



# Energy Technology Perspectives 2024

Clean technology manufacturing and trade

L. Paoli, F. Papadimoulis, M. Huismans, J. Sery, T. Lombardo, C. Delmastro, F. Pavan

26 November 2024

- **Clean technology manufacturing and trade**  
26 November 2024, 12:00 – 13:15 (CET)
  
- **The future of shipping**  
26 November 2024, 14:30 – 15:30 (CET)
  
- **Unlocking manufacturing opportunities in emerging markets**  
3 December 2024, 12:30 – 13:45 (CET)
  
- **Near zero emission materials production and trade**  
6 December 2024, 15:00 – 16:00 (CET)

- **12:00 Global outlook for manufacturing and trade**
- **12:05 Technology deep dives**
  - Solar PV
  - Wind
  - Electric cars
  - Batteries
  - Heat pumps
  - Electrolysers
- **12:50 Commentary by Dr. Frank van Tongeren**, former Head of OECD's SMART Data and Modelling unit within the Directorate on Trade and Agriculture
- **12:55 Q&A**

Electric cars

Electrolysers

Batteries

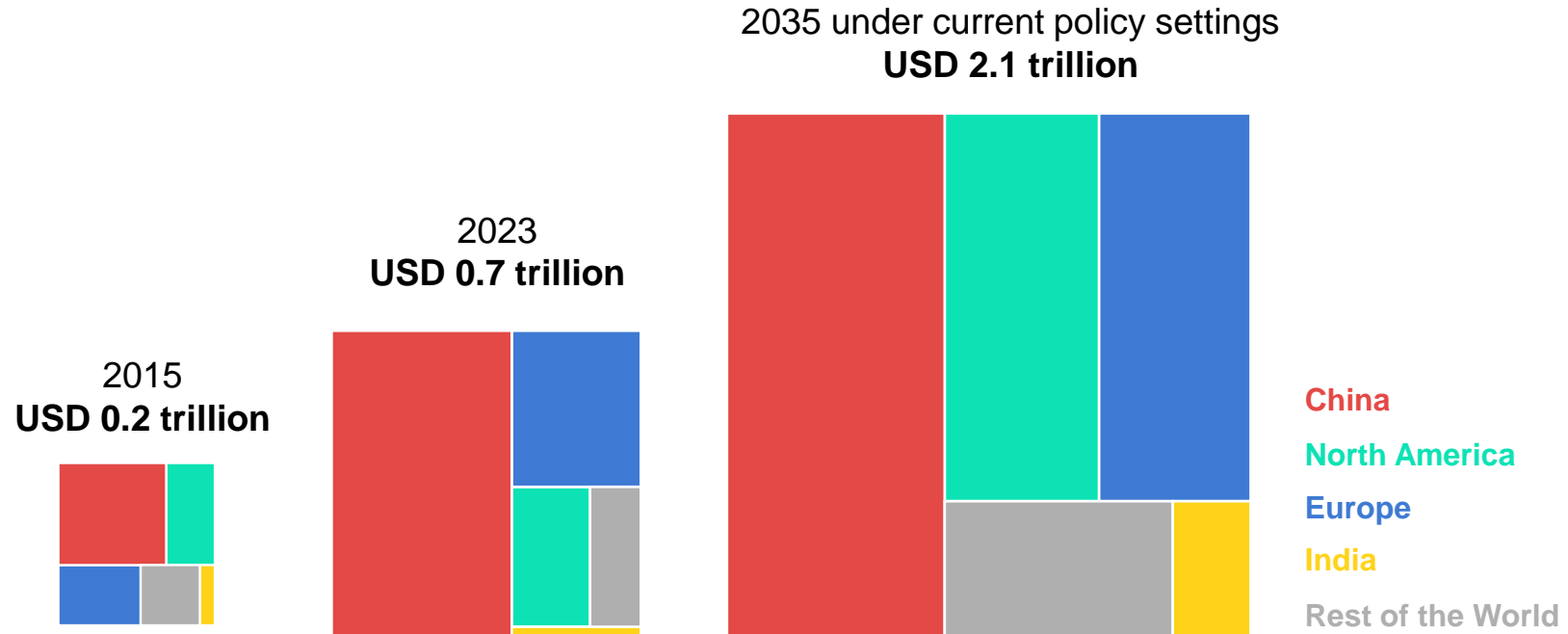
Solar PV

Heat pumps

Wind

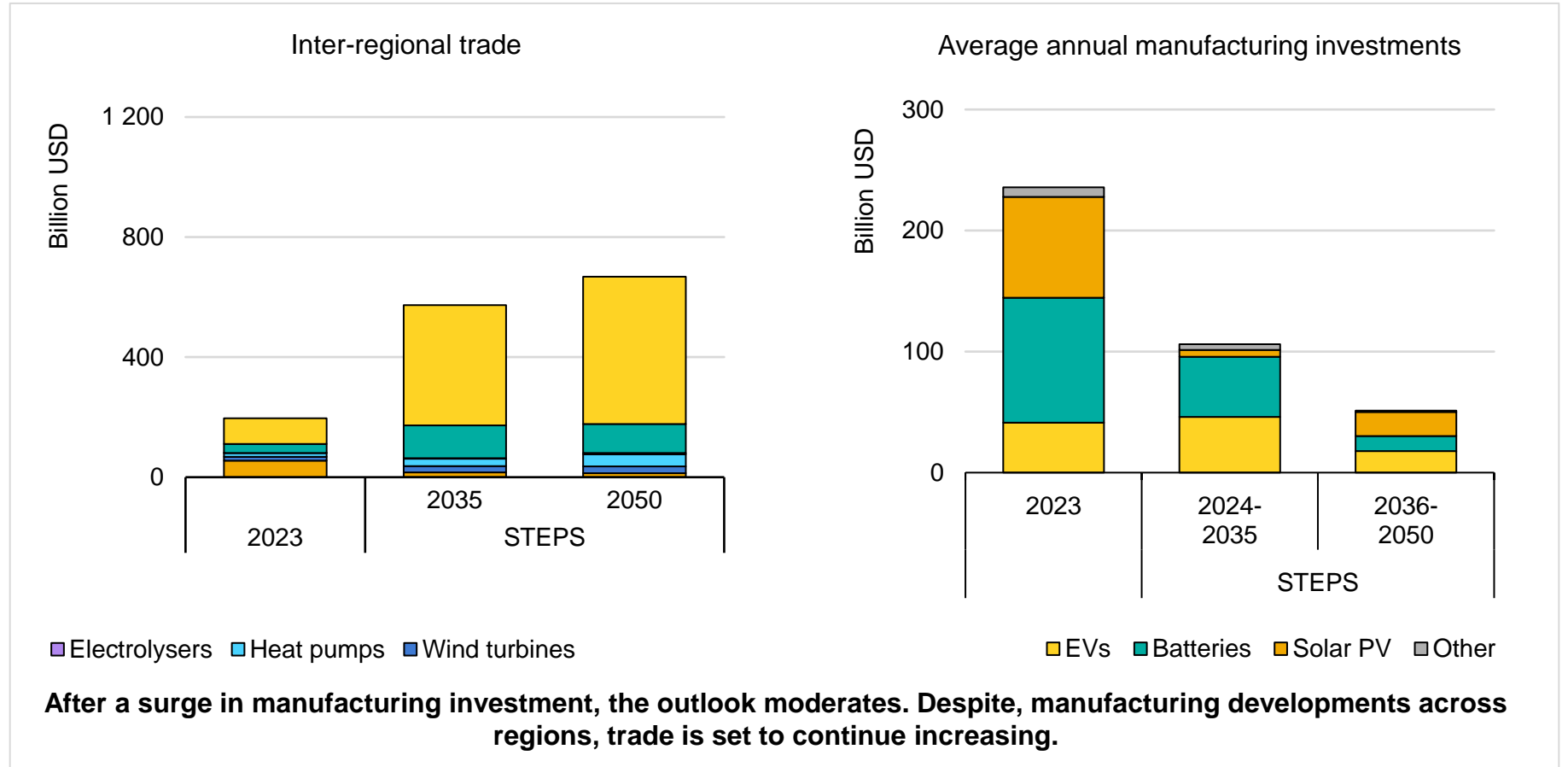
# Clean energy technologies are a sizeable economic opportunity

Global market value for clean energy technologies



**The market for clean technologies is set to triple to 2035 under current policy settings, close to value of the global crude oil market in recent years.**

# Clean tech trade is set to nearly triple under current policy settings



## Stated Policies Scenario (STEPS)

Where do existing policies take us?

## Announced Pledges Scenario (APS)

What is the impact of announced net zero and other pledges if they are met in full?

### Manufacturing capacity

Only projects that reached FID

All announced projects

### Industrial Policy

**US:** Inflation Reduction Act  
**EU:** The European Green Deal  
**India:** Production Linked Incentive

**US:** IRA non finalised provisions  
**EU:** Net Zero Industry Act  
**India:** Make in India

# Solar PV



# Solar PV manufacturing increased steeply in recent years

## Solar PV

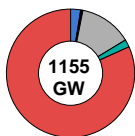
- Polysilicon
- Wafer
- Cell
- Module

Manufacturing facilities in operation for the solar PV supply chain, 2023

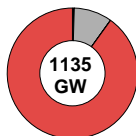


Manufacturing capacity, 2023:

