UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

Powering trade

Fine-tuning trade policy for solar and wind energy value chains

UN trade & development | UNCTAD | >60 years

Introduction

**In our race against global warming,
every fraction of a degree matters.**

Renewable energy has the power to decouple our prosperity from the CO_2 emissions that fuel global warming. Moreover, it has the potential to bring power to more than 680 million people living without electricity, and reduce the poverty that implies.

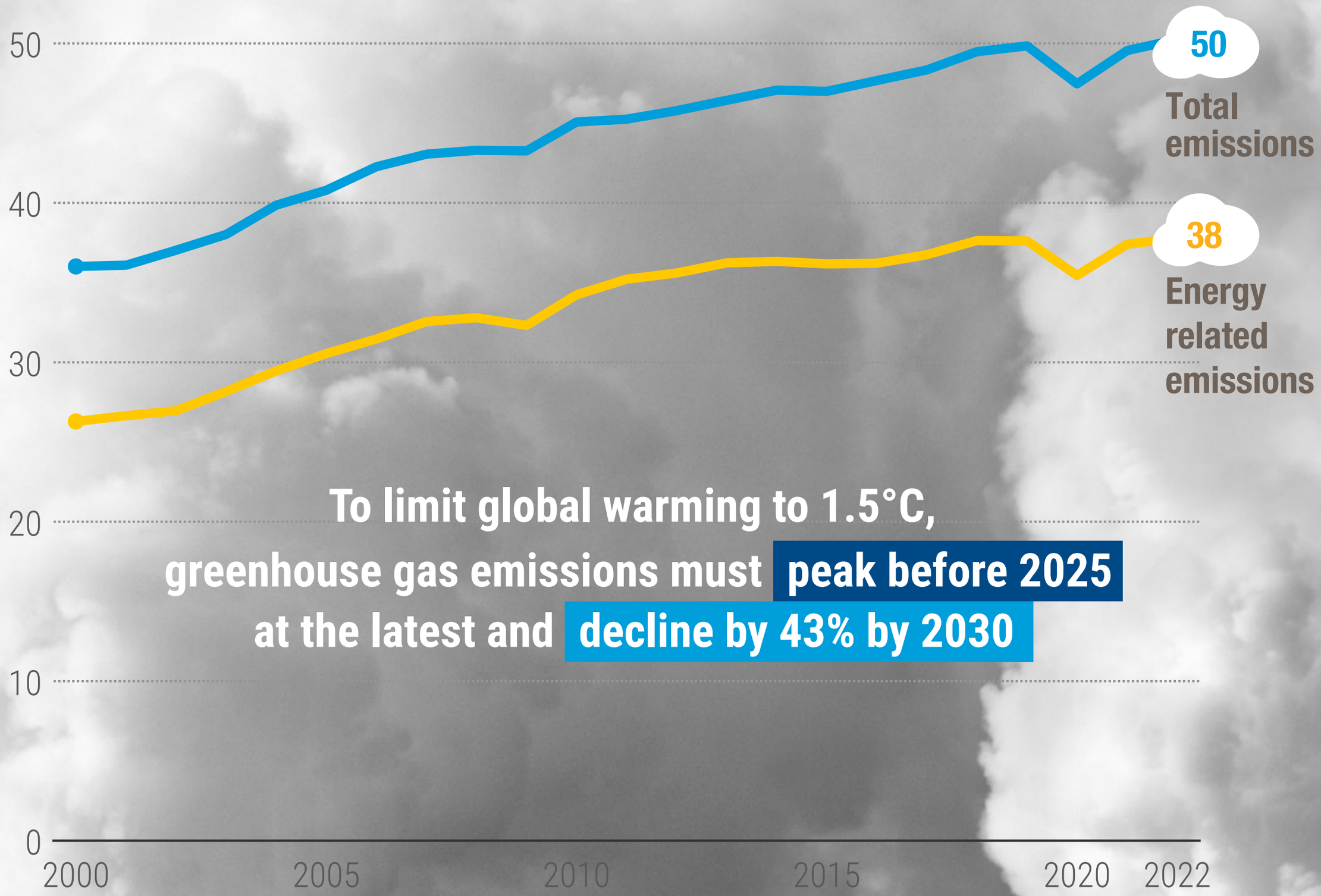
To minimise dependency on fossil fuels, we must expand our capacity to produce renewable energy everywhere. This expansion means that trade in renewable energy goods must grow faster than it has done over the last decade.

We must reassess whether tariffs and other trade measures support or hinder the expansion of solar and wind energy technologies worldwide. This will provide insights for trade policy improvements.

**Better trade policy can help save
the fractions of a degree we sorely need.**

Greenhouse gas emissions continue to rise, despite energy transition efforts.

