JUNE 4, 2025

#EU GREEN WEEK

EU Green Week Partner Event

Incorporation of Geopolitical Risk Factors in EU National Energy and Climate Policies (NECP): Developing a Geopolitical Energy Vulnerability Index

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ETOS

AGAUR Agència de Gestió d'Ajuts Universitaris i de Recerca

THE WATER-ENERGY-FOOD NEXUS: BUILDING RESILIENCE TO GLOBAL CHALLENGES

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BACKGROUND

The Shifting Global Energy Landscape: Opportunities and Challenges

- **IPCC AR6** – to limit global warming from rising above 1.5 °C
- **Policies** - European Green Deal and European National Energy and Climate Policies (NECPs)

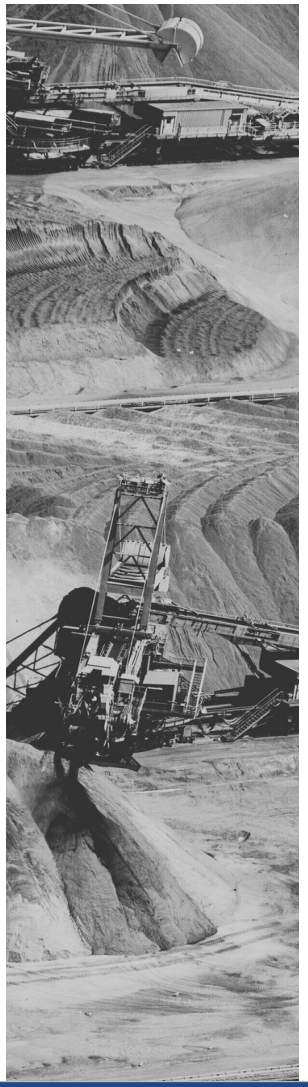
- Rapid growth in renewable energy is crucial for climate goals.
- **Shift of dependencies**

- Understanding the **geopolitical implications** of these new **dependencies is vital.**

BACKGROUND

New Dependencies, New Vulnerabilities in Renewables

- **Supply chains** for renewable technologies - **interconnected**.
- Concentration of raw material mining and processing in **few countries**.
- Reliance on **specific nations for manufacturing and technological expertise**.
- Potential for trade disruptions, geopolitical leverage, and supply chain instability.



How can we systematically assess these emerging geopolitical vulnerabilities?

OBJECTIVE

Development of the Geopolitical Energy Vulnerability Index (GEVI)

A **composite index** that **quantifies** the geopolitical energy **vulnerability** for key global providers of selected renewable energy technologies.

To provide a **tool for policymakers**, industry, and researchers to understand and mitigate these risks.

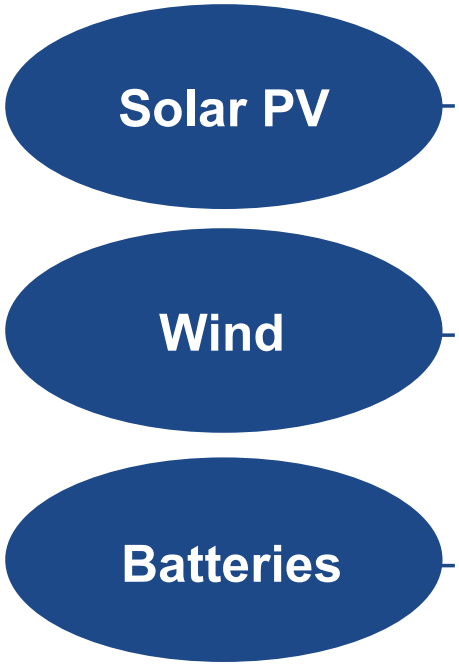
METHODOLOGY

- **The GEVI** is derives from **five core factors** based literature review and interviews, weighted through expert consultation (interviews and survey) and tailored for relevance to the **three renewable technologies** and their leading global country providers.

- Applied to the **Spanish case study**

SCOPE OF ANALYSIS

Renewable Technologies Covered:



Main country providers for Spain:

- China
- Germany
- The Netherlands
- Portugal
- Malaysia

- China
- India
- Germany
- Portugal
- France
- The Netherlands

- Germany
- France
- Italy
- Portugal
- China

RESULTS

Factor Selection (Interviews and Survey), Indicator Selection and Data Collection

- The results from the interviews and the survey are the following:
- 6 interviewees from **national level (Spain)**
  - Ministry of Ecological Transition (MITECO) of Spain
  - Institute of Energy Diversification of Spain (IDAE)
  - Office of Climate Change of Spain (OCC)

Dependence on Raw Material Imports (DRMI)	Ratio of Net Imports to Domestic Production: (Imports - Exports) / Domestic Production
Trade Restrictions (TR)	OECD (2025), OECD Services Trade Restrictiveness Index
Raw Material Concentration (RMC)	Herfindahl–Hirschman Index (HHI)
Dependence on Technology Imports (DTI)	Ratio of High-Tech Imports to Total Imports: (Value of High-Technology Imports / Total Value of Imports) * 100%
Geopolitical Tensions (GT)	Geopolitical Risk Index (Caldara and Iacoviello 2022)

RESULTS

Weighting: Survey

Figure 1. Weighting per Factor and Renewable Technology

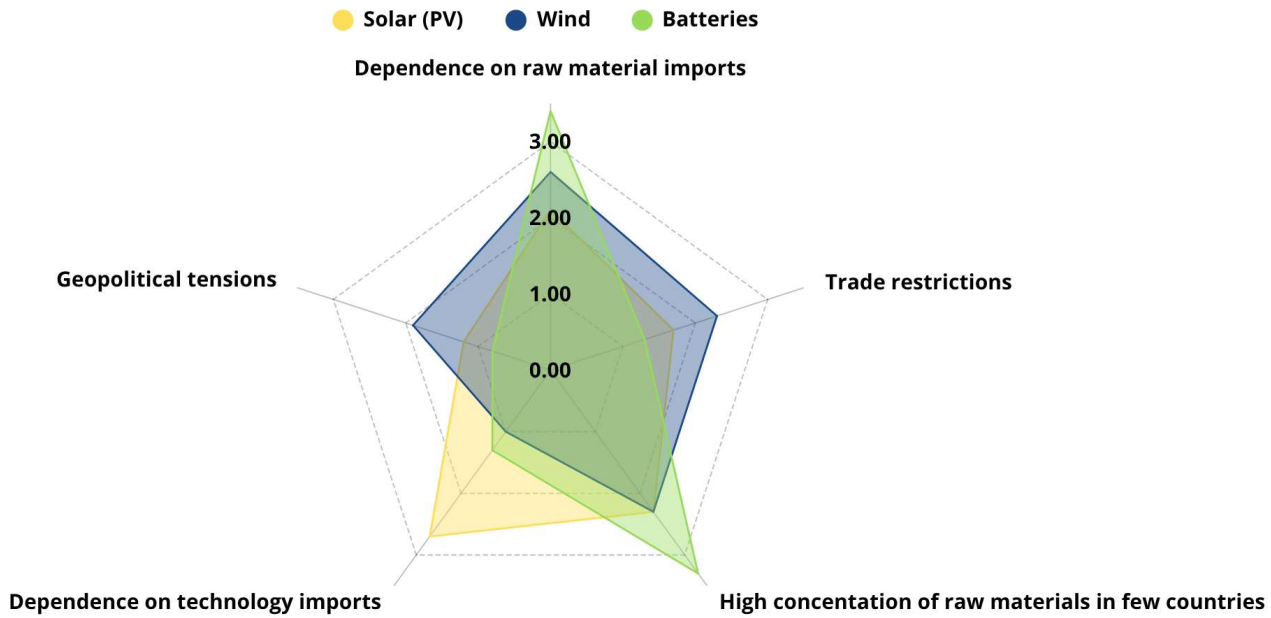
Geopolitical factor	Solar (PV)	Wind	Batteries
Dependence on raw material imports	2.1	2.6	3.4
Trade restrictions	1.7	2.3	1.3
High concentration of raw materials in few countries	2.3	2.3	3.3
Dependence on technology imports	2.7	1.0	1.3
Geopolitical tensions	1.2	1.9	0.8
TOTAL	**10.0**	**10.0**	**10.0**

- **12 respondents** (in process) from international and national level
- Exercise of **constant sum:** distribute 10 points to the 5 factors

RESULTS

Weighting

Figure 2. Weighting by Factor and Renewable Technology



- Depending on the technology the **weight is different**
- For the case of Spain :
  - Solar and Batteries technologies had very similar results – importing
  - Wind technology – domestic manufacturing

RESULTS

Aggregation to a single GEVI index

$$GEVI_{country,tech} = \sum_{factor}(NormalizedFactorScore_{country} \cdot Weight_{factor,tech})$$

$GEVI_{country,tech}$ - Geopolitical Energy Vulnerability Index score per country provider and technology (Solar, Wind, Batteries)

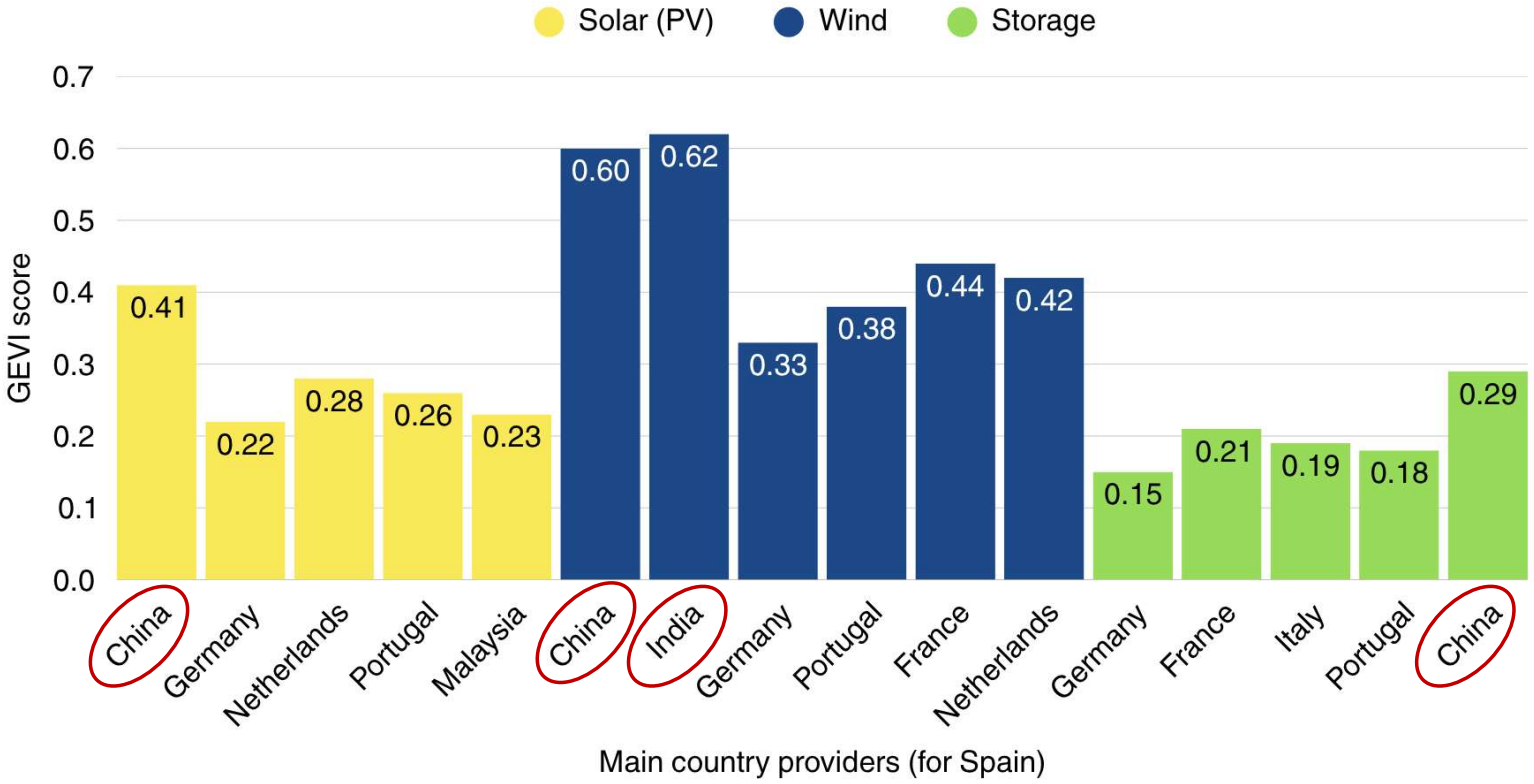
$\sum_{factor}$ - Sum of the different factors selected

$NormalizedFactorScore_{country}$ - Normalised score for a particular factor within a specific country (0-1)

$Weight_{factor,tech}$ - Weight assigned to that specific factor for a given technology (expert consultation)

RESULTS

Figure 3. GEVI Score by Country and Renewable Technology



- GEVI identifies specific **countries** and **technologies** that create higher **geopolitical vulnerability**:
  - China and India
  - Wind Technology
- GEVI compares vulnerability profiles across different technologies and countries

CONCLUSION

Main takeaways:

- The transition to renewable energy brings **new geopolitical vulnerabilities** that require careful assessment.
- The **GEVI** provides a structured framework to **quantify and compare these vulnerabilities** across key technologies and countries.
- Understanding these risks is the first step towards building more secure and resilient clean energy supply chains and energy transition.

CONCLUSION

Why it is relevant?

- Provides a crucial analytical tool for navigating the complex geopolitics of the energy transition.
- Highlights the need for **proactive measures to de-risk** renewable energy supply chains.
- Informs policymakers and encourages **investment in domestic production** of technologies and processing of critical materials.

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THANK YOU!

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