



Agenda on the Renewable Energy Trade between India and China (ARETIC)

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Project Scope & Objectives

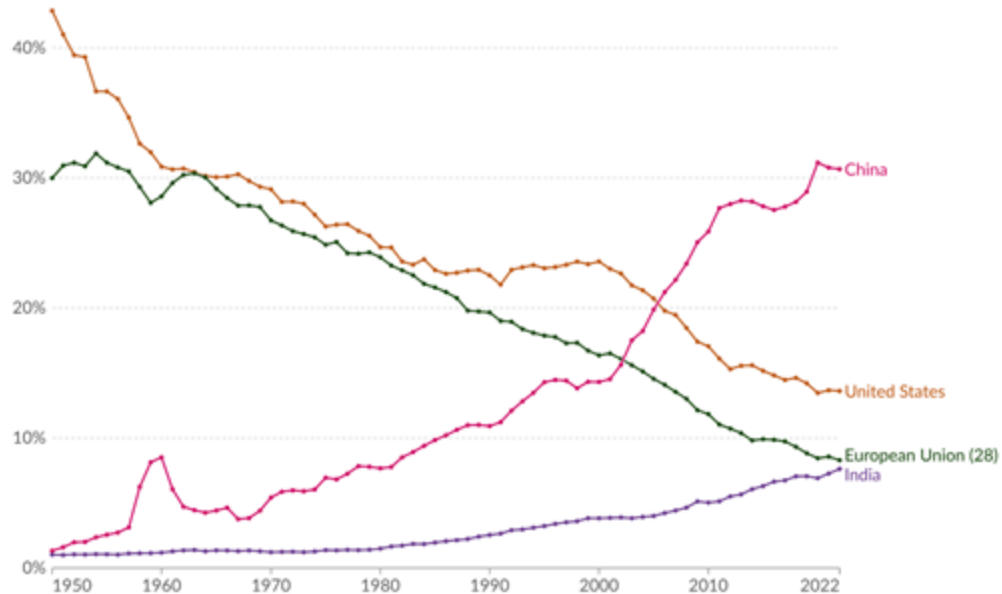
- Exploring trends in the trade in renewable energy (RE) goods between India and China
- What policies matter? What effect are they having?
- Summarize the state of knowledge & debates
- Centralize data sources
- Use data to generate novel descriptive insights
- Identify key policy questions & gaps in the academic literature

Why does China & India's RE trade matter?

Share of global CO₂ emissions

Carbon dioxide (CO₂) emissions from fossil fuels and industry¹. Land-use change is not included.

Our World
in Data



Data source: Global Carbon Budget (2023)

OurWorldInData.org/co2-and-greenhouse-gas-emissions | CC BY

1. Fossil emissions: Fossil emissions measure the quantity of carbon dioxide (CO₂) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO₂ includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.

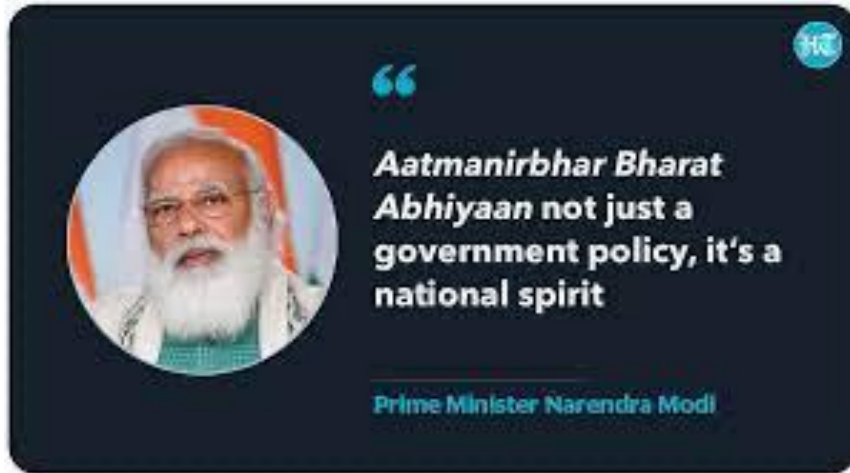
China & India account for a growing share of emissions



China & India have ambitious decarbonization targets

- China:
 - Net Zero by 2060
- India:
 - Net Zero by 2070
 - Meet 50% of energy requirements from RE by 2030
 - Reach a non-fossil fuel capacity of 500GW by 2030
 - Reduce carbon emissions by 1 billion tons by 2030
 - Reduce carbon intensity by 45% from 2005 levels by 2030

“Aatma-Nirbhar Bharat” (Self-Reliant India) initiative



“Friend-shoring” -> Western appetite for India to compete.

