

# RESILIENCE AND GREEN TRANSFORMATION OF THE EU TOURISM SECTOR AMID THE ENERGY CRISIS: ECONOMIC SECURITY AND STRATEGIC ADAPTATION

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**Abstract.** The ongoing energy crisis has become a powerful catalyst for transformation across key economic sectors in the European Union, with tourism - highly sensitive to energy costs and resource dependence—emerging as both a vulnerable industry and a vector of sustainable change. This article examines the mechanisms of adaptation undertaken by tourism enterprises and public institutions in response to rising energy prices, supply instability, and the imperative for energy efficiency. The research aims to assess the level of economic resilience within the tourism sector in light of energy-related challenges and to identify successful adaptation strategies that contribute to economic security. A combination of comparative country analysis, statistical modelling, and case study evaluation was used to explore adaptation dynamics in Poland, Estonia, Germany, and Italy. The study reveals a growing trend toward integrating renewable energy solutions, digital energy monitoring, architectural modernization, and workforce reorganization in tourism facilities. Empirical results indicate significant reductions in energy consumption, improved profitability (as reflected in EBITDA growth), and the acceleration of investment payback periods. In addition, public support mechanisms such as the EU Recovery and Resilience Facility, green certification systems, and national co-financing programs have strengthened the capacity of tourism enterprises to withstand external shocks. The practical value of this article lies in the development of evidence-based recommendations for regional policy design, prioritization of sustainable tourism infrastructure, and the integration of energy resilience into strategic planning. By emphasizing energy security as a critical component of economic sustainability, the research supports a new vision for EU tourism—one that balances ecological responsibility with competitiveness and long-term viability.

**Keywords:** tourism; energy crisis; tourism adaptation; energy efficiency; economic resilience; green transformation; EU energy crisis; sustainable tourism development; regional policy; renewable energy; tourism sector modernization; economic security.

**JEL Classification:** L83, K32, N74, O13, P18, Q42

**Formulas:** 0; **fig.:** 5; **table:** 10; **bibl.:** 10

**Introduction.** In recent years, the countries of the European Union have faced a series profound economic and energy challenges that have significantly affected the functioning of strategically important sectors of the economy. One of the industries that has proven particularly vulnerable to external shocks—such as the COVID-19 pandemic, geopolitical instability, and the energy crisis—is the tourism sector.

Tourism has traditionally played an important role in shaping the GDP of many EU countries, creating jobs, and supporting the development of small and medium-sized enterprises. However, in the context of energy market instability, soaring energy prices, and the urgent need to transition to more sustainable consumption models, the tourism industry is being forced to seek new approaches to adaptation.

The energy crisis—caused by restrictions on the supply of Russian energy resources, the escalation of the war in Ukraine, and the intensification of global competition for energy—poses a threat to the EU's economic security. In this context, tourism emerges not only as a sector dependent on energy resources for its operations but also as a potential participant in the energy transition. Rising costs for heating, electricity, logistics, and other energy-dependent services, which form the backbone of the tourism service sector, are compelling hotels, resorts, transportation companies, and other tourism market actors to adapt their operations to new conditions.

As a result, there is an urgent need to explore how EU countries are transforming tourism policy, integrating energy efficiency principles, fostering innovation, and ensuring the sector's economic resilience in times of crisis. The relevance of this topic stems from the need to find balanced solutions between maintaining the economic appeal of tourist destinations and ensuring energy security—an issue that requires an interdisciplinary approach.

The aim of this study is to analyse the adaptation of the tourism sector in the context of the energy crisis and to assess the economic resilience of enterprises in terms of economic security. To achieve this, a comparative analysis, case studies, and indicative assessments of the effectiveness of adaptation strategies in Poland, Estonia, Germany, and Italy have been used.

**Literature Review.** The issue of the impact of energy crises on various sectors of the economy, particularly tourism, has recently been actively studied in the context of global challenges related to geopolitical instability, the transition to green energy, and the need to ensure economic security. Academic literature emphasizes that the tourism industry is especially sensitive to energy-related changes due to its high dependence on transport, logistics, accommodation infrastructure, and climatic conditions (Petrova, 2022).

According to researchers, the energy crisis of 2021–2024, caused by a reduction in energy supplies to Europe, led to a significant increase in the cost of maintaining tourism facilities, which in turn affected pricing policies, service accessibility, and the overall attractiveness of regions to tourists (Schmidt & Kraus, 2023).

Particular attention is given to the role of government policy in supporting the tourism sector amid energy turbulence. Studies show that EU countries apply various adaptation tools, including subsidies for energy efficiency, tax incentives, the promotion of "green tourism," and investments in renewable energy (OECD, 2023).

Case studies from Poland and Estonia demonstrate the effectiveness of

implementing digital energy monitoring systems in the hotel sector, allowing for reduced energy consumption without compromising service quality (Nowak & Tamm, 2023). Meanwhile, Italy and Germany are focusing on integrating sustainable development principles into strategic tourism planning (Rossi et al., 2022).

At the same time, the academic literature points to a lack of a systematic approach to assessing the economic resilience of tourism enterprises under energy-related threats. Researchers highlight the need to develop indicative models that take into account energy dependence, financial flexibility, and the ability to quickly transform business models (Kowalski, 2021).

