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.

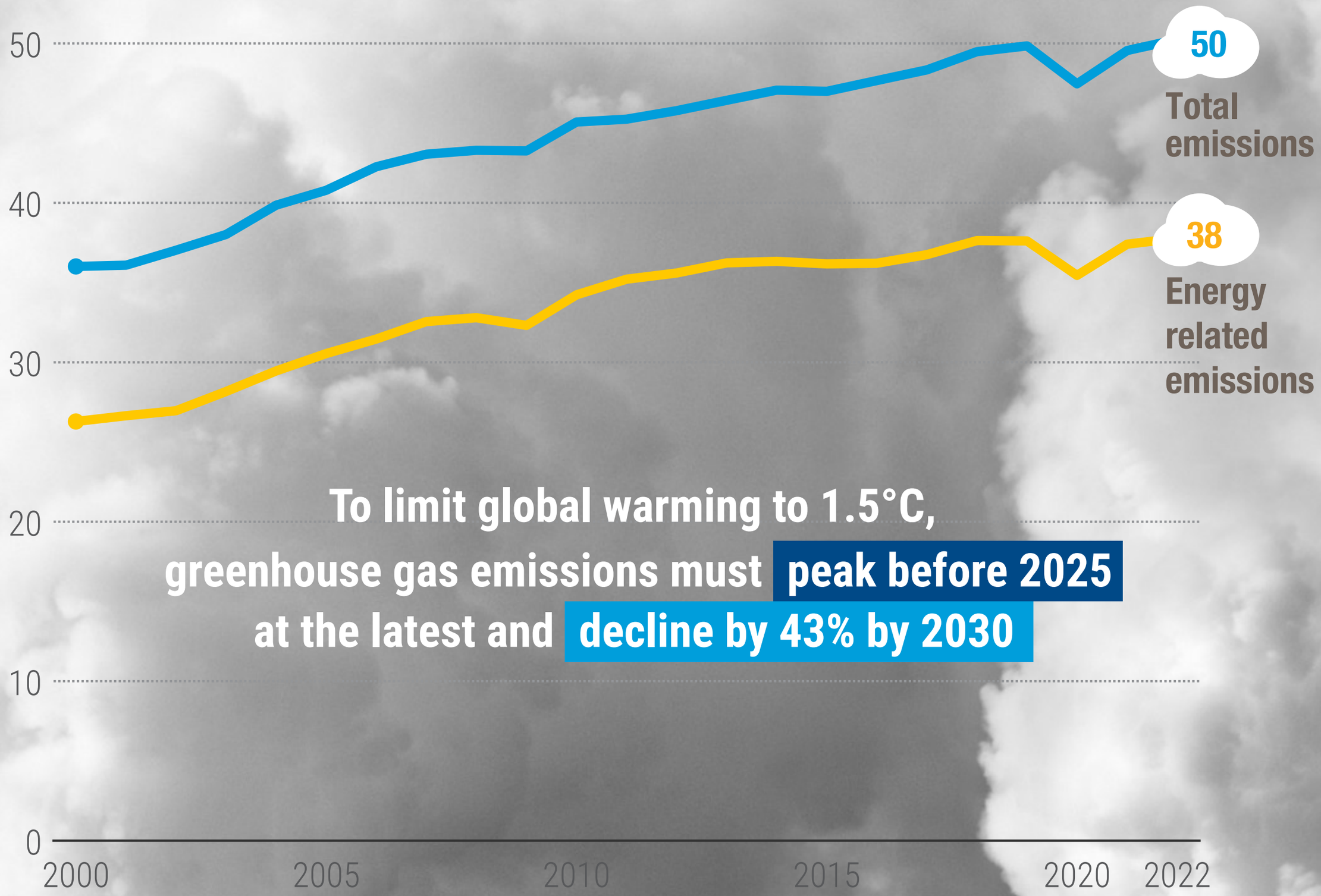
To minimise dependency on fossil fuels, we must expand our capacity to produce renewable energy everywhere. This expansion means that trade in renewable energy goods must grow faster than it has done over the last decade.