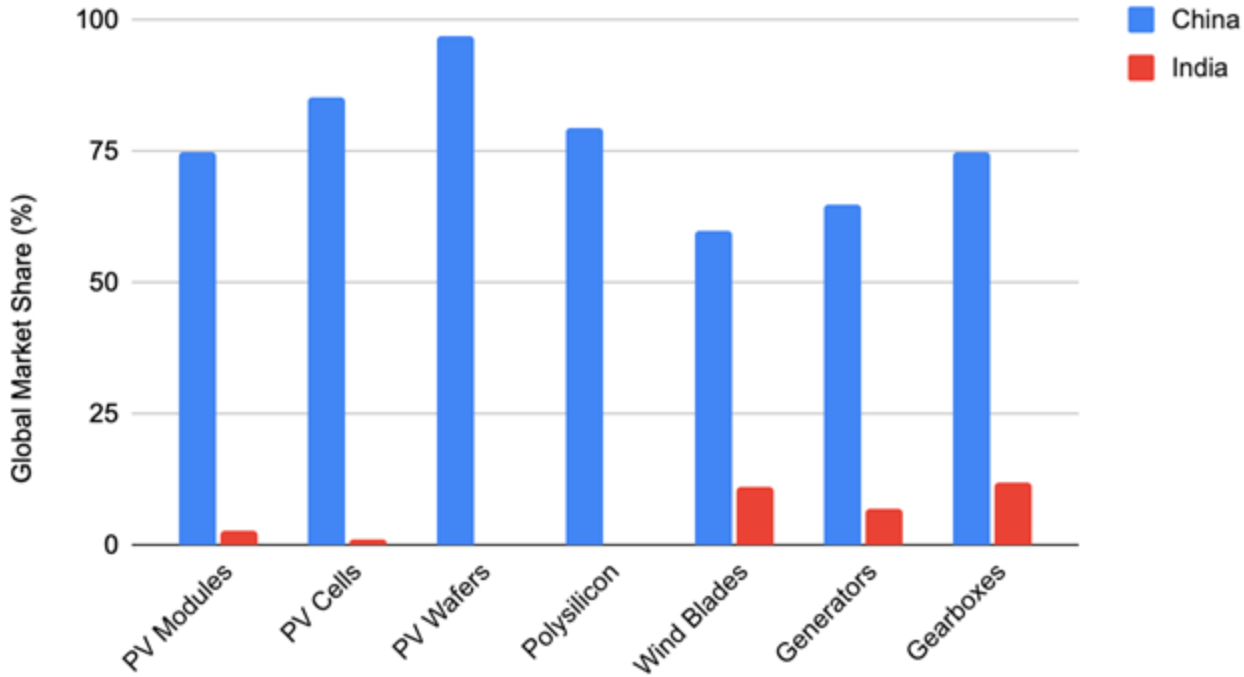


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U.S. Pursues India as a Supply-Chain Alternative to China

Biden administration turns to New Delhi as it seeks to steer critical technologies away from Beijing





Source: IEA (2022), GWEC (2023)