### Modules



### Cells



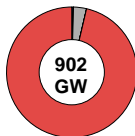
China

EU

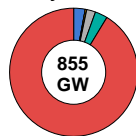
North America

Other Asia Pacific

### Wafers

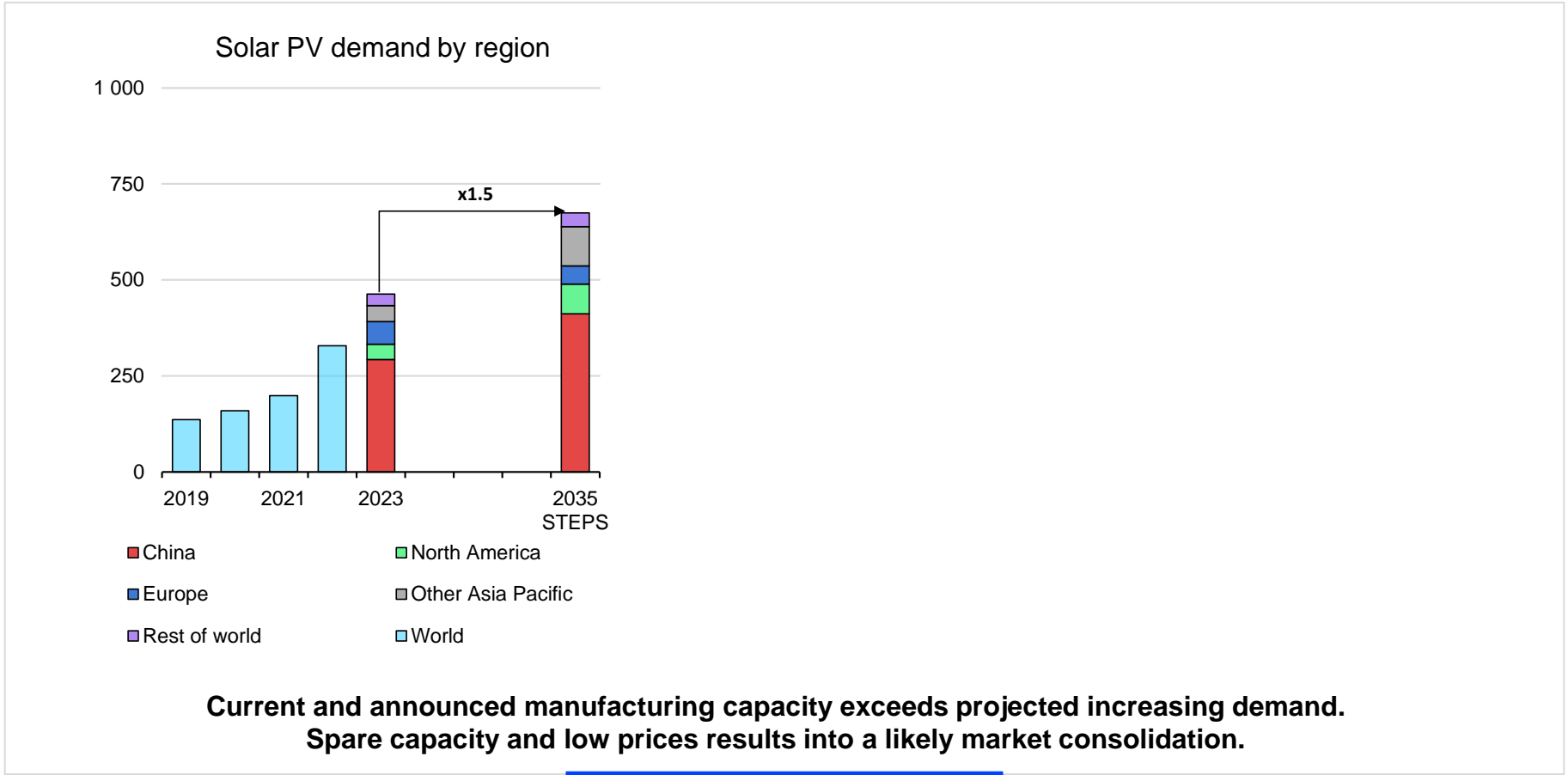


### Polysilicon

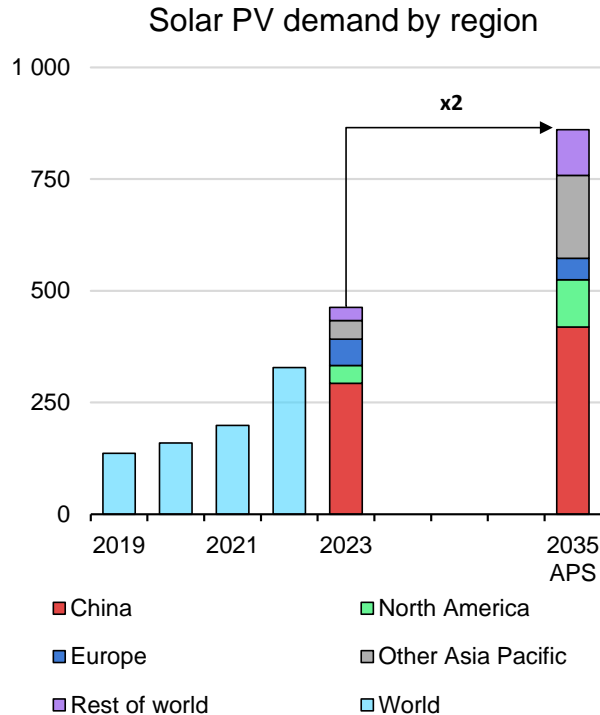


**China accounts for the big majority of manufacturing capacity along the solar PV supply chain, with over 80% for every step.**

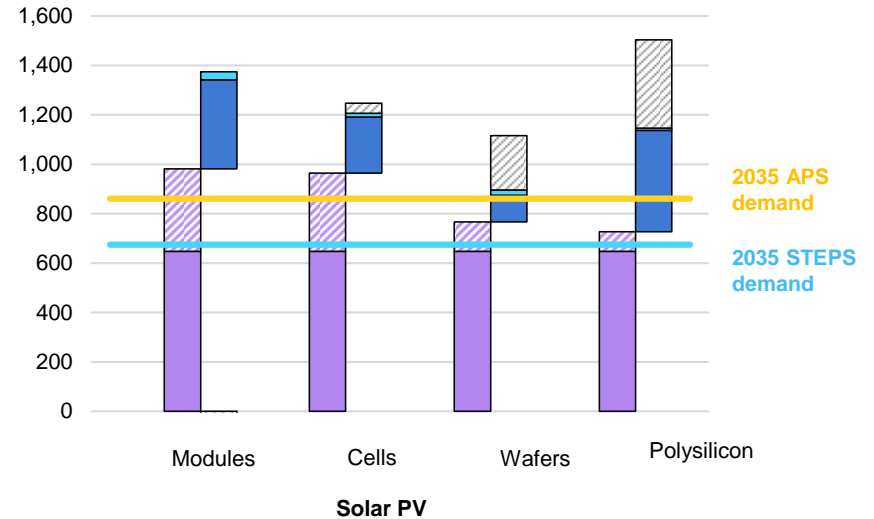
# PV demand keeps growing, but capacity is ready to meet it



# PV demand keeps growing, but capacity is ready to meet it



### Solar PV manufacturing capacity as share of deployment in 2035

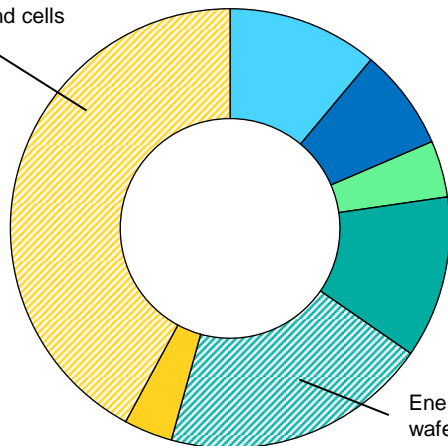


**Current and announced manufacturing capacity exceeds projected increasing demand. Spare capacity and low prices results into a likely market consolidation.**

# China is the most competitive across the PV supply chain

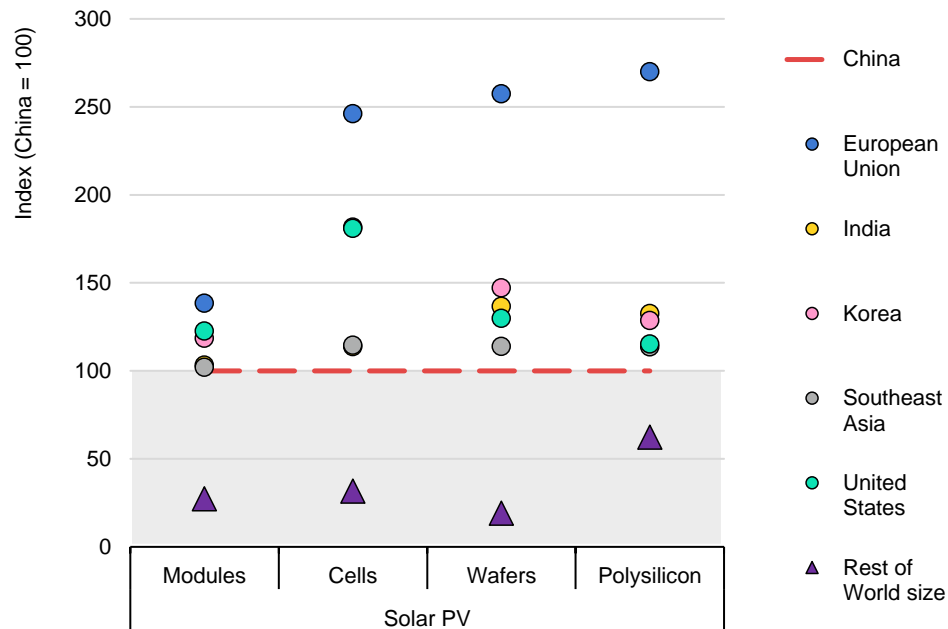
Levelised cost of production for solar PV modules

Material costs of modules and cells



- CAPEX
- Fixed OPEX
- Labour costs
- Energy costs
- Material costs

Regional production costs relative to China and facilities sizes



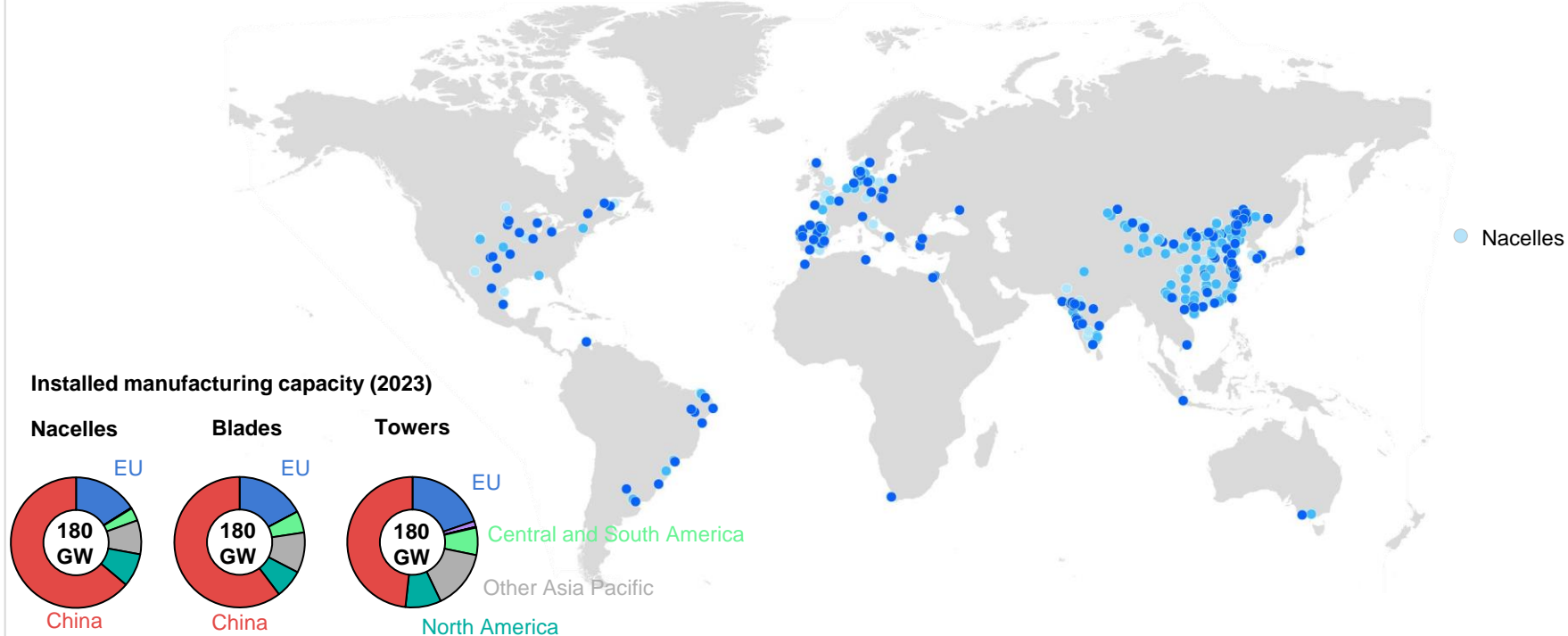
**China's competitiveness across all components of the PV supply chain is not only due to lower costs of inputs, but also due to the economies of scale and vertical integration.**