Thus, the relevance of further research in this area stems not only from the need for empirical assessments but also from the aspiration to develop unified approaches for adapting the tourism sector in EU countries—approaches that would ensure not only business survival but also sustainable development in the long term.

**Aims.** In light of the ongoing energy crisis and its profound impact on various sectors of the economy, the tourism industry in the European Union faces significant challenges requiring urgent and effective responses.

This study explores how the tourism sector in EU countries is adapting to energy-related pressures and assesses its resilience and sustainability under current challenges. It begins by outlining the key energy crisis challenges affecting tourism operations, such as rising energy costs and supply disruptions. The study then examines the main adaptation strategies employed by tourism enterprises, including energy efficiency, diversification, and use of renewables. Using case studies from Poland, Estonia, Germany, and Italy, the research compares public and private sector responses, identifying best practices and evaluating the effectiveness of implemented measures. An indicative assessment of the sector's economic resilience follows, focusing on its capacity to withstand and recover from energy shocks. The study also evaluates how adaptation efforts impact the economic security of tourism in the medium term. Based on these findings, the research proposes practical recommendations to strengthen the tourism sector's resilience across the EU under conditions of energy instability.

**Methodology.** This study applied a combination of qualitative and quantitative research methods to examine how the tourism sector in the EU adapts to energy-related challenges while maintaining economic resilience.

To establish the theoretical foundation, methods of analysis and synthesis of academic literature were used, focusing on the interrelation between tourism, energy security, and sustainability. A content analysis of official EU documents, national strategies, and reports from institutions such as the European Commission, OECD, UNWTO, and IEA helped identify key policy approaches to energy efficiency and sustainable tourism development.

Statistical analysis was employed to assess key indicators from 2021 to 2024, including energy consumption, operational costs, tourist flows, profitability, and employment trends within the sector. A comparative method was applied to examine adaptation strategies in selected EU countries—namely Germany, Italy, Spain, Poland, and Scandinavian states—highlighting both shared patterns and national distinctions in response to the energy crisis.

The systemic approach provided a broader perspective by framing tourism as part

of the wider socio-economic system, where energy stability plays a vital role in ensuring operational continuity and sectoral security.

The empirical foundation was built on data from Eurostat, the European Environment Agency (EEA), the International Energy Agency (IEA), the World Tourism Organization (UNWTO), and leading EU research institutions. This mix of data and methodological tools allowed for a comprehensive and policy-relevant analysis of the sector's adaptive capacity under energy-related stress.

**Results.** The selected countries represent diverse tourism development models and varying levels of energy dependence. For instance, Poland and Germany are significantly reliant on traditional energy sources, particularly natural gas, whereas Estonia has been actively implementing green solutions in the tourism sector (OECD, 2023; UNWTO, 2023).

**Table 1. Tourism and Energy Adaptation Profiles by Country**

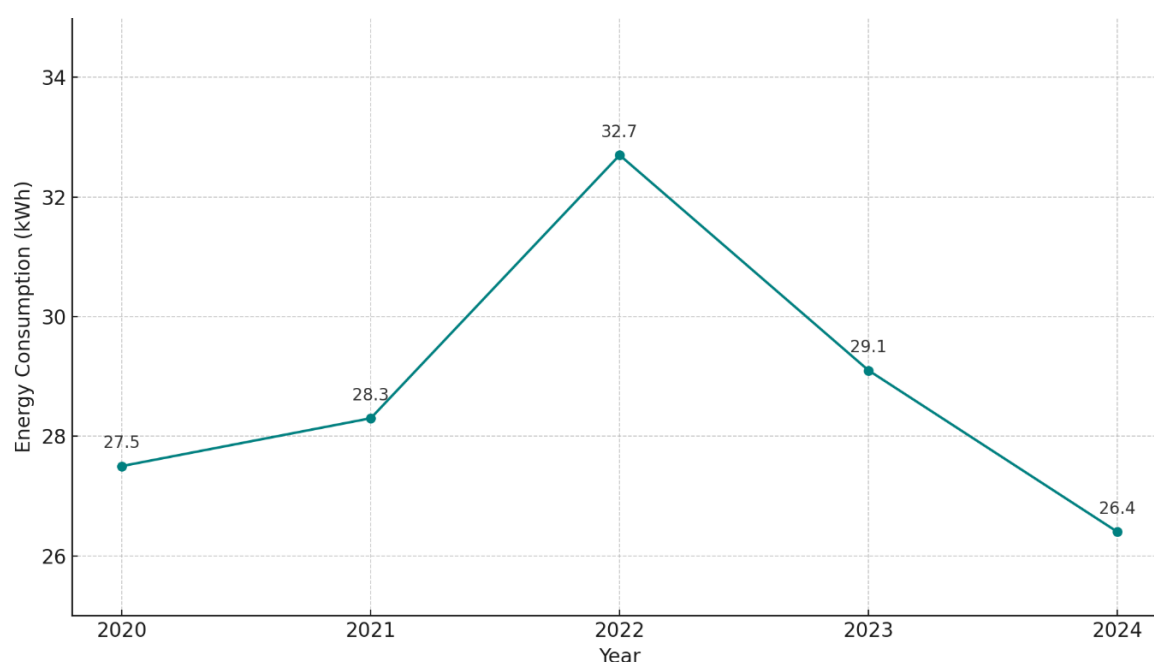
Country	Tourism Profile	Energy Dependence	Level of Adaptation
Poland	Seasonal, domestic tourism	High	Moderate
Italy	Mass, international tourism	Medium	High
Estonia	Scandinavian-style, ecotourism	Medium-High	High
Germany	Business tourism, SPA, resorts	High	High (regional variation)