However: China controls many key markets for RE goods

Initial Descriptive Findings

Surveying the data landscape

Name	Organization	Description	Used by:
UNCTAD TRAINS	WITS	MFN and Applied Tariff at the HS 6 digit level	Garg & Saxena (2022)
China's Customs Data	Self-collected	Custom data at firm-year level	
GTA database	Global Trade Alert	52500+ records of unilateral commercial policy interventions	
World Integrated Trade Solution	World Bank	Product-country level trade w/ sources, destinations, & tariffs	
Volza Grow Global	Volza	Global export/import data for 78+ countries	
India Solar Export Import Tracker	Mercom India	Monthly solar trade	
UN Comtrade	UN	Global annual and monthly trade statistics by product and trading partner	
ITPD-E	US ITC	Agriculture, mining, energy, manufacturing, and services trade data	
CHELLEM Trade	CEPII	Bilateral flows on all traded goods	
Trade Unit Value	CEPII	Trade unit values (in USD/ton) at year-reporter-partner-product level	
Trade in Value-Added (TiVA)	OECD	Country-level value added data	Scheifele et al. (2022) Scheifele et al. (2022) Jackson et al. (2021) Joseph (2021)
BACI	CEPII	Bilateral trade flows for 200 countries at the 6 digit product level.	
Trade Data	OECD	Trade data for 5018 products on 6-digit HS code level	
China Overseas Solar PV Database	N/A	China's overseas trade and investments in PV technology and projects	
EXIOBASE	UN	Environmentally extended multi-regional input-output (EE MRIO) tables	Mondal (2024)
World Trade Flows Characterization	CEPII	Reconciled unit values at the year - exporter - importer product level	
ICIO Tables	OECD	Input, output and final demand for industries in countries	
Trade and Foreign Economy	EPS China Statistics	Monthly and yearly trade value data on product and ownership level.	
Export-Import Data Bank	India DoC	Monthly and yearly trade value data	
TradeProd	CEPII	International and domestic trade flows and trade protection	
PV Directory	ENF	Comprehensive database of firms operating in solar industry	
Product Database	ENF	Shows which solar firms produce which products	
Project database	Bridge to India	All utility scale solar and wind projects in India	
Tender tracker	Bridge to India	Comprehensive record of all solar and wind tenders	
Price indices	Bridge to India	Auction tariffs, grid power tariffs, prices of all key solar components	Garg & Saxena (2022) Garg & Saxena (2022) Garg & Saxena (2022) Garg & Saxena (2022)
BloombergNEF	Bloomberg	Commodity prices, deployment & installation, policy, ESG	
Renewable Power Generation Costs	IRENA	Global weighted average cost of solar & wind projects	
India Solar Market Share Tracker	Mercom India	Top players, installations, shipment figures, growth rates for solar market	
RE Regulatory Updates	Mercom India	Indian renewable energy regulations	



Key Indian trade policies

Production-Linked Incentive (PLI) Scheme

In 2020, the Indian government pledged \$600 million to subsidize the solar PV module industry under the PLI Scheme. In this scheme, companies can apply for incentives on incremental sales.

Faster Adoption & Manufacturing of Hybrid & Electric Vehicles (FAME)

The FAME scheme employs demand-side incentives in the form of EV purchase subsidies to stimulate the creation of an indigenous electric vehicle value chain (Rajshekhar 2023b). It applies to commercial and public sector purchases of electric three-wheelers, electric four-wheelers, and electric buses, as well as private purchases of electric two-wheelers. To be eligible for the subsidies, the products must use locally sourced components.

Approved List of Models and Manufacturers (ALMM)

Since the conclusion of the LCR program, the Indian government has used public sector procurement to incentivize domestic solar manufacturing. Starting in 2021, the government requires that solar development projects bid out by the government source panels from the ALMM. As of March 2022, the ALMM did not include any foreign manufacturers (Minocha 2022).