Gigatons of CO_2 equivalent

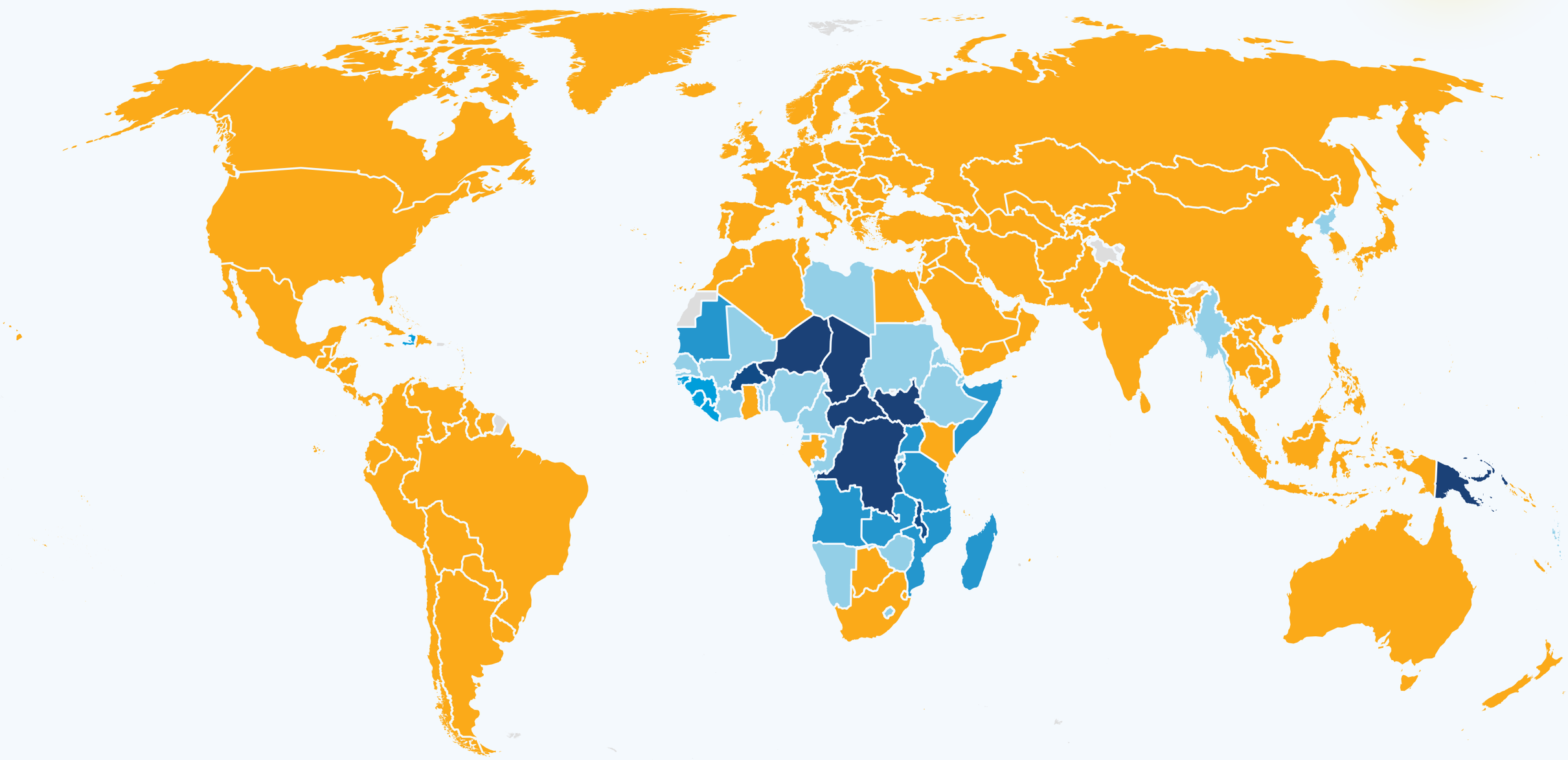


Source: UN GCRG – technical team, based on Climate Watch / World Resources Institute (2024), and growth rates for 2022 from International Energy Agency (2023) and European Commission, JRC (2023). UNFCCC on the Paris Agreement.

Globally, 685 million people lack access to electricity, and for many more, it is still a luxury.

Share of population with access to electricity in 2022 (%)