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

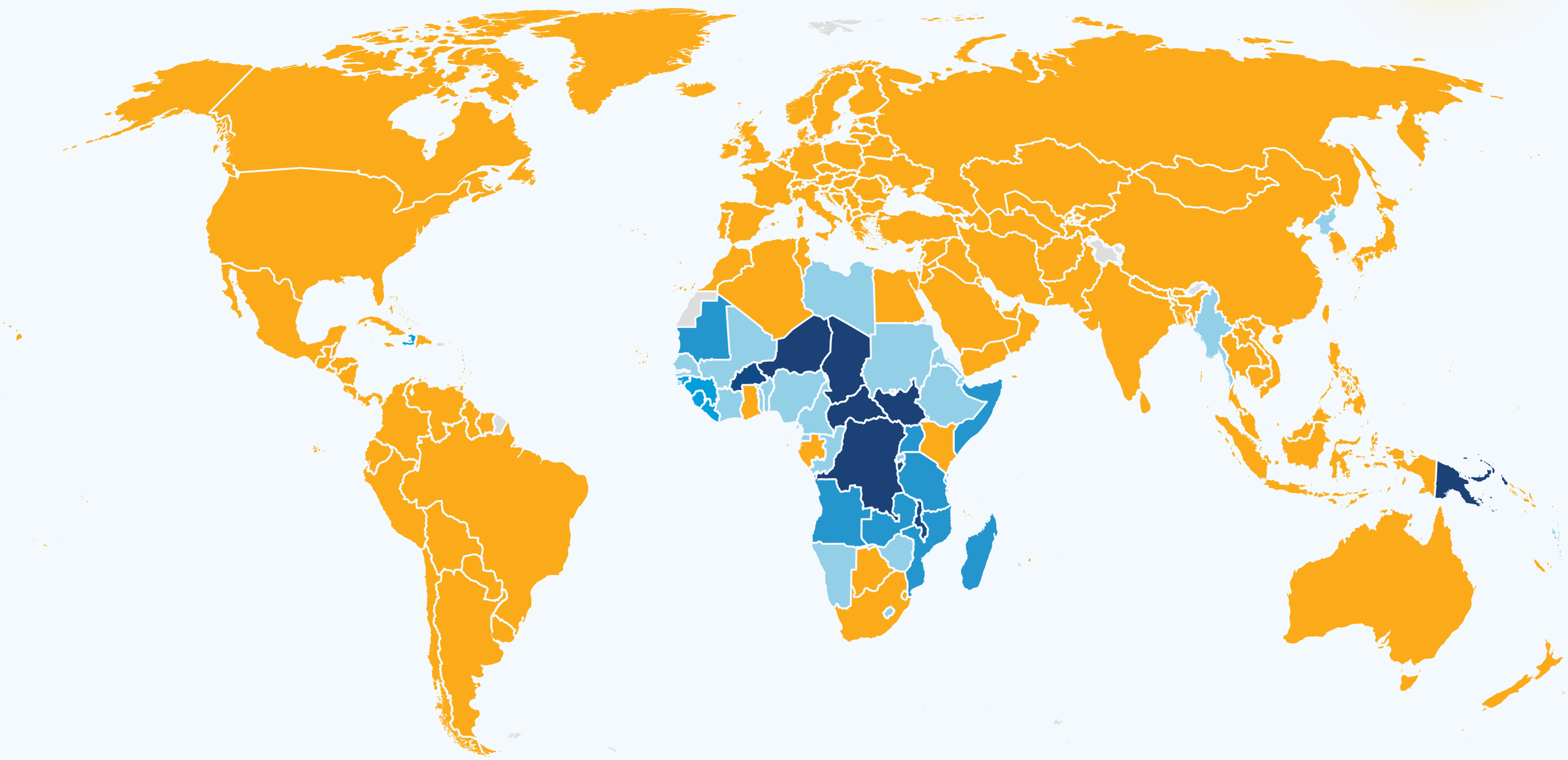



*Source:* UN GCRG – technical team, based on Climate Watch / World Resources Institute (2024), and growth rates for 2022 from International Energy Agency (2023) and European Commission, JRC (2023). UNFCCC on the Paris Agreement.