# Wind

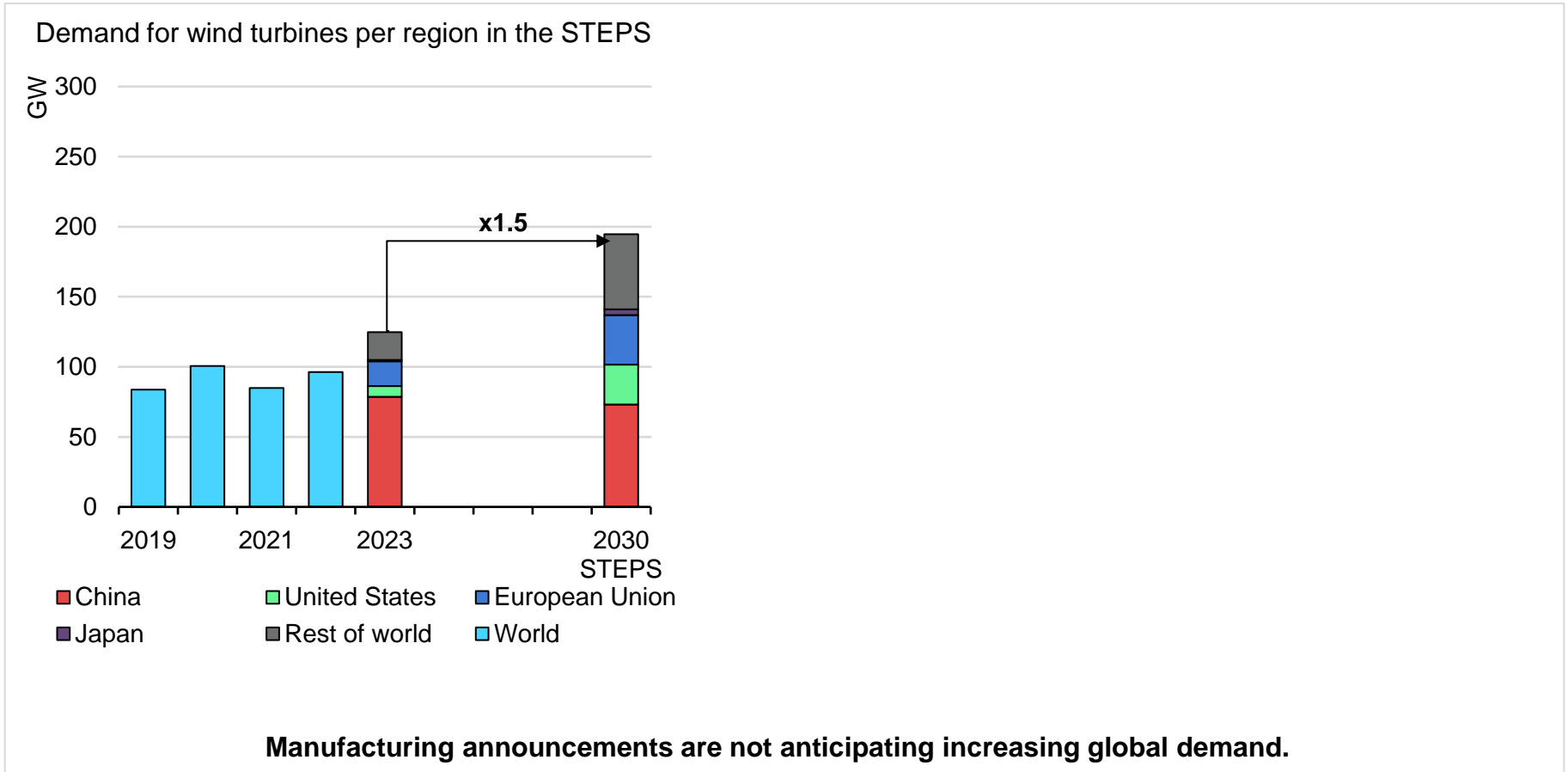
# The wind sector is a regional diversified supply chain

Operating nacelles, blades and tower manufacturing facilities, 2023



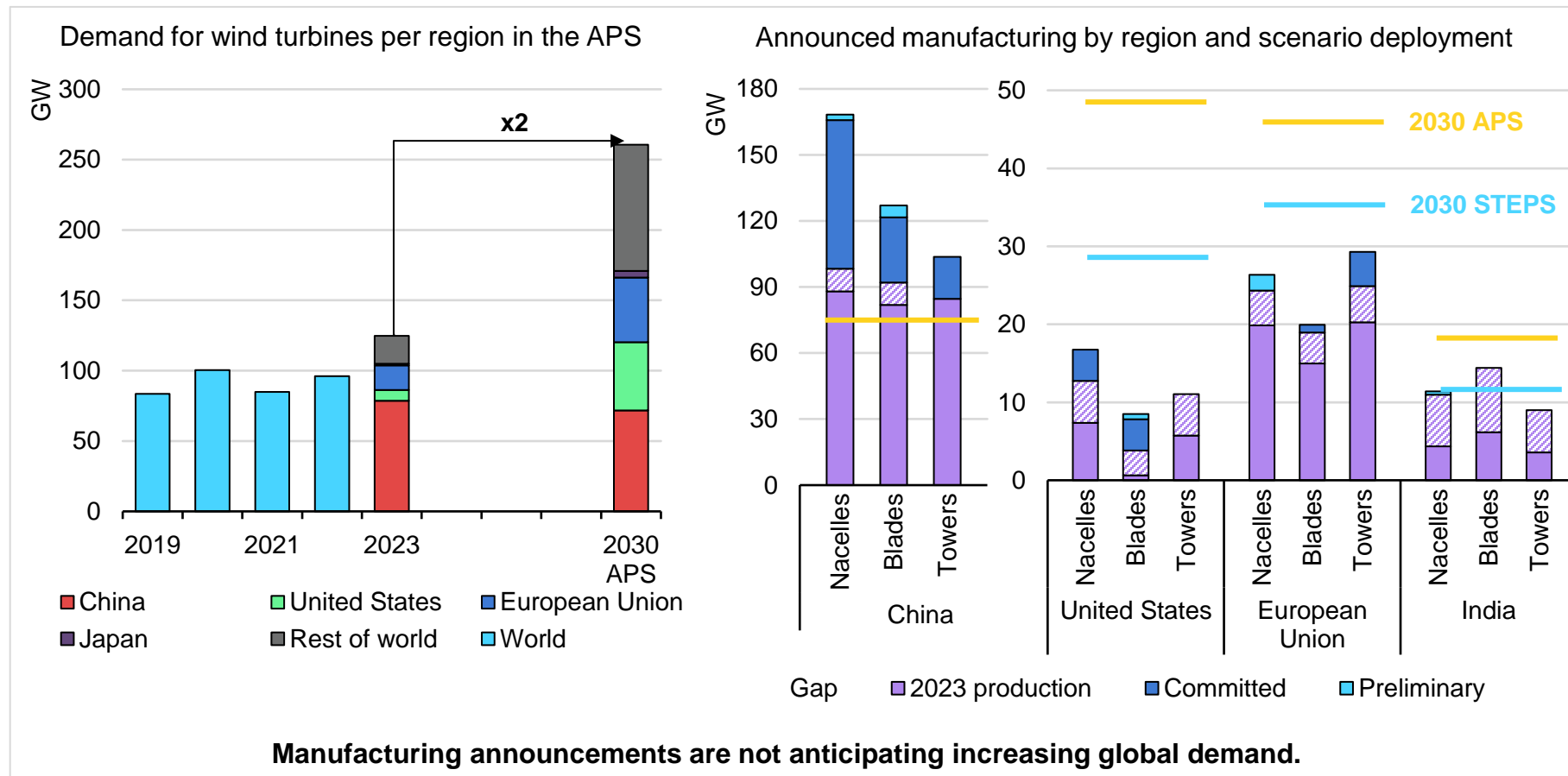
**China and Europe are the main wind component manufacturers.**