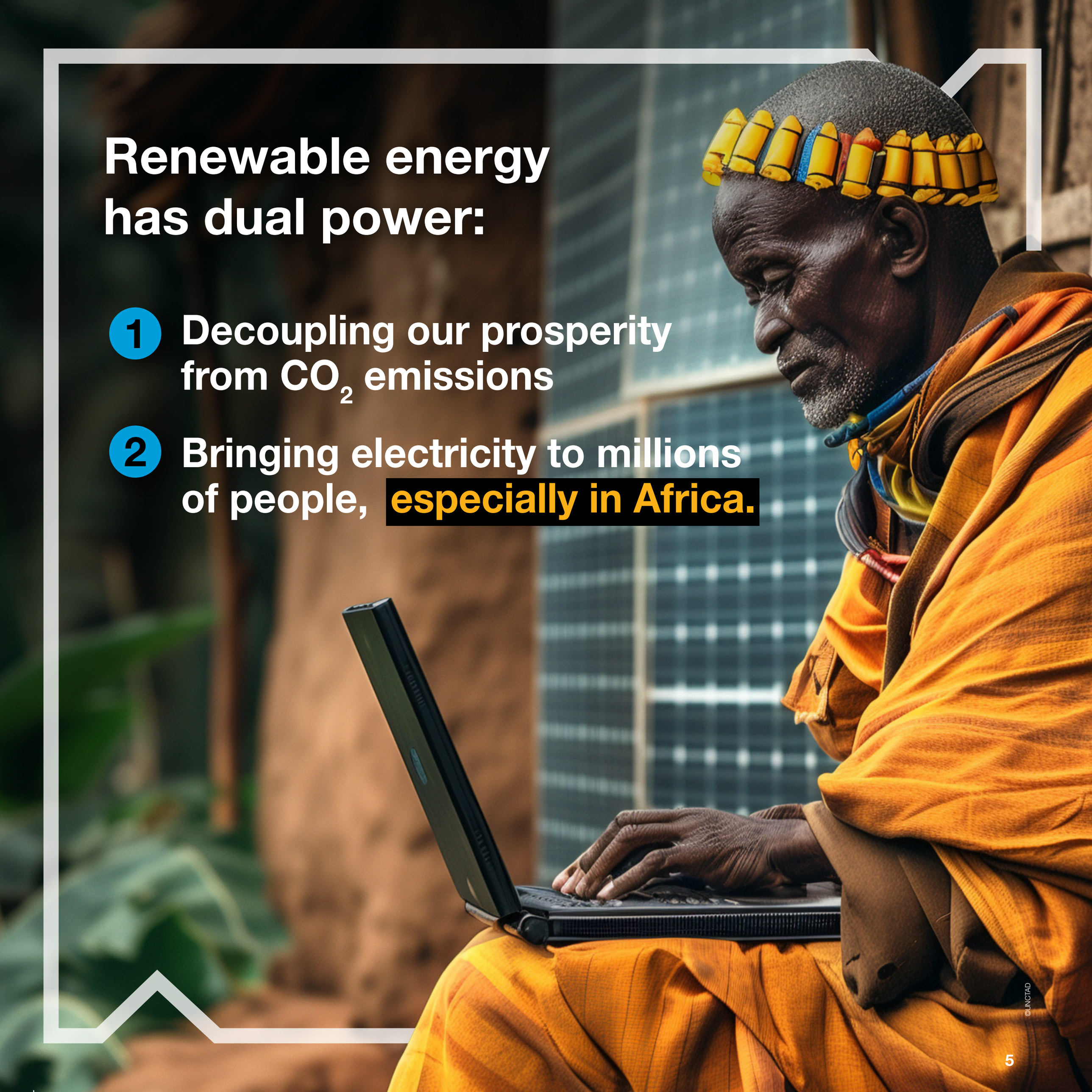
< 25% 25%–50% 50%–75% ≥ 75%



Source: UN GCRG – technical team, based on World Bank (2023), The Energy Access Report.

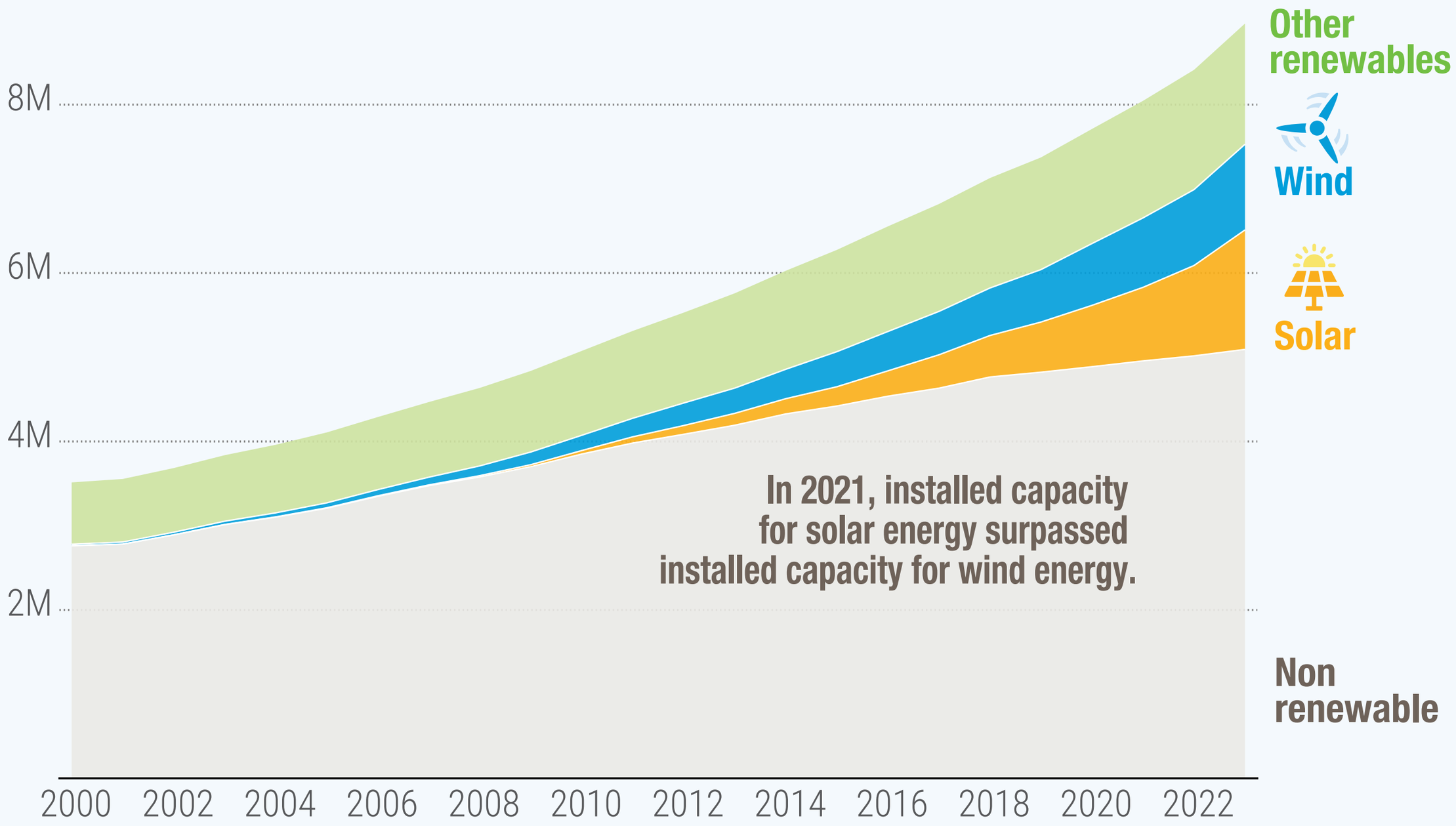
Renewable energy has dual power:

1. Decoupling our prosperity from CO_2 emissions
2. Bringing electricity to millions of people, **especially in Africa.**



Solar and wind power capacity is on the rise.

Power capacity in megawatts

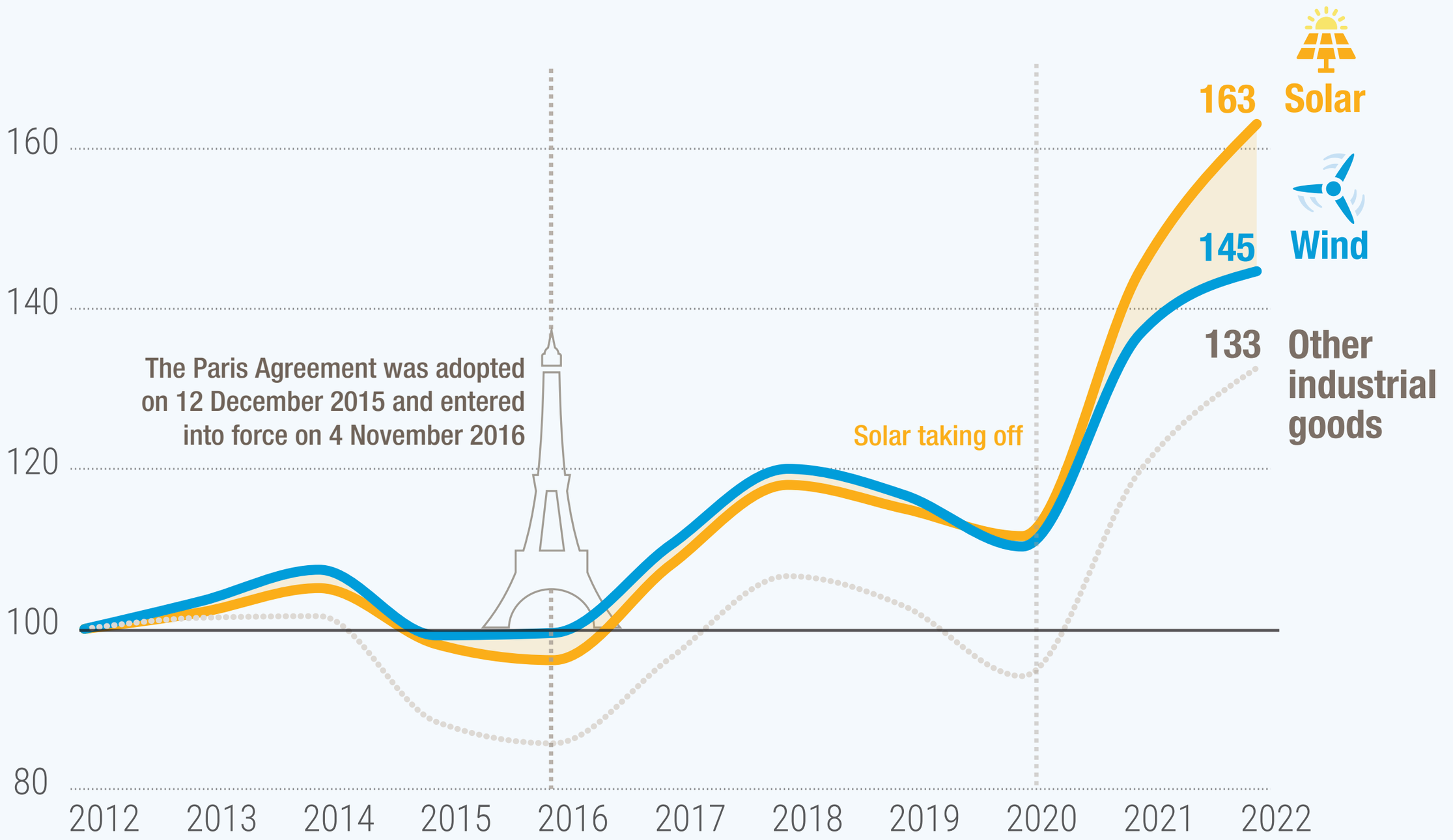


Source: UN GCRG – technical team calculations, based on IRENA Renewable capacity statistics (2024).

Notes: Renewable power capacity is the maximum net generating capacity of power plants and other installations that use renewable energy sources to produce electricity. Other renewables comprise mainly hydropower (excl. pumped storage), bioenergy, geothermal energy and marine energy.