Tariffs on Solar Products

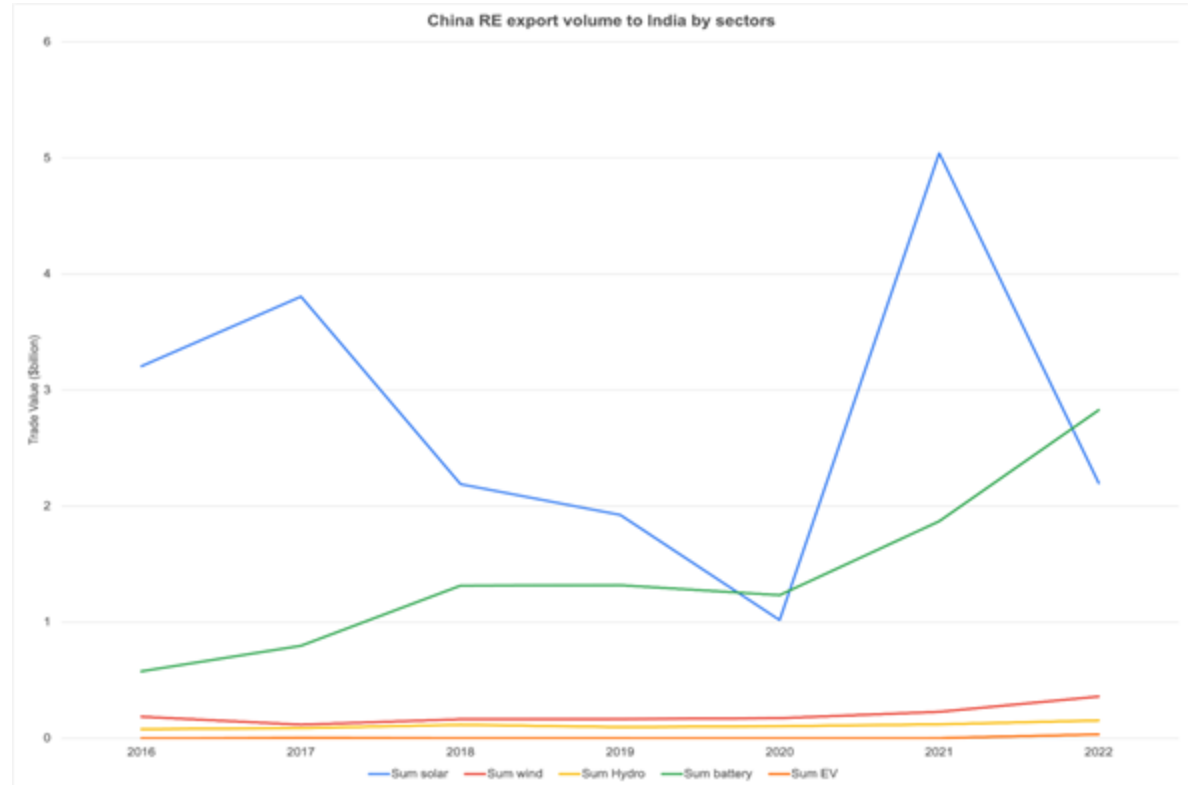
Starting in 2018, India introduced significant tariffs on solar module and cell imports. Initially, the tariffs were set at 25% and applied only to imports from China, Malaysia, and Chinese Taipei; additionally, the tariffs were scheduled to decrease over time, to 14.5% in 2021. Yet, in 2022, the tariffs were increased to 40% for solar panels and 25% for solar cells, as well as changed to a basic customs duty applying to all imports.

Remissions of Duties or Taxes on Export Products (RoDTEP)

The RoDTEP Scheme provides a 0.8% credit rebate on all wind turbine parts exported out of India. It was announced in January 2021 to replace the Merchandise Exports from India (MEIS) Scheme; when this occurred, the credit rebate for wind turbine parts was reduced from 2% to 0.8% (Global Wind Energy Council 2023a). The scheme was recently extended to last until June 2024 (Ministry of Commerce & Industry 2023).

How have RE trade volume & policy evolved?