# Global demand for wind energy components



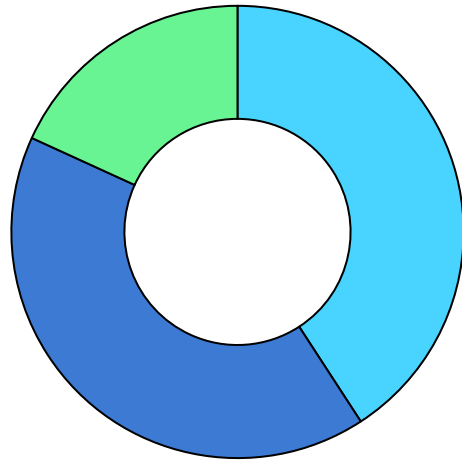


# Global demand for wind energy components



# What drives wind manufacturing production costs?

Levelised cost of production for wind components

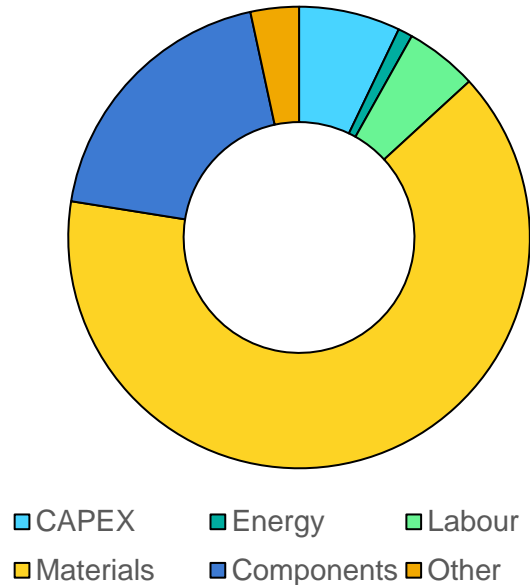


■ Nacelles ■ Towers ■ Blades

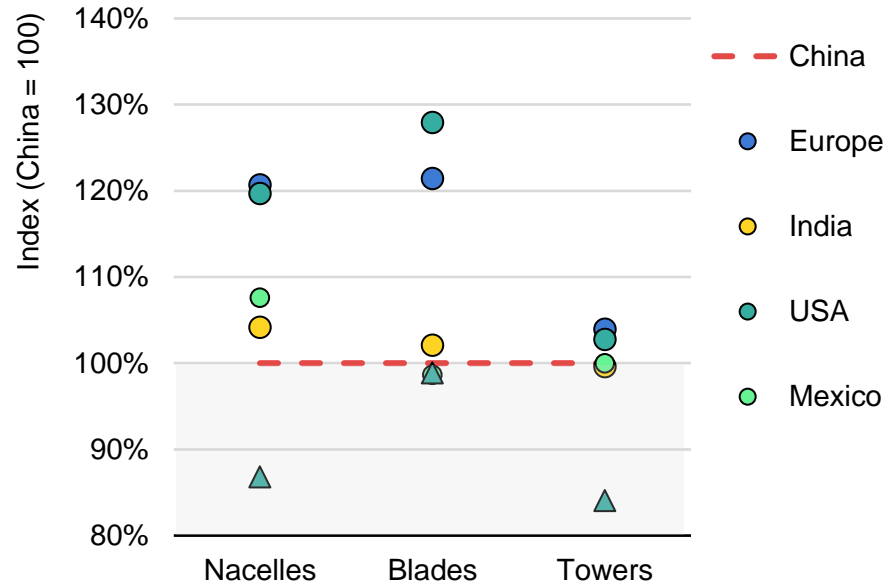
**Materials and downstream components of nacelles are the biggest contributors to production costs.**

# What drives wind manufacturing production costs?

Levelised cost of production for wind components

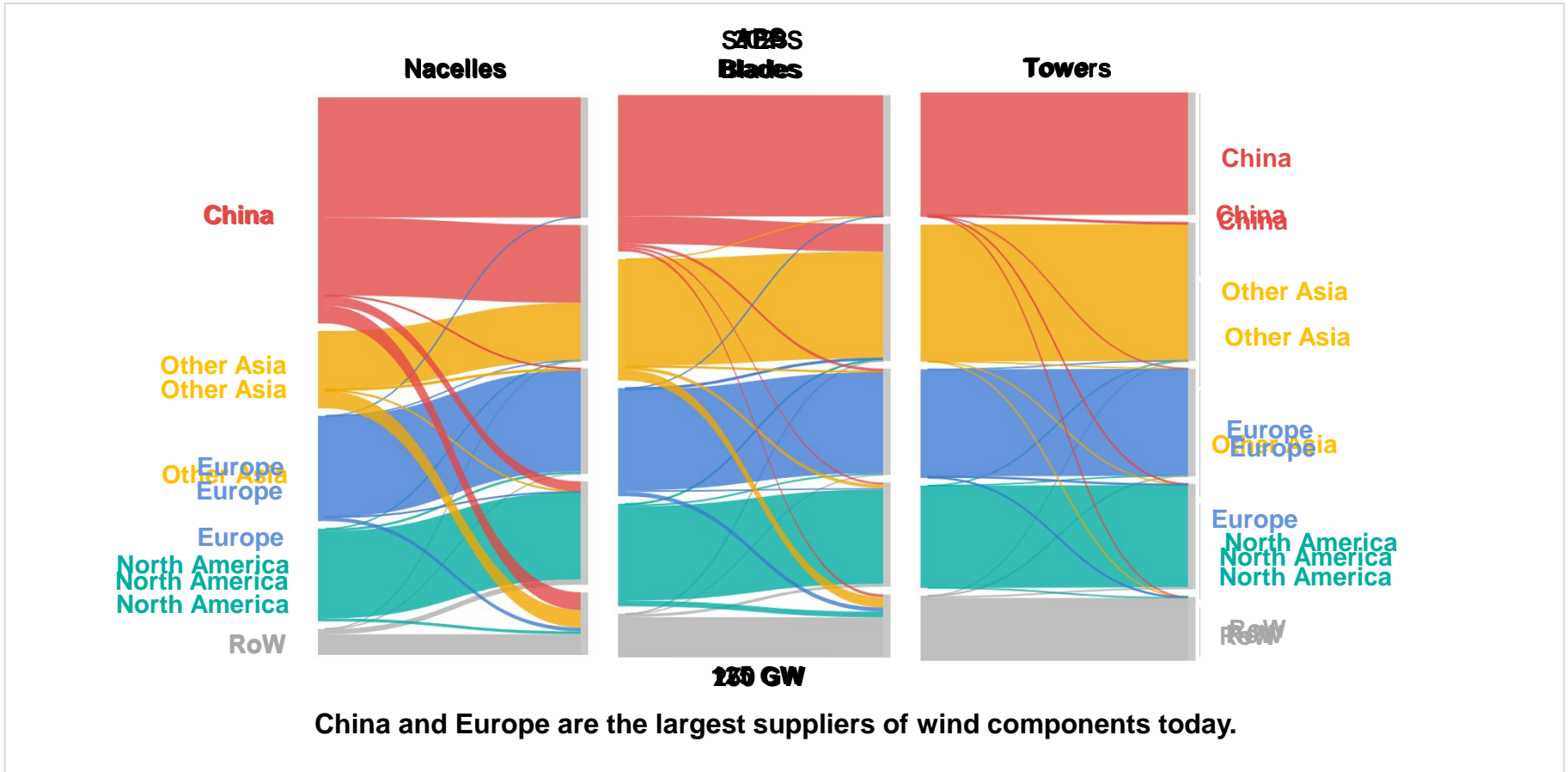


Regional differences total production costs



**Materials and downstream components of nacelles are the biggest contributors to production costs.**

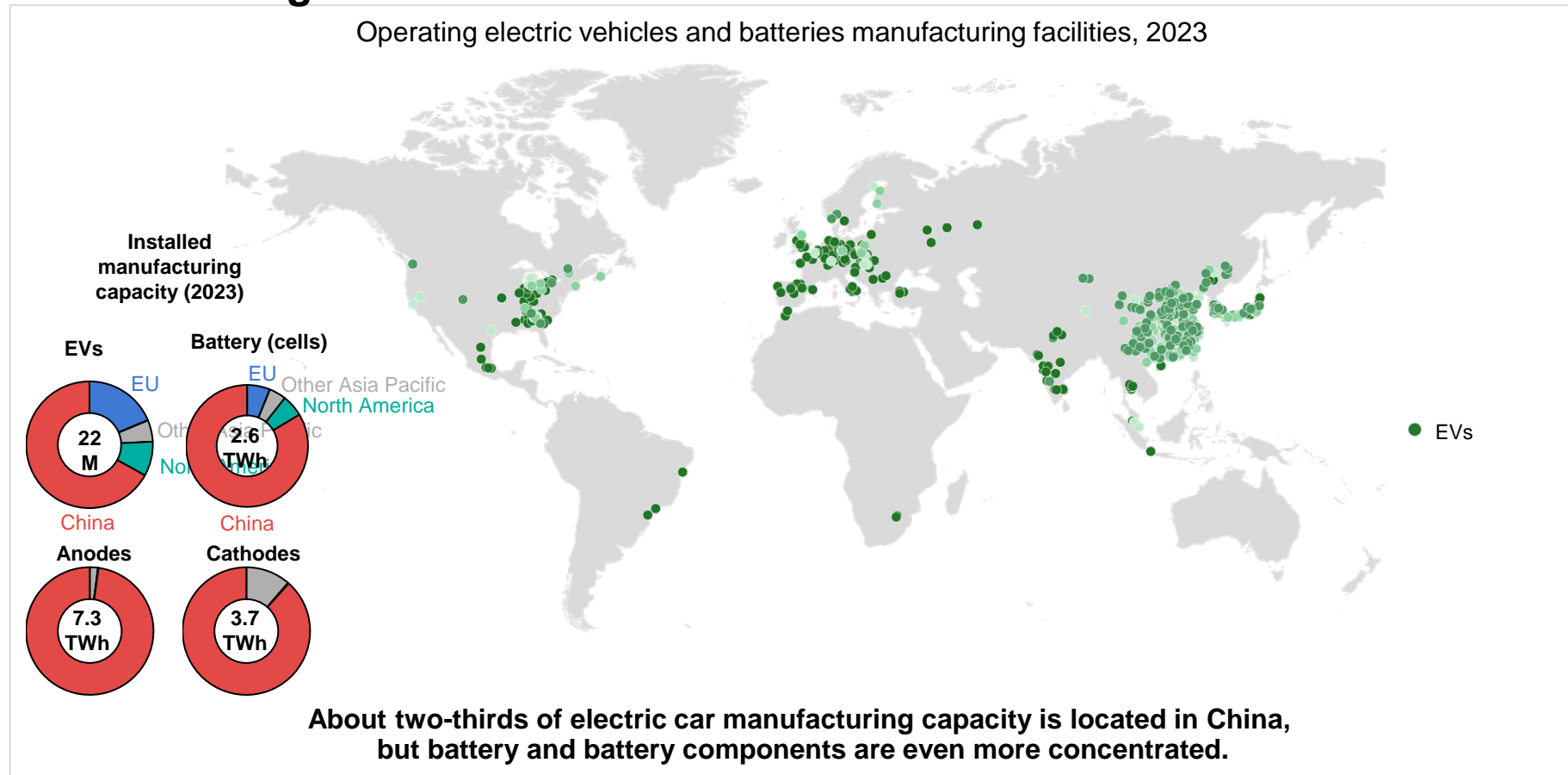
# Trade of wind components



# Electric cars and batteries

# Electric vehicles and batteries are underpinning a new wave of manufacturing investments

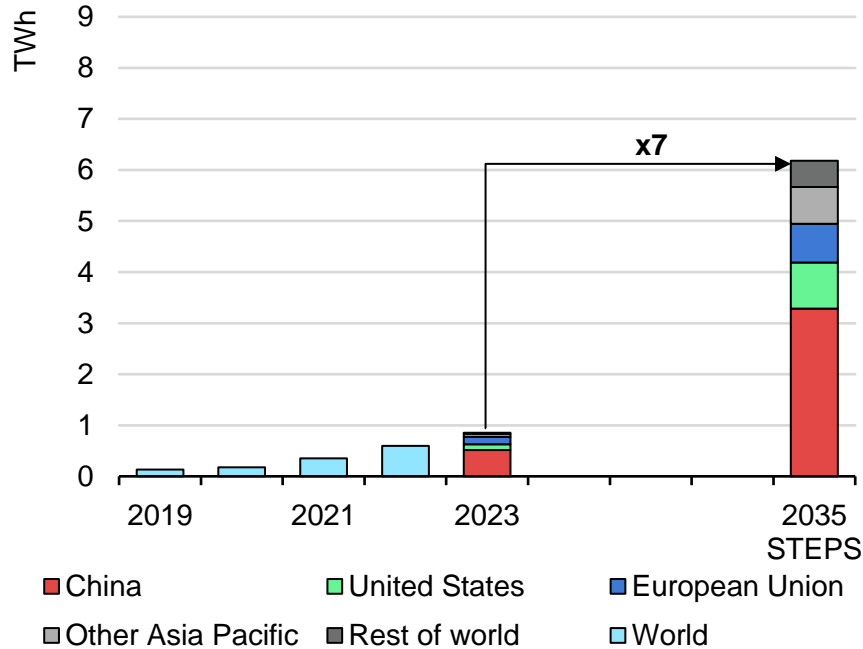
Operating electric vehicles and batteries manufacturing facilities, 2023



