How Can Trade Policy Maximize Benefits From Clean Energy Investment?

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1.0 Introduction

The growth of renewable energy capacity has been the most significant dynamic in the global electricity market over the last two decades. Costs have reached a point where renewable energy is competitive in almost all countries. Given the boom in the construction of renewable energy projects, national governments are keen to maximize local economic benefits.

Renewable energy projects are made up of components, subassemblies, and systems, some of which are manufactured in large, centralized factories, and some of which are fabricated on site based on locally specified designs. In between these two extremes there lies a range of components and systems that could be constructed locally, but, in many cases, it is not economically feasible to do so. In this case, trade policy can play a role and create incentives for local manufacturing. Indeed, many governments have introduced local content requirements of one form or another. However, the imposition of trade restrictions also comes at a cost. Increased barriers to trade increase project costs and therefore prices for consumers. They may also prevent projects from being viable at all, leading to a delay in the renewable energy transition and a failure to meet global climate commitments.

This paper aims to provide information to help governments determine how to strike a balance between maximizing local benefits and minimizing project costs with a particular focus on developing countries. The paper first reviews the major components that make up a renewable energy project and their respective value as a proportion of project cost. Each component is then evaluated in terms of its ease of local manufacture. A range of illustrative scenarios are then discussed of how local manufacturing may evolve over time. It is intended that these illustrations form a starting point for how each of the relevant World Customs Organization (WCO) Harmonized Item Description and Coding System (HS) codes—which are used to categorize trade in these products—should be treated from a trade perspective to align trade policy with energy policy and maximize economic benefit from renewable energy deployment.

2.0 How to Build Wind Farms and Solar Parks

This section examines the typical bill of materials (BOM) for wind and solar projects with attention to what components can be imported and what components can be manufactured within the country. Many countries in general—and developing countries in particular—may be looking to increase their share of renewable energy electricity production and support local industries working in the renewable energy sector. The below breakdown for solar and wind projects indicates that wind and solar projects typically involve a mix of very specialized components that are manufactured in a small number of places at very large scales, components that are produced in many countries and everything in between. National factors, including trade policy, will determine the current mix of local and global sourcing. This table can serve as an overview of how to maximize local production while allowing imports of components that may require high investment costs and deep technical expertise.

Table 1. BOM of a typical large-scale wind project

Components and component services incl. operations and maintenance	HS code	Indicative percentage of BOM	Usual sourcing
Wind turbine incl. generator, gearbox, and nacelle	8501.61; 8501.63; 8501.64;	~18	Global
Rotor blades incl. ball bearings	8412.90; 8482.10; 8482.30;	13–15	Global/local
Tower	7308.xx; 7326.xx;	16–18	Global/local
Transformer	8504.21; 8504.22; 8504.34; 8504.40;	~2.3	Global/local
Electrical	-	10–13	Local
Civil work (incl. foundation, instrumentation and control, engineering procurement and construction contracts, transportation)	-	15–37	Local

Source: Authors' analysis based on International Renewable Energy Agency (IRENA), 2017, 2020a, 2020b.

Table 1 breaks down the components of a typical onshore large-scale wind project. The table includes a generic qualitative indication of whether it is likely to be most economical to source the components of a wind project internationally or domestically. As the table indicates, components such as generators, transformers, nacelles, and rotors are likely to be most economically procured from global manufacturers. Components such as the blades, foundation, cabling, and civil work can be procured and built locally. Naturally, the procurement pattern will depend on national manufacturing capacity and other factors that can vary significantly across developing countries.

Table 2 breaks down the components of a typical solar photovoltaic installation with examples of HS codes, contributions to the overall BOM, and the prices ranges of different components per megawatt (MW), to give a sense of which components tend to be more expensive to procure. The table includes a qualitative indication of which components or services are typically more economical to source internationally versus locally in a large-scale solar project. As the table indicates, components such as solar modules and inverters are most likely to be procured from global manufacturers. Components such as the structures and electrical components—including wiring, protection equipment, and civil work—can be procured and built locally. Countries such as South Africa and Saudi Arabia, for example, already have either the capacity to locally assemble or to design and manufacture specific types of inverters (Blue Horizon, 2017; AlOtaibi et al., 2020). However, it is important to note that regional differences in the cost structure of a solar plant still exist and will continue to do so for the foreseeable future. In order to stimulate and grow the market, developing countries need to understand the differences in the costs for each component of the photovoltaic (PV) system (IRENA, 2020a).

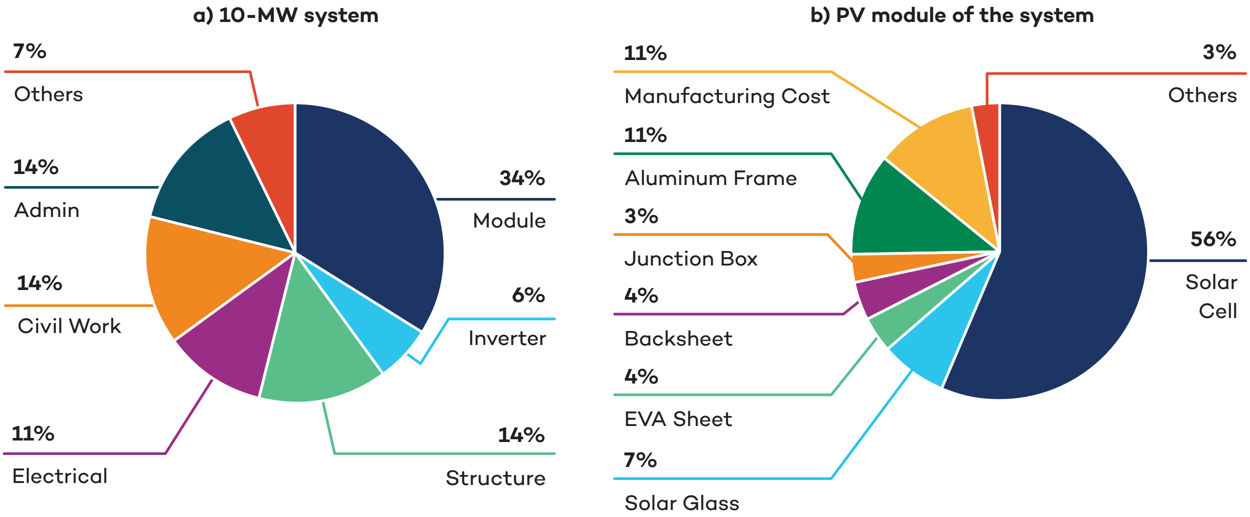
Table 2. BOM of a typical utility-scale solar installation

Components and component services, incl. operation and maintenance	HS6 (2012)	USD per MW	Percentage of BOM	Usual sourcing
Solar modules	8541.29; 8541.40; 8541.90;	~0.5–0.8	30–50	Global
Inverter	8504.40; 8504.90;	~0.4–0.5	5–10	Global/local
Structure (racking & mounting)	7005.10; 7007.19; 7009.91; 7610;	~0.2–0.3	7–10	Global/local
Electrical	8544.xx;	~0.3–0.5	3–11	Global/local
Civil work (incl. instrumentation and control, engineering, procurement, and construction contracts)	-	~0.4–0.5	7–13	Local

Source: Authors' analysis based on Blue Horizon, 2017; IRENA, 2016, 2020a.