Global trade in solar and wind energy goods is rising faster than in other industrial goods.

Index: for each category, global trade in 2012 = 100



Source: UN GCRG - technical team calculations, based on UN Comtrade.

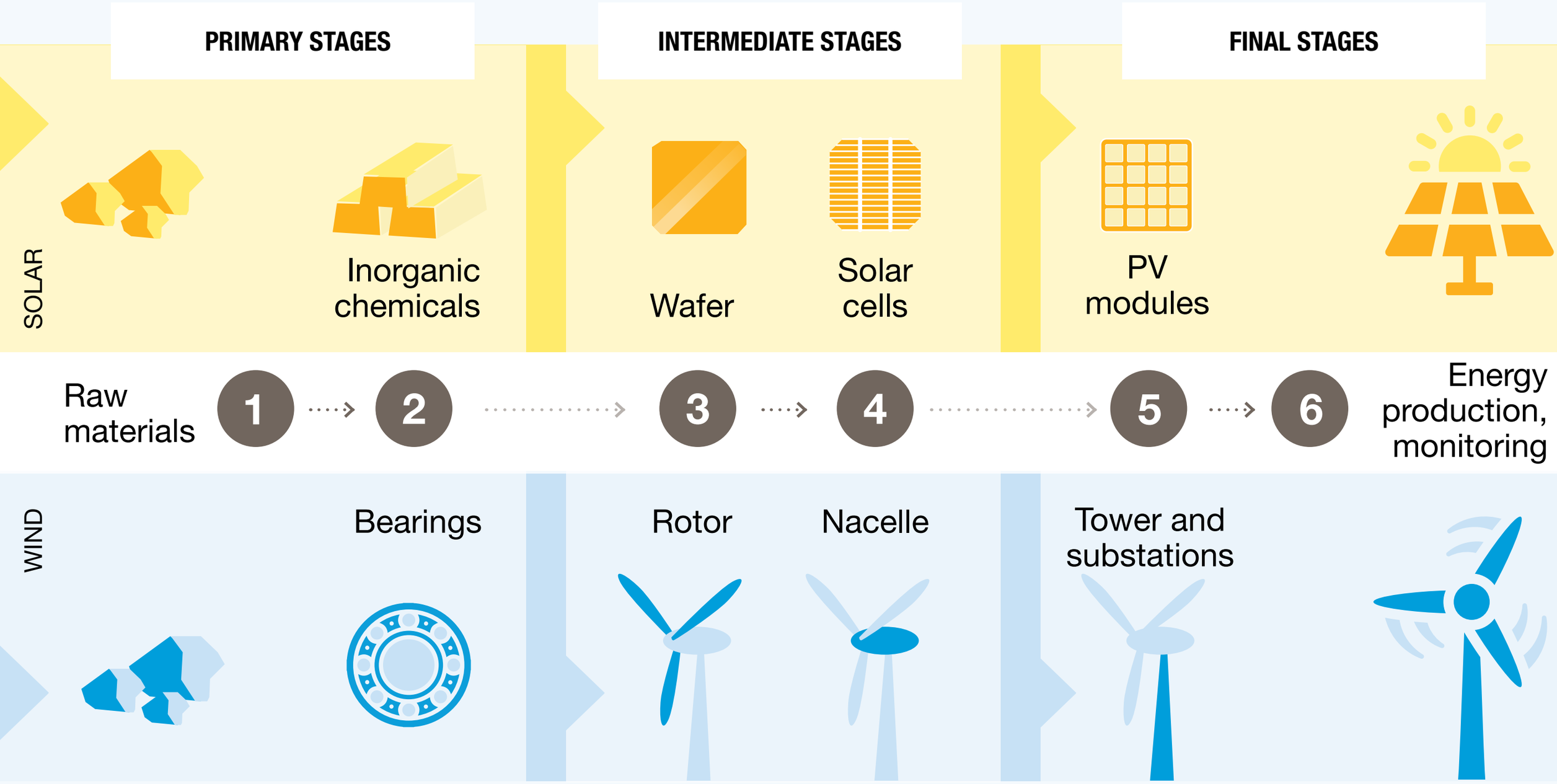
Notes: Many products used in renewable energy technologies can be used for several other purposes. Depicted trade flows correspond to total global trade flows of these goods, as their final use cannot be tracked with bilateral trade data.