# 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 (%)

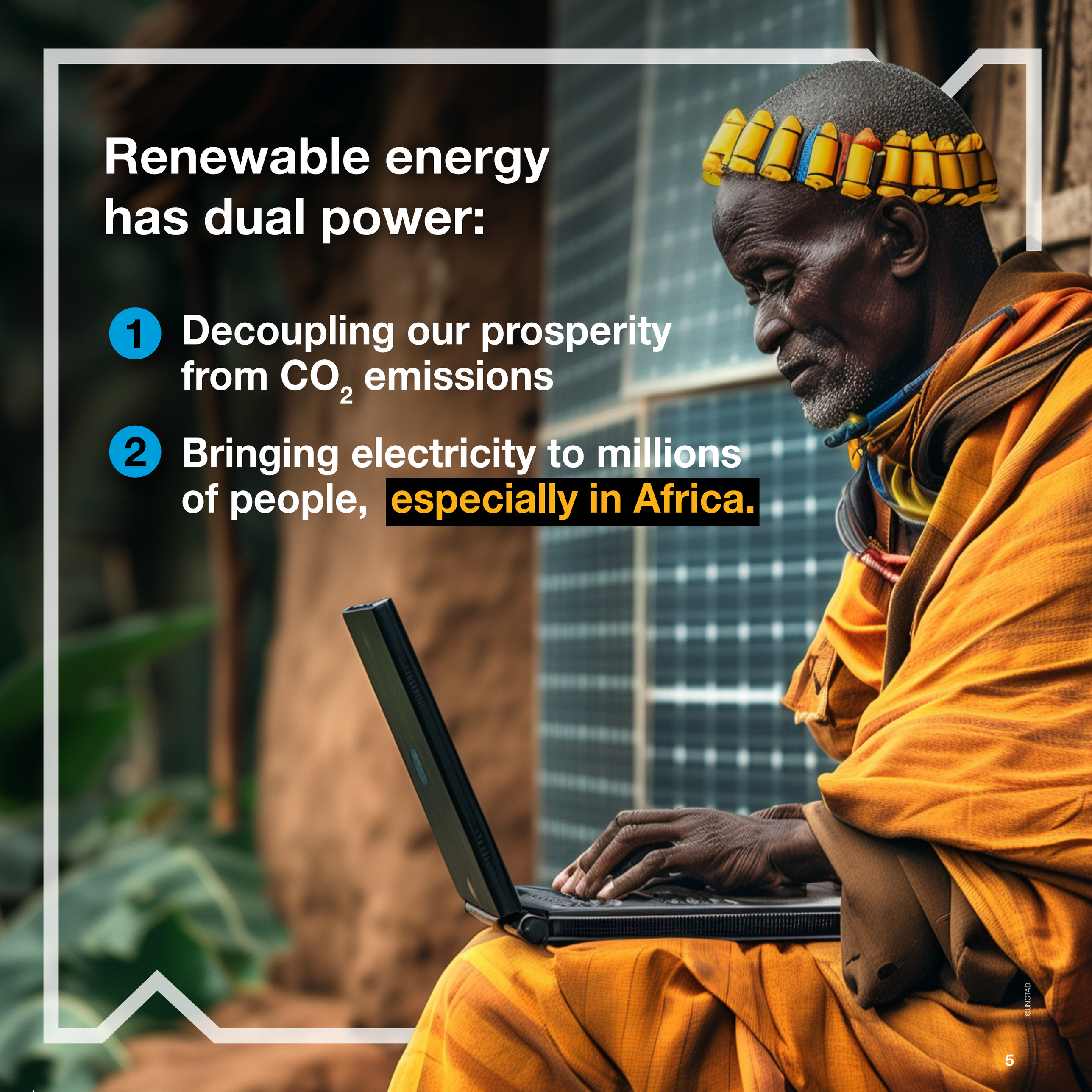
< 25% 25%–50% 50%–75% ≥ 75%



*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.