Members' statements, technical papers, and other sources.

Table 1. Indicative list of identified services related to the development, installation, operation and decommissioning of renewable energy projects

Services	Example / Comment
Architectural services	Preparing site plans, working drawings, and specifications for the development of the land required for renewable energy projects.
Urban planning services	Integration of renewable energy considerations into urban planning is important as urban form, functionalities and zoning impact energy demand and production. Urban infrastructure such as rooftops or bridges can serve as potential sites for solar PV or wind turbines.
Site identification and evaluation services	Site investigation services help find the most suitable site for RE projects such as the construction of dams or of wind turbines.

Services	Example / Comment
Nature and landscape protection services	Relevant for the protection of ecosystems around hydropower projects or wind turbines.
Engineering services for energy projects	Relevant for the design and development of renewable energy facilities. Examples: engineering services needed for the development of robust wind turbines used in offshore projects; engineering services needed for designing hydrogen production, storage and transportation systems.
Engineering design services for industrial processes and production	Relevant for the design of industrial processes related to the production of renewable energy goods such as solar panels and wind turbines as well as the design of these goods themselves.
Testing and analysis, including certification	Testing and analysis of the physical properties of materials or of mechanical and electrical characteristics can ensure that renewable energy systems meet safety and performance standards. This includes testing and certifying that these systems and goods/services within these systems meet relevant standards.
Environmental consulting services	An example of such services are marketing services to improve the commercialization of renewable energy technologies.
Construction services	Relevant for the generation, storage, and deployment of renewable energy. Power plant constructions. Solar: Design and construction services for PV solar systems, energy storage systems, and installation of energy grids. Hydropower: Construction services required for the erection of massive hydroelectric dams. Support the use of environmental goods or technologies. Hydrogen: construction of hydrogen production facilities, storage tanks, refuelling stations.
Installation and assembly services	Relevant for renewable energy projects. For example, installation of energy grids, assembly of solar PV modules and solar water pumps, installation and assembly of wind turbines and offshore substation construction.
Logistics and transport services	Relevant for the transport of renewable energy equipment for installation or for maintenance and repair. For example, transport of wind turbines for installation in wind farms, or spare parts for maintenance.
Financial services	Relevant for the financing of renewable energy projects, which can be capital-intensive and require large upfront costs for equipment. Lending and leasing services important for developing Members.
Insurance services	Insurance services are used to protect against financial losses associated with renewable energy projects. For green hydrogen projects, this includes tasks such as insuring hydrogen production facilities, hydrogen storage tanks, and hydrogen refuelling stations.
Regulatory services (as provided by public sector)	Regulatory support is needed to ensure that hydrogen energy projects can be developed and operated safely and efficiently. This includes tasks such as developing regulations for production, storage, and transportation, and providing guidance on how to comply with these regulations.
Legal services	Provide legal certainty in the development stages of renewable energy projects. For example, legal services related to setting up a special purpose vehicle (SPV) for managing the development process of an offshore wind project.
Accounting services	Relevant during the development phase in the context of building a financial model, providing due diligence, and reviewing financial information.

Services	Example / Comment
Consulting and advisory services	Provide advice and guidance on renewable energy projects. Help customers evaluate solar energy options and design tailored solutions that fit their needs. Identify potential hydrogen projects, develop plans and secure financing.
Wholesale trade services	Wholesale trade services ensuring the supply of large quantities of panels placed on PV fields. Support the use of environmental goods or technologies.
Operation services for renewable energy projects	Solar: Operation and management of power plants and solar energy infrastructure.
Maintenance and repair for renewable energy projects	Solar: Maintenance and repair services for PV solar systems and power plants. Relevant to guarantee their optimal operation and prolong their useful life. Wind and hydropower: Repair services incidental to metal products, machinery and equipment – relevant for wind energy installations and hydro turbines.
Grid connection and monitoring	Solar: Data monitoring and analysis services for efficient and optimal performance.
Renewable energy storage services	Increase the efficiency and performance of the PV solar systems.
Recycling	Particularly relevant for solar and for wind turbines where the first generation of wind turbines is reaching the end of its lifecycle and the quantity of material that needs to be recycled is therefore dramatically increasing.
Waste treatment and disposal services	An example is the treatment of wind turbines blades made of carbon fibre.
R&D	R&D on chemistry, engineering, and technology relevant for solar energy sector. R&D relevant for the provision of wind power. R&D services on natural sciences and engineering.
Services related to the manufacturing, sale, delivery and installation of renewable energy systems	Services that relate to the manufacturing, sale, delivery and installation of renewable energy goods such as those included in the indicative lists of goods in section 1.3.

1.12. Initiatives that include lists of services related to renewable energy projects, *inter alia*, include:

- Asia-Pacific Economic Cooperation (APEC) Reference List of Environmental and Environmentally Related Services.
- Singapore-Australia Green Economy Agreement.
- EU-New Zealand Free Trade Agreement.

1.2.2 Barriers to trade in services

1.13. According to the presentation by the Secretariat, there are few barriers that specifically impede trade in renewable energy services. However, barriers that apply to services more generally will have an impact on trade in renewable energy services. These can include measures on investment, land use, professional licensing and movement of natural persons. Governments take various policies to encourage renewable energy, including investment incentives, tax measures, incentive tariffs (e.g. guaranteed prices, feed-in tariffs and bidding systems), and legislation (e.g. environmental standards). While these policies typically target one participant in the renewable energy market (e.g. generator, electric utilities or consumers), they commonly produce upstream or downstream effects and affect other, sometimes all, market participants, including services suppliers.

1.14. Table 2 below provides an indicative and non-exhaustive list of barriers to trade in renewable energy services as mentioned by Members in TESSD discussions.

Table 2. Barriers to trade in services related to the development, installation, operation and decommissioning of renewable energy projects

Barriers to trade
Conditions on market entry
Limitations on the legal types or forms of commercial presence or requirements for joint ventures with domestic entities.
Limitations on foreign equity.
Limitations on the number or types of services that can be provided and economic needs tests.
Investment screening procedures.
Conditions for obtaining authorization to supply a service, including those related to licensing procedures, qualification requirements (including limited recognition of third country diplomas and professional qualifications), or nationality or residency requirements.
Conditions on operations
Procurement policies and subsidy policies which favour domestic services suppliers.
Local content or performance requirements, including requirements to hire host country nationals.
Limitations affecting the movement of professionals or the duration of stay of foreign service suppliers, including for technical and managerial personnel from abroad.
Regulatory barriers such as restrictions to cross-border data flows that restrict digitally delivered services.
Administrative procedures and regulatory transparency
Lengthy, costly or burdensome licensing and authorization procedures for the supply of renewable energy services.
Regulatory heterogeneity, including different qualification requirements and procedures, and different licensing requirements.
Lack of transparency regarding the regulatory framework applied to services related to renewable energy projects, including on licensing requirements.