**About two-thirds of electric car manufacturing capacity is located in China, but battery and battery components are even more concentrated.**

# Announced manufacturing capacity exceeds demand by 2035

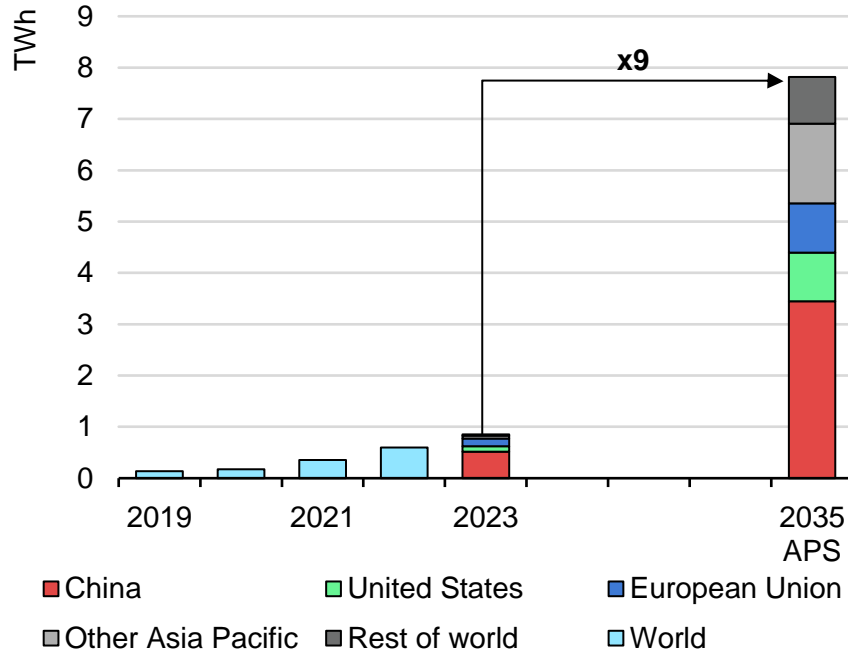
Demand for batteries per region



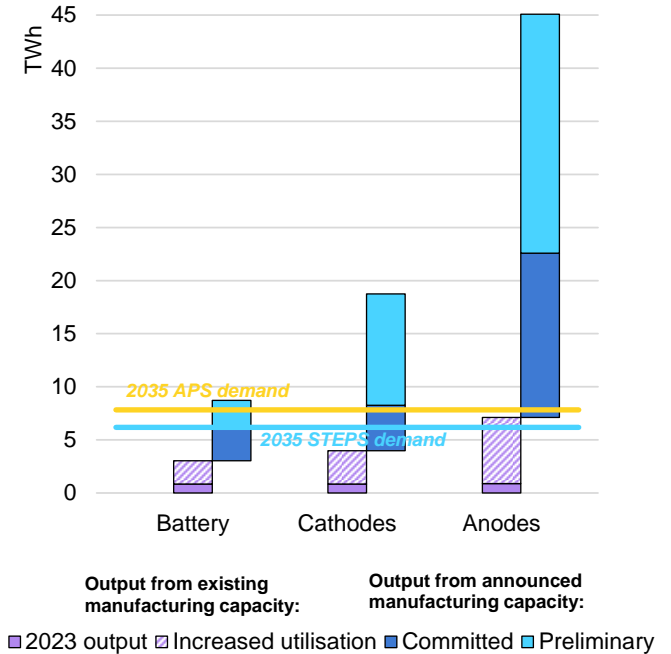
**Investments in electric cars, batteries, and battery components can underpin a more diversified supply chain, and the global announced capacity for batteries can meet deployment needs in the Announced Pledges Scenario.**

# Announced manufacturing capacity exceeds demand by 2035

Demand for batteries per region



Announced manufacturing capacity in 2035 by technology and scenario

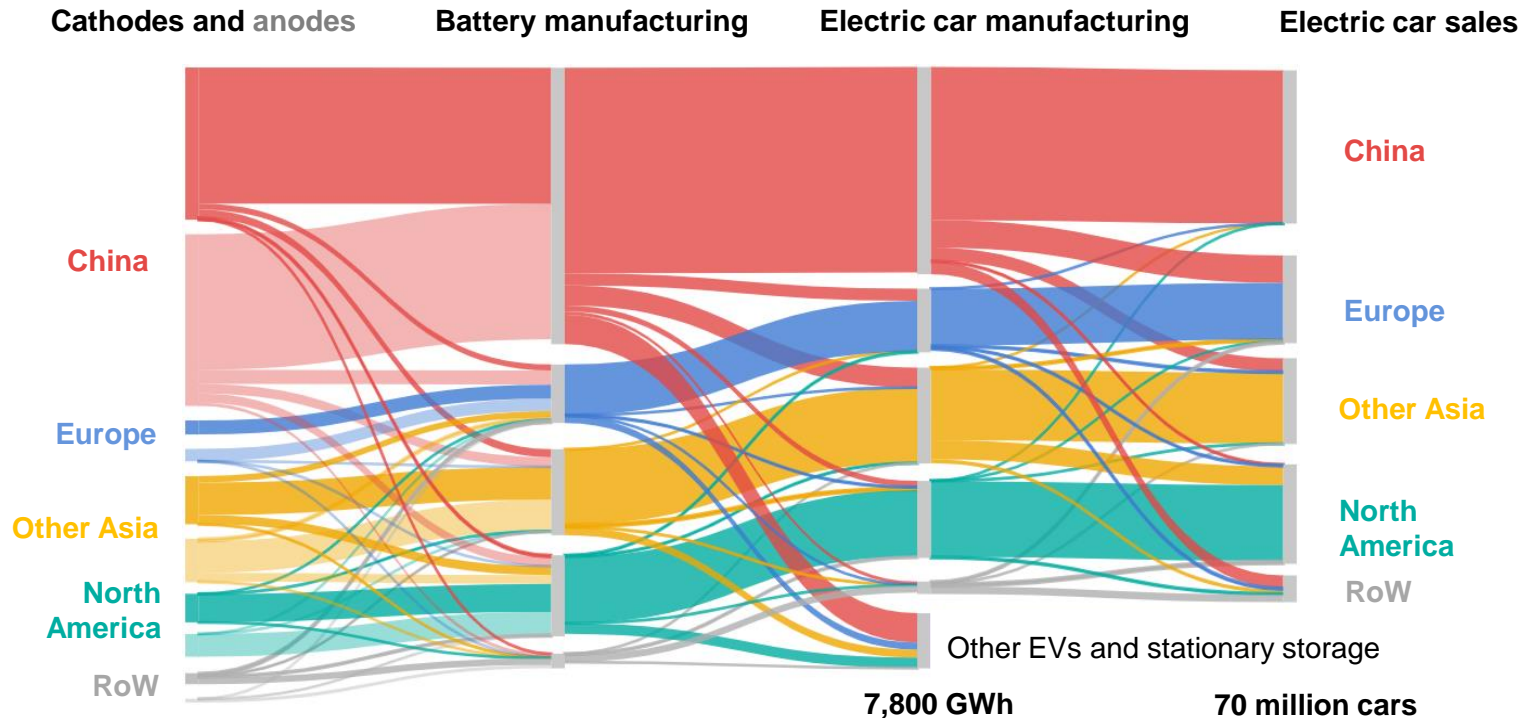


**Investments in electric cars, batteries, and battery components can underpin a more diversified supply chain, and the global announced capacity for batteries can meet deployment needs in the Announced Pledges Scenario.**



# Manufacturing and trade within the battery supply-chain

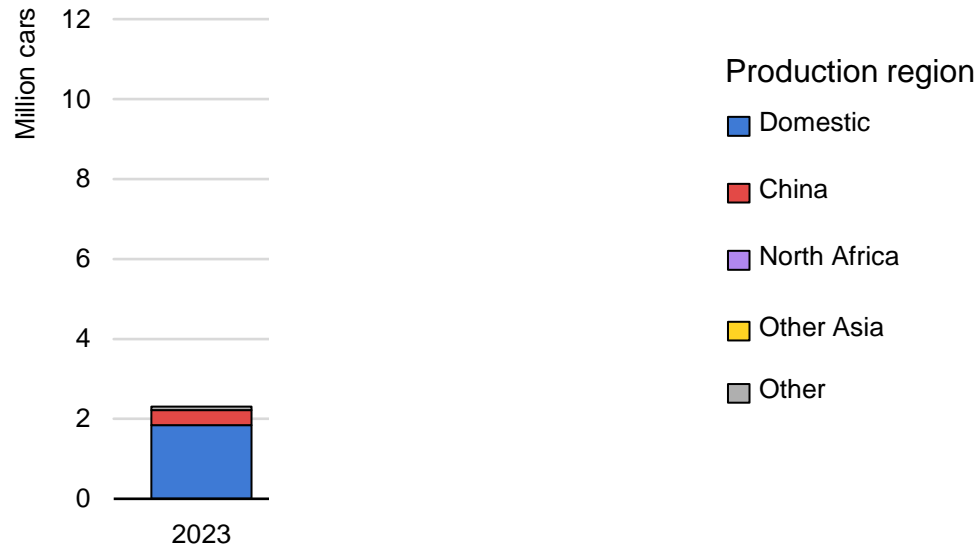
Battery components, cells and electric car manufacturing concentration and trade flows, 2035 (APS)