**



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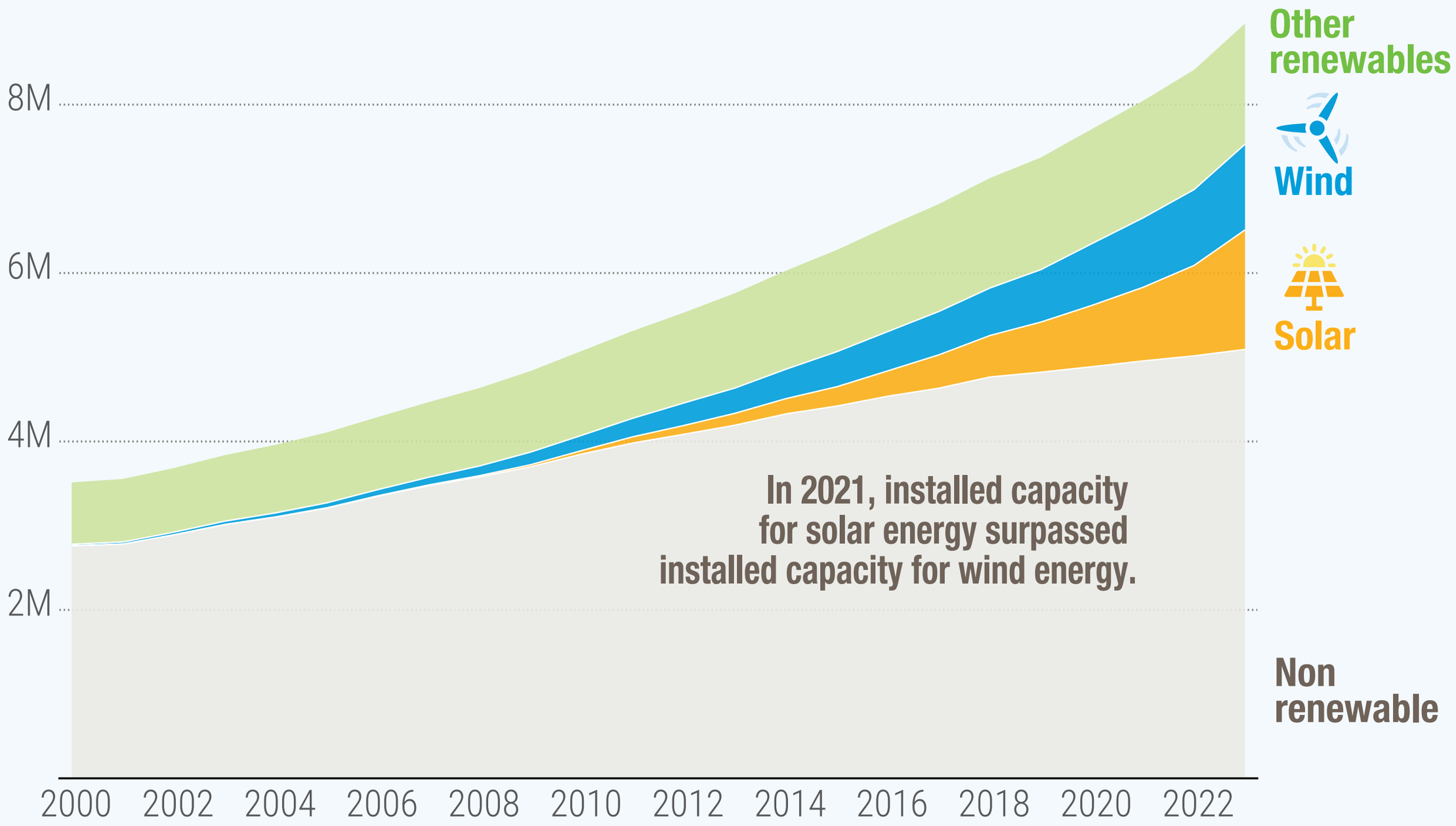
# Solar and wind power capacity is on the rise.