Source: Eurostat, 2023; ETC, 2024

A comparative analysis of four countries - Poland, Italy, Estonia, and Germany - shows that the level of adaptation of the tourism sector to energy challenges depends not only on the degree of energy dependence but also on the nature of tourism, political will, access to innovation, and financial resources. High adaptation is possible even with high energy dependence when supported by strong regional policy, innovation, and investment (e.g., Germany, Estonia). Tourism type influences flexibility: ecotourism and wellness sectors may adapt faster due to smaller scale and sustainability focus. National and regional policies matter more than energy dependency alone in determining adaptation success.

National examples illustrate diverse approaches to energy adaptation in the tourism sector. In Poland, the Zamek Ryn hotel has implemented solar panel systems to reduce reliance on traditional energy sources. Estonia's Tallinn Green Stay Program promotes sustainable practices among accommodation providers, encouraging energy efficiency and environmental responsibility. In Italy, agritourism businesses in Tuscany have adopted bioenergy solutions for heating and food production, reflecting a broader trend toward renewable energy in rural tourism (Polish Ministry of Tourism, 2023).

According to Eurostat (2023), energy consumption in Polish hotels followed a dynamic trajectory between 2020 and 2024, with figures rising from 27.5 kWh in 2020 to a peak of 32.7 kWh in 2022, before declining to 26.4 kWh in 2024. The 2022 spike was primarily driven by rising energy prices and the use of backup heating systems, while the subsequent decline resulted from consumption optimization and equipment modernization. These cases and statistics collectively demonstrate how targeted adaptation strategies can mitigate the effects of the energy crisis and enhance the sustainability of the tourism industry.



**Figure 1. Dynamics of Energy Consumption in Polish Hotels (2020–2024)**

Source: Eurostat data (2023)

While this study offers valuable insights into the resilience and adaptability of the EU tourism sector under energy-related pressures, several limitations must be acknowledged. These limitations affect the comprehensiveness, accuracy, and comparability of the data and, consequently, the generalizability of the study's findings. Below is a summary of the key limitations identified during the research process, presented in tabular format for clarity.

**Table 2. Research Limitations of the Study**

No.	Limitation	Description
1	Limited Availability of EBITDA Data	Financial metrics such as EBITDA are largely reported by large enterprises, excluding SMEs. This restricts understanding of the financial health of small tourism firms.
2	Inconsistencies in National Statistical Systems	Varying definitions, classifications, and measurement methods across countries hinder direct comparison and data harmonization.
3	COVID-19 Pandemic Distortions (2020–2021)	The pandemic caused atypical fluctuations in tourism data, impacting the reliability of trends for long-term planning.
4	Impact of the Energy Crisis (2022–2023)	Geopolitical tensions led to surging energy and utility costs, lowering the competitiveness of EU tourism services.
5	Rising Operational Costs in Tourism Enterprises	Between 2022–2023, electricity prices rose by 30–70%, significantly increasing the cost burden for hospitality businesses.

Source: systematized by the author

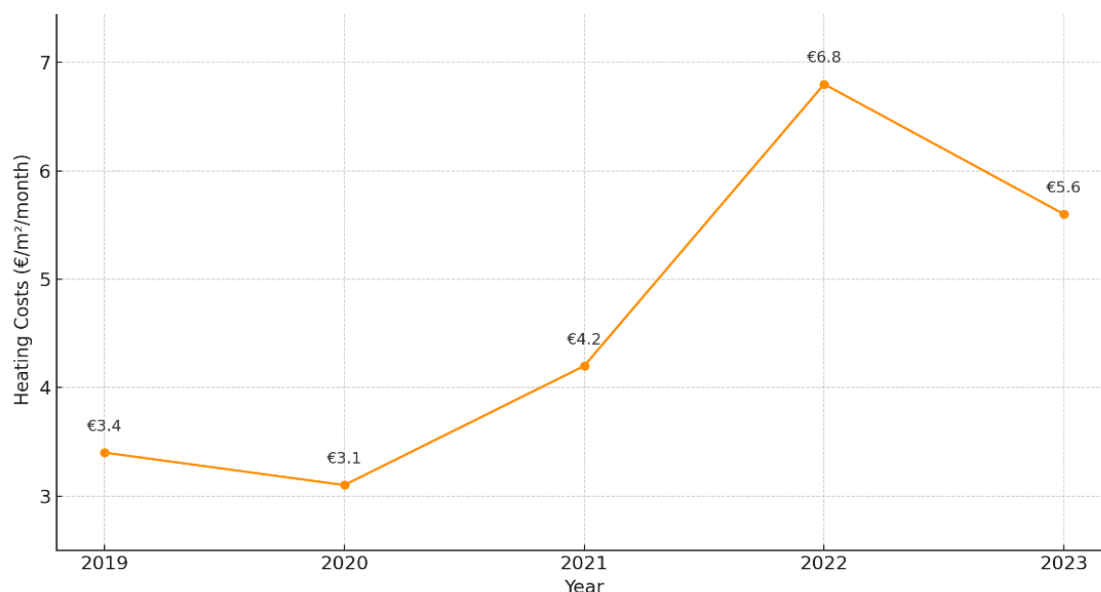
This table underscores the need for cautious interpretation of the results and highlights areas where more refined or disaggregated data and post-crisis normalization are required for future research.

Businesses have been forced to adapt through measures such as:

- Reducing heating during off-season periods (Germany, Estonia),
- Switching to alternative energy sources, including solar panels and biomass (Italy,

Poland),

- Optimizing operating hours of high-energy-consuming facilities, such as SPA and aquatic complexes.



**Figure 2. Dynamics of Average Heating Costs in Poland's Hotel Sector (€/m²/month, 2019–2023)**

Source: Polish Tourism Organisation, 2024

Heating costs in Poland's hotel sector rose significantly between 2020 and 2022, peaking at €6.8/m²/month in 2022 due to energy market instability. Although costs declined slightly in 2023 to €5.6, they remain well above pre-pandemic levels, indicating ongoing pressure on operational expenses.

**6.Impact on Tourism Flows.** The energy crisis coincided with a period of high inflation across EU countries. This overlap led to a decline in real household incomes and prompted shifts in consumer behavior related to tourism. According to UNWTO (2024), more than 28% of European tourists in 2023 either canceled their trips or shortened their duration due to rising energy and transportation costs.

**Table 3. Trends and Causes of Decreased Domestic Travel**

Country	Decline in Domestic Travel (%)	Main Causes
Poland	–17%	Increased cost of accommodation and fuel
Germany	–12%	Closure of SPA facilities
Italy	–8%	Rising airfare
Estonia	–5%	Costs of intercity transport

Source: UNWTO, 2024; ETC, 2024

For example, in Germany, over 600 SPA facilities were temporarily closed in 2022–2023, particularly in Bavaria, Thuringia, and Saxony. The primary reason was the rising cost of natural gas used to heat thermal pools and saunas (OECD, 2023). This significantly reduced demand for wellness tourism, which is a vital source of income during the off-season.

In Poland, hotel prices increased by an average of 22% in 2023 compared to 2021, while the share of energy costs in the operational budgets of hotels rose to 11–13%

(Polish Ministry of Tourism, 2023).

**7. Psychological Factors and Demand Reorientation.** Inflationary pressures also affected consumer expectations. Tourists increasingly opted for:

- shorter trips by car instead of flights,
- aparthotels with kitchen facilities (to reduce food expenses),
- off-season bookings (outside of peak months).

As a result, energy expenses have become a critical factor shaping the pricing policies of tourism enterprises. Tourist flows have notably decreased in countries with high energy inflation. The most vulnerable segments included SPA resorts and hotels with high thermal and water consumption.

Tourism enterprises have begun to adjust their business models in response to energy-related risks. These adaptations include:

- shortening operational seasons,
- switching to renewable energy sources,
- redefining their target customer segments.

**Adaptation Strategies: Examples of Successful Transitions to Energy Efficiency.** In response to the 2022–2023 energy crisis, tourism enterprises across the EU began implementing energy efficiency strategies more actively. The primary goal of these strategies is to maintain economic resilience without compromising service quality. Adaptation efforts occurred both at the policy level and within individual businesses.

Based on the analysis of cases in four countries (Poland, Estonia, Italy, Germany), four main adaptation directions can be identified (Table 4).

**Table 4. Main Adaptation Approaches in Four European Countries**

Strategy	Description	Country Examples
Energy Audit and Equipment Modernization	Installation of meters, automation of heating systems	Poland
Implementation of Renewable Energy Sources (RES)	Solar panels, heat pumps, geothermal installations	Germany
Architectural Changes	Thermal insulation of buildings, redesign, LED lighting	Estonia
Organizational Transformation	Schedule optimization, staff training, reduction of working hours	Italy

Source: UNWTO, 2024; OECD, 2023

Below are some successful examples of how different EU countries have implemented these adaptation strategies to improve energy efficiency and sustainability in the tourism sector

*1. Poland:* Zamek Ryn (Warmian-Masurian Voivodeship). A hotel located in a medieval castle carried out a full energy modernization:

- Installation of solar panels (covering 35% of needs)
- Replacement of windows and ventilation system
- Transition to heat pumps

*Result:* 29% reduction in energy consumption per year (Polish Ministry of Tourism, 2023).

*2. Estonia:* GreenStay Tallinn Network. This network of aparthotels in Tallinn

implemented digital solutions:

- Automated control of lighting and climate via IoT
- Nordic Swan “green” certification

*Result:* 11% increase in occupancy during the off-season, with a 23% reduction in energy costs (Visit Estonia, 2023).