Note: Barriers to services trade have been categorized in line with the WTO-World Bank Services Trade Policy Database accessible at: http://i-tip.wto.org/services/.

1.15. Analytical work covering services related to renewable energy projects and barriers to their trade, *inter alia*, include:

- APEC Secretariat (2021) – "Environmental Services in the APEC Region: Definition, Challenges and Opportunities".
- OECD Services Trade Restrictiveness Index (STRI).
- OECD (2017) – "Trade in services related to the environment".
- World Economic Forum (2022) – "Accelerating Decarbonization through Trade in Climate Goods and Services".

1.3 Goods and renewable energy

1.16. A useful tool in identifying and analysing renewable energy goods and services associated with various key technologies is value chain analysis, which provides a unifying conceptual framework for understanding a wide array of policy issues.[6] Value chain analysis is useful for assessing the relationships between trade, production and the environment for key environmental technologies, and can be based on value chain diagrams that visualize related information along the value chain. Value chain diagrams can be annotated with further information to support policy

[6] Technical paper by the United Kingdom, "Building our Evidence Base around Environmental Goods", INF/TE/SSD/W/23.

decisions related to goods, such as classification, links between goods and services, barriers to trade and lifecycle considerations.

1.17. Lifecycle considerations can provide a balanced view regarding a product's relationship to the environment, covering both benefits and risks to the environment. Environmental costs linked to the extraction of raw materials and production of a good, or its disposal and recycling at end of life, might be offset against environmental benefits associated with its end-use.[7]

1.18. Examples of lifecycle challenges include the viability of recycling methods for wind turbine blades and solar PV modules as compared to the costs of their disposal in landfills. For example, wind turbines are mostly comprised of recyclable materials, with the exception of the blades, which are made from fibre (typically glass or carbon) reinforced polymer matrix composites. These materials are non-toxic and landfill safe, however, they are difficult to recycle. Recycling methods are either energy or cost prohibitive, or else entail downcycling such that the material recovered is of lower quality than the original material.

1.19. At the same time, new techniques provide opportunities for improving energy efficiency and material recovery along the lifecycle. For instance, the use of laser irradiation in debonding EVA sheets from solar cells can allow their reuse and recycling, while traditional methods such as chemical dissolution or pyrolysis prevent EVA recycling and can cause environmental problems.

1.20. A variety of factors therefore need to be considered when deciding on the nature of policy interventions matched to individual goods in order to achieve the positive environmental effects of an increase in the volume of goods and trade, while minimizing any possible negative effects.

1.3.1 Relevant goods

1.21. The following tables include goods that are relevant for the renewable energy subsectors solar, wind and hydro, as well as green hydrogen and biofuels. These lists of goods are indicative and do not aim to be exhaustive. Relevant goods are also included in other initiatives such as the APEC List of Environmental Goods, the Singapore-Australia Green Economy Agreement, the EU-New Zealand Free Trade Agreement, and the New Zealand-UK Free Trade Agreement.

1.22. Discussions pointed furthermore to a number of horizontal issues such as the importance of goods for energy storage and grid integration. Energy storage is important for storing excess energy generated, bridging differences between energy production and consumption, while grid integration of renewable energy projects is important to ensure reliable and efficient distribution of power.

Solar energy

1.23. Table 3 lists the goods mentioned by Members in TESSD discussions as being important for the solar industry to contribute to climate change mitigation and adaptation. Table 10 in the Annex provides indicative Harmonized System (HS) 2022 codes and descriptions for these goods based on Members' statements, technical papers and other sources. It should be noted that a number of goods relevant for renewable energy such as monitoring and control systems have multiple uses, which means that they are also used in other sectors. Similarly, HS codes at the subheading level (6-digit) can comprise several goods in addition to the good considered relevant for renewable energy.

[7] Lifecycle considerations, included the examples mentioned, are included in the technical papers by the United Kingdom, which provide for lifecycle considerations in solar (INF/TE/SSD/W/23) and wind (INF/TE/SSD/W/26 and INF/TE/SSD/W/26/Add.1) energy value chains.

Table 3. Indicative list of key goods to allow solar energy to achieve climate change goals

Good	Relevance / related policy aspects
Solar photovoltaic modules and panels	Component of solar energy systems and main end product of solar industry. Solar PV cells can be assembled in modules or made up in panels.
Solar photovoltaic cells	Product in the global PV industry chain.
Silicon wafers	Product in the global PV industry chain.
Polysilicon	Raw material for solar industry. Metallurgical-grade silicon, basis for polysilicon, is mostly used in other areas than the solar industry.
Energy storage batteries	Allow storing the energy generated by solar panels during the day for use when there is not enough sunlight available. This is especially important in rural areas.
Solar inverters	Converts variable direct current (DC) from solar PV cells into alternating current (AC) electricity that can be fed into a commercial electrical grid or used by a local, off-grid electrical network.
High-voltage power cables	Transmit electricity generated by solar energy plants.
Monitoring and control systems	Optimize the use of solar energy by allowing users to monitor the performance of their solar energy systems and make necessary adjustments.
Smart-grid technologies	Supports the efficient distribution and effective management of renewable energy sources.
Solar powered appliances and equipment (e.g. solar water heaters, solar power electric generating sets)	Solar water heaters use solar thermal energy to heat water, producing no pollution or carbon emissions.

Note: Further detail regarding inputs and intermediate goods in the solar PV value chain can be found in the technical paper by the United Kingdom (INF/TE/SSD/W/23).

Wind energy

1.24. Table 4 lists the goods mentioned by Members in TESSD discussions as being important for the wind industry to contribute to climate change mitigation and adaptation. Table 11 in the Annex provides indicative HS 2022 codes and descriptions for these goods based on Members' statements, technical papers and other sources.