But this growth is not enough to meet the 2030 agenda.

Trade policy is key
to reducing trade barriers and
providing the right incentives that expand
solar and wind energy technologies
across the world.

Solar and wind energy technologies entail complex supply chains.

2 value chains • 6 production stages • 130+ products



Source: UN GCRG - technical team, based on Africa Centre for Energy Policy (ACEP) and Trade and Environment Sustainability Structured Discussions (TESSD) communication by the United Kingdom (INF/TE/SSD/W/26/Add. 1).

Notes: Many products used in renewable energy technologies can be used for several other purposes. Iron and steel materials in primary forms (ores, concentrates, ingots, etc.) were not considered.

See the full list of HS 6-digit products.

Moreover, the top-5 exporters account for more than 40% of trade across value chain stages.

Export shares for top-5 exporters (%), 2020-2022

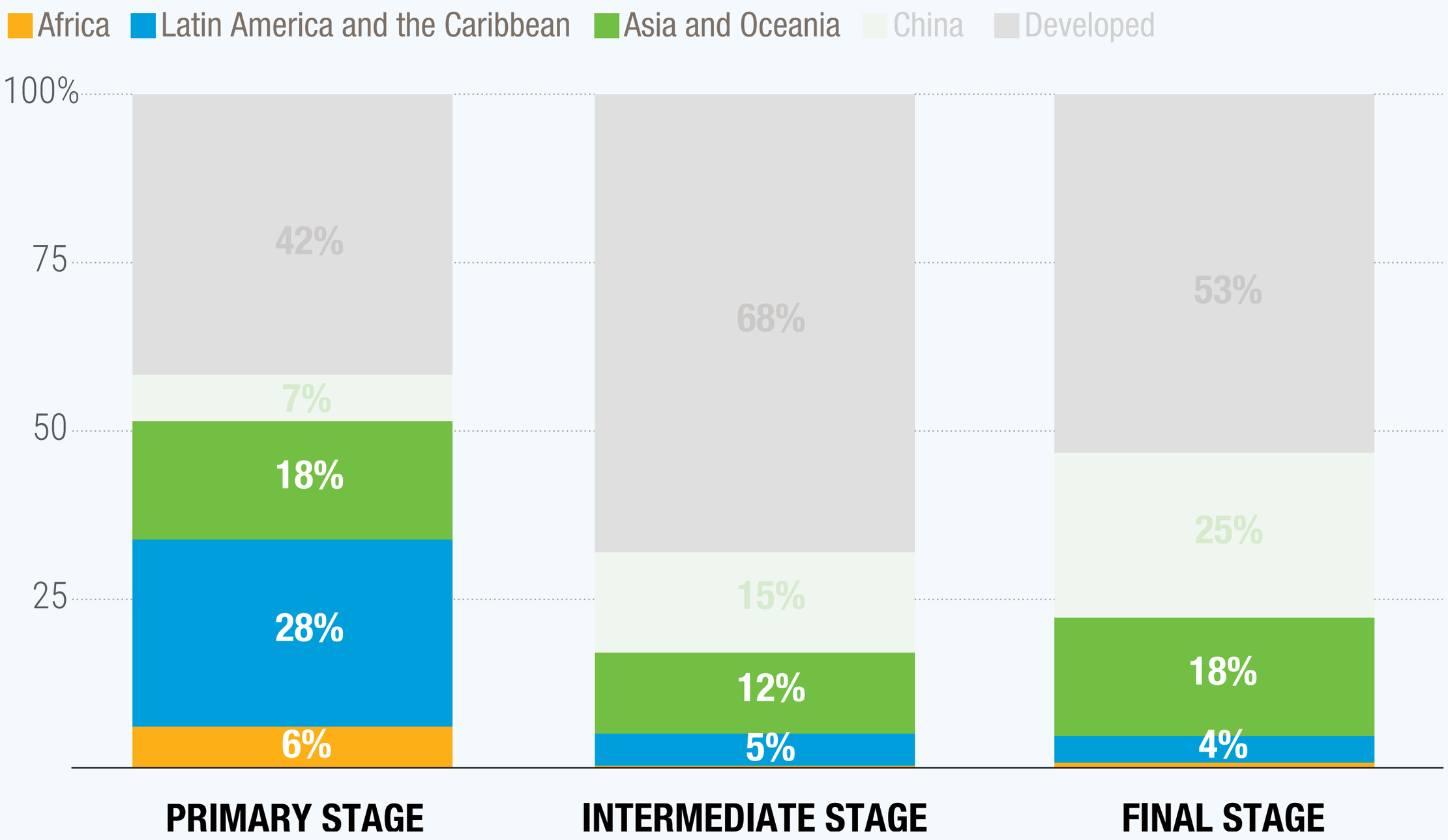
	Stage of the value chain	1st		2nd		3rd		4th		5th		Sum of top-5 exporters
SOLAR	PRIMARY STAGE	Raw materials	CHL	21	PER	13	AUS	8	IDN	5	CAN	4	51
		Inorganic chemicals	AUS	20	BRA	12	CHN	8	TTO	7	IDN	5	53
	INTERMEDIATE	Wafer	JPN	21	CHN	20	DEU	11	USA	11	KOR	5	69
		Solar cell	DEU	12	CHN	11	USA	8	KOR	6	JPN	5	42
	FINAL STAGE	Solar module	CHN	27	HKG	6	DEU	6	USA	6	JPN	6	51
		Energy production	CHN	21	DEU	13	USA	8	JPN	5	MEX	5	52
WIND	PRIMARY STAGE	Raw materials	CHL	17	PER	10	AUS	8	CAN	6	IDN	4	45
		Bearings	CHN	19	DEU	14	USA	8	JPN	6	ITA	5	51
	INTERMEDIATE	Rotor	DEU	20	JPN	16	USA	11	CHN	9	MEX	4	59
		Nacelle	CHN	21	DEU	14	USA	8	JPN	6	ITA	5	54
	FINAL STAGE	Tower and substations	CHN	21	DEU	10	USA	8	JPN	4	ITA	4	47
		Energy production	CHN	22	DEU	13	USA	8	MEX	5	JPN	5	52

Source: UN GCRG - technical team calculations, based on UN Comtrade.

Note: For readability, countries readability countries are indicated by their International Organization for Standardization (ISO) 3166-1 alpha-3 code.

Developing regions are mostly confined to the exports of raw materials.

Shares of world exports of goods in solar and wind energy technologies, 2020-2022

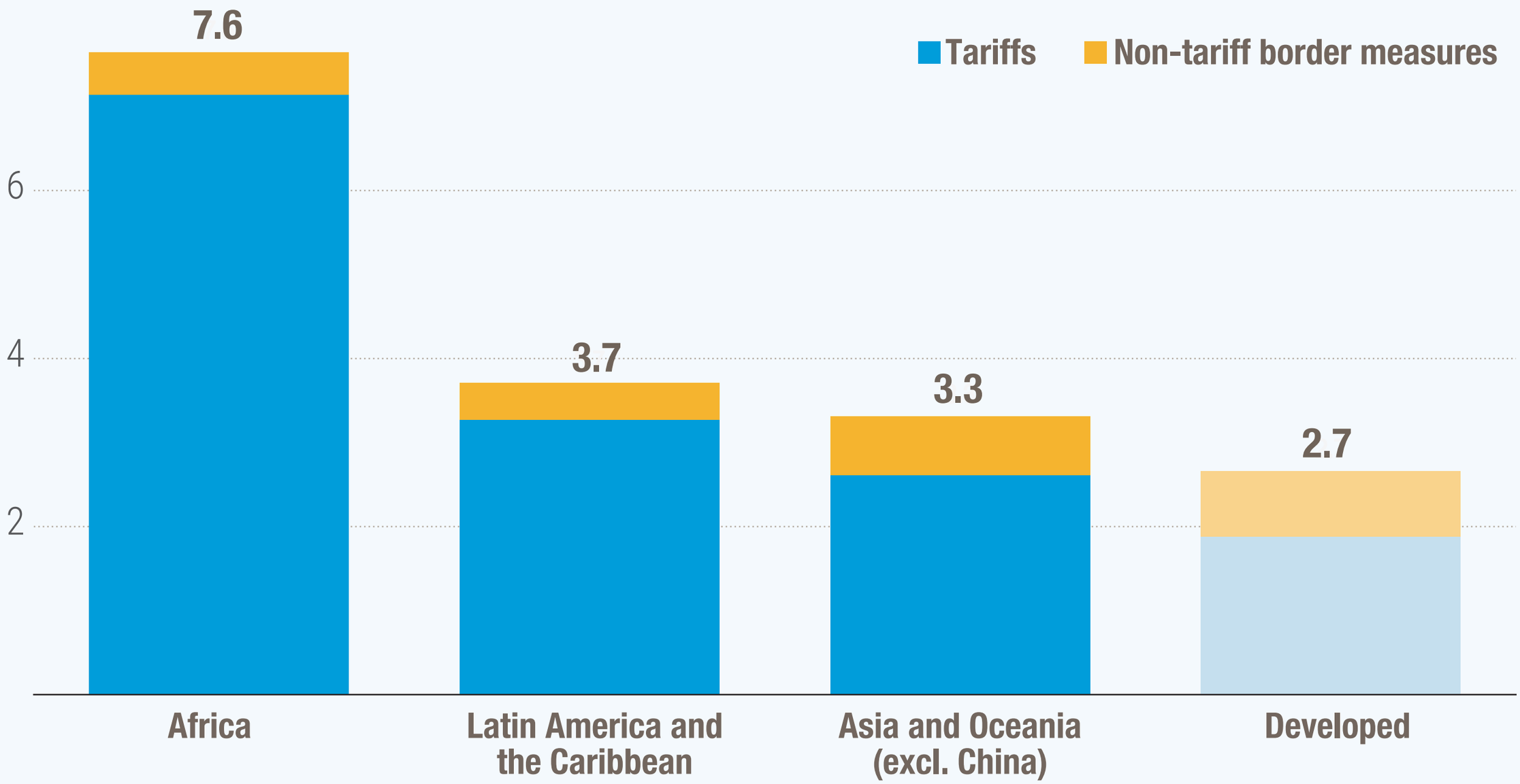


Source: UN GCRG - technical team calculations, based on UN Comtrade.