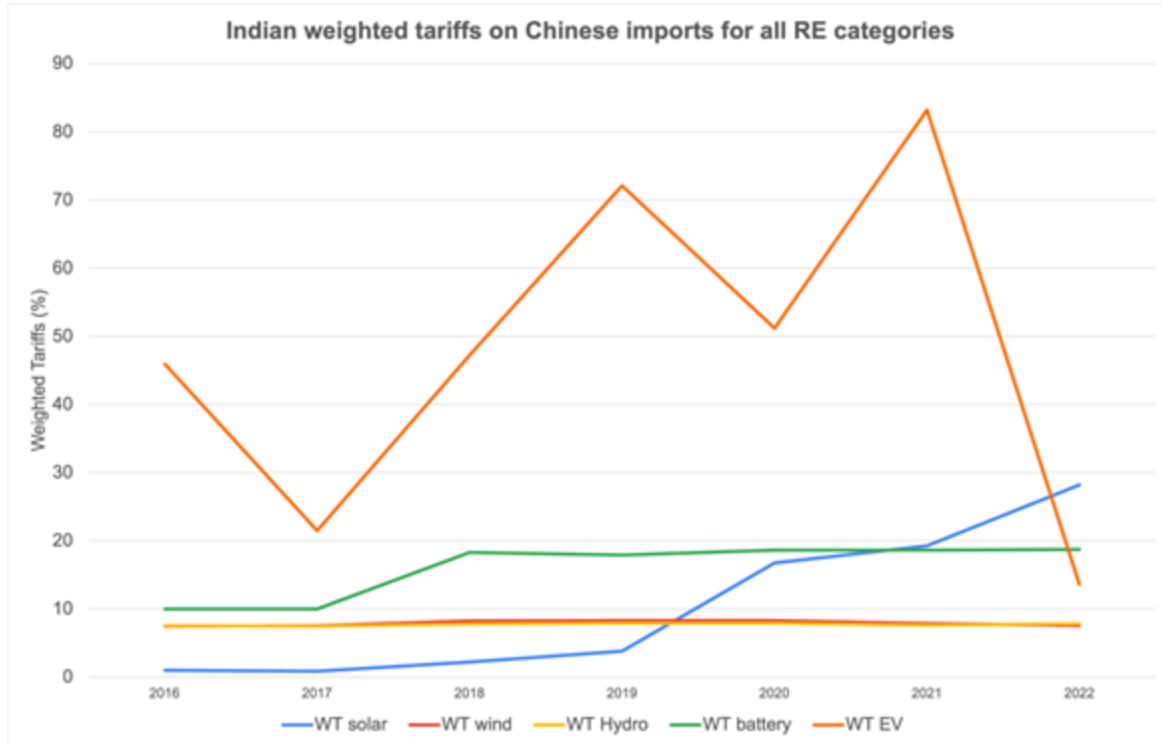
- Fluctuating solar imports
- Battery imports steadily rising



Data source: Indian Department of Commerce,
Indian Central Board of Indirect Taxes & Customs

How have RE trade volume & policy evolved?

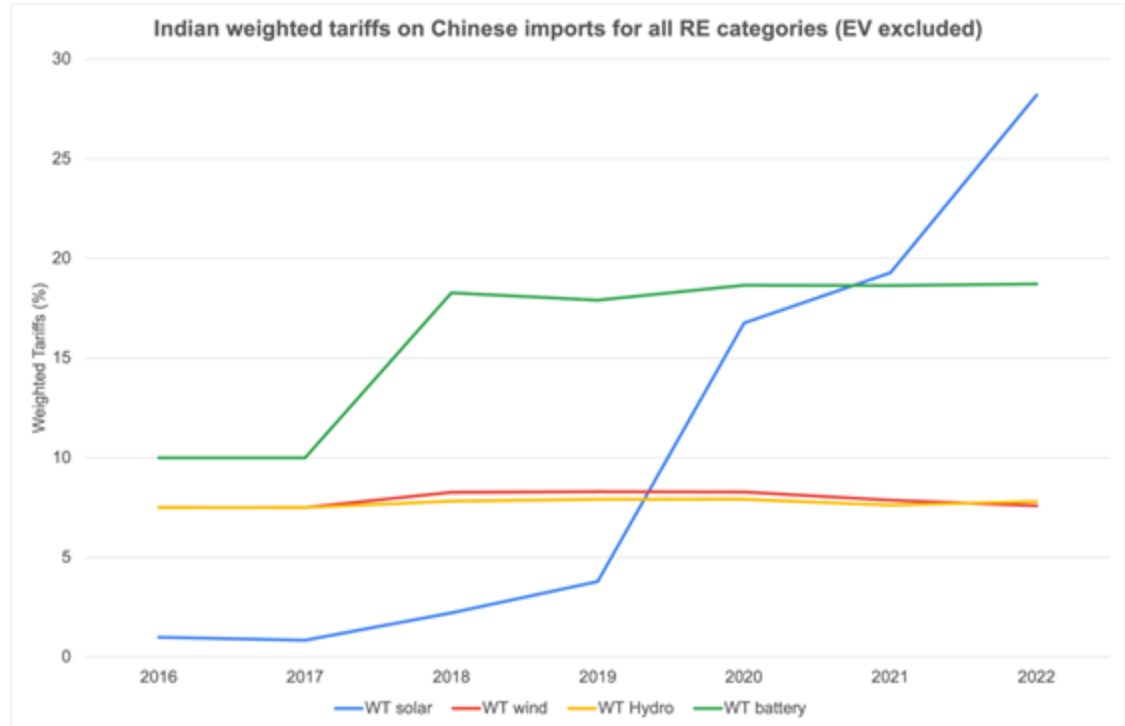
- Very high EV tariff, fluctuating greatly
 - Artifact of weighting methodology