**China holds most of the upstream segment of the battery supply chain, battery cells and components production. By 2035, China's share decrease while production in other countries increases.**

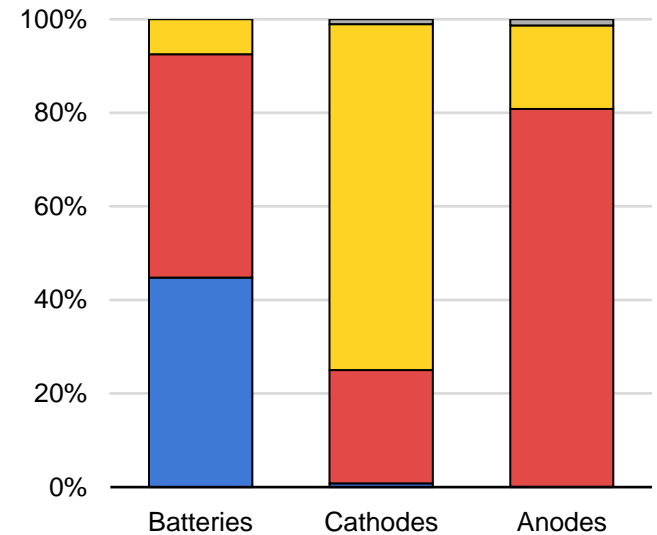
# Industrial policy in the EU can shape the future of EV manufacturing

### Electric car sales



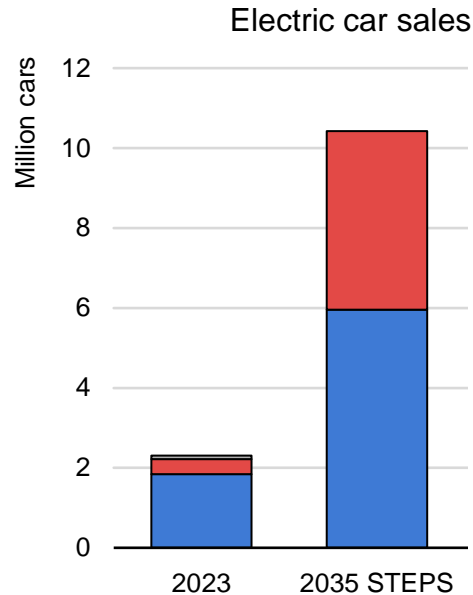
2023

### Battery supply chain production breakdown



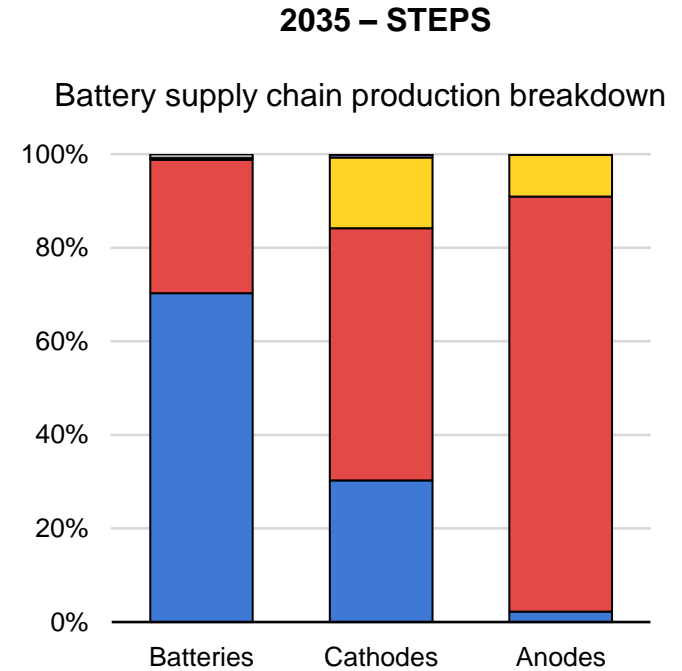
**Innovation and investments along the supply chain can improve the competitiveness of EVs made in Europe.**

# Industrial policy in the EU can shape the future of EV manufacturing



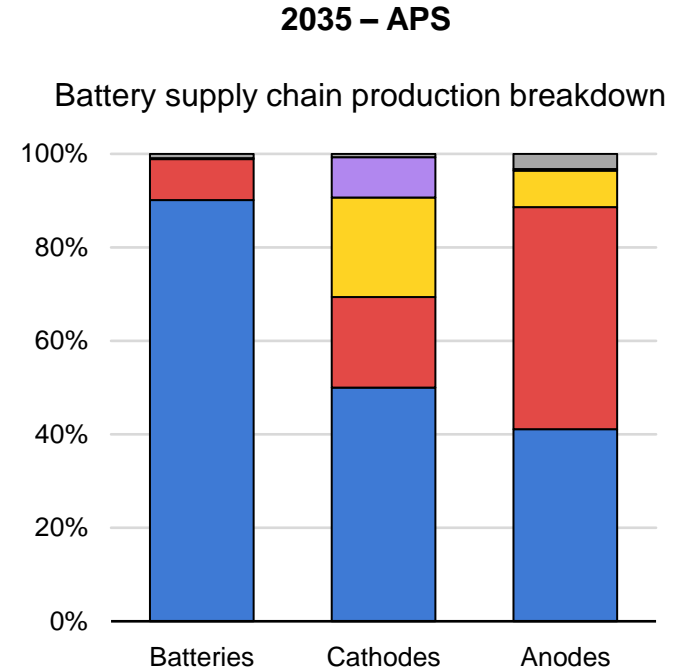
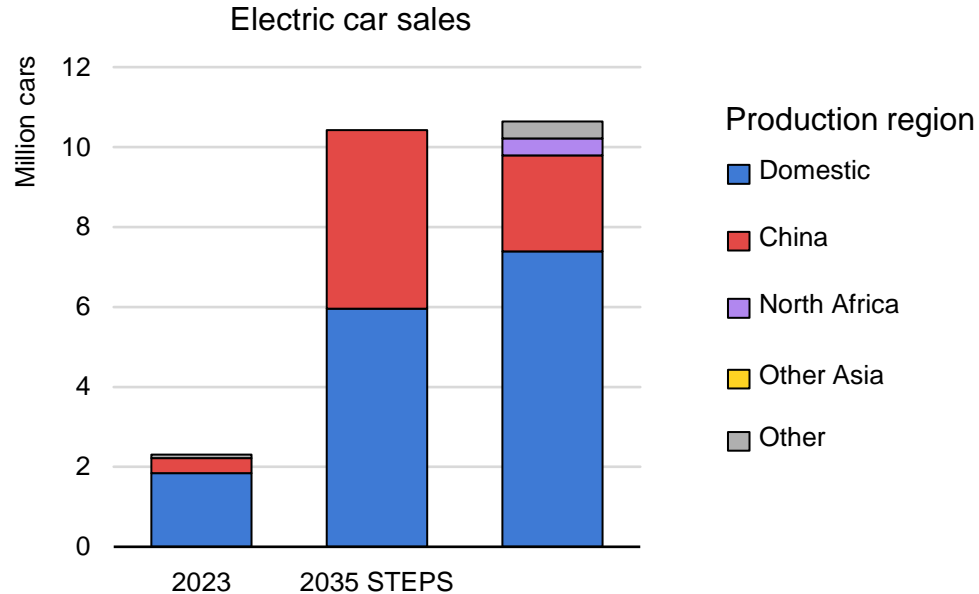
### Production region

- Domestic
- China
- North Africa
- Other Asia
- Other



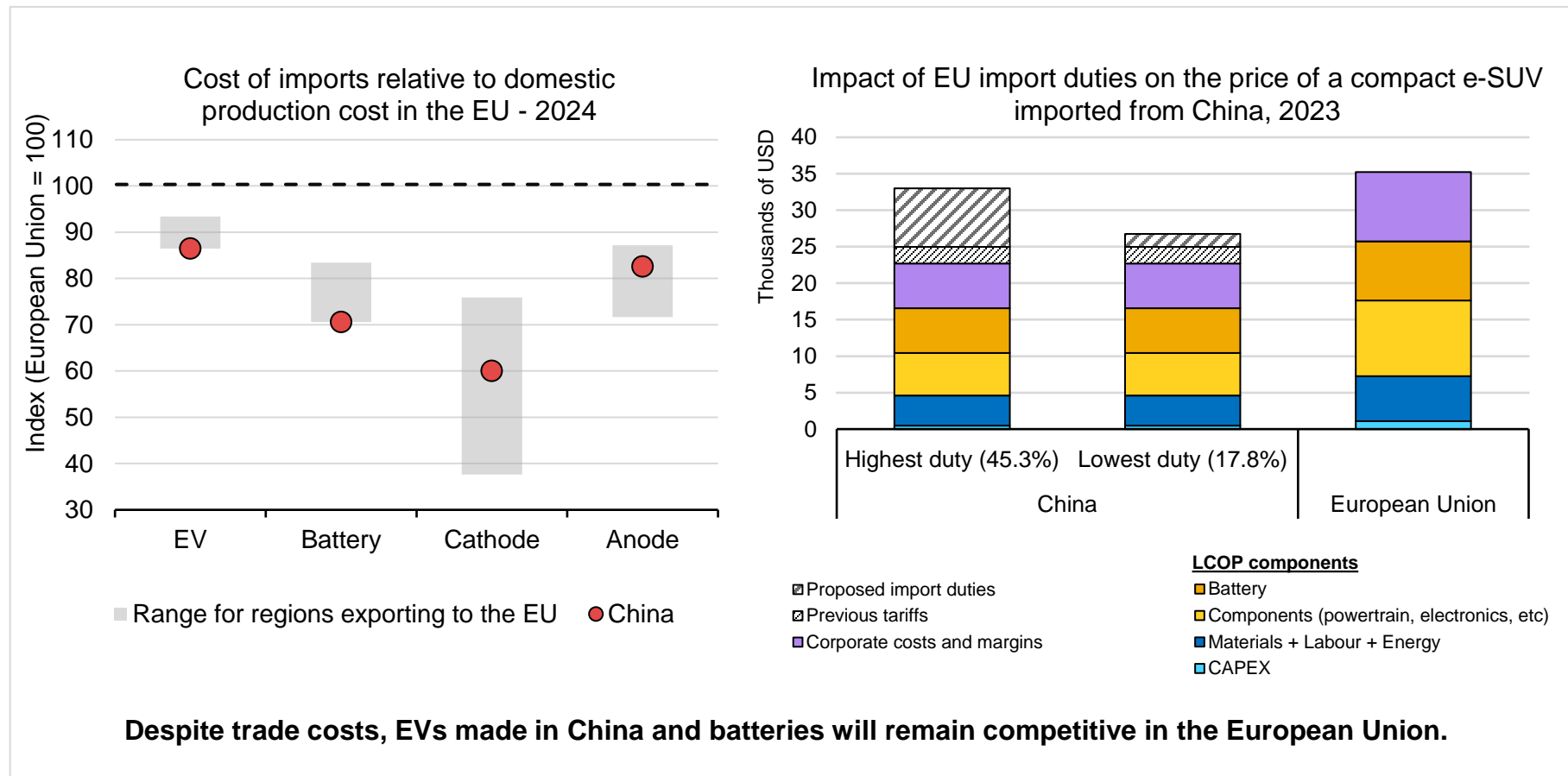
**Innovation and investments along the supply chain can improve the competitiveness of EVs made in Europe.**