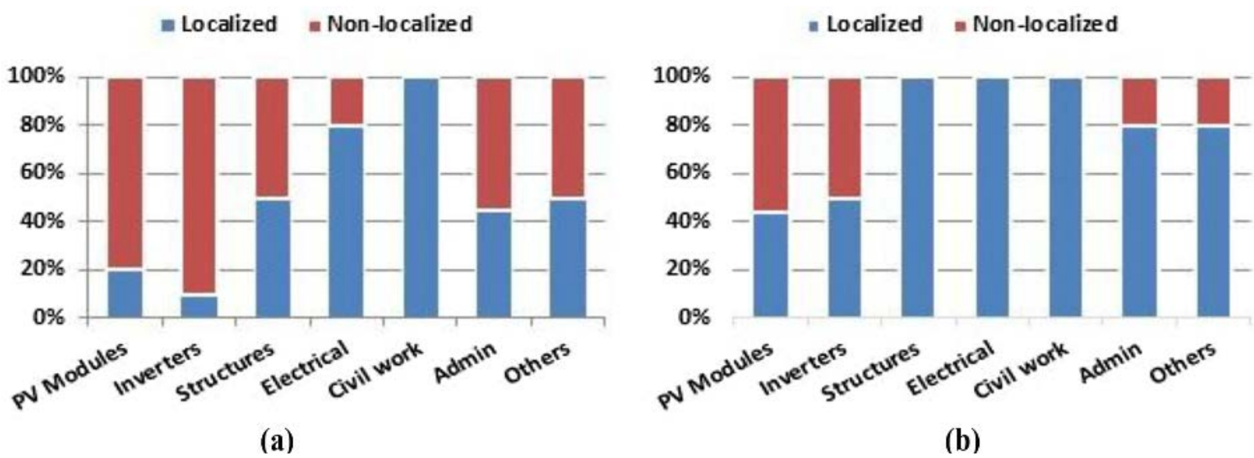
To give an example, one Saudi Arabian study (AlOtaibi et al., 2020) reviewed the cost breakdown of a typical solar project and solar module (Figure 1) and the approximate proportion of each component that could be produced locally in 2018, based on current data and projected data in 2023 (Figure 2). The analysis is representative of both the currently reality of many countries with varying degrees of production capability and political/economic objectives to increase local production where possible.

Figure 1. Breakdown of costs in the PV industry for a) a 10-MW system and b) a PV module of the system



Source: AlOtaibi et al., 2020

Figure 2. Components of the PV value chain a) supplied locally and externally in 2018 and b) potentially supplied locally and externally based on anticipated values for 2023



Source: AlOtaibi et al., 2020.

In this example, PV structures and electrical components could, like civil work, be provided exclusively locally by 2023, as could an increasing proportion of administrative services linked to the project. A greater proportion of PV Modules and inverters could be supplied locally, but more than half of these components would likely continue to be sourced internationally.

3.0 Local Production Spectrum

In order to capture the greatest possible economic benefit from renewable energy deployment, governments are keen to manufacture locally where possible. However, for some components, the centralization of the market and the barriers to entry render competition with international incumbent competitors very difficult. For these components, most governments of smaller countries will recognize that there is a long-term need to import. Larger countries may hope to encourage an established player to establish local manufacturing. At the other end of the scale, there are components that can be readily produced almost anywhere. Between these two extremes there is a large grey area where some countries may decide to develop local manufacturing capacity. In addition, there are opportunities to specialize as regional and potentially global exporters.

As per the trends seen in many developing countries over the past few years, there is a move toward localizing clean energy industries. This has led many countries to consider how to approach trade policy in the renewable energy sector with a view to maximizing local production as a strategic priority.

To understand the prospects for localization of key components, it is informative to consider the degree to which global production for these components is centralized or decentralized. Table 3 presents a summary of the global production for key components of renewable energy projects, based on data drawn from industry literature, and allocates to each component an indicative "Centralization score" indicating whether production is highly centralized (1), involves a wider range of competing producers (2) or is relatively decentralized (3). The table shows that solar module and wind turbine production is concentrated in a relatively small number of countries indicating relatively high barriers to entry for local competitors and potentially high economy of scale effects.

Table 3. Global market for key components for renewable energy projects

Key components	Key companies	Global production	Centralization score
Utility-scale solar PV			
Solar Modules [8541]	JinkoSolar, JA Solar, SunPower, Canadian Solar, Panasonic	Over 75% in China, followed by rest of Asia, North America, India, and Europe	1
Inverter [8504]	Huawei, Sungrow, SMA, Power Electronics, Firmer, ABB	Top 10 largest inverter vendors manufacturers accounted for 75% of global trade	1
Structures [e.g., 7005]	Countries will have several suppliers for structures. Typical market entrants are steel companies.	Racks and mounting market is highly fragmented, with production capacity available in many countries	3

Key components	Key companies	Global production	Centralization score
Onshore wind power plants			
Wind turbine incl. Generator, Nacelle, Gearbox [e.g., 8501]	Vestas, Siemens Gamesa, Goldwind, GE, Envision, Ming Yang	The top 10 largest wind turbine manufacturers accounted for over 75% of the total global installed capacity. An industry with around 40 players globally concentrated in Europe, North America, China, and India.	1 e.g., Vestas has manufacturing facilities in eight countries.
Rotor blades [e.g., 8412]	LM Wind, Enercon, Zhongfu, Suzion, Tecsis Market shared between wind turbine manufacturers and, independent manufacturers, who supply the products to wind turbine generator manufacturers.	Most rotor blade manufacturing facilities are located in Europe, North America, China, India, Brazil, and several other countries.	2 e.g., LM Wind is present in 10 countries in North and South America, Europe, and Asia. Their factories are represented in all major wind energy markets.
Towers [e.g., 7308]	Nordex Group, Broadwind, Suzlon Group, Trinity Structural Towers Inc, Valmont Industries Inc.	Fragmented market of regional and national manufacturers	3

Sources: Fraunhofer, 2020; International Energy Agency (IEA), 2020; Global Wind Energy Council (GWEC), 2020; Loomsolar, 2020; LM, 2020; Mordor Intelligence, 2019; Wood Mackenzie, 2019.

A key finding of this analysis is that the greatest opportunities to increase local production come not from the big-ticket items, such as modules or wind turbine components, but from promoting local production of structures, towers, and electrical subsystems as well as through local services, including design and civil works. Development of local capacity for design and construction services may still face barriers, but the barriers to skills transfer are likely to be lower than the barriers to technology transfer.

4.0 Trade Impacts on Local Production

This section explores the trade policy implications for selected developing countries of the findings in previous sections. It assesses, in particular, the kinds of tariff setting developing countries have in place regarding components of wind and solar energy generation and how these settings may reflect different countries' policy priorities. Tariff policy can often lag behind the economics of rapidly evolving sectors, so this section seeks to understand whether existing tariff levels are appropriately set to achieve governments' policy priorities in light of the rapid evolution of the renewable energy sector.[1] Based on this analysis, the section concludes with recommendations for future trade negotiations at the regional, plurilateral, or multilateral level.