Power capacity in megawatts

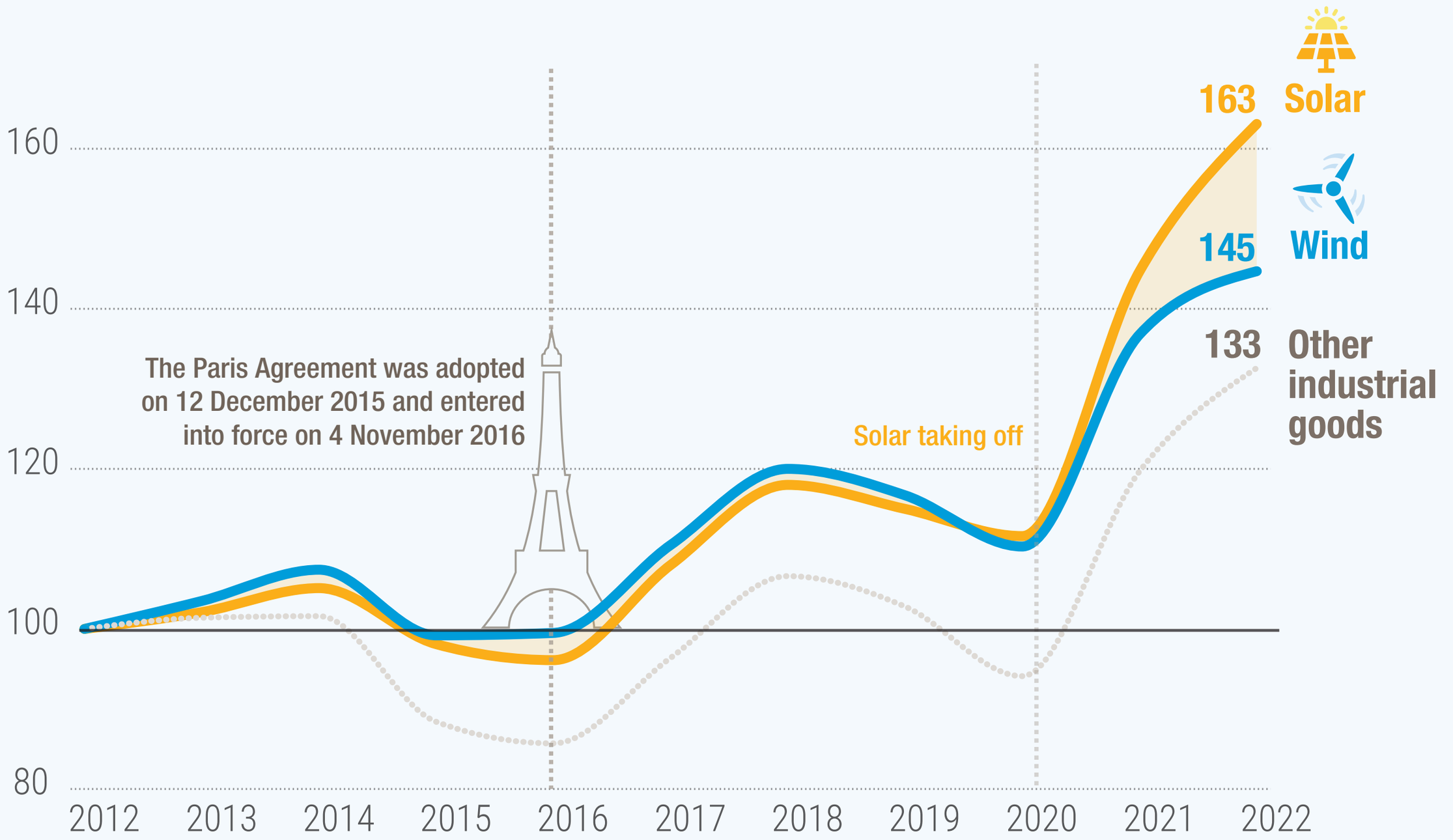



*Source:* UN GCRG – technical team calculations, based on IRENA Renewable capacity statistics (2024).

*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.