Data source: Indian Department of Commerce,
Indian Central Board of Indirect Taxes & Customs

How have RE trade volume & policy evolved?

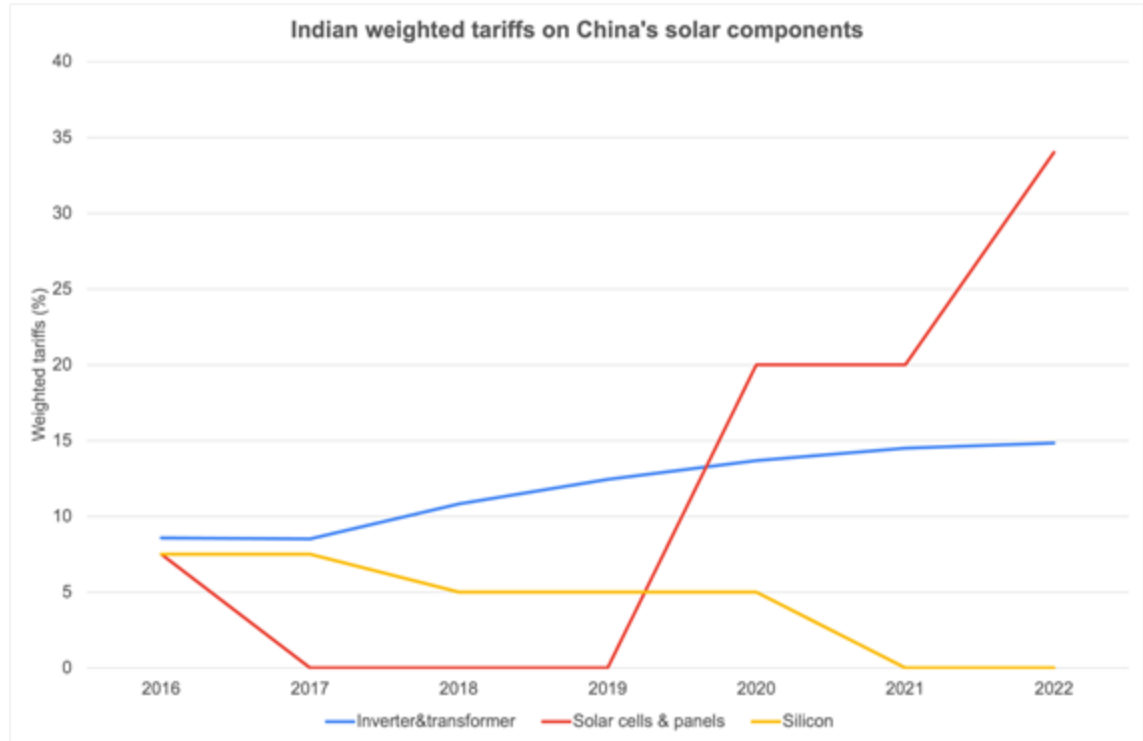
- Recent increases in solar tariffs
- Batteries protected as well



Data source: Indian Department of Commerce,
Indian Central Board of Indirect Taxes & Customs

How have RE trade volume & policy evolved?