Table 4. Indicative list of key goods to allow wind energy to achieve climate change goals

Good	Relevance / related policy aspects
Wind turbine	Capture wind energy and convert it into electricity. Key components of wind turbines are nacelles, rotor blades and towers.
Nacelles	The nacelle supports the rotor and converts the rotational energy from the rotor into three-phase AC electrical energy.
Gearbox	Converts rotor torque into a higher speed rotation for conversion to electrical energy by the generator.
Generator	Converts mechanical energy to electrical energy.
Power converter	Transforms the variable-frequency electricity generated by the wind turbine into a stable grid-compatible frequency.
Control systems	Monitor and regulate various aspects of turbine operation for efficient, safe, and effective turbine operation.
Rotor	The rotor extracts kinetic energy from the air and converts this into rotational energy in the drive train.

Good	Relevance / related policy aspects
Blades	Capture the energy in the wind and transfer torque to the drive train in the nacelle.
Hubs	Connects the blades to the main shaft.
Towers	The tower is typically a tubular steel structure that supports the nacelle.
Transformer (inside nacelle or outside of tower)	The voltage for transmission of the electricity through the power grid.
High-voltage power cables	Transmit electricity generated by wind turbines to urban areas.
Electrical equipment (panels, meters)	Electrical goods relevant for wind energy.
Electrical infrastructure	Includes the collection system, substation, and transmission lines between various wind turbines.
Meteorological equipment / sensors	To optimize turbine performance, predict power output, and ensure safe turbine operation.

Note: Further detail regarding manufacturing activities and intermediate inputs in the offshore wind energy value chain can be found in the technical paper by the United Kingdom (INF/TE/SSD/W/26 and INF/TE/SSD/W/26/Add.1).

Hydropower

1.25. Table 5 lists the goods mentioned by Members in TESSD discussions as being important for hydropower to contribute to climate change mitigation and adaptation. Table 12 in the Annex provides indicative HS 2022 codes and descriptions for these goods based on Members' statements, technical papers and other sources.

Table 5. Indicative list of key goods to allow hydropower to achieve climate change goals

Good	Relevance / related policy aspects
Hydraulic turbine and water wheels	Convert the energy from flowing water into electricity. The turbines and wheels come in different sizes, and produce varying amounts of electricity depending on the water flow.
Hydro generators	Convert the energy from flowing water into electricity.
Turbine inlet valves (wicket gates)	Mechanisms that control the flow of water entering the turbine of a hydropower plant.
High-voltage power cables	Transmit electricity generated by hydropower turbines.
Automation and Control systems/equipment	Relevant for safe, efficient and effective operation, monitoring, and control of various components and processes within a hydropower plant.
Power transformers	Power transformers transform the electrical voltage levels in a hydropower plant, ensuring that the electricity generated by the turbines is compatible with the transmission and distribution infrastructure, minimizing transmission losses and maximizing the efficiency of power transfer.
Auxiliary transformers (station service transformers)	Separate transformers used to supply electricity for the plant's auxiliary systems and equipment, including lighting, heating, ventilation, air conditioning.
Penstocks	Large pipes or conduits that transport water from the dam or reservoir to the turbines of a hydropower plant.
Intake gates (sluice gates or head gates)	Devices used to control the flow of water into the penstocks or diversion channels of a hydropower plant.
Steel castings and forgings	Steel castings and forgings for turbines and other components of hydropower.

Green hydrogen

1.26. Hydrogen is an energy carrier (like electricity and fuels), and can be converted into derivative fuels and feedstocks such as ammonia (used, *inter alia*, for fertilizer production) and methanol (used, *inter alia*, as feedstock in chemical industry). Hydrogen can be produced from compounds such as water and fossil fuels using various methods and energy sources, resulting in different levels of GHG emissions. Green hydrogen is produced through the electrolysis of water, using renewable electricity to split water into hydrogen and oxygen. Low-carbon hydrogen can furthermore be produced through electrolysis using electricity from nuclear energy, from fossil fuels with carbon capture, utilization, and storage (CCUS), from biomass gasification and from methane pyrolysis.[8]

1.27. Renewable energy can be converted to green hydrogen via electrolysis. For certain energy uses, electrification is technically difficult or costly. Green hydrogen can act as a link between renewable electricity generation and such hard-to-abate sectors, offering a solution to decarbonize some applications, for example, in heavy industry (including those where fossil-fuel-based hydrogen is used today) and shipping and aviation. It can also serve as a long-term, seasonal energy storage, supporting the integration of renewables into the power grid. [9]

1.28. Table 6 lists the goods mentioned by Members in TESSD discussions as being important to support the production trade and use of green hydrogen. Table 13 in the Annex provides indicative HS 2022 codes and descriptions for these goods based on Members' statements, technical papers and other sources.

Table 6. Indicative list of key goods to allow green hydrogen to achieve climate change goals

Good	Relevance / related policy aspects
Green hydrogen	Hydrogen can be produced through electrolysis, where electricity is used to split water into hydrogen and oxygen. Green hydrogen is produced when renewable electricity is used for this process.
Electrolysers[a]	Electrolysers produce hydrogen through electrolysis, splitting water into hydrogen and oxygen. Electrolysers are based on different technologies and, *inter alia*, include Polymer Electrolyte Membrane (PEM) electrolysers, alkaline electrolysers and solid oxide electrolysers (SOE). All technologies require to a different extent raw materials (e.g. graphite, platinum group metals, nickel, chromium).
Hydrogen compressor	Hydrogen is produced at relatively low pressures and needs to be compressed for transport and storage.
Pipelines	Pipelines for transporting gaseous hydrogen.
Steel containers / tanks	Steel containers for storing hydrogen in gaseous or liquid form.
Hydrogen fuel cells[a]	Hydrogen fuel cells used in electric vehicles convert hydrogen gas stored in an on-board tank into electricity.
On-board hydrogen tanks[a]	On-board high-pressure hydrogen tanks store compressed hydrogen gas in hydrogen fuel cell electric vehicles, where an on-board fuel-cell system converts the compressed hydrogen into electricity.

Note: [a] Further details regarding the underlying value chains for these goods can be found in the technical non-paper on hydrogen energy and trade by the United Kingdom (INF/TE/SSD/W/30).

Biofuels

1.29. Biofuels can be produced from a wide variety of feedstocks and different processing technologies. For example, commonly used feedstocks for bioethanol include corn, wheat starch and molasses from sugarcane, while feedstocks for biodiesel include vegetable oils such as canola and soybeans and animal fats such as tallow. Biofuels can, *inter alia*, be derived from dedicated crops or wastes and agricultural residues, with related considerations being the biofuel's sustainability and

[8] United Kingdom (2023) – Technical non-paper on hydrogen energy and trade (INF/TE/SSD/W/30).
[9] WTO-IRENA (2023) – "International trade and green hydrogen: Supporting the global transition to a low-carbon economy": https://www.wto.org/english/res_e/publications_e/green_hydrogen_e.htm.

greenhouse gas savings, as well as the balance between biofuel production and environmental protection. Table 7 provides an illustrative list of biofuels and Table 14 in the Annex provides additionally indicative HS 2022 codes and descriptions.