In the absence of consistent production data for the different HS codes identified in Section 2, the analysis looks at exports of these components as a proxy for productive capacity. Countries with the ability to export have arguably developed some level of competitiveness in those areas, be it at the regional or international level. This approach tends, however, to underestimate existing technological capabilities because some countries may be able to produce those components but do not necessarily export them. Second, it should be noted that the HS codes listed in Tables 1 and 2 may not be used exclusively in the production of solar or wind energy.[2] This is particularly the case for HS codes at the four-digit level, though probably less so in the case of six-digit level codes. For example, goods falling under HS code 8544 cover insulated wire, cable, and other insulated electric conductors, as well as optical fiber cables. These can have multiple purposes besides being used as electrical components in the production of solar energy. Third, exports may reflect assembling capacities as opposed to complex production capacities. For example, a country may import solar cells and assemble them into modules that are subsequently re-exported. Notwithstanding these limitations, we consider that, generally, exports in the HS codes listed here—and particularly those at the six-digit level—are sufficiently detailed to indicate at least a potential technological capacity to produce solar and wind components, if not an actual one.

Keeping those assumptions in mind, Tables 5 and 6 show trade performances of the top 30 low-income and lower-middle-income exporters of solar and wind components, using the World Bank country classification. For each of them, the table indicates average exports and net trade (i.e., exports minus imports) between 2017 and 2019, and highlights in red countries that are net exporters. To complement the trade data, the four columns on the right show the level of average tariffs applied to the different categories of components described in Section 2 for both wind and solar.

[1] It should be noted that besides tariff protection, non-tariff measures are likely to play a critical role in defining market access conditions and export capacities. This dimension is, however, beyond the scope of this policy brief.

[2] Differences reflecting the exact end-use of products are often established at the eight, ten or even twelve-digit level. However, HS codes are harmonized internationally only up to the six-digit level.

Table 4. Trade and applied tariffs in solar components in top 30 low-income countries and low middle-income exporters.

	Trade (avg. 2017–2019, USD million)		Average applied tariff (%)			
Country	**Exports**	**Net trade**	**Solar Modules**	**Inverter**	**Structure (Racking & mounting)**	**Electrical**
Vietnam	8,077.4	2,297.4	0.0	1.2	16.0	7.9
Philippines	7,274.8	4,710.8	0.0	0.7	9.8	8.6
Morocco	3,680.8	2,964.3	2.5	4.8	15.4	14.8
India	2,442.2	-4,185.5	0.0	13.1	10.0	10.3
Tunisia	2,066.7	1,508.0	5.0	12.3	20.0	12.5
Egypt	692.0	-314.8	0.0	0.7	43.3	6.3
Nicaragua	669.5	511.0	0.0	0.0	7.5	4.6
Honduras	615.3	369.5	0.0	0.0	7.5	4.6
Cambodia	299.6	1.4	15.0	14.5	15.0	11.0
El Salvador	152.3	13.5	0.0	0.0	7.5	4.6
Sri Lanka	76.6	-89.5	0.0	0.0	18.0	12.8
Lao PDR	42.7	-58.2	5.0	5.0	6.4	5.0
Myanmar	20.3	-309.3	7.5	3.0	3.6	4.1
Zambia	16.0	-65.1	10.0	2.5	13.3	22.5
Senegal	8.1	-122.6	3.8	5.0	20.0	13.8
Angola	7.3	-297.9	2.0	2.0	10.5	9.0
Bangladesh	7.2	-463.7	3.8	14.4	21.7	19.1
Kenya	6.8	-213.5	0.0	0.0	11.3	21.9
Pakistan	5.8	-857.9	3.0	10.6	20.0	21.2
Ethiopia	4.7	-95.0	n.a.	n.a.	n.a.	n.a.
Nigeria	2.9	-511.7	3.8	5.0	20.0	13.8
Eswatini	2.4	-10.8	0.0	2.5	9.3	12.8
Mozambique	2.1	-90.7	7.5	5.0	10.6	7.5
Tanzania	1.9	-139.8	0.0	0.0	17.5	21.9
Ghana	1.9	-199.0	3.8	5.0	20.0	13.8
Cameroon	1.8	-89.0	10.0	10.0	22.0	16.9

	Trade (avg. 2017–2019, USD million)		Average applied tariff (%)			
Country	**Exports**	**Net trade**	**Solar Modules**	**Inverter**	**Structure (Racking & mounting)**	**Electrical**
Cote d'Ivoire	1.7	-97.7	3.8	5.0	20.0	13.8
Zimbabwe	1.7	-38.6	3.3	0.0	22.5	14.7
Mauritania	1.4	-45.8	7.7	13.0	18.3	16.5
Sierra Leone	1.1	-14.3	11.7	20.0	20.0	14.4
Average Tariffs			**3.8**	**5.4**	**15.8**	**12.4**

Source: Author's elaboration based on Comtrade and World Trade Organization (WTO) Integrated Database (IDB).

Table 5. Trade and applied tariffs in wind components in top 30 low-income countries and low- middle-income exporters

	Trade (avg. 2017–2019, USD million)		Average applied tariff (%)			
Country	**Exports**	**Net trade**	**Wind turbine**	**Rotor Blades**	**Tower**	**Transformer**
India	2,882.2	-124.5	8.0	7.5	10.2	12.8
Philippines	1,971.3	741.1	1.0	1.8	10.5	4.6
Vietnam	1,837.7	-359.5	9.0	1.2	11.6	7.6
Tunisia	145.9	11.3	0.0	0.0	20.0	20.0
Cambodia	96.9	-130.8	15.0	15.0	11.0	12.9
Morocco	87.3	-301.9	2.5	2.5	22.7	11.4
Egypt	68.7	-633.1	5.0	4.0	14.6	4.0
Sri Lanka	17.9	-142.1	0.0	0.0	14.9	7.5
El Salvador	17.8	-43.2	0.0	0.0	4.1	0.0
Angola	13.5	-353.3	0.0	0.0	11.7	0.0
Pakistan	11.5	-637.2	16.6	5.7	17.4	17.0
Bangladesh	11.5	-522.5	1.0	5.3	19.6	16.4
Lao PDR	10.1	-175.9	5.0	5.0	5.0	5.0
Ethiopia	4.6	-157.3	5.0	13.3	14.1	3.3

	Trade (avg. 2017–2019, USD million)		Average applied tariff (%)			
Country	**Exports**	**Net trade**	**Wind turbine**	**Rotor Blades**	**Tower**	**Transformer**
Myanmar	4.3	-326.0	3.0	2.4	3.0	3.0
Kenya	3.6	-175.4	0.0	6.7	19.5	0.0
Ghana	3.2	-218.4	5.0	8.3	11.8	5.0
Cote d'Ivoire	3.0	-125.7	5.0	8.3	11.8	5.0
Nicaragua	2.9	-45.9	0.0	0.0	4.0	0.0
Papua New Guinea	2.8	-87.1	0.0	0.0	10.7	0.0
Zimbabwe	2.3	-41.0	0.0	5.0	22.3	9.2
Eswatini	2.2	-11.5	0.0	0.0	9.8	7.5
Nigeria	2.0	-570.3	5.0	8.3	10.5	4.2
Senegal	1.9	-146.7	5.0	8.3	11.8	5.0
Sierra Leone	1.6	-24.6	5.0	11.7	15.0	20.0
Tanzania	1.2	-135.7	0.0	6.7	15.0	0.0
Mauritania	1.1	-75.8	7.0	10.3	16.3	7.0
Congo, Republic	1.1	-49.8	5.0	10.0	11.8	5.0
Cameroon	1.0	-97.6	10.0	10.0	11.3	10.0
Haiti	0.9	-19.5	3.8	3.3	1.4	2.5
Average tariffs			**4.1**	**5.4**	**12.4**	**6.9**

Source: Author's elaboration based on Comtrade and WTO IDB.