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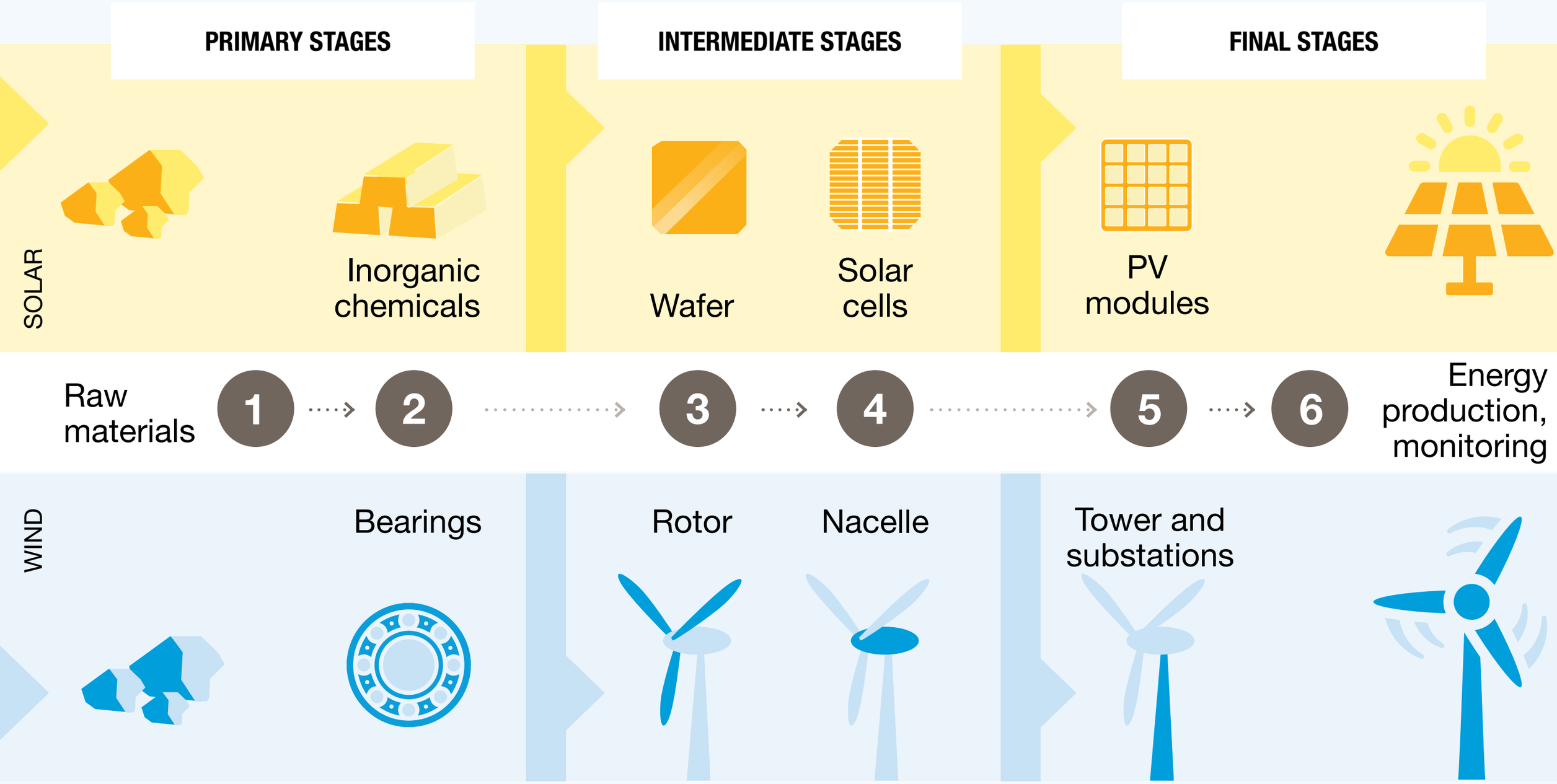
# Solar and wind energy technologies entail complex supply chains.