Table 7. Illustrative list of biofuels

Good	Relevance / related policy aspects
Bioethanol	Additive or replacement for transportation fuels traditionally provided by petroleum.
Biodiesel	Additive or replacement for transportation fuels traditionally provided by petroleum.
Renewable diesel	Renewable diesel is made from fats and oils. It is processed to be chemically the same as petroleum diesel so it can be blended with any amount of petroleum diesel or be used as a drop-in replacement.
Biomethane - renewable natural gas (RNG)	Biomethane is an upgraded, purified biogas that can be used as a substitute for natural gas.
Sustainable aviation fuel (SAF)	The use of SAFs can contribute to the decarbonization of air transport.

1.3.2 Barriers to dissemination and supply chain bottlenecks

1.30. Table 8 below lists the barriers and supply chain bottlenecks mentioned by Members in TESSD discussions that can hinder the dissemination of goods relevant for the solar energy sector.

Table 8. Supply chain bottlenecks and barriers to the dissemination of these goods

Barriers to dissemination and supply chain bottlenecks	Examples
Tariffs	Tariffs on final renewable energy goods such as solar panels, as well as intermediate and raw materials.
Limitations regarding the approval of products from foreign manufacturers	Relevant for solar.
Inappropriate use of trade remedies	Relevant for solar.
Local content requirements (LCR)	LCRs included as eligibility condition in renewable energy public procurement or for access to financial support through feed-in tariffs or other support programmes.
Excessive supply chain traceability requirements and related standards	
Vulnerabilities to disruptions in supply chains due to concentration of production as well as dependence on certain minerals and raw material inputs	Solar, wind and hydropower equipment rely on various raw materials, such as metals, composites, and rare earth minerals, which can create vulnerabilities in the supply chain and lead to price volatility if there is high demand or limited global supply. Delays or disruptions in receiving inputs for controls, automation devices, and other small subcomponents involving microchips, which rely mostly on imports, can significantly delay projects.
Limited technical capacity and regulatory challenges to integrate solar, wind and hydro energy into electrical grids	Variable power generation, grid stability, and system balancing require grid upgrades and advanced control systems. These grid integration challenges can slow down the dissemination of renewable energy goods.

Barriers to dissemination and supply chain bottlenecks	Examples
Technical regulations and voluntary product standards that are inconsistent with international standards and certification and conformity assessment procedures	Differences in domestic standards and technical regulations can lead to regulatory divergence, often requiring compliance with different data and testing requirements. Wind: International standards for floating offshore wind are being developed for markets with deep water and extreme weather; these standards may not be appropriate for areas with calmer climates.
Duplicative conformity assessment procedures across the components of renewable energy facilities	Separate conformity assessment procedures for different components of a facility increase cost and time compared to a single conformity assessment process of all components of a facility.
Lack of skilled labour	Developing a skilled workforce capable of installing, operating, and maintaining wind and hydropower systems.
Financing challenges, especially for SMEs	
Inadequate transport infrastructure and logistics	Wind and hydropower goods are often large and heavy. Transportation challenges, including long-distance shipping, limited infrastructure, and regulatory constraints, can increase costs and cause delays.
Lengthy authorization and administrative procedures to build projects	Relevant for wind energy.
Inadequate definitions of goods supporting environmental objectives in HS classification	Many goods supporting environmental objectives are not well defined in the HS. This makes it difficult to target goods with trade policy measures, and hard to collect international trade statistics. Traders struggle with a lack of clarity over classification as well as the time and administrative burden of seeking formal classification opinions from customs. Examples: heat pumps, solar powered water pumps, electric aircraft and boats.
Education and awareness	
Technological limitations	
Environmental concerns	
High cost of adoption	

1.31. Analytical work that covers relevant goods and barriers to their dissemination, *inter alia*, include:

- United Kingdom (2023) – Technical paper, "Building our Evidence Base around Environmental Goods", INF/TE/SSD/W/23.
- United Kingdom (2023) – Technical paper, "Offshore Wind Energy", WTO document INF/TE/SSD/W/26 and INF/TE/SSD/W/26/Add.1.
- United Kingdom (2023) – Technical non-paper, "Hydrogen Energy and Trade", WTO document INF/TE/SSD/W/30.
- WTO-IRENA (2023) – "International trade and green hydrogen: Supporting the global transition to a low-carbon economy".
- International Institute for Sustainable Development (IISD) (2021) – "How Can Trade Policy Maximize Benefits From Clean Energy Investment?"
- World Economic Forum (2022) – "Accelerating Decarbonization through Trade in Climate Goods and Services".

1.4 Developing country perspectives

1.32. Based on discussions, Members noted that developing countries face several challenges in developing their renewable energy sector. These challenges, *inter alia*, include:

- Weak infrastructure
- Access to technology
- Specialist know-how and expertise
- Qualified manpower
- Financing, resources, and investment
- Trade barriers
- Regulatory environment

1.33. Trade in goods and services can play an important role in addressing these challenges by supporting access to and affordability and deployment of technology for solar, wind or hydro energy, as well as green hydrogen and biofuels such as solar panels, wind turbines, hydroelectric impellers, and water electrolysers, among others. This can support the development and enhance the competitiveness of countries' renewable energy sectors, encouraging investment and economic development. To help developing countries benefit from these opportunities resulting from the shift to low-carbon technologies, addressing non-tariff barriers and implementing technical assistance and technology development can be useful.

1.34. Trade in services through commercial presence can help bring investment, and the movement of professionals and specialist service providers bring required expertise and can help transfer skills and knowledge to local staff and communities. Open services trade can support the energy sector by improving access to a larger variety of products at a lower quality-adjusted cost. Additionally, there is a need to focus on developing and improving the skills of the workforce, enabling them to effectively install, operate and maintain solar, wind and hydropower systems.