Notes: Primary stages summarize raw materials, inorganic chemicals and bearings. Intermediate stages include goods used in the wafer, solar cell, rotor and nacelle. The final stages include goods entering the PV modules, tower and substations. The label “Asia and Oceania” excludes China.

There is scope to reduce barriers on green energy goods, in all regions.

Trade policy costs on the trade of goods in wind and solar energy technologies (%), 2020-2022



Source: UN GCRG – technical team calculations, based on UN Comtrade, UNCTAD and Kee and Nicita (2022).

Notes: Trade costs as trade-weighted average of applied tariffs and ad-valorem equivalents of non-tariff border measures on goods entering solar and wind energy technology value chains by importing region. The label “Asia and Oceania” excludes China.

In Africa, costs on intermediate stages are twice as high as in Asia.

Trade policy costs by stage and region (%), 2020-2022

	Stage of the value chain	Africa	Latin America and the Caribbean	Asia and Oceania
PRIMARY STAGE	1 Raw materials	1.8	1.8	0.9
INTERMEDIATE STAGE	2 Chemicals Bearings	7.2	3.6	3.2
	3 Wafer Rotor	6.9	4.8	3.6
	4 Solar cells Nacelle	8.2	4.1	4.0
FINAL STAGE	5 PV modules Tower, substations	7.7	3.4	3.5
	6 Energy production and monitoring	8.7	3.8	3.3

Source: UN GCRG – technical team calculations, based on UN Comtrade, UNCTAD and Kee and Nicita (2022).

Notes: Average trade-weighted tariffs and ad-valorem equivalents of non-tariff measures by importing region. The label “Asia and Oceania” excludes China.

African and Latin American firms often face up to 4x higher border costs than external competitors.

Cost of border measures (%), 2020-2022

	Stage of the value chain	Africa extra-regional	Africa intra-regional	Latin America and the Caribbean extra-regional	Latin America and the Caribbean intra-regional	Asia and Oceania extra-regional	Asia and Oceania intra-regional
PRIMARY STAGE	1 Raw materials	0.1	0.3	0.2	1.1	0.0	0.0
	2 Chemicals Bearings	0.4	0.8	0.3	1.3	0.5	0.5
INTERMEDIATE STAGE	3 Wafer Rotor	0.5	2.1	0.7	1.8	0.8	0.7
	4 Solar cells Nacelle	0.7	0.6	0.6	0.9	0.5	0.4
FINAL STAGE	5 PV modules Tower, substations	1.2	0.6	0.6	1.1	1.8	1.1
	6 Energy production and monitoring	0.6	1.7	0.2	0.4	1.3	1.1

Source: UN GCRG - technical team calculations, based on UN Comtrade and Kee and Nicita (2022).

Notes: Average trade-weighted ad-valorem equivalents of border measures, including products for which non-tariff measures were not applied or ad-valorem equivalents were not significantly different from zero, but excluding products for which information on non-tariff measures was unavailable. The label “Asia and Oceania” excludes China.

Asian countries face double the trade defence measures of developed ones.

Number of anti-dumping and anti-subsidy duties on goods in solar and wind energy technologies entering into force during 2020-2022.

	Targeted exporting region				
Imposing region	**Developed**	**Asia and Oceania (excl. China)**	**China**	**Africa**	**Latin America and the Caribbean**
Developed	18	32	9	0	0
Asia and Oceania (excl. China)	0	12	6	0	0
China	1	0	0	0	0
Africa	0	3	0	0	0
Latin America and the Caribbean	0	1	2	0	0

Source: UN GCRG - technical team calculations, based on WTO, Trade Remedies Data Portal (2024).

Notes: Anti-dumping and anti-subsidy (countervailing) duties are aimed at reducing negative effects from import surges resulting from price-dumping and subsidies, respectively.

Areas of opportunity

Lower trade costs on intermediates
could boost green energy industries, especially in Africa.

Reducing border costs
could foster intra-regional trade, in Africa and Latin America.

Re-evaluating trade defence measures
to seek mutual solutions before imposing duties could boost growth in renewable energy value chains, particularly in Asia.

What can we do?

Re-evaluate trade policy to strike a better balance between fiscal concerns, the imperatives of energy transition and universal energy access;

Boost value addition through raw material processing and assembly of solar and wind energy technologies to drive structural transformation and integrate developing countries into global value chains;

Harness South-South trade and regional integration to strengthen developing countries' participation in renewable energy value chains; and

Read the report

In our race against global warming, every fraction of a degree matters.

We must shift from the trade policy we have to the trade policy we need.

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