## 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

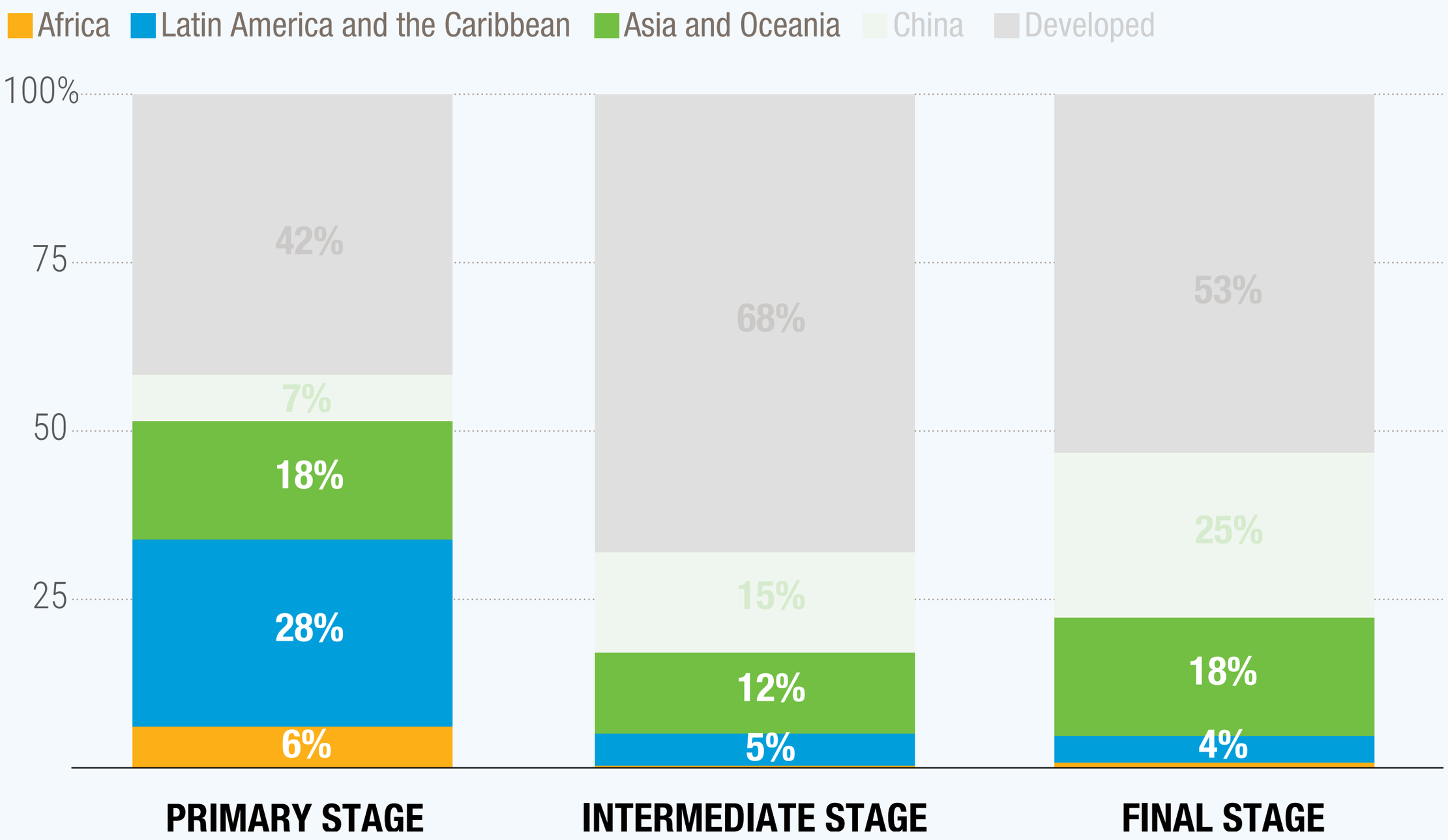
| | Stage of the value chain | 1st | | 2nd | | 3rd | | 4th | | 5th | | Sum of top-5 exporters |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOLAR | PRIMARY STAGE | Raw materials | CHL | 21 | PER | 13 | AUS | 8 | IDN | 5 | CAN | 4 | 51 |
| | | Inorganic chemicals | AUS | 20 | BRA | 12 | CHN | 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

