



Emerging Risk Introduction

Ecopetrol defined emerging risks as follows: Risks that are expected to have a long-term future impact on the company (3-5 years and beyond) or in some instances, they have already begun to impact Ecopetrol. Emerging risks are considered those that meet some of the following characteristics:

1. The risk is new, developing, or significantly increasing in importance.
2. A familiar risk in a new or unfamiliar context or under new context conditions (re-emerging)
3. The potential material financial or reputational impact of the risk is long-term and significant.
4. It is an external risk that arises from events external to the company which are beyond its influence or control.
5. The risk and its impact on the company are specific.
6. Has a high potential impact to Ecopetrol and may require Ecopetrol to adapt its strategy and/or business model.





Risk Management Lifecycle

A risk is considered well understood and 'well captured' if it can be managed using an established and recognized methodology or if it is incorporated into the existing risk register and risk policy framework. The following is Ecopetrol's risk management cycle, through which its emerging risks are identified:



Ecopetrol's risk management lifecycle used for emerging risk management.

Below is a high-level summary of the key steps in Ecopetrol's emerging risk management lifecycle, that will be explained later in more detail:

1. Plan: As part of the emerging risk planning process, Ecopetrol utilizes qualitative and quantitative research methods to perform industry scanning and gather internal information to enable the identification of emerging trends.

2. Identify: Based on the emerging trends identified, Ecopetrol reviews each trend and identifies the potential emerging risks that may impact Ecopetrol.

3. Evaluate / Review: Ecopetrol reviews each of the potential emerging risks and rates them based on the following criteria:

- Potential Impact
- Speed of Emergence

4. Handle / Treat: The assessment allows Ecopetrol to prioritize the potential emerging risks and determine the appropriate risk treatment plans. Ecopetrol assesses each potential risk and defines the treatment plan for each of the emerging risks identified. Ecopetrol's emerging risk treatment plans include the following:




- New Enterprise Risk
- Incorporation into Existing Enterprise Risk
- Ongoing Monitoring of the Emerging Risks
- Drop Emerging Risk.



Emerging Risk Planning: Trend Identification

External risks arise from events outside the organization and are typically beyond Ecopetrol's control. The trends include natural disasters and geopolitical and macroeconomic shifts. Ecopetrol cannot prevent such risks from occurring and, consequently, needs to focus on the identification of such trends / risks and related mitigating measures.

In the trend identification stage, Ecopetrol determines, in a systematic and structured way, the emerging trends that may affect its overall business strategy and operations. To ensure adequate trend identification, Ecopetrol deploys the following approach:

 Signal Scanning	 STEP Framework	 Trends Criteria
Using qualitative and quantitative research methods, Ecopetrol identifies patterns that lead to insights for more informed decision making.	STEP (Social & People, Technology, Economic, Political & Regulatory, plus Environmental) is the approach used to landscape assessments, taking into consideration the environmental conditions that impact the organization outside of its control.	To arrive at a set of trends that represent the emerging risk landscape for Ecopetrol, the trends are outlined to meet the following criteria: Consistent Elevation: all the trends look at patterns of signals across the industry, rather than single data points, but are specific enough to demonstrate a connection, direct or indirect, to the industry and organization. Mutually Exclusive, Collectively Exhaustive (MECE): Each trend is unique and distinct from the others, without overlap. The aggregate of all trends is exhaustive and doesn't leave any critical areas unaddressed. Both Opportunity and Risk: The trend indicates risk to the organization, but also opportunity from which strategic planning could be derived.

The following activities were carried as part of the qualitative and quantitative method Ecopetrol deployed:

- ✓ Consultation of published reports and / or interviews with partners of consulting firms.
- ✓ Analysis of studies published by insurance companies and risk rating firms.
- ✓ Information on the industry, economics and geopolitical issues in the regions where Ecopetrol operates.
- ✓ Consultation of public information on risks, of the main companies in the sector with better ratings.
- ✓ Information and strategic intelligence studies of the World Economic Forum – the global risk report 2021.

Leveraging the initial information gathered, Ecopetrol used the STEP framework as trend identification approach. In addition to the key elements noted in the STEP framework, Ecopetrol also reviewed the following:

- ✓ Internal information (e.g., Company strategy, business risk management documentation) review.
- ✓ The current and expected context of the Oil & Gas sector worldwide.
- ✓ The risk profiles of the companies in the sector and the relevant issues of the country.



Emerging Risk Planning: Trend Identification

Ecopetrol's analysis identified 13 trends in the company's internal and external environment in 2021:

<p>Societal</p> <p>Social pressure around energy future is growing and includes concerns from job creation to environmental protection, health and wellbeing.</p> <p>Social unrest leads to disruption in supply chain and transportation channels putting stress on energy systems relying on fossil fuels.</p> <p>Trends:</p> <ol style="list-style-type: none">1. Consumer behavior trickle up effects2. Social and political unrest3. Rising standards of regulation across ecosystems	<p>Environmental</p> <p>Decarbonization and biodiversity protection is a growing national and global priority.</p> <p>ESG is a driving issue in Upstream O&G, and throughout the supply chain, given the rising urgency for climate action and the regulatory focus on fossil fuels.</p> <p>Trends:</p> <ol style="list-style-type: none">4. Energy mix prerogative5. Responsibility to local ecosystems6. Aging infrastructure	<p>Economic</p> <p>Natural gas plays a key role in the economy with its contribution to affordable domestic energy, role in the job market, and global transition to net-zero emission goals as a "bridge" fuel.</p> <p>Oil & Gas is still a primary export for Colombia, while a majority of Colombia's own energy comes from hydropower. This energy mix is certain to continue shifting as E&P companies look for alternative end uses for their raw materials.</p> <p>Trends:</p> <ol style="list-style-type: none">7. Redirection of global investment8. Price and reliability9. Tapping into alternative markets	<p>Technological</p> <p>Digital transformation innovation is bringing new capabilities to the Oil and Gas (O&G) industry, including to Exploration and Production (E&P), and is seