

Europe-30's Import Dependence in Environmental Goods

Data-Driven Roadmaps for Catalyzing Green Growth in Eastern Europe

Marek Tiits & Tarmo Kalvet



Title: Europe-30's Import Dependence in Environmental Goods. Data-Driven Roadmaps for Catalyzing Green Growth in Eastern Europe

Authors: Marek Tiits & Tarmo Kalvet

Cite as: Tiits, M., Kalvet, T. (2026). Europe-30's Import Dependence in Environmental Goods. Data-Driven Roadmaps for Catalyzing Green Growth in Eastern Europe. Tartu: Institute of Baltic Studies

Supported by:



on the basis of a decision
by the German Bundestag



The research has been supported by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) on behalf of the German Federal Ministry for Economic Affairs and Climate Action (BMWK), under the European Climate Initiative (EUKI).

Large language models were used to assist with the data processing and final language editing. The authors remain fully responsible for the conceptual framework, analysis, interpretation, conclusions and final content.

Institute of Baltic Studies
Lai 30, Tartu 51005,
Estonia
tel +372 699 9480
ibs.ee



Table of Contents

1. EUROPE-30'S IMPORT DEPENDENCE IN ENVIRONMENTAL GOODS	5
1.1. Product groups with sensitive dependence on geopolitical rivals	6
1.2. Implications for Europe-30's strategic resilience.....	7
2. THREE COUNTRY CASES	8
2.1. Bulgaria	8
2.2. Estonia	9
2.3. Romania	10
3. LESSONS FOR THE INDUSTRIAL STRATEGY IN THE CONTEXT OF THE GREEN TRANSITION	12

EXECUTIVE SUMMARY

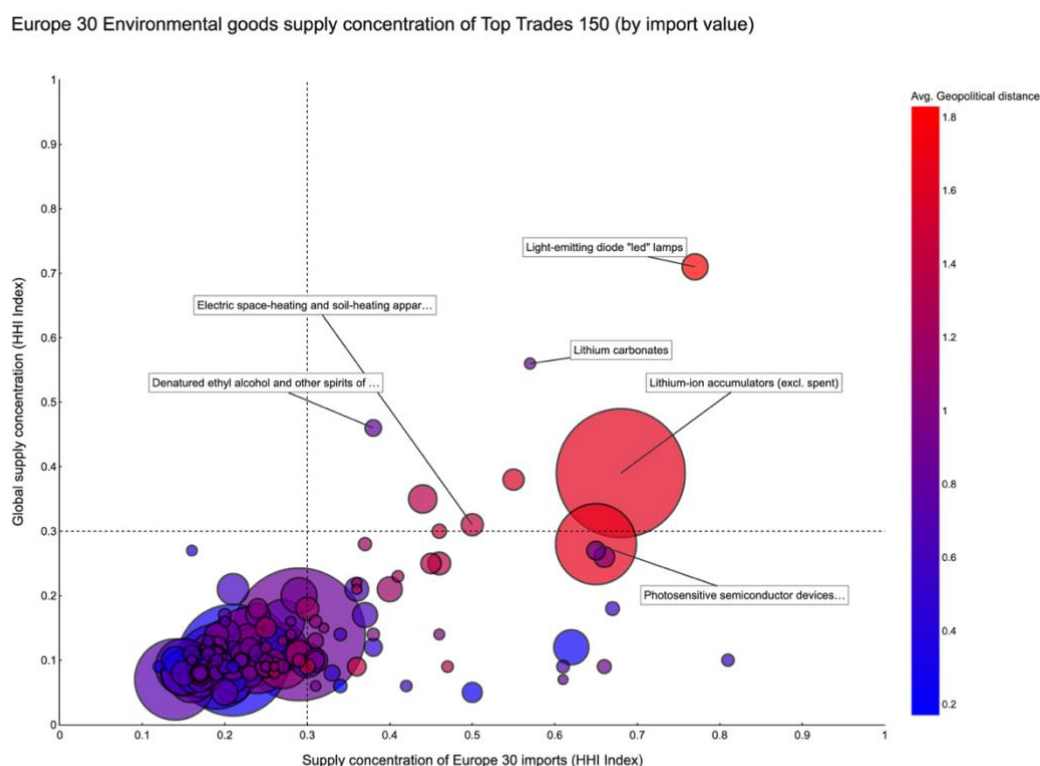
This paper examines import dependencies in environmental goods and a narrower set of low-carbon technologies (LCTs) in Europe-30, with a closer focus on Bulgaria, Estonia and Romania. Using product-level trade data and indicators of supply concentration and geopolitical distance, the analysis identifies several product groups where Europe relies heavily on a limited number of external suppliers, often located in rival geopolitical blocs. The country case studies show that while many LCT imports in Central and Eastern Europe are embedded in European production networks, several strategically important technologies – including solar panels (photovoltaic components), batteries and specialised equipment – remain dependent on highly concentrated external supply. The findings suggest that these import dependencies also signal sizeable unmet demand within the European market. The paper therefore recommends treating such dependencies as opportunities for industrial and export development by strengthening regional manufacturing capabilities, integrating CEE producers into European value chains, and supporting investment in selected LCT segments where domestic production could both reduce strategic vulnerabilities and expand export potential in rapidly growing global clean-technology markets.

1. EUROPE-30'S IMPORT DEPENDENCE IN ENVIRONMENTAL GOODS

Figure 1 compares supply concentration of Europe-30 imports with global supply concentration across the 150 largest environmental-goods trades. The horizontal axis reports the Herfindahl-Hirschman Index (HHI) for Europe's import sourcing, while the vertical axis reports the global HHI. Points above the diagonal indicate product groups where Europe's sourcing is more concentrated than global supply conditions would imply. The colour scale represents the weighted geopolitical distance of suppliers: blue indicates imports from allied economies, while red signals reliance on suppliers located in geopolitical rival blocs.

The distribution of observations indicates that Europe's environmental-goods imports are generally moderately diversified, yet several high-value trades combine two vulnerabilities. First, Europe's sourcing is more concentrated than global production structures would require. Second, the dominant suppliers are frequently located outside the allied geopolitical sphere, most notably China. In these cases, the risk stems less from global scarcity and more from Europe's supplier structure. The data show repeated patterns of strong Chinese shares across equipment, electrical components, and materials used in environmental technologies.

Figure 1. Europe-30 supply concentration in the top 150 imported environmental goods (2024)



Source: authors based on UN Comtrade and United Nations.

1.1. Product groups with sensitive dependence on geopolitical rivals

The most pronounced vulnerability concerns lithium-ion accumulators (HS 850760). Europe imports this product overwhelmingly from China, which accounts for around 82% of supply, with only small shares from Korea and others. The import market is highly concentrated ($\text{HHI} \approx 0.68$) relative to global supply concentration (≈ 0.39), indicating that Europe relies far more heavily on a single supplier than the global production structure would require.

A similar pattern appears for photovoltaic cells (HS 854140), another core energy-transition technology. China supplies roughly 80% of Europe's imports. Europe's import concentration is again markedly higher than global concentration (HHI about 0.65 versus 0.28 globally), which places the product in the high-risk quadrant of the visualisation.

Several equipment categories used in energy systems and environmental technologies also exhibit concentrated sourcing dominated by China. Electric heating radiators (HS 851629) show roughly 69% Chinese supply with high import concentration relative to global conditions. Thermostats (HS 903210) are similarly concentrated with China supplying about 56%. Power-

driven hand pumps (HS 841320) and several mechanical appliance categories display comparable patterns, with China supplying more than half of imports in some cases.

Intermediate goods essential for environmental equipment also appear in the risk cluster. Examples include articles of plastics used in technical components (HS 392690) and electrical control boards and apparatus (HS 853710). These products combine large import volumes with sizeable Chinese shares, typically above 40%, while global supply is less concentrated.

Finally, several enabling materials for environmental technologies show emerging vulnerabilities. Activated carbon (HS 380210) used in filtration systems and nonwoven glass-fibre materials (HS 701990) both show meaningful Chinese supply shares combined with moderate supply concentration. These inputs are not as concentrated as batteries or photovoltaics but remain sensitive due to their role in pollution control and industrial filtration systems.

1.2. Implications for Europe-30's strategic resilience

Taken together, the pattern suggests that Europe's most sensitive environmental-goods dependencies arise not from globally scarce technologies but from concentrated sourcing structures dominated by a small set of suppliers in rival geopolitical blocs. Batteries and photovoltaic components represent the clearest strategic vulnerabilities, while a broader tier of equipment, sensors, and intermediate materials exhibits moderate but still notable dependence on Chinese production. In many of these cases Europe's import concentration exceeds global concentration, indicating scope for diversification through alternative suppliers without requiring major global capacity expansion.

2. THREE COUNTRY CASES

The following section examines a narrower group of low-carbon technologies (LCT), a more technology-intensive subset of environmental goods comprising around 120 HS6 product groups. Building on the Europe-30 perspective discussed above, the analysis focuses on Bulgaria, Estonia and Romania to assess whether smaller EU economies exhibit similar patterns of supplier concentration and geopolitical exposure.

2.1. Bulgaria

Bulgaria's import structure in low-carbon technologies combines two distinct patterns. Many product groups are sourced primarily from European partners, especially Germany, Italy, the Netherlands and neighbouring Central and Eastern European countries. At the same time, several key technologies linked to the energy transition display strong dependence on Chinese supply chains, replicating the broader European pattern identified earlier.

The clearest example concerns photovoltaic technology. Bulgaria's imports of photosensitive semiconductor devices, including photovoltaic cells (HS 854140), are heavily dominated by China, which accounts for roughly 84% of supply. This product group also exhibits a relatively high level of supplier concentration compared with global production structures, indicating that Bulgaria relies more strongly on a single external supplier than global market conditions would require.

A similar, though somewhat less extreme, pattern appears in lithium-ion accumulators (HS 850760), where China supplies about 61% of Bulgarian imports. These batteries form a key input for electric vehicles and energy storage systems, and the concentration of supply implies potential exposure to disruptions in Chinese manufacturing or trade relations.

Beyond these core technologies, China also appears as a significant supplier in several equipment categories associated with low-carbon systems. Examples include LED lighting products and electronic components. For instance, LED lamps (HS 853950) are overwhelmingly supplied by China, accounting for more than 90% of Bulgarian imports, making this one of the most concentrated supplier relationships in the dataset.

Nevertheless, Bulgaria's import structure differs from the Europe-30 aggregate in that many technology categories remain embedded within European production networks. Electric control

boards and similar equipment (HS 853710) are supplied by a mix of Chinese and EU partners, while machinery and mechanical appliances (HS 847989) and measurement instruments (HS 903180) are primarily sourced from Germany and other European economies.

A further group of low-carbon technologies illustrates the role of regional supply chains. Hydraulic turbines and related components used in hydropower installations are largely imported from European suppliers such as Poland and Italy, with China typically playing a secondary role. Similarly, materials such as lithium carbonate or lithium hydroxide used in battery supply chains are sourced mainly from EU countries or closely integrated partners.

Overall, Bulgaria's import dependencies in low-carbon technologies reflect a dual structure. Advanced components for renewable energy systems and energy storage display significant exposure to Chinese suppliers, particularly in photovoltaics, batteries and lighting technologies. At the same time, a large share of industrial equipment and supporting technologies continues to be supplied by EU partners, suggesting that regional production networks still play a central role in Bulgaria's access to low-carbon technologies.

2.2. Estonia

Estonia's import structure in low-carbon technologies shows a split between large-value items sourced through established partner networks and a smaller set of technology inputs where reliance on higher geopolitical-distance suppliers is pronounced. In the top LCT trades, hybrid passenger cars (non-plug-in) (HS 870340) account for a substantial share of import value, with leading suppliers including Japan, France and Germany, which keeps the weighted geopolitical distance low for a material part of the basket.

The clearest sensitivity is in photovoltaic technology. Imports of photosensitive semiconductor devices, including photovoltaic cells (HS 854140), are dominated by China at roughly 71% of supply, alongside much smaller shares from the United States and Poland. This line is also more concentrated than global supply conditions (HHI about 0.52 for Estonia versus 0.28 globally), implying that Estonia's sourcing is tighter than the underlying global supplier structure would suggest.

A similar pattern appears in lithium-ion accumulators (HS 850760), where China supplies about 81% of Estonia's imports. The import market is highly concentrated relative to global supply (HHI about 0.67 versus 0.39 globally), and the weighted geopolitical distance is high, indicating that a

strategically important low-carbon input is both rival-leaning and difficult to substitute quickly if supply is disrupted.

Beyond PV and batteries, Estonia's most exposed dependencies also include infrastructure and component categories where the dominant suppliers are outside close-alignment groups. Towers and lattice masts of iron or steel (HS 730820) are supplied primarily by Indonesia (around 72%), with Turkey and China also present, and Estonia's sourcing is far more concentrated than global supply (HHI about 0.55 versus 0.11 globally).

Several equipment and component lines show a similar geography of risk even when supplier shares are less extreme. Parts and accessories for measuring and checking instruments (HS 903190) are dominated by China at around 69%, with a high local concentration (HHI about 0.50) relative to the global benchmark (0.08), indicating a narrow sourcing pattern for inputs that support monitoring, control and process efficiency.

At the same time, a large part of Estonia's LCT basket remains anchored in European supply chains, which reduces exposure in several supporting technologies. Electric control boards and cabinets (HS 853710) are sourced from a mix led by China, Finland and Germany, while several machinery and equipment items show leading roles for Germany and Nordic partners. This indicates that the most geopolitically sensitive dependencies are concentrated in a limited number of product groups rather than spread evenly across the LCT import basket.

2.3. Romania

Romania's import structure in low-carbon technologies is characterised by strong integration into European industrial supply chains. Many of the largest product groups are sourced primarily from EU partners, especially Germany and neighbouring Central European economies. At the same time, a number of technology components and specialised equipment categories reveal a stronger presence of suppliers from outside the EU, including China, which creates pockets of higher geopolitical exposure within the broader import basket.

One of the largest technology lines concerns photosensitive semiconductor devices, including photovoltaic cells (HS 854140). In contrast to the Europe-wide pattern where Chinese supply dominates, Romania's imports are led by European partners, with Germany accounting for around 32% and China representing a smaller share of roughly 12%, alongside Greece and other suppliers. This indicates a more diversified sourcing pattern and a lower geopolitical exposure compared with the more China-centred structures observed elsewhere.

A similar structure is visible in lithium-ion accumulators (HS 850760). Germany is the leading supplier with roughly 22% of imports, followed by China (about 16%) and Bulgaria (around 12%). While batteries remain a critical input for electric vehicles and energy storage systems, Romania's supply pattern is less concentrated in a single country than in many other European markets, reflecting stronger links with regional manufacturing networks.

Several equipment categories used in low-carbon technologies also remain anchored in European production systems. Electric control boards and cabinets (HS 853710) are supplied mainly by Germany and Hungary, while machinery and mechanical appliances (HS 847989) are sourced primarily from Germany and Italy with China playing a secondary role. Similar supplier patterns appear in parts for measuring and checking instruments (HS 903180), where European partners dominate the import structure.

Nevertheless, some technology components display stronger exposure to suppliers from outside the EU. Parts of gas turbines (HS 841199), for instance, are heavily supplied by China, which accounts for close to half of Romania's imports in this category. Certain consumer-oriented technology lines, such as electric motorcycles (HS 871160) and air-conditioning systems (HS 841581), also show a notable role for Chinese manufacturers.

Overall, Romania's import dependencies in low-carbon technologies reflect a supply structure that is strongly embedded within European manufacturing networks. Core technology inputs such as photovoltaic components, batteries and industrial machinery are sourced from a diversified set of EU partners, while Chinese suppliers play a more limited role concentrated in specific equipment segments. This suggests that, compared with many other markets, Romania's access to low-carbon technologies relies more heavily on regional production linkages than on single external suppliers.

3. LESSONS FOR THE INDUSTRIAL STRATEGY IN THE CONTEXT OF THE GREEN TRANSITION

Across the three case studies, the analysis suggests that import dependence in low-carbon technologies reflects both structural vulnerabilities and emerging industrial opportunities for Central and Eastern European economies. Bulgaria and Estonia show strong dependence on external suppliers in several critical technology segments, particularly photovoltaic components and lithium-ion batteries, where supply is concentrated in China. Romania displays a somewhat more diversified structure embedded in European manufacturing networks, yet even here several specialised components and equipment categories rely on imports that domestic producers currently do not supply at scale. Taken together, these patterns confirm that import dependence in LCT is not primarily the result of global technological scarcity but rather reflects gaps in regional production capacity and competitiveness.

Import dependence in LCTs points to market segments where domestic and EU supply is not meeting demand on price, scale, or delivery terms. Industrial strategy should treat the most exposed product groups as demand-led targets for capability building, with a focus on parts, subassemblies, and testing and control equipment that can be integrated into existing European value chains, rather than attempting full end-to-end production in every technology line.

A practical lesson is to prioritise “scalable niches” where CEE firms can enter with lower capital needs and shorter ramp-up times: battery modules and packs, power electronics and control cabinets, balance-of-system components for PV, and instrument parts used in monitoring and efficiency applications. Where imports are both rival-leaning and concentrated, diversification can be achieved through supplier development inside Europe, anchored by long-term offtake, standardisation, and procurement rules that reward reliability and lifecycle performance, not only unit cost.

For export development, the same dependencies highlight where future foreign demand is likely to be sustained. The route is to build export capacity via OEM partnerships, contract manufacturing, and certification-to-market (EU and third-country standards), using the CEE region’s manufacturing base to supply the wider European market first and then adjacent markets. Export policy can be linked to climate policy by aligning investment support with deployment targets, grid and building renovation programmes, and public procurement, so that domestic scale is created before firms are pushed into global competition.