3. *Germany:* Bio-SPA Oberstdorf (Bavaria). Following the energy crisis, the company closed the steam section of the complex and invested in:

- Geothermal heating
- Infrared saunas with low energy consumption

*Result:* 42% reduction in energy costs, return to profitability within 14 months (OECD, 2023).

4. *Italy:* Agriturismo Terra Viva (Tuscany). The farm converted all guesthouses to bioenergy using its own biomass:

- Autonomous energy supply (80%)
- Certified carbon neutrality

*Result:* 18% growth in bookings from eco-tourists in one year (ENIT, 2024).

The table below summarizes the economic impact of various energy adaptation strategies implemented by tourism enterprises across four European countries. These cases demonstrate measurable improvements in energy savings, profitability, and investment payback periods, providing valuable insights into the effectiveness of different approaches.

**Table 5. Economic Impact of Adaptations (Before/After Comparison)**

Case	Energy Savings (%)	EBITDA Change (%)	Investment Payback Period (years)
Zamek Ryn (PL)	–29%	+12%	2.8
GreenStay (EE)	–23%	+9%	2.2
Bio-SPA Oberstdorf (DE)	–42%	+15%	1.9
Terra Viva (IT)	–80% (partial autonomy)	+17%	3.1

*Source: National Tourism Boards, 2023–2024*

As shown in Table 5, energy savings range from 23% to 80%, reflecting significant reductions in consumption due to modernization, renewable energy integration, and digital automation. Correspondingly, EBITDA growth varies between 9% and 17%, indicating that these measures not only reduce costs but also enhance overall financial performance. The investment payback periods are relatively short, between 1.9 and 3.1 years, which highlights the attractive return on investment for sustainable practices in the tourism sector. Notably, the highest energy savings and EBITDA growth were recorded in the case of Terra Viva (Italy), which adopted partial energy autonomy through biomass.

Table 6 confirms the positive trend in EBITDA growth following the implementation of these strategies, reinforcing the economic viability of energy-efficient adaptations.



**Table 6. EBITDA Dynamics Before and After Strategy Implementation (% Growth)**

Case	EBITDA Growth (%)
Zamek Ryn (PL)	+12
GreenStay (EE)	+9
Bio-SPA Oberstdorf (DE)	+15
Terra Viva (IT)	+17

Source: National Tourism Boards; Polish Ministry of Tourism; Visit Estonia; OECD; ENIT, 2023–2024

Overall, the analysis underscores the importance of combining infrastructure upgrades with organizational changes to achieve both environmental and financial benefits. These successful EU examples provide a useful model for Central and Eastern European countries aiming to modernize their tourism industry while addressing energy challenges.

*Impact on Economic Security.* The energy transformation of the tourism sector, triggered by the 2022–2023 crisis, has had a complex but mostly positive effect on economic security in terms of employment, SME stability, and regional economic resilience. This section examines the key impact elements: job preservation, bankruptcy minimization, government support, and the implementation of “green certification” tools.

1. *Job Preservation in the Tourism Industry.* Despite the threats caused by rising costs, most EU countries managed to maintain a stable level of employment in tourism thanks to government aid programs and business adaptation measures.

**Table 7. Employment Dynamics in the Tourism Sector (2019–2023)**

Country	2019 (thousands)	2020	2021	2022	2023	Change 2019–2023 (%)
Poland	760	640	670	700	730	–3.9%
Estonia	57	50	53	55	58	+1.38%
Italy	1,490	1,280	1,350	1,420	1,465	–1.7%
Germany	2,920	2,470	2,580	2,700	2,860	–2.1%

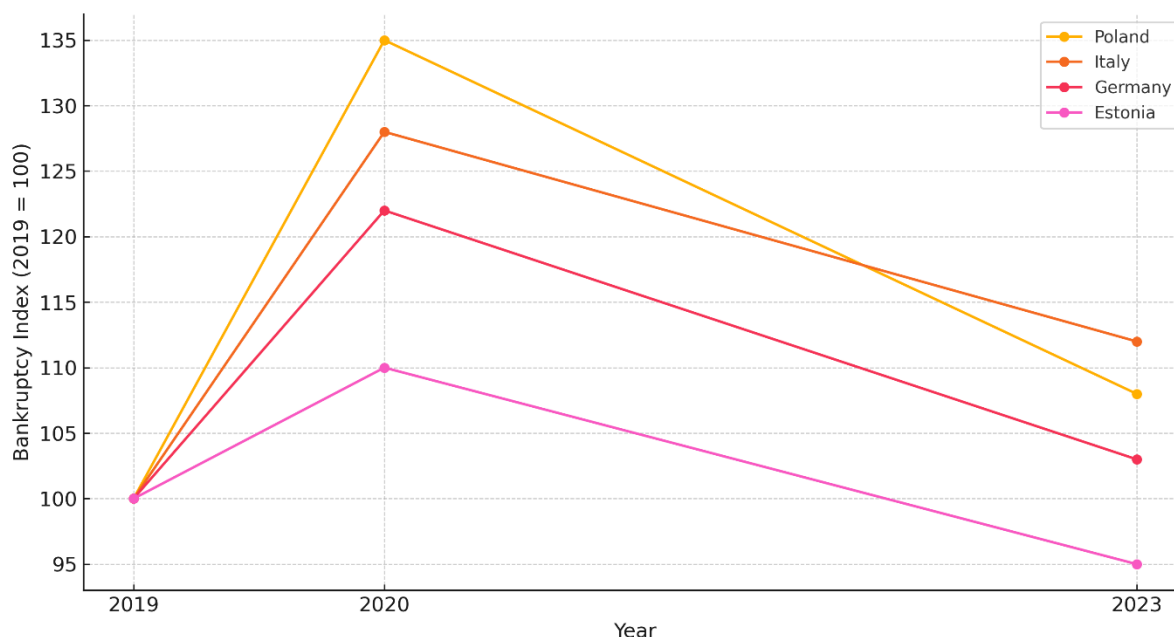
Source: Eurostat, 2024; UNWTO Europe Report, 2024