# Industrial policy in the EU can shape the future of EV manufacturing



**Innovation and investments along the supply chain can improve the competitiveness of EVs made in Europe.**

# Chinese imports of EVs are primarily driven by competitive costs

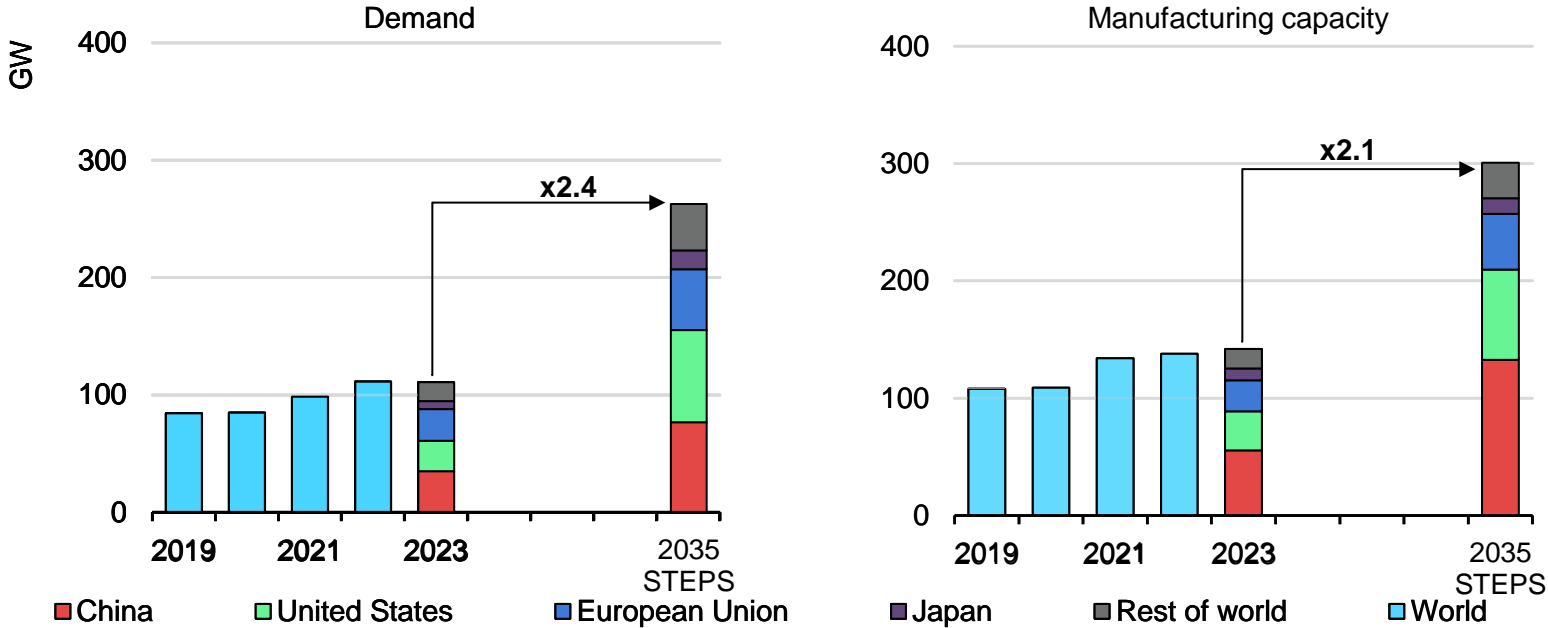


**Despite trade costs, EVs made in China and batteries will remain competitive in the European Union.**

# Heat pumps

# Heat pumps markets differ substantially across regions

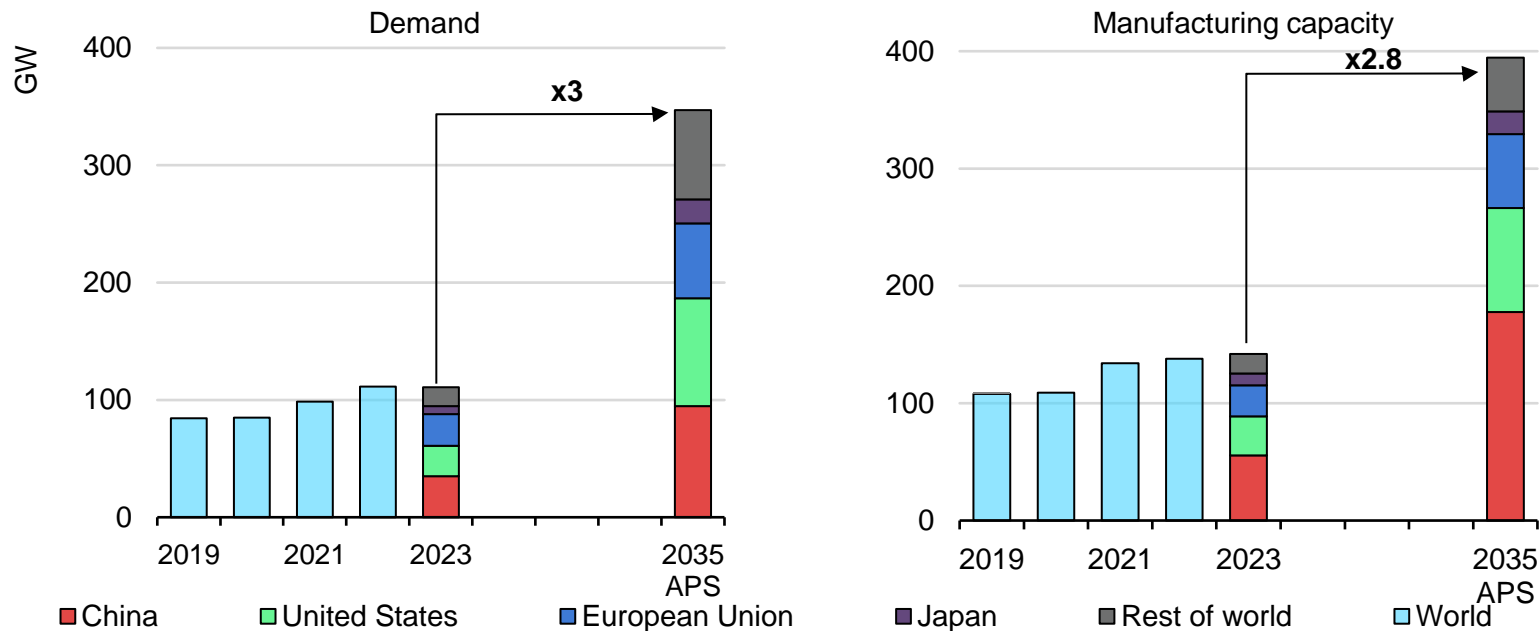
Heat pumps demand and manufacturing capacity, 2019-2035



**Heat pumps tend to be manufactured locally; sustaining high enough production volumes is critical to ensure competitive production costs.**

# Heat pumps markets differ substantially across regions

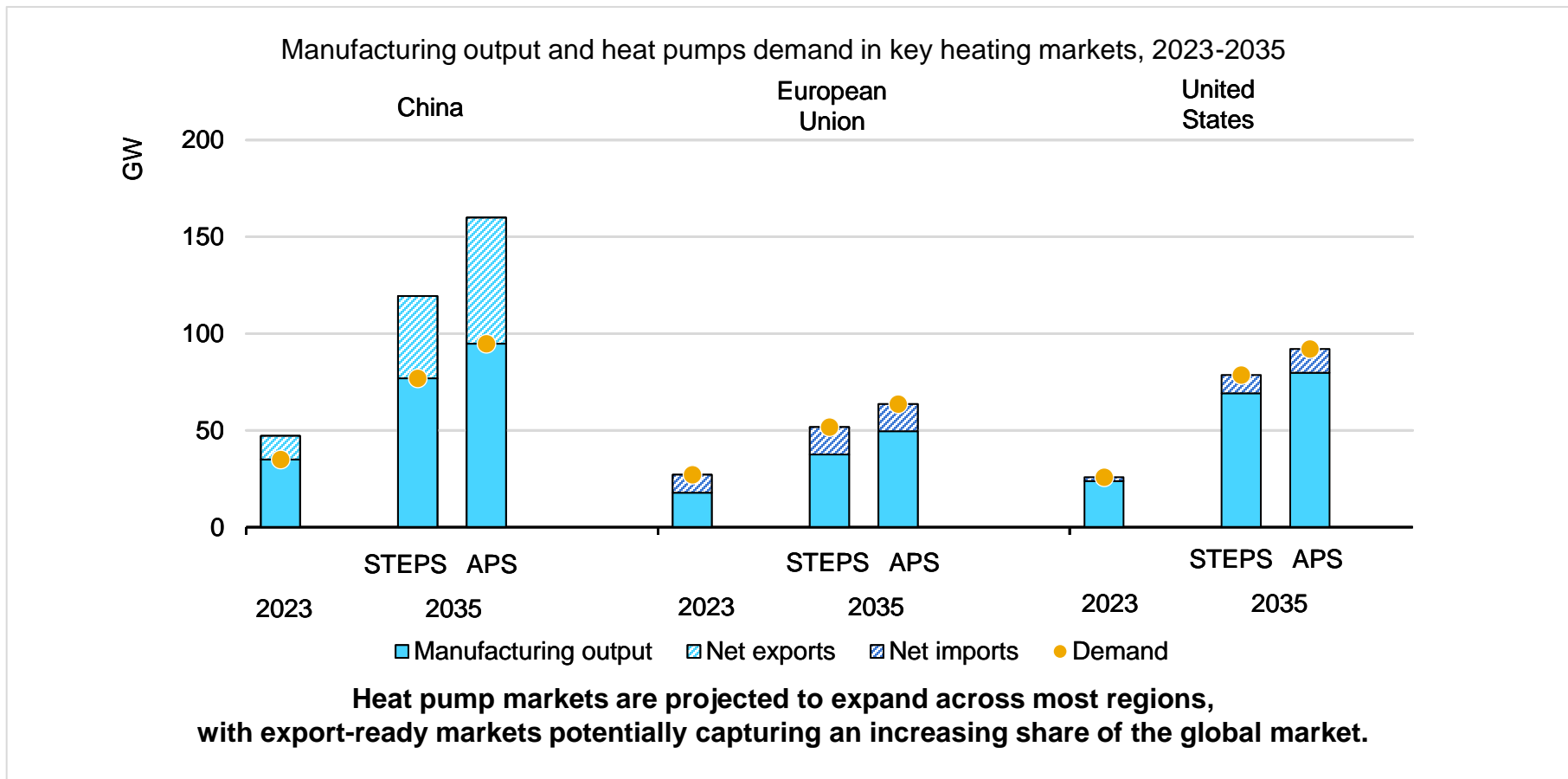
Heat pumps demand and manufacturing capacity, 2019-2035