Overall, the vast majority of low-income and lower-middle-income countries are net importers of wind and solar components. Among the top 30 leading exporters of solar components, only eight have a trade surplus, while 22 are net importers. This is even more marked in the wind sector, where only two countries export more than they import. In terms of trade protection, it is interesting to see that average tariffs on solar modules (3.8%) and inverters (5.4%) are significantly lower than the ones applied to structure (15.8%) and electrical (12.4%) components. This seems consistent with the findings from Section 3, highlighting that solar modules need to be sourced globally, and, therefore, lower tariff levels would help ensure they are accessible to businesses. Similarly, in the case of wind, average tariffs on wind turbines (4.1%), which are generally sourced internationally, are lower than those applied to wind towers (12.4%), which can be produced locally. They are, however, only marginally lower than those on transformers (6.9%), which could also arguably be produced domestically.

In short, the average tariff structure of low-income and lower-middle-income countries only partially reflects the extent to which specific components are expected to be sourced internationally or locally. Residual tariffs remain on items expected to be sourced globally, while those expected to be sourced domestically do not always benefit from a significantly higher level of protection. Several factors may explain this reality.

To get a clearer picture, we compare applied levels of tariff protections and export data in the different solar and wind components. Table 6 illustrates the different situations resulting from the interaction of those two variables using a matrix approach. It represents a rough typology of the different trade policy settings present in the countries studied. Quadrant 1 of the matrix corresponds to situations where the country has production or export capacity and maintains only a low level of (or no) tariff protection. This combination of factors suggests that the country has a comparative advantage in this export-oriented sector and is able to withstand international competition. Quadrant 2 shows a situation where the government maintains medium to high tariffs on items that are produced domestically. This may be as a result of a policy of protecting nascent or already established domestic industry from international competition. Quadrant 3 suggests a situation of import dependency when domestic productive capacities are limited, and the country relies on imports of components to meet local demand. Finally, Quadrant 4 refers to cases where no or limited domestic production exists but medium to high tariffs are still imposed. This suggests governments may be taxing imports essentially to generate revenues. Alternatively, it may be that the government anticipates future domestic production and is applying preemptive domestic protection.

Table 6. Trade policy objectives: the productive capacity and applied tariffs matrix

		Level of applied tariffs	
		Low to no tariff protection	**Medium to high tariff protection**
Productive capacity	**Existing production and export capacity**	1. Export-oriented sector	2. Protection of domestic industry
	No or limited production or export capacity	3. Import dependent	4. Use of tariffs to generate revenue

Table 6 highlights the possible objectives of using tariffs in different industrial circumstances, including where there is existing production and export capacity. Depending on the context, the imposition of tariffs may stimulate the deployment of additional productive capacity, particularly for products that are suited to local production. Table 7 explores the relationship between tariffs and local sourcing and revenue raising. It shows that where tariffs promote local sourcing without substantially increasing project costs, the overall impact may be positive. However, the overall impact of tariffs on highly centralized components is very likely to be negative, as tariffs increase costs and reduce the deployment of renewable energy. For moderately centralized components (for example, wind turbine blades), the results are strongly case dependent. It should also be noted that all tariffs increase project costs and reduce renewable energy deployment.

Table 7. Trade policy objectives: impact of tariffs on local sourcing and production

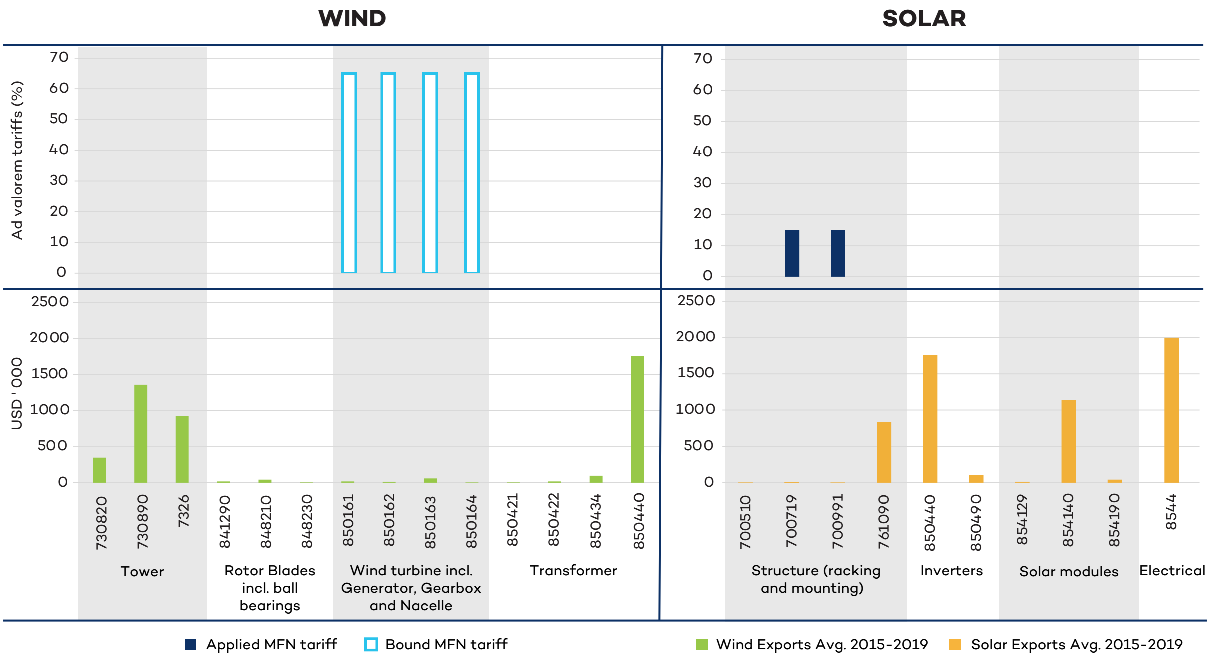
Tariffs applied to component type	Possible intended impacts	Potential unintended impact/cost	Balance of costs and benefits
Components that have existing competitive local production or are suited to local production	Increased local sourcing	Increased project costs, reduced rate of renewable energy deployment	Positive
Moderately centralized components	Increased local production capacity		Strongly case dependent
Highly centralized components	Revenue raising		Mostly negative

The rest of this section provides examples of the four situations highlighted in Table 6 by comparing average exports between 2015 and 2019 and applied and bound tariffs for each of the HS codes corresponding to the various components of solar and wind identified in Section 2. The examples cover four different countries from Africa and Asia illustrating a variety of situations. Bound tariffs correspond to the maximum limit authorized under a country's specific WTO schedule of commitments. In practice, however, most WTO members apply lower tariff levels, referred to as applied rates. The difference between the maximum bound at the WTO and the level effectively applied on a most-favoured-nation (MFN) basis is called tariff overhang or "water in the tariff."[3]

Mauritius, shown in Figure 3, provides an example of a country maintaining a very low level of tariff protection, with most solar and wind components being imported duty free. This applies both to items where the country has limited productive capacity and therefore needs to source those components internationally (e.g., wind turbines), and items where Mauritius has export capacity (e.g., wind towers, solar modules, or static converters (HS 850440)), indicating that those sectors are probably competitive. It is also interesting to note that Mauritius undertook commitments in the WTO only on solar and wind components, which tend to be more difficult to produce domestically (e.g., wind turbines, solar modules, inverters), leaving those easier to source locally completely unbound—a situation that allows Mauritius to impose any level of tariff to protect its domestic production if the need occurs.

[3] This does not reflect tariff preferences granted to some trading partners only under bilateral or regional trade agreements.

Figure 3. Tariffs and exports of wind and solar components in Mauritius



Source: Author's elaboration based on Comtrade and WTO IDB.

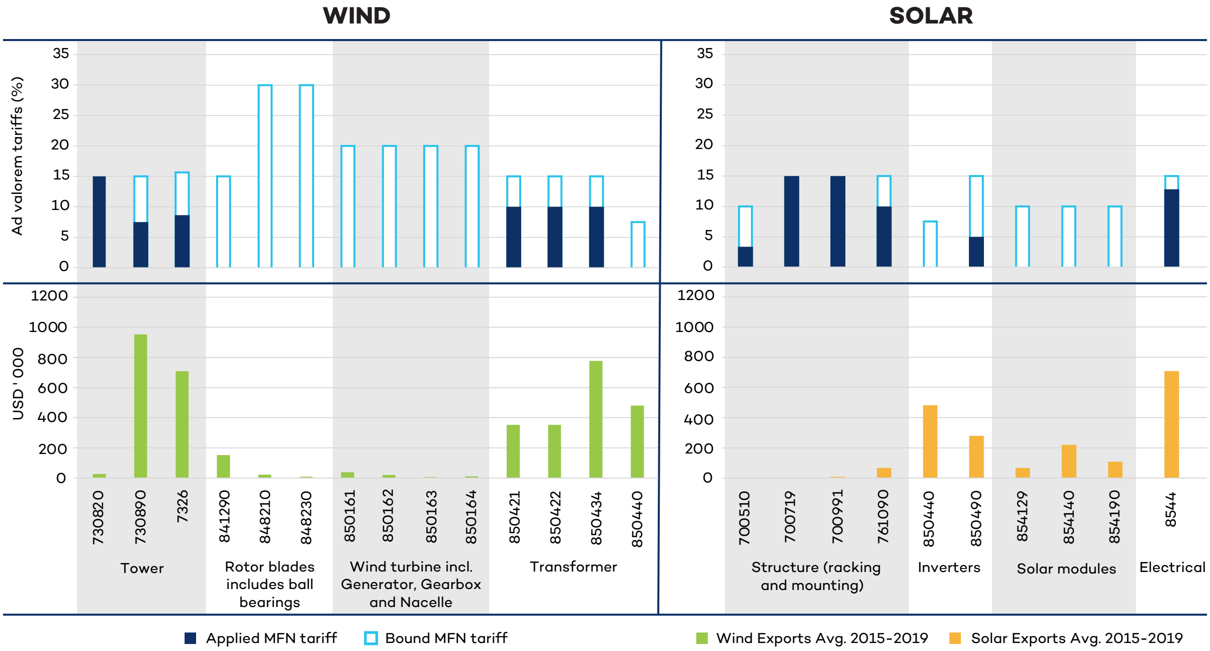
Note: In its schedule of commitments, Mauritius has bound its tariffs on the four items listed here as wind turbines (HS 850161 – 4) at 65% and its tariff on static converter (HS 850440) at zero. Regarding solar components, Mauritius has bound items listed here as inverters, solar modules, and electrical at zero. All other components (i.e., wind towers, rotor blades or solar structures) are unbound, meaning that Mauritius is free to set the level of tariff protection on those items without any constraint from a WTO perspective. In practice, however, Mauritius allows all these items to enter the country duty free with the exception of a 15% tariff on HS 700719 and 700991.

Namibia's wind sector, in Figure 4, illustrates a situation where some tariff protection is maintained on items produced domestically, such as components for wind towers or transformers, while allowing items sourced internationally like rotors, blades, or wind turbines, to enter the country free of charge. This provides an example of targeted industry protection, probably indicating that the sector is not yet able to face international competition.[4] It is interesting to note that bound tariffs in the WTO on those components oscillate between 15% and 30% in a rather uniform way, whereas applied rates seem to match more precisely the country's industrial policy objectives to protect domestic production while removing trade obstacles where the country depends on imports.

[4] As explained further below, the tariff structure in Namibia reflects the SACU common external tariff and is not fully defined by Namibia's productive capacity.

Interestingly, however, the situation is quite the opposite when looking at the solar sector. Here, tariffs are mostly applied to components for which Namibia does not seem to have strong productive capacities, while several items being exported do not benefit from any tariff protection. This counterintuitive situation may be explained by the fact that Namibia is a member of the Southern African Customs Union (SACU) together with Botswana, Lesotho, South Africa, and Eswatini and needs to apply the same external tariff as other members. In other words, the tariff structure might have been designed to protect sensitivities in other countries of the customs union.[5]

Figure 4. Tariffs and exports of wind and solar components in Namibia

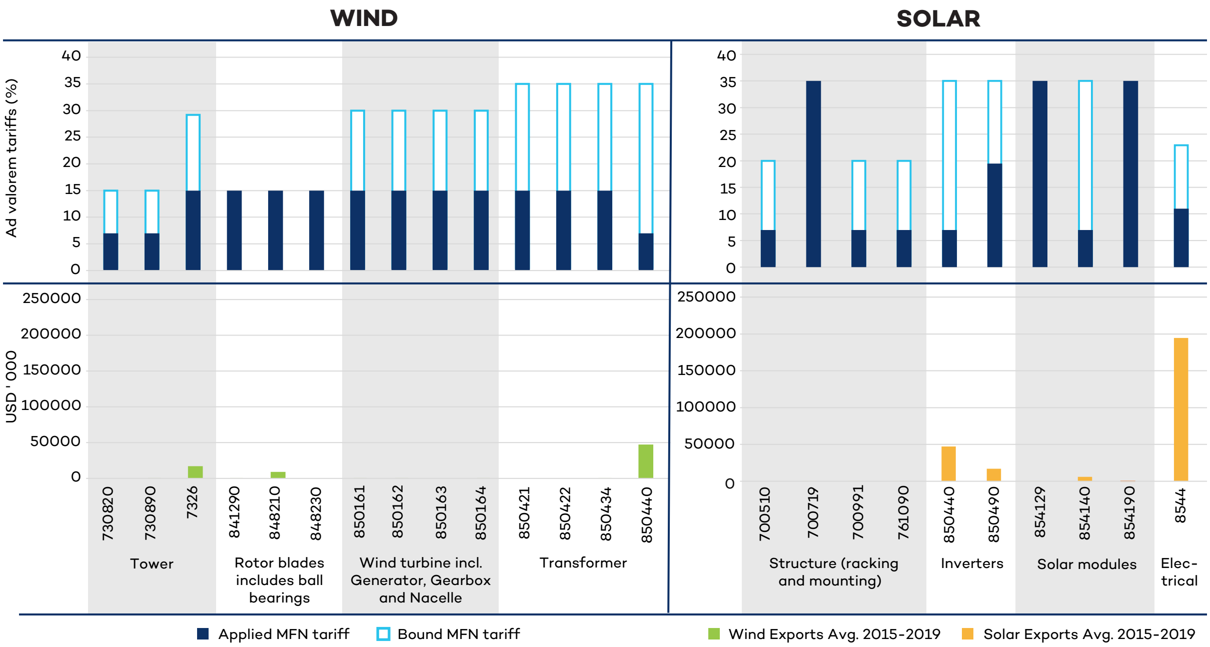


Source: Author's elaboration based on Comtrade and WTO IDB.

The third example looks at Cambodia, shown in Figure 5, which provides yet another tariff profile. Cambodia is the only least developed country (LDC) covered in Table 5 that exhibits a net trade surplus in solar components. This is exclusively due to exports in electrical items under HS code 8544, which covers insulated wire, cable, and other insulated electric conductors. Overall, however, tariff protection is consistently applied to all wind and solar components regardless of the productive capacity of the country or its export performances. While the bound rates seem to increase for more technology-intensive items such as wind turbines or solar modules, applied rates do not follow this pattern. This seems to indicate a situation where tariffs are used mostly as a source of government revenue rather than a particular attempt to protect industry.

[5] It should be noted, however, that this hypothesis explains only part of the discrepancies. While South Africa has slightly better productive capacity in solar structures, overall, its export profile for wind and solar components does not present a significantly different structure than the one from Namibia.

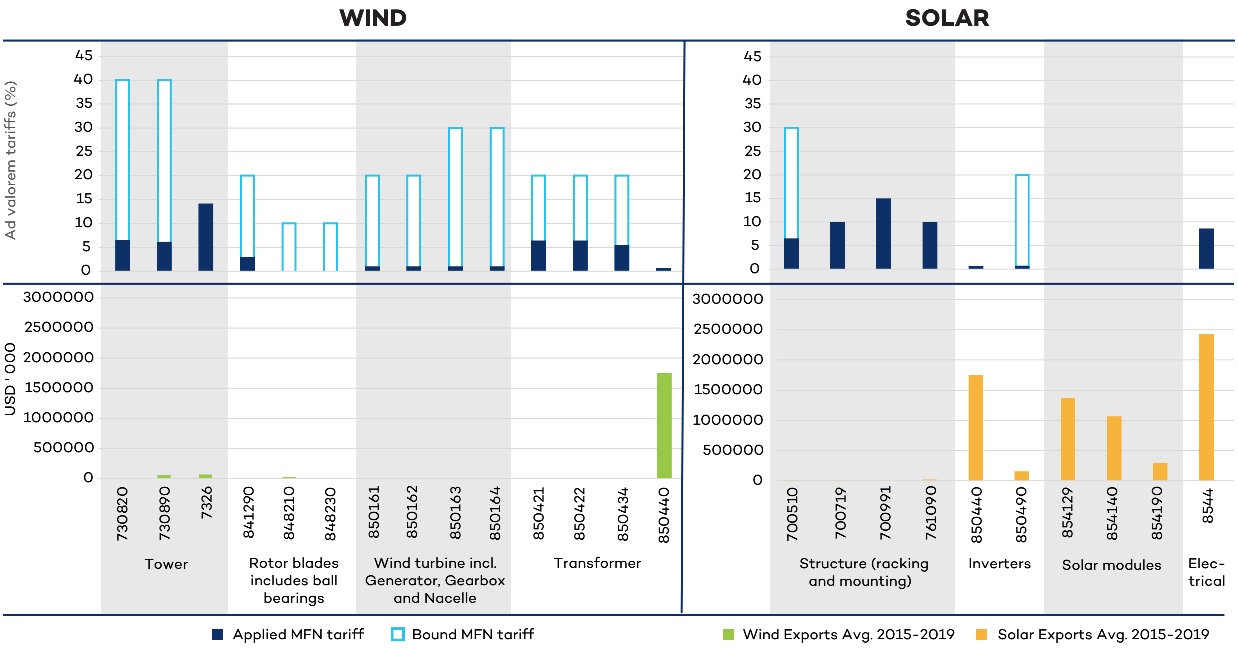
Figure 5. Tariffs and exports of wind and solar components in Cambodia



Source: Author's elaboration based on Comtrade and WTO IDB.

Finally, Figure 6 shows the case of the Philippines, the only country, along with Tunisia, that is a net exporter of both solar and wind components. In the case of wind, exports concentrate almost exclusively on static converters (also used in the solar industry). In solar, however, the country has significant export capacity for several items under solar modules including photosensitive semiconductor devices and electrical components. It is interesting to note that the most-exported items are those for which tariffs have been consolidated at zero in the WTO. This further indicates a strong level of competitiveness in this export-oriented sector. By contrast, residual tariffs maintained—particularly for solar structures or wind turbines, transformers, and towers where the Philippines does not have strong producing capacities—look more like nuisance tariffs that may disincentivize imports if margins are thin without generating significant tariff revenues.

Figure 6. Tariffs and exports of wind and solar components in the Philippines



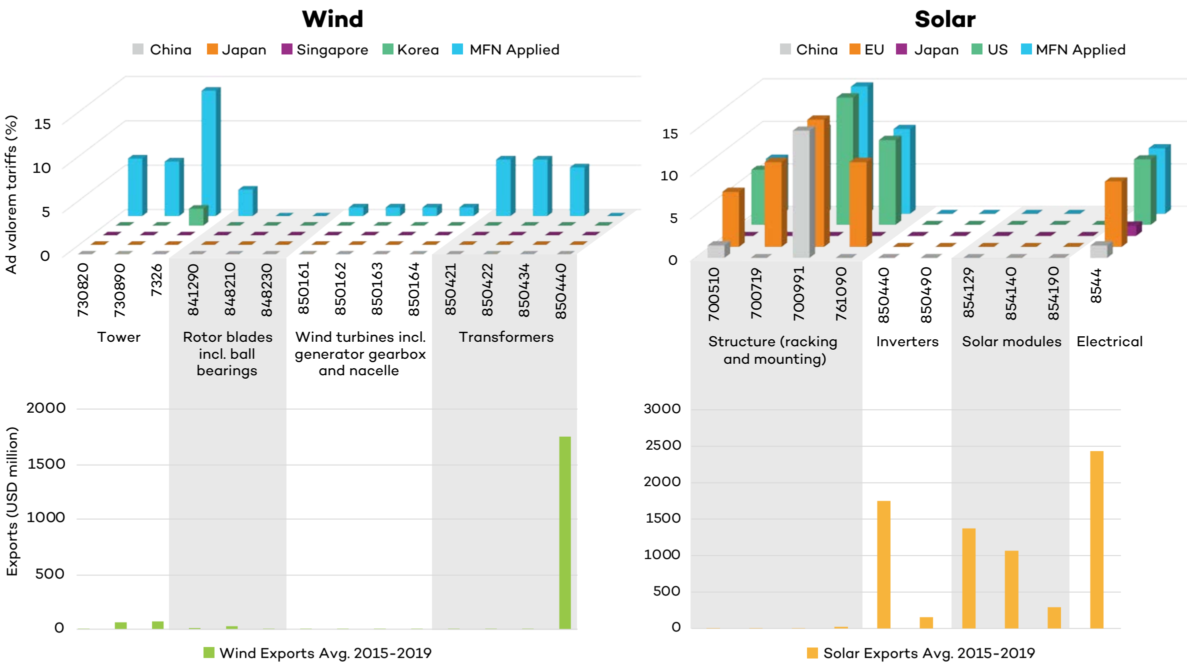
Source: Author's elaboration based on Comtrade and WTO IDB.

For a full picture, however, the analysis should not be limited to MFN applied rates. In today's highly integrated world economy, numerous countries have negotiated bilateral or regional trade agreements that further reduce their tariffs below MFN levels. In other words, effective market access conditions are increasingly defined by commitments undertaken in free trade agreements, while MFN rates tend to become the exception. To consider this dimension, Figure 7 looks at market access concessions granted by the Philippines to its main trading partners under different free trade agreements. For each set of wind and solar components, the figure shows the country production, the top four trading partners exporting to the Philippines, and the tariff rate paid by those exporters. For comparison purposes, the figure also shows the MFN applied rate.

In the case of wind, the figure clearly illustrates how nuisance tariffs applied on an MFN basis to wind towers or transformers have been removed under the Philippines' free trade agreements with the main providers of those components—China, Japan, Singapore, and Korea. In the case of solar, however, tariffs on structural components including racking and mounting have only been partially removed through regional trade agreements. While imports from Japan are entirely duty free, the Philippines' free trade agreement with China excludes some sensitive products from its list of commitments. In the case of the European Union and United States, which also represent a major source of import, the Philippines still applies MFN rates in the absence of a specific agreement.

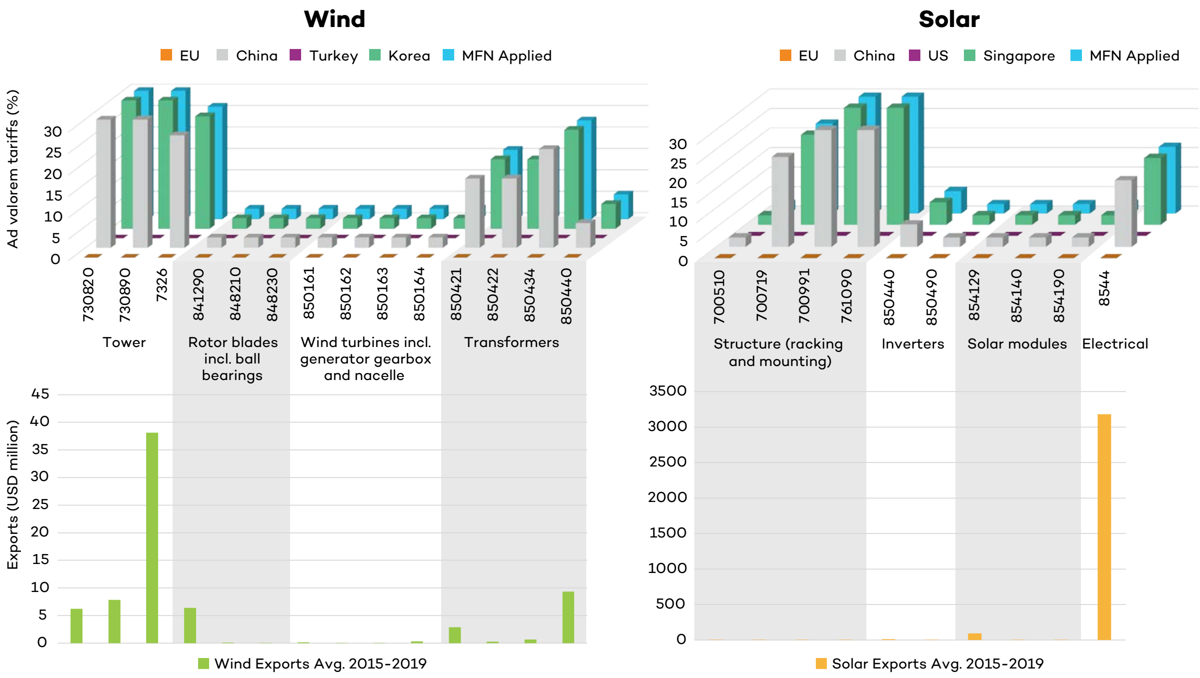
Figure 8 does the same analysis for Morocco, one of the countries with the strongest productive capacities in wind and solar components. Here, tariff protections provided through MFN rates on wind components produced domestically (such as wind towers or transformers) have been removed for exports from the European Union and Turkey, two of the largest providers of wind components, while Morocco still trades under MFN conditions with China and Korea. Such commitments may undermine efforts at protecting the domestic industry if national production is not ready to face international competition. In the case of solar, by contrast, regional trade agreements with the European Union and the United States may facilitate imports of components such as solar structures that are not produced domestically.

Figure 7. Preferential tariffs and exports of wind and solar components in the Philippines



Source: Author's elaboration based on Comtrade and WTO IDB.

Figure 8. Preferential Tariffs and exports of wind and solar components in Morocco



Source: Author's elaboration based on Comtrade and WTO IDB.

These examples illustrate a variety of situations depending on existing productive or export capacity, existing trade agreements, and the particular trade policy objectives pursued by the country. This, in turn, should inform the extent to which a country may want to engage in new initiatives at the regional or multilateral level aimed at removing trade barriers on solar and wind components. On the offensive side, countries such as the Philippines or Mauritius—which have well established export capacities (e.g., in static converters and solar modules) and fairly low levels of protection—have an obvious interest in removing trade obstacles on those goods internationally. For example, with a significant share of its exports going to the United States or the European Union on an MFN basis, the Philippines might benefit from a broad-based initiative involving a critical mass of importing economies at the global level. With roughly half of all its exports of wind and solar components going to China and India, Mauritius might in particular benefit from targeting liberalization by those trading partners as a priority. Cambodia, another net exporter of solar components, may want to pursue a similar exercise in the context of the Asia-Pacific Economic Cooperation group, where over 90% of its exports go.

Countries that rely on imports to meet their domestic needs would also have an interest in reducing trade obstacles on specific solar and wind HS codes. The rationale for international cooperation is, however, weaker in this case, as nothing would prevent them from unilaterally reducing their own tariff protection on items being sourced internationally. In several cases, as shown by the Philippines or Morocco examples, such market opening also takes place under regional or bilateral free trade agreements. This may nonetheless serve as a trade-off opportunity to achieve concessions in products where they have a more offensive interest.

The situation may be more complex for countries that maintain some level of protection on HS codes where they have export capacity. These tariffs may be designed to protect domestic industry. Removing such protection may result in imports outcompeting domestic production if domestic businesses are less competitive than foreign suppliers. On the other hand, such protection may also result in economic inefficiencies (e.g., less choice, higher prices, potential adverse impacts on the long-term development of infant industries, etc.) and may cause more harm than good. In other words, exposure to international trade may force domestic industries to become more competitive. These are some of the trade-offs governments must consider in protecting domestic industries versus allowing competitive imports from foreign suppliers. This reflection is especially pertinent in the context of the renewable energy sector, the development of which promises a range of environmental benefits that need to be factored into any considerations related to protecting domestic industries versus reducing trade barriers.

At the same time, if the country has export capacity, it may naturally have an interest in removing trade barriers affecting those items in global markets. Here again it is relevant to look at export destinations. For example, Namibia exports nearly 80% of its wind components to South Africa, which is part of SACU. In these circumstances, the country may want to maintain some level of protection under the common external tariff and continue to benefit from preferential access to the South African market. By contrast, a country like Tunisia—which protects static converters, or electrical components for solar while exhibiting a large trade surplus in those goods—could consider reducing its level of protection in exchange for enhanced market access, including with the European Union where a large proportion of its exports go.

Finally, countries that impose trade barriers for tariff revenue purposes have lower incentives to engage in international collaborative efforts, particularly if they do not have products of export interest for which they would want to remove trade obstacles internationally. Given the importance of scaling up the diffusion and uptake of clean energy technologies, these countries may still want to remove obstacles to trade in renewables, at least gradually. Barriers increase project costs and therefore prices for consumers. They may also delay the renewable energy transition and affect the ability of a country to meet its global climate commitments. The longer transition periods associated with technical assistance and capacity building may encourage those countries to join international initiatives aimed at liberalizing trade in wind and solar components.

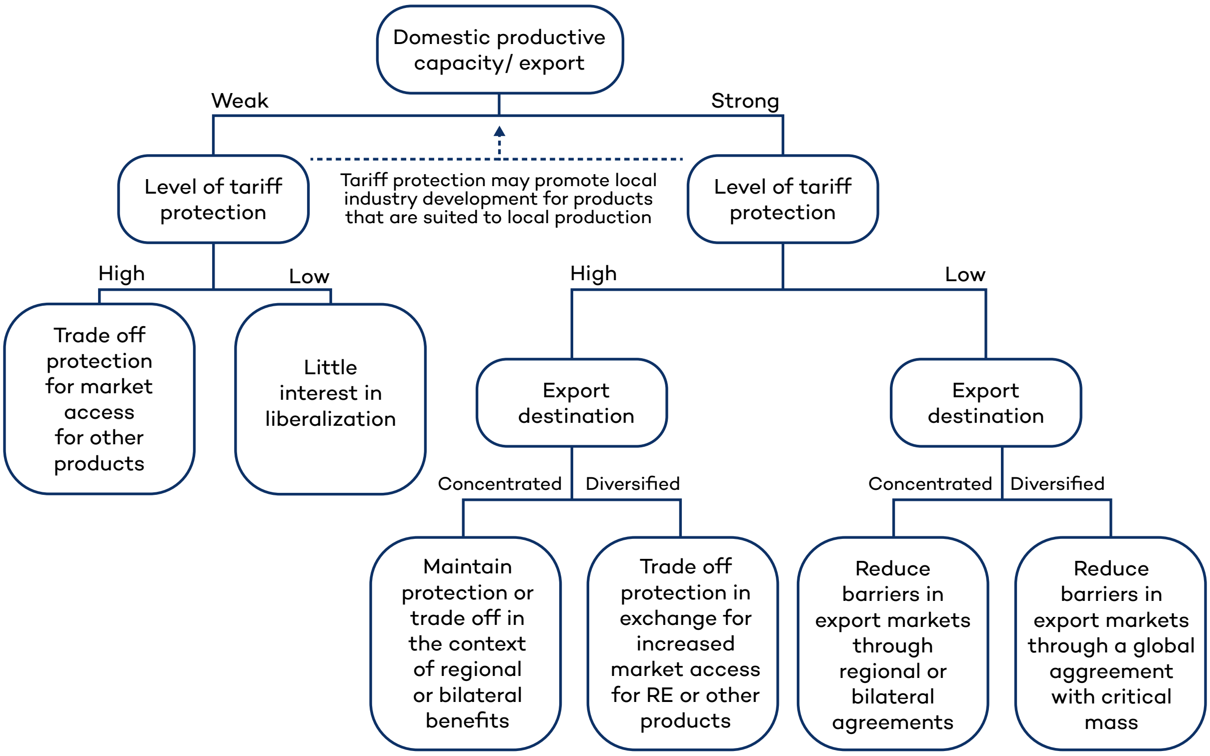
5.0 Conclusion

The analysis here highlights that in most cases the reduction of trade barriers in renewable energy components will reduce project costs and increase deployment of renewable energy. Many of the more complex and expensive components are produced in a small number of countries in a competitive market. For these components, the barriers to entry for new manufacturers are high, and tariffs on imports are likely to simply increase costs without fostering local production. However, there is much value to be captured for countries deploying renewable energy. Structures, and ancillary components which are often locally manufactured, represent significant proportions of the total project cost.

There are also some cases where trade barriers can be justified, at least for a time, such as where governments are aiming to protect local production of components that can soon be competitively produced locally. A good example of this is the production of heavy or bulky components such as towers, for which minimizing transport distances provides a cost advantage. In these cases, there is the need for judgement regarding the likelihood of achieving competitive production along with the balance between increased project cost and the economic value of local production. Imposing tariffs without a realistic chance of achieving competitiveness can be regarded as simply a revenue-raising measure that is likely to push up the cost of renewable energy deployment without creating wider economic benefits and without generating national industries.

International initiatives that reduce barriers to environmental goods and to trade in environmental services could reduce costs and barriers to trade and increase renewable energy deployment as a whole. These initiatives could be pursued at a multilateral level at the WTO, where similar initiatives have been attempted under the Doha Development Agenda. They could also be pursued at a regional or plurilateral level, where they have already been successful; Asia-Pacific Economic Cooperation (APEC) economies agreed in 2012 to reduce tariffs on environmental goods and published details of the cuts planned in 2016 (APEC, 2016). The Agreement on Climate Change, Trade and Sustainability currently being negotiated between New Zealand, Iceland, Switzerland, Norway, Fiji, and Costa Rica will include commitments on reductions to barriers to trade in environmental goods and services. This paper has shown how countries' interests in liberalizing trade in environmental goods, in particular those related to equipment for wind and solar energy generation, vary depending on their productive capacity, trade policy settings, and export structure. Generalized examples of the countries' different positions are summarized in Figure 9.

Figure 9. Policy options and considerations regarding tariffs on renewable energy equipment



Source: Author's elaboration.

However, the opportunities for liberalization of environmental goods and services should be accompanied by policies that support the competitive local production of components and the provision of local services to support renewable energy production in the long term. This paper has identified many of the components that are usually sourced locally, including in particular services related to the construction, operation, and maintenance of wind and solar energy installation. Complete reliance on imports of components (and in particular of imported services) may reduce the political acceptability of renewable energy investments among domestic constituents. Producing components and ancillary services domestically wherever it is economically viable to do so can help to build the political—as well as the economic—case for a transition to renewable energy. This may call for allowing exceptions for some of these components as part of a list of sensitive items under either regional or plurilateral initiatives.

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