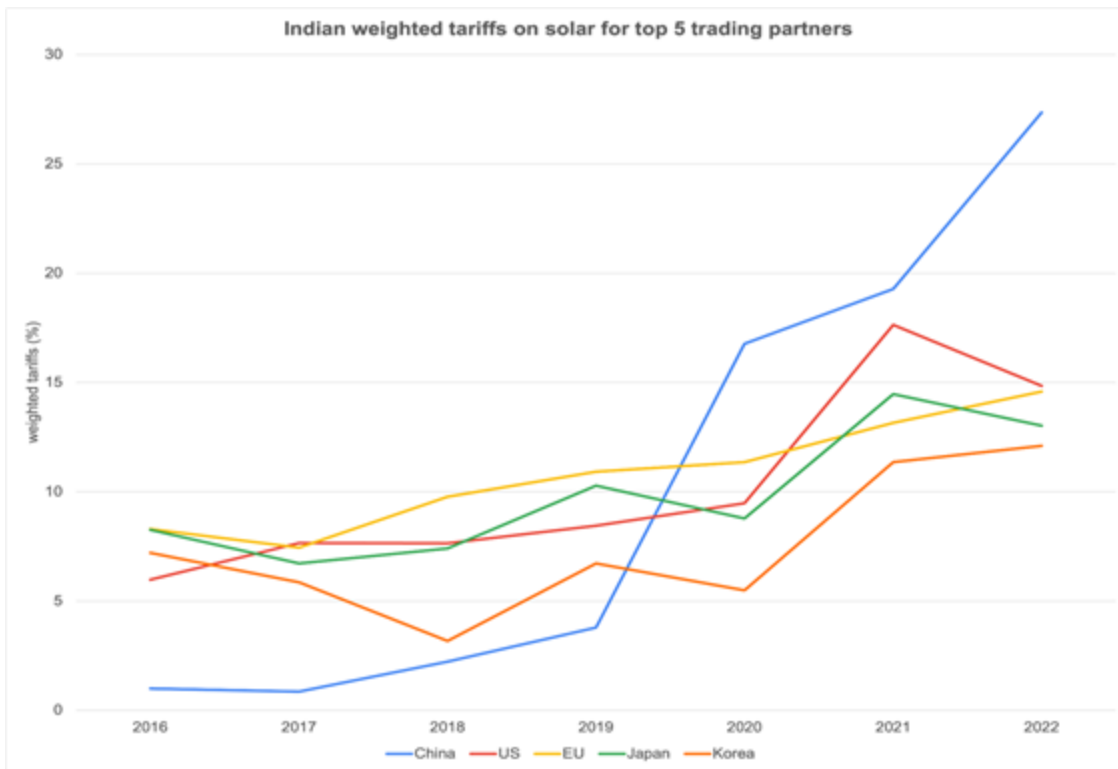
- Solar tariff increase driven tariffs on solar cells & panels



Data source: Indian Department of Commerce,
Indian Central Board of Indirect Taxes & Customs

How have RE trade volume & policy evolved?