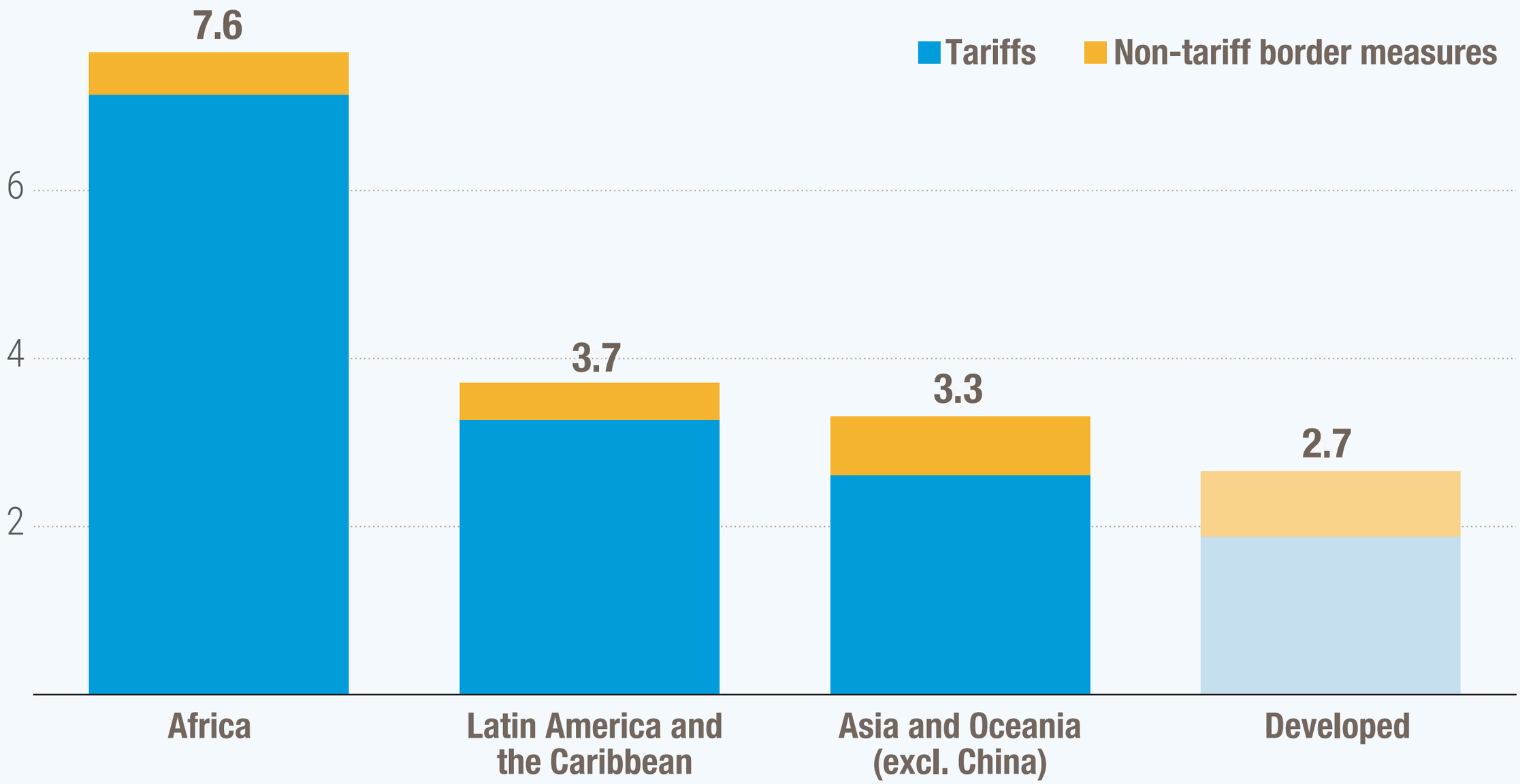



*Source:* UN GCRG - technical team calculations, based on UN Comtrade.

*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<br>Bearings | 7.2 | 3.6 | 3.2 |
| | 3 Wafer<br>Rotor | 6.9 | 4.8 | 3.6 |
| | 4 Solar cells<br>Nacelle | 8.2 | 4.1 | 4.0 |
| FINAL STAGE | 5 PV modules<br>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<br>Bearings | 0.4 | 0.8 | 0.3 | 1.3 | 0.5 | 0.5 |
| INTERMEDIATE STAGE | 3 Wafer<br>Rotor | 0.5 | 2.1 | 0.7 | 1.8 | 0.8 | 0.7 |
| | 4 Solar cells<br>Nacelle | 0.7 | 0.6 | 0.6 | 0.9 | 0.5 | 0.4 |
| FINAL STAGE | 5 PV modules<br>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

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**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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