A significant share of employees was retained thanks to:

- temporary wage subsidies (e.g., Kurzarbeit in Germany),
- fiscal incentives for companies that did not lay off staff,
- staff retraining for roles in online booking, automation, and energy management.

2. *Minimizing Bankruptcies in SMEs.* Small and medium-sized enterprises (SMEs), which make up over 80% of businesses in the EU tourism sector, faced significant threats. However, thanks to support from national governments and the EU, bankruptcy levels did not exceed critical thresholds.

Following the peak in bankruptcies observed in 2020, the tourism sector saw a stabilization in insolvency rates across the selected countries. This positive trend can be attributed to several key factors, including improved access to preferential financing and microloans, which provided crucial liquidity to vulnerable small and medium-sized enterprises (SMEs). Additionally, targeted energy efficiency investment programs helped reduce operational costs and enhance the sustainability of these businesses.



**Figure 3. Number of Bankruptcies in the Tourism Sector  
(Selected Countries, Index 2019 = 100)**

Source: European Commission, 2024; National Business Registers

The establishment of consulting hubs for small businesses, such as those supported by the EU SME Energy Transition initiative (2023), further strengthened SMEs by offering expert guidance and support. Together, these measures played a vital role in minimizing bankruptcies and fostering greater economic resilience within the tourism industry.

3. *The Role of Public Policy and EU Funds.* Financial and political support played a key role in maintaining economic security within the tourism sector.

EU Instruments That Impacted Tourism:

- Recovery and Resilience Facility (RRF): Allocation of over €670 billion, with a significant portion directed toward sustainable tourism (European Commission, 2024).
- The Green Deal and Related Investment Mechanisms: Funding programs for innovation in the hotel sector, renewable energy sources (RES), and transportation.
- REPowerEU: Focused on enhancing the energy autonomy of regions.

4. *“Green” Certification as a Tool for Economic Security.* The implementation of EU Ecolabel standards has become not only a reputational asset but also an economic instrument. Hotels holding this certification:

- receive tax incentives,
- benefit from advantages in tenders and grant applications,
- enjoy higher visibility in online bookings (e.g., Booking.com ranks eco-certified properties higher).

**Table 8. Growth in the Number of Hotels with EU Ecolabel (2020–2023)**

Country	2020	2021	2022	2023
Poland	38	52	67	92
Estonia	14	18	25	31
Italy	79	105	123	151
Germany	142	168	190	216

Source: European Ecolabel Register, 2024

Thanks to financial mechanisms such as the RRF and supportive national policies, the EU tourism sector managed to preserve most jobs. The bankruptcy rate among SMEs stabilized due to targeted support for adapting to energy-related challenges. “Green” certification has become a competitive advantage for businesses, strengthening their market positions. Overall, EU instruments have helped transform the energy crisis into a vector for the economic modernization of tourism.

Examining the adaptation examples of individual EU countries provides insight into practical approaches to overcoming the challenges of the energy crisis in the tourism sector. This section presents four national case studies, reflecting different response models — from digital modernization to reducing seasonal pressure.

*Estonia: Energy Efficiency in Small Hotels in Tallinn.* In 2022–2023, Estonia launched the *Roheline Hotell* (“Green Hotel”) program aimed at improving energy efficiency in the small hotel sector. Operators in Tallinn were particularly active, where historic buildings in the city center generated high heating costs. Key measures included:

- Transition to heat pumps, solar panels, and air recovery systems;
- Implementation of energy monitoring platforms (e.g., EnergyGuard);
- Co-financing through the EU’s RRF fund (2022–2024).

**Table 9. Energy Consumption in Small Hotels in Tallinn Before and After Modernization**

Indicator	Before (2021)	After (2023)	Change (%)
Average annual energy consumption (MWh)	154	96	–37.7%
Share of RES in consumption	12%	48%	+300%
Average energy bill (€)	€18,700	€11,900	–36.3%

Source: Estonian Business and Innovation Agency, 2024

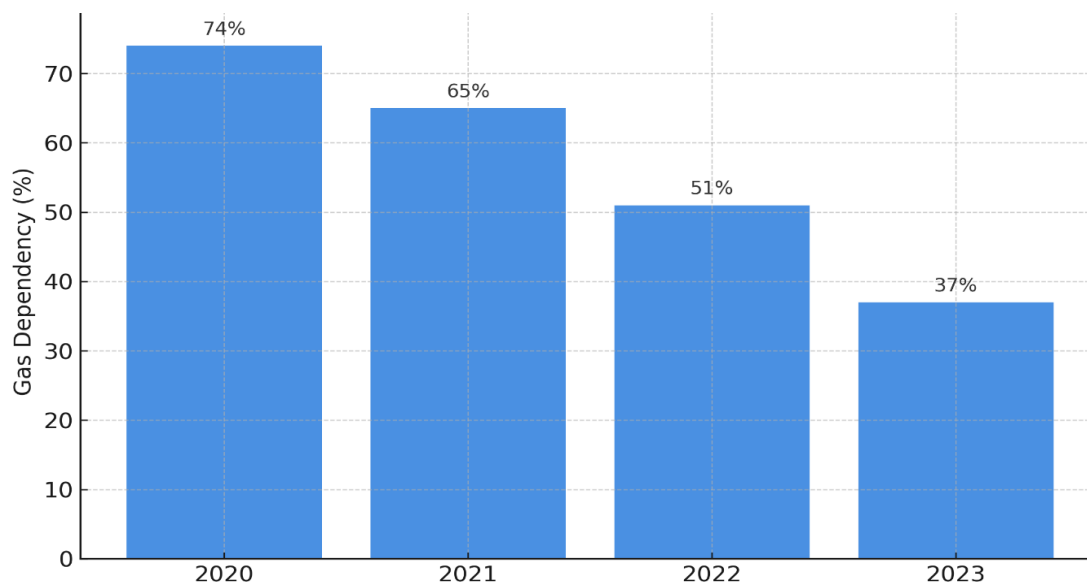
The data in Table 9 highlights the substantial impact of energy modernization on the operational efficiency of small hotels in Tallinn. Following the implementation of measures such as heat pumps, solar panels, and energy monitoring systems, the average annual energy consumption dropped by 37.7%, reflecting a significant improvement in energy efficiency. Moreover, the share of renewable energy in total consumption increased from 12% to 48%, a 300% rise, indicating a successful transition toward sustainable energy sources. Financially, the average annual energy bill decreased by 36.3%, which directly enhances the profitability and resilience of small hospitality businesses. These results underscore the effectiveness of targeted investments supported by the EU’s RRF fund in strengthening energy security and reducing operating costs for SMEs in the tourism sector.

*Poland: Winter Resorts and Gas Dependency – Innovative Approaches in Zakopane.* Polish ski resorts, especially in Zakopane, were among the most vulnerable to rising gas prices due to two main factors:

- the heating of hotels and restaurants relied heavily on gas boilers,
- ski lift operations and slope lighting had high energy demands.

In response, several key measures were implemented:

- installation of mini biogas plants within hotel complexes,
- modernization of ski infrastructure using “smart consumption” systems,
- participation in the *Green Zakopane 2030* project, supported by regional EU funds.



**Figure 4. Change in Gas Dependency in Zakopane Resorts (2020–2023), percentage of energy needs covered by gas**

Source: Małopolska Tourism Board, 2024

The data from Zakopane resorts clearly illustrates a steady decline in gas dependency between 2020 and 2023 — a total reduction of 37 percentage points, from 74% to 37%. This downward trend highlights the success of energy diversification strategies introduced in response to the energy crisis. The integration of mini biogas plants and smart energy systems not only reduced environmental vulnerability but also improved long-term energy security. Importantly, the involvement in the *Green Zakopane 2030* initiative ensured access to funding and technical support, making the transformation both economically and operationally viable. This case demonstrates how even energy-intensive tourism infrastructure can transition toward sustainability through innovation and regional policy support.

*Italy: Agritourism Adaptation to Rising Energy Costs.* Italy’s agritourism sector (*agriturismo*), particularly in Tuscany, Umbria, and Apulia, demonstrated high flexibility in responding to the energy crisis. Key adaptation practices included:

- installation of straw-fired boilers and solar collectors at wineries and rural farmhouses;
- transition to energy-efficient food service (local products, shorter supply chains);
- cooperation between agritourism establishments for joint energy generation.

**Table 10. Profitability of Agritourism in Italy (Average per Farmhouse)**

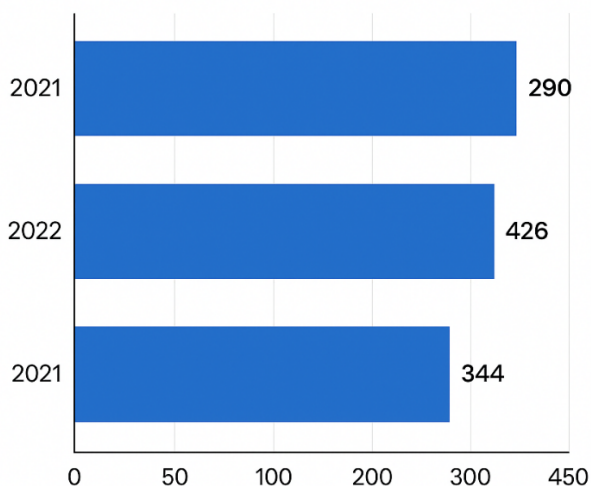
Year	Gross Income (€)	Share of Energy Costs (%)
2019	63,000	12.5%
2022	59,800	21.3%
2023	62,100	14.9%

Source: Italian Agritourism Association, 2024

The data in Table 10 shows how agritourism businesses in Italy were affected by the energy crisis and how they began to recover. In 2022, the average gross income per farmhouse dropped slightly compared to 2019 (from €63,000 to €59,800), while the share of energy costs sharply increased from 12.5% to 21.3%, indicating a significant burden on operating expenses due to rising energy prices. However, by 2023, income levels nearly returned to pre-crisis levels (€62,100), and energy costs fell to 14.9%, suggesting that adaptation measures—such as renewable energy installations and local supply chain optimization—were effective. This recovery highlights the resilience and adaptability of the agritourism sector, particularly when supported by sustainable energy solutions and regional cooperation.

*Germany: Temporary Winter Closures of Pools and Hotels.* In Germany, where winter heating costs are particularly high, many municipalities opted for temporary facility closures. Examples:

- in the federal states of Saxony and Bavaria, over 400 municipal swimming pools were closed during the 2022/23 winter season;
- hotels in regions with unstable winter tourism flow limited operations until spring.

**Figure 5. Number of Closed Municipal Pools in Winter (2021–2023)**

Source: Deutscher Tourismusverband, 2024

Despite a reduction in services, this approach enabled a significant decrease in energy consumption—up to 28% in the municipal sector—and allowed funds to be redirected toward modernization efforts, such as thermal insulation and the integration of renewable energy sources. EU countries adopted localized adaptation strategies tailored to the type of tourism and existing infrastructure. For small and medium-sized enterprises, modernization, innovation in renewable energy, and cooperation proved to be critical factors for resilience. Partial or seasonal closures were viewed as a rational

compromise to maintain long-term sustainability in the face of ongoing energy challenges

**Discussion.** The tourism sector of the European Union, being one of the most energy-dependent industries, demonstrated a relatively high capacity for adaptation during the energy crisis of 2021–2023. However, the scale and intensity of the crisis revealed the deep vulnerability of tourism actors—primarily small and medium-sized enterprises operating in energy-intensive segments (such as the hotel industry, spas, ski resorts, etc.).

Despite the challenges, the sector also showcased a strong innovative potential, which manifested in the following areas:

- implementation of local energy generation capacities (biogas, solar energy);
- improvement of energy efficiency in facilities (thermal modernization, “smart” management);
- rethinking of tourism formats (seasonal closures, digital services);
- instead of remaining a “victim” of the energy crisis, tourism is taking on a new role as a sector for implementing the EU’s climate policy.

The energy transformation of tourism is not only a necessity but also a strategic advantage:

- it allows for a reduction in long-term operational costs;
- enhances environmental appeal to tourists;
- ensures the sustainability of regional development.

To preserve the economic security of the tourism sector, a more active role from governments and intergovernmental institutions is required, particularly through:

- integration of energy security indicators into tourism support programs;
- introduction of “green certification” standards at the EU level (EU Ecolabel, EMAS);
- expansion of SME access to credit programs for energy modernization;
- tax incentives for businesses that reduce their carbon footprint.

Tourism and energy security are not merely parallel areas but interdependent components of the EU’s economic resilience. The future of the tourism industry depends not only on demand but also on its ability to operate under resource constraints. A systematic policy supporting the “green transformation” of the sector should become a key tool for preserving jobs, investment attractiveness, and sustainable regional development.

**Conclusions.** The energy crisis of 2021–2023 exposed the European tourism sector’s acute dependence on energy-intensive infrastructure, highlighting the vulnerability of small and medium-sized enterprises and the structural fragility of traditional tourism models. Despite this, the research demonstrates that tourism in the EU has not only managed to adapt but has also evolved into a dynamic platform for advancing the green transformation agenda.

The empirical findings reveal that adaptation strategies—ranging from renewable energy integration and architectural modernization to digital monitoring and organizational restructuring—have yielded measurable economic benefits. These include reductions in energy consumption, increased profitability, and shortened

investment payback periods. Moreover, the resilience of the sector has been reinforced by public policy instruments such as the EU Recovery and Resilience Facility, national co-financing programs, and certification schemes like the EU Ecolabel, which have elevated environmental performance into a competitive advantage.

Country-level case studies from Poland, Estonia, Germany, and Italy illustrate diverse yet effective pathways toward sustainable adaptation. These cases affirm that strategic flexibility, public–private coordination, and access to innovation are more critical determinants of success than energy dependence alone.

The transformation of the tourism sector should thus be viewed not merely as a crisis response but as a strategic shift toward a more sustainable, resilient, and economically secure model. For long-term viability, this shift must be institutionalized through the integration of energy security indicators into tourism policy, expanded support for SMEs, and the embedding of sustainability criteria into infrastructure investment decisions. The sector's future competitiveness will increasingly depend on its ability to align ecological responsibility with operational efficiency, turning energy constraints into drivers of modernization.

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