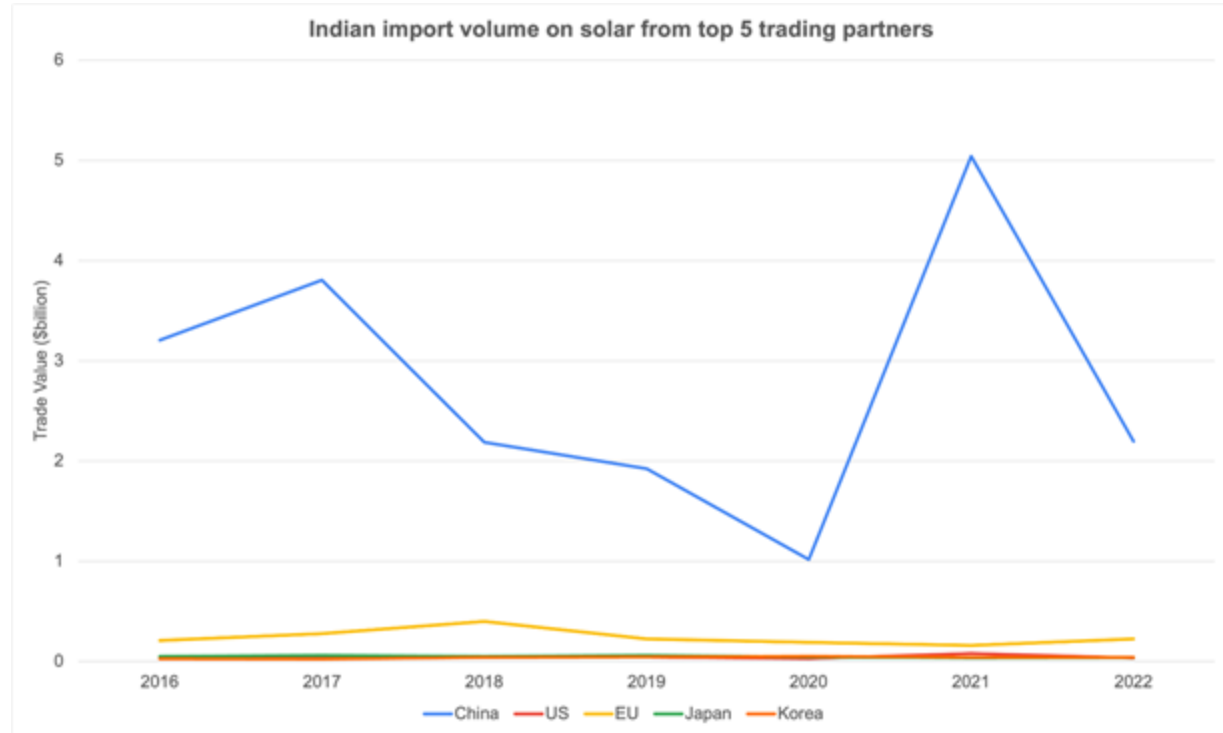
- Not just about China!



Data source: Indian Department of Commerce,
Indian Central Board of Indirect Taxes & Customs

How have RE trade volume & policy evolved?

- ...but China has outsize importance!



Data source: Indian Department of Commerce,
Indian Central Board of Indirect Taxes & Customs

How have RE trade volume & policy evolved?-Solar

[illegible]

How have RE trade volume & policy evolved?-Wind

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
if change					India: Definitive countervailing duty on imports of certain castings for wind operated electricity generators from China			India: Expiry of definitive antidumping duty on imports of certain castings for wind operated electricity generators from China		India: Preference for local procurement of renewable energy technology in government purchases	India: Scheme for renewable energy power generation by farmers with local content requirement s	India: Increased local content requirement for public procurement of goods related to the power distribution sector		India: Relaxation in public procurement of goods related to renewable energy projects	
content requirement								India: Local sourcing requirement s for domestically funded power projects				India: Preference for local procurement of renewable energy technology in government purchases (September 2020)			
								India: Requirement of local operations for wind turbines							

Key Questions



What effect is Indian trade policy having?

- Literature on Indian RE trade policy focuses on 2014-2017 local content requirements (LCR)
 - Probst et al. (2020); Scheifele, Brauning, & Probst (2022); Münch & Scheifele (2022)
- Scant literature on other policies (ALMM, PLI, tariffs)
- **Imports from China down 80% in 2023, up 45% from other trade partners... why?**



The deployment/domestic manufacturing trade-off

- Interests of solar developers and solar manufacturers at odds – not just in India
- Historically: *resolved in favor of “the deployment of mature RE technologies at the lowest cost over support for indigenous innovation and manufacturing” (Bhatia, 2023)*
- **Are tariff increases product of shifting political landscape?**
 - Are tariffs inhibiting deployment?
- **What political/economic factors drive outcome of this interest group competition?**



How will this affect the global policy & trade landscape?

- How do changes in the India-China RE trade relationship reverberate globally?
 - How is the relationship affected by China's/India's relationships with other countries?
- Will new forms of LCR bring WTO disputes?
- How will it affect the overall pace of innovation?
- How are capital movements affected?

Challenges



Challenges

- Categorizing “renewable energy goods”
- Multiple dimensions to explain general trends and turning points in trade volume and weighted tariffs
- Policy regulation not specified on HS code level, hard to trace specific policy influencing our core product
- Broad scope – what direction to go for (academic) papers?