**Heat pumps tend to be manufactured locally; sustaining high enough production volumes is critical to ensure competitive production costs.**

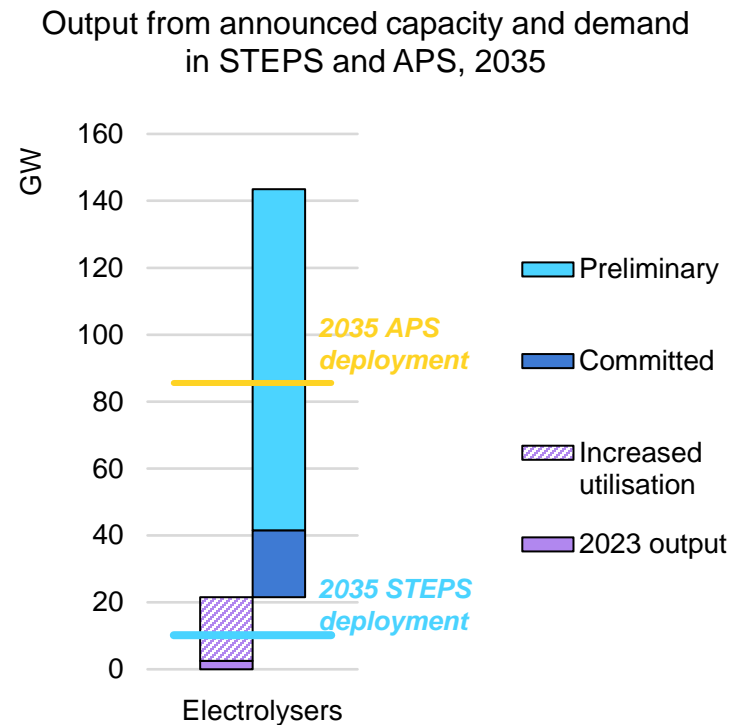
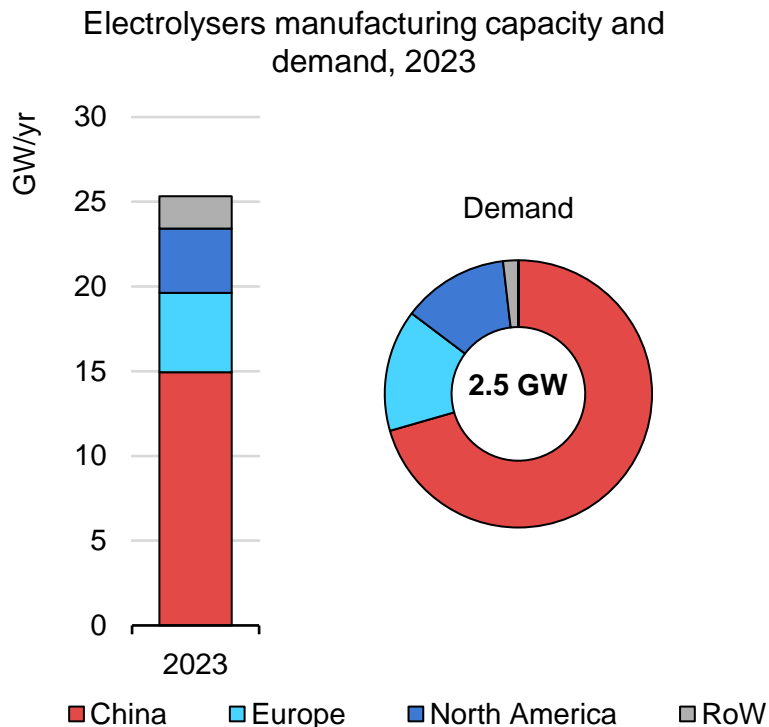


# China remains the principal global exporter of heat pumps



# Electrolysers

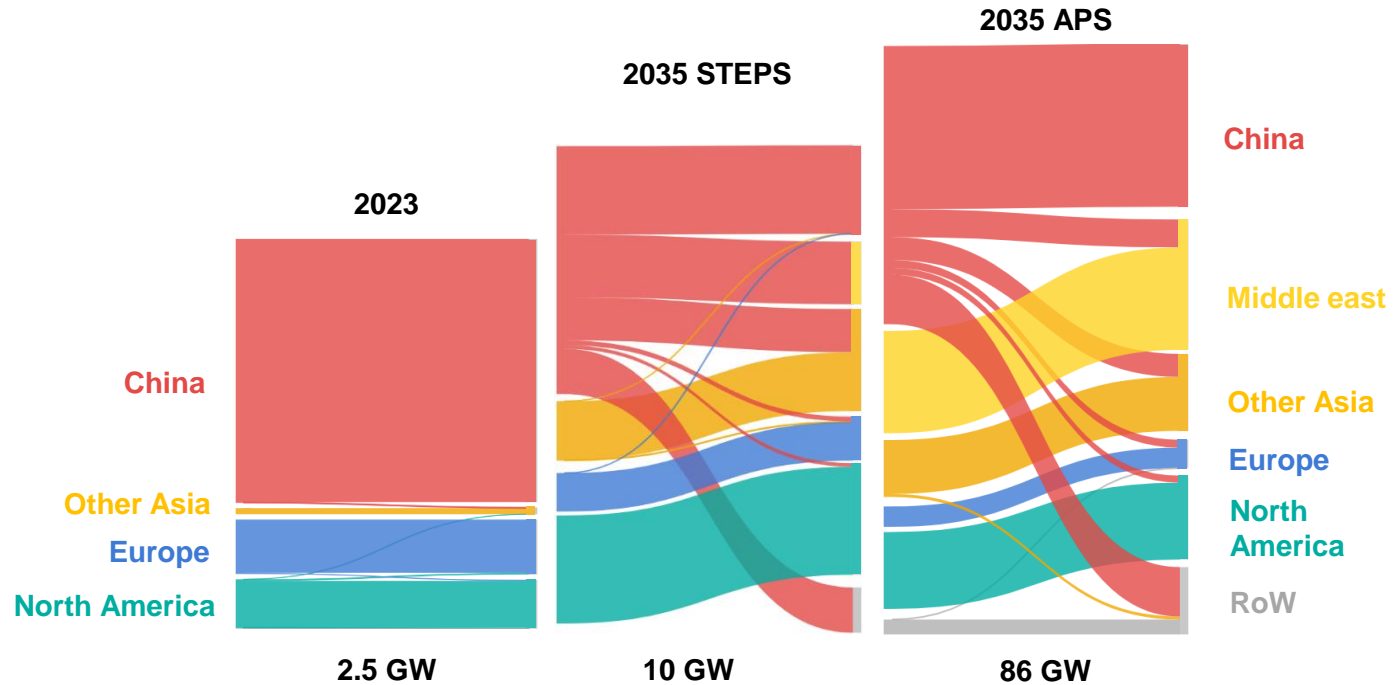
# Manufacturing capacity continues to scale up



**Electrolysers manufacturing capacity is today dominated by China, at 60%, which is also the main market. If projects move ahead to FID and construction, announced facilities could satisfy the demand of all scenarios.**

# A blank canvas for trade

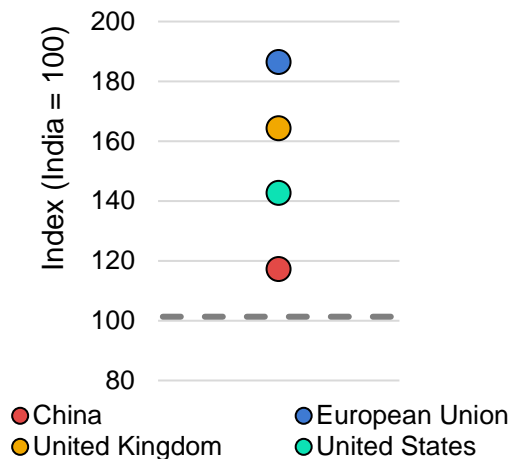
Global trade flows of electrolyzers in 2023, and in the STEPS and APS in 2035



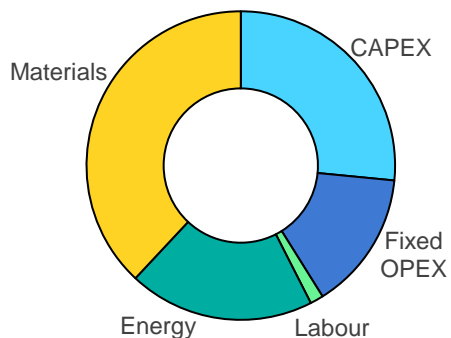
**Electrolysers trade grows from virtually zero today to represent 45% of global demand in STEPS in 2035, almost entirely from China. It grows 4-fold in APS, although in parallel with domestic production in other regions.**

# India: opportunity for a new market

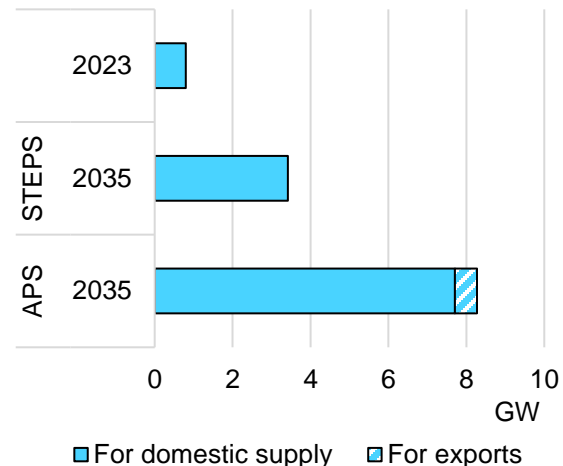
### Cost of imports relative to domestic production



### Manufacturing cost by component



### Manufacturing capacity in 2023 and in STEPS, APS



**Policies to support manufacturing capacity are important to kick-off the creation of a domestic industry, as electrolysers manufacturing in India could be cost competitive relative to imports.**

iea

# Response by Dr van Tongeren

# Questions and Answers



**iea**