1.35. Trade between developing countries in electrification and clean energy technologies, including solar photovoltaic cells and modules, batteries, wind-powered generating sets, hydraulic turbines, and biomass generation-related products, has been experiencing overall growth. The development of renewable energy technology can create local business and employment opportunities for installers, technicians and material suppliers. According to IISD (2021), opportunities for local production and value creation could be found in ancillary components or services, such as structures, mounting equipment, electrical components, and civil work for renewable energy projects and blades, as well as foundation, cabling and civil work for wind energy projects.[10]

1.36. Similarly, developing the biofuels sector using feedstocks suitable to each country can contribute to providing energy security, economic growth, and bring value addition to farmers while also resulting in valuable co-products and decreased dependence on fossil fuels. Developing countries also have opportunities to leverage comparative advantage in natural resource abundance to attract investment and develop green hydrogen production thereby contributing to economic diversification, reducing dependence on traditional industries. Regional trade agreements like the African Continental Free Trade Area (AfCFTA) could create economies of scale to foster participation of developing and LDC Members in global value chains as well as regional value chains.

1.37. Attraction, retention and expansion of green investment is important to the development of the renewable energy sector, particularly in developing countries. According to the UNCTAD World Investment Report 2023, the number of international investment projects in renewables has nearly tripled since 2015. While this increase was largely driven by developed economies, the growth in projects in developing countries has been slower and more gradual. The countries most in need of energy investment are least successful in attracting energy-sector FDI; since 2015, 31 developing countries, including 11 LDCs, have not yet registered a single utility-sized international investment project in renewables or other energy transition sectors.[11] Members underlined the need to enhance developing countries' access to international climate finance and to strengthen cooperation and technical assistance to encourage energy investments in developing countries. This may be accompanied by domestic efforts towards creating a stable investment environment through legal certainty (including taxation), education and skill development, addressing barriers that discourage

[10] IISD (2021) – "How Can Trade Policy Maximize Benefits From Clean Energy Investment?".
[11] UNCTAD (2023) – World Investment Report 2023: Investing in Sustainable Energy for All.

cross border capital flows, and building investor confidence through detailed investment planning in national energy transition strategies.

1.38. Green innovation presents opportunities for developing countries to enhance their technological capacities, grow their economies, reduce inequalities, and simultaneously meet their environmental goals.[12] Policy and investment targeted at building skills and capacities can create low-carbon technological opportunities in developing countries, including the domestic generation of technological solutions, while incentives could address possible market failures. Weak infrastructure, lack of access to expertise and technologies, and the knowledge gap between technological needs and solutions serve as barriers to greater adoption of green technology in developing countries.

1.5 Opportunities and approaches to promote and facilitate trade in renewable energy goods and services

1.39. Members provided suggestions on opportunities and approaches to promote and facilitate trade in renewable energy goods and services. Enhancing the resilience of global supply chains for renewable energy products, as well as improving market access and trade facilitation could lower costs and encourage the flow of goods, services, technologies, and investments across borders, helping to accelerate the energy transition and achieve emission reduction goals. Addressing challenges faced by developing and LDC Members, including through technical assistance and capacity building, can help them take advantage of opportunities in renewable energy sectors.

1.40. Members also underlined the importance of collaboration in facilitating the development of renewable and low-carbon energy markets such as for a global low-carbon hydrogen trading market. This could include the formulation of trade rules ensuring the interoperability of guarantee of origin certifications. Another example of collaboration includes the Singapore-Australia Green Economy Agreement, in which Singapore and Australia have committed to collaborate on facilitating and lowering the barriers to entry for cross-border electricity trade, including developing bilateral electrical trade architecture, facilitating secure transport of electricity, and developing and maintaining the necessary infrastructure. It was also suggested that future collaborative efforts could address new types of green cross-border flows such as renewable energy, green and transitional financing, green transport and connectivity, carbon trading, and other forms of environmental goods and services.

1.41. Experiences shared by Members highlighted that an approach of non-binding indicative lists of goods and services can be a useful tool and guide discussions on cooperation in areas such as technical standards and domestic regulatory regimes. Indicative lists could also be useful in signalling policy intent to markets even where liberalization did not occur.

1.42. Further, Members pointed to collective efforts aimed at expanding lists of environmental and environmentally related services beyond the traditional "core" environmental services included in Division 94 of the CPC, through initiatives such as the Exploratory Discussions on Market Access: Environmental Services in the Council for Trade in Services-Special Session; the APEC Reference List of Environmental and Environmentally Related Services adopted in November 2021; and new trade agreements like the Singapore-Australia Green Economy Agreement, the EU-New Zealand Free Trade Agreement and the Agreement on Climate Change, Trade and Sustainability (ACCTS; still under negotiation) between New Zealand, Costa Rica, Fiji, Iceland, Norway and Switzerland. It was suggested that TESSD could contribute to establishing a clear and credible scope of environmental services and services important to renewable energy, recognizing the range of services referenced by Members. It was also suggested by some participants that Members participating in TESSD could recognize that environmental services go beyond CPC 94.

1.43. As renewable services are often complementary to renewable energy goods and technologies, poor market access conditions for trade in services can hinder trade in renewable goods and technologies and, more broadly, the development of renewable energy projects. In this context, it was suggested to further explore both up- and downstream services needed in the development and distribution of renewable energy, as well as the relevant modes of supply.

[12] UNCTAD (2023) – Technology and Innovation Report 2023: Opening Green Windows: Technological opportunities for a low-carbon world.

1.44. Based on discussions, Members pointed to a number of opportunities and approaches to promote trade in goods and services relating to renewable energy. It was also suggested that enhanced engagement between TESSD and other WTO bodies on these issues could ensure information exchange, avoid duplication of work and raise awareness of the work of TESSD to non-members.

1.45. Opportunities and approaches that are mainly related to services, *inter alia*, include:

- Improving regulatory transparency through better access to information on regulatory frameworks applied to services relevant to renewable energy. This could include providing companies, including MSMEs, with practical information on the requirements they need to fulfil in order to export relevant services. Work on regulatory databases by the WTO and the World Bank or by the OECD could help enhance transparency on measures affecting trade in services relevant to renewable energy.
- Applying good regulatory practices for licensing and authorization procedures. Good practices can reduce the time and costs required for dealing with administrative procedures and might be particularly beneficial for allowing MSMEs to engage in international trade. Examples could be drawn from disciplines related to Services Domestic Regulation to promote transparency, predictability and efficiency of authorization procedures for service providers.
- Facilitating authorization, certification and licensing procedures relating to investment in the renewable energy sector through the adoption of non-arbitrary and non-discriminatory rules.
- Improving market access to facilitate the establishment of commercial presence as well as the supply of services through other modes to support the development of renewable energy sectors. Market access may be improved by reducing barriers to services trade relevant for renewable energy or by increasing transparency through binding commitments, including for services where barriers are already low.
- Regulatory cooperation can support trade in renewable energy and related services by addressing regulatory divergences and heterogeneity.
- Inclusion of sustainability skills as a requirement for recognition by accredited bodies to better promote environmental goals.
- Continue building empirical knowledge on services trade and its relative role in energy markets to account for issues of magnitude when setting priorities regarding removing impediments to services trade.

1.46. Opportunities and approaches that are mainly related to goods, *inter alia*, include:

- Trade facilitation measures to streamline or expedite the movement of goods related to renewable energy projects across borders. This could include sharing of best practices on trade facilitation measures, including in the context of the implementation of the WTO Trade Facilitation Agreement and regional initiatives, to simplify customs procedures.
- Simplification of regulatory processes related to trade in renewable energy goods, including through establishing clear and transparent guidelines for permits, certification, and quality control.
- Cooperation on technical regulations, labelling, certification, and conformity assessment procedures, including in the TBT Committee/WTO. This could include sharing of information on the regulatory requirements for renewable energy goods with the aim of minimizing regulatory fragmentation. Also, in the area of carbon measurement and related certifications, cooperation could help minimise divergence in methodologies, and enhance transparency on certification requirements as well as qualified third-party certification institutions.
- Cooperation on supply chain traceability and reliable certification can help improve consumer confidence in the sustainability credentials of renewable energy goods across complex supply chains.
- Harmonization and mutual recognition of standards can facilitate trade by ensuring that goods meet a common set of criteria and are integrated into existing energy systems. Encourage inclusivity of technical committees of international standards-making bodies.
- Market access commitments and preferential treatment for renewable energy goods, and key materials needed for their production, in bilateral and regional trade agreements.

- Preferential tariff treatment for low-carbon goods related to renewable energy. Lower tariffs on goods that comply with carbon standards could incentivize the reduction in carbon emissions in the production of goods along renewable energy supply chains.
- Reduction of import tariffs on final products and intermediate inputs important for renewable energy projects and supply chains. A project-based approach may be one possible approach, among others, for reducing tariffs.
- Government support in the form of non-discriminatory, WTO-compliant financial incentives to stimulate demand and production of renewable energy goods.
- Prioritization of renewable energy goods in public procurement to stimulate demand and set a standard for the private sector to follow. Implementation of the WTO Government Procurement Agreement can help with the dissemination of renewable energy technologies.
- Collaboration on proposals for HS amendments to allow for a better identification of the goods needed to meet environmental and climate objectives. This could take the form of a letter to the World Customs Organization outlining proposals for HS reform supported by the TESSD membership and other relevant co-sponsors. Distinct codes can support the monitoring of trade in environmental technologies and more targeted trade policy.

1.47. Members also pointed to opportunities and approaches related to addressing developing country needs and interests, and international cooperation more broadly:

- Collaboration on identifying how to facilitate investments in renewable energy projects in developing countries. In this context, disciplines related to negotiations on investment facilitation for development (IFD) could help developing countries attract foreign direct investment, among other things.
- More discussion on the sharing of technology in the renewable energy sector in view of a balanced approach.
- Support to address financing barriers.
- Support to facilitate the development of a skilled workforce.
- International cooperation to develop common frameworks to accelerate the development of renewable energy projects and facilitate cross-border energy trade.
- International collaboration or support to enhance the resilience of supply chains.
- Development cooperation aimed at the deployment of renewable energy technologies.

ANNEX

Table 9. Indicative list of services related to the development, installation, and operation of renewable energy projects – with indicative CPC codes

Service	Example / Comment	CPC 2.1	CPC 2.1 Description
Architectural services	Preparing site plans, working drawings, and specifications for the development of the land required for renewable energy projects.	8321	Architectural services and advisory services
Urban planning services	Integration of renewable energy considerations into urban planning is important as urban form, functionalities and zoning impact energy demand and production. Urban infrastructure such as rooftops or bridges can serve as potential sites for solar PV or wind turbines.	83221	Urban planning services
Site identification and evaluation services	Site investigation services help find the most suitable site for the construction of dams or of wind turbines.		
Nature and landscape protection services	Relevant for the protection of ecosystems around hydropower projects or wind turbines.		
Engineering services for energy projects	Relevant for the design and development of renewable energy facilities. Examples: engineering services needed for the development of robust wind turbines used in offshore projects; engineering services needed for designing hydrogen production, storage and transportation systems.	83324	Engineering services for power projects
Engineering design services for industrial processes and production	Relevant for the design of industrial processes related to the production of renewable energy goods such as solar panels and wind turbines as well as the design of these goods themselves.	83322	Engineering services for industrial and manufacturing projects
Testing and analysis, including certification	Testing and analysis of the physical properties of materials or of mechanical and electrical characteristics can ensure that renewable energy systems meet safety and performance standards. This includes testing and certifying that these systems and goods/services within these systems meet relevant standards.	8344	Technical testing and analysis services
Environmental consulting services	An example of such services are marketing services to improve the commercialization of renewable energy technologies.	83931	Environmental consulting services
Construction services	Relevant for the generation, storage, and deployment of renewable energy.	54	Construction services

Service	Example / Comment	CPC 2.1	CPC 2.1 Description
Construction services	Power plant constructions.	54262	General construction services of power plants
	Solar: Design and construction services for photovoltaic (PV) solar systems, energy storage systems, and installation of energy grids.	54252	General construction services of local cables and related works
		53242	Long-distance communication and power lines (cables)
Construction services	Hydropower: Construction services required for the erection of massive hydroelectric dams. Support the use of environmental goods or technologies.	54233	General construction services of dams
Installation and assembly services for renewable energy projects	Relevant for renewable energy projects. For example, installation of energy grids, assembly of solar PV modules and solar water pumps, installation and assembly of wind turbines and offshore substation construction.	546	Installation services (as part of construction services)
		873	Installation services (other than construction) – physical placement, configuration, set-up, calibration and testing of proper operation of various types of machinery and equipment
		87360	Installation services of electrical machinery and apparatus n.e.c. (electric motors, generators and transformers)
Logistics and transport services	Relevant for the transport of renewable energy equipment for installation or for maintenance and repair. For example, transport of wind turbines for installation in wind farms, or spare parts for maintenance.	65	Freight transport services
Financial services	Relevant for the financing of renewable energy projects, which can be capital-intensive and require large upfront costs for equipment. Lending and leasing services important for developing Members.	711	Financial and related services
		71140	Financial leasing services
Insurance services	Insurance services are used to protect against financial losses associated with renewable energy projects. For green hydrogen projects, this includes tasks such as insuring hydrogen production facilities, hydrogen storage tanks, and hydrogen refuelling stations	7133	Other non-life insurance services (excluding reinsurance services)

Service	Example / Comment	CPC 2.1	CPC 2.1 Description
Regulatory services (as provided by public sector)	Regulatory support is needed to ensure that hydrogen energy projects can be developed and operated safely and efficiently. This includes tasks such as developing regulations for production, storage, and transportation, and providing guidance on how to comply with these regulations.		
Legal services	Provide legal certainty in the development stages of renewable energy projects. For example, legal services related to setting up a special purpose vehicle (SPV) for managing the development process of an offshore wind project.	821	Legal services
Accounting services	Relevant during the development phase in the context of building a financial model, providing due diligence, and reviewing financial information.	822	Accounting, auditing and bookkeeping services
Consulting and advisory services	Provide advice and guidance on renewable energy projects. Help customers evaluate solar energy options and design tailored solutions that fit their needs. Identify potential hydrogen projects, develop plans and secure financing.	831	Management consulting and management services; information technology services
Wholesale trade services	Wholesale trade services ensuring the supply of large quantities of panels placed on PV fields. Support the use of environmental goods or technologies.	61	Wholesale trade services
Operation services for renewable energy projects	Solar: Operation and management of power plants and solar energy infrastructure.	8631 83115	Support services to electricity transmission and distribution Operations management consulting services
Maintenance and repair for renewable energy projects	Solar: Maintenance and repair services for PV solar systems and power plants. Relevant to guarantee their optimal operation and prolong their useful life. Wind and Hydro: Repair services incidental to metal products, machinery and equipment.	871	Maintenance and repair services of fabricated metal products, machinery and equipment
Grid connection and monitoring	Solar: Data monitoring and analysis services for efficient and optimal performance.		
Renewable energy storage services, such as batteries	Increase the efficiency and performance of the PV solar systems.		
Recycling	Particularly relevant for solar.	894	Materials recovery (recycling) services, on a fee or contract basis

Service	Example / Comment	CPC 2.1	CPC 2.1 Description
Waste treatment and disposal services	An example is the treatment of wind turbines blades made of carbon fibre.	94339	Other non-hazardous waste treatment and disposal services
R&D services	R&D on chemistry, engineering, and technology relevant for solar energy sector. R&D relevant for the provision of wind power. R&D services on natural sciences and engineering.	8111 8112 8113	Basic research services in natural sciences and engineering Applied research services in natural sciences and engineering Experimental development services in natural sciences and engineering
Services related to the manufacturing, sale, delivery and installation of renewable energy systems	Services that relate to the manufacturing, sale, delivery and installation of renewable energy goods such as those included in the indicative lists of goods in section 1.3.		

Table 10. Key goods to allow solar energy to achieve climate change goals – with indicative HS codes

Good	HS 2022	Description
Solar PV modules / panels	854143	Photovoltaic cells assembled in modules or made up into panels
Solar PV cells	854142	Photovoltaic cells not assembled in modules or made up into panels
Silicon wafers	381800	Chemical elements and compounds doped for use in electronics, in the form of discs, wafers, cylinders, rods or similar forms, or cut into discs, wafers or similar forms, whether or not polished or with a uniform epitaxial coating (excl. elements that have been further processed, e.g. by selective diffusion)
Polysilicon	280461	Silicon containing >= 99,99% by weight of silicon
	280469	Silicon containing < 99,99% by weight of silicon
Energy storage batteries	8507	Electric accumulators, incl. separators therefor, whether or not square or rectangular; parts thereof (excl. spent and those of unhardened rubber or textiles)
Solar inverters	850440	Electrical static converters
High-voltage power cables	8544	Insulated "incl. enamelled or anodised" wire, cable "incl. coaxial cable" and other insulated electric conductors, whether or not fitted with connectors; optical fibre cables, made up of individually sheathed fibres, whether or not assembled with electric conductors or fitted with connectors
Monitoring and control systems	902830	Electricity supply or production meters, incl. calibrating meters therefor
	903031	Multimeters for voltage, current, resistance or electrical power, without recording device
	903032	Multimeters with recording device
	903082	Instruments and apparatus for measuring or checking semiconductor wafers or devices, incl. integrated circuits
Smart-grid technologies	903289	Regulating or controlling instruments and apparatus (excl. hydraulic or pneumatic, manostats, thermostats, and taps, cocks and valves of heading 8481)
Solar powered appliances and equipment: solar water heaters	841912	Solar water heaters
Solar powered appliances and equipment: solar power electric generating sets	850239	Generating sets (excl. wind-powered and powered by spark-ignition internal combustion piston engine)

Note: Descriptions are self-contained and taken from the WTO HS Tracker: https://hstracker.wto.org/.

Table 11. Key goods to allow wind energy to achieve climate change goals – with indicative HS codes

Good	HS 2022	Description
Wind turbine		
Nacelles	850231	Generating sets, wind-powered
Gearbox	848340	Gears and gearing for machinery (excl. toothed wheels, chain sprockets and other transmission elements presented separately); ball or roller screws; gear boxes and other speed changers, incl. torque converters
Generator	850231	Generating sets, wind-powered
Power converter	850440	Static converters
Control systems	8537	Boards, panels, consoles, desks, cabinets and other bases, equipped with two or more apparatus of heading 8535 or 8536, for electric control or the distribution of electricity, incl. those incorporating instruments or apparatus of chapter 90, and numerical control apparatus (excl. switching apparatus for line telephony or line telegraphy
	9032	Regulating or controlling instruments and apparatus (excl. taps, cocks and valves of heading 8481)
Rotor	841280	Engines and motors (excl. steam turbines, internal combustion piston engine, hydraulic turbines, water wheels, gas turbines, reaction engines, hydraulic power engines and motors, pneumatic power engines and motors and electric motors)
	841290	Parts of non-electrical engines and motors, n.e.s.
Blades	841290	Parts of non-electrical engines and motors, n.e.s.
Hubs	841290	Parts of non-electrical engines and motors, n.e.s.
	732599	Cast articles of iron or steel, n.e.s. (excl. articles of non-malleable cast iron, and grinding balls and similar articles for mills)
Towers	730820	Towers and lattice masts, of iron or steel
Transformer (inside nacelle or outside of tower)	8504	Electrical transformers, static converters, e.g. rectifiers, and inductors; parts thereof
High-voltage power cables	8544	Insulated "incl. enamelled or anodised" wire, cable "incl. coaxial cable" and other insulated electric conductors, whether or not fitted with connectors; optical fibre cables, made up of individually sheathed fibres, whether or not assembled with electric conductors or fitted with connectors
Electrical equipment: panels	853710	Boards, cabinets and similar combinations of apparatus for electric control or the distribution of electricity, for a voltage <= 1.000 V
Electrical equipment: meters	902830	Electricity supply or production meters, incl. calibrating meters therefor
Electrical infrastructure		

Good	HS 2022	Description
Meteorological equipment / sensors	901580	Instruments and appliances used in geodesy, topography, hydrography, oceanography, hydrology, meteorology or geophysics (excl. compasses, rangefinders, theodolites, tachymeters "tacheometers", levels and photogrammetrical surveying instruments and appliances)

Note: Descriptions are self-contained and taken from the WTO HS Tracker: https://hstracker.wto.org/.

Table 12. Key goods to allow hydro energy to achieve climate change goals – with indicative HS codes

Good	HS 2022	Description
Hydraulic turbine and water wheels	8410	Hydraulic turbines, water wheels, and regulators therefor (excl. hydraulic power engines and motors of heading 8412)
Hydro generators	8501	Electric motors and generators (excl. generating sets)
Turbine inlet valves (wicket gates)	8481	Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, incl. pressure-reducing valves and thermostatically controlled valves; parts thereof
High-voltage power cables	8544	Insulated "incl. enamelled or anodised" wire, cable "incl. coaxial cable" and other insulated electric conductors, whether or not fitted with connectors; optical fibre cables, made up of individually sheathed fibres, whether or not assembled with electric conductors or fitted with connectors
Automation and Control systems/equipment	8537	Boards, panels, consoles, desks, cabinets and other bases, equipped with two or more apparatus of heading 8535 or 8536, for electric control or the distribution of electricity, incl. those incorporating instruments or apparatus of chapter 90, and numerical control apparatus (excl. switching apparatus for line telephony or line telegraphy)
	9032	Regulating or controlling instruments and apparatus (excl. taps, cocks and valves of heading 8481)
Power transformers	8504	Electrical transformers, static converters, e.g. rectifiers, and inductors; parts thereof
Auxiliary transformers (station service transformers)	8504	Electrical transformers, static converters, e.g. rectifiers, and inductors; parts thereof
Penstocks	730890	Structures and parts of structures, of iron or steel, n.e.s. (excl. bridges and bridge-sections, towers and lattice masts, doors and windows and their frames, thresholds for doors, props and similar equipment for scaffolding, shuttering, propping or pit-propping)
	7304	Tubes, pipes and hollow profiles, seamless, of iron or steel (excl. products of cast iron)
	7305	Tubes and pipes, having circular cross-sections and an external diameter of > 406,4 mm, of flat-rolled products of iron or steel "e.g., welded, riveted or similarly closed"

Good	HS 2022	Description
	7306	Tubes, pipes and hollow profiles "e.g., open seam or welded, riveted or similarly closed", of iron or steel (excl. of cast iron, seamless tubes and pipes and tubes having internal and external circular cross-sections and an external diameter of > 406,4 mm)
Intake gates (sluice gates or head gates)	730890	Structures and parts of structures, of iron or steel, n.e.s. (excl. bridges and bridge-sections, towers and lattice masts, doors and windows and their frames, thresholds for doors, props and similar equipment for scaffolding, shuttering, propping or pit-propping)
Steel castings and forgings	7301	Sheet piling of iron or steel, whether or not drilled, punched or made from assembled elements; welded angles, shapes and sections, of iron or steel

Note: Descriptions are self-contained and taken from the WTO HS Tracker: https://hstracker.wto.org/.

Table 13. Goods important for the production, trade and use of green hydrogen – with indicative HS codes

Good	HS 2022	Description
Green hydrogen	280410	Hydrogen
Electrolysers	854330	Machines and apparatus for electroplating, electrolysis or electrophoresis
Hydrogen compressor	841480	Air pumps, air or other gas compressors and ventilating or recycling hoods incorporating a fan, whether or not fitted with filters, having a maximum horizontal side > 120 cm (excl. vacuum pumps, hand- or foot-operated air pumps, compressors for refrigerating equipment and air compressors mounted on a wheeled chassis for towing)
	841490	Parts of: air or vacuum pumps, air or other gas compressors, fans and ventilating or recycling hoods incorporating a fan, and gas-tight biological safety cabinets, n.e.s.
Pipelines	730411	Line pipe of a kind used for oil or gas pipelines, seamless, of stainless steel
	730419	Line pipe of a kind used for oil or gas pipelines, seamless, of iron or steel (excl. products of stainless steel or of cast iron)
Steel containers / tanks	731100	Containers for compressed or liquefied gas, of iron or steel.
Hydrogen fuel cells	850133	DC motors and DC generators of an output > 75 kW but <= 375 kW (excl. photovoltaic generators)
	850680	Primary cells and primary batteries, electric (excl. spent, and those of silver oxide, mercuric oxide, manganese dioxide, lithium and air-zinc)
	850690	Parts of primary cells and primary batteries, n.e.s.

Good	HS 2022	Description
On-board hydrogen tanks	761300	Aluminium containers for compressed or liquefied gas
	870899	Parts and accessories, for tractors, motor vehicles for the transport of ten or more persons, motor cars and other motor vehicles principally designed for the transport of persons, motor vehicles for the transport of goods and special purpose motor vehicles, n.e.s.

Note: Descriptions are self-contained and taken from the WTO HS Tracker: https://hstracker.wto.org/.

Table 14. Illustrative list of biofuels – with indicative HS codes

Good	HS 2022	Description
Bioethanol	2207	Undenatured ethyl alcohol of an alcoholic strength of >= 80%; ethyl alcohol and other spirits, denatured, of any strength
Biodiesel	382600	Biodiesel and mixtures thereof, not containing or containing less than 70 % by weight of petroleum oils or oils obtained from bituminous minerals.
Renewable diesel	382600	Biodiesel and mixtures thereof, not containing or containing less than 70 % by weight of petroleum oils or oils obtained from bituminous minerals.
Biomethane		
Sustainable aviation fuels		

Note: Descriptions are self-contained and taken from the WTO HS Tracker: https://hstracker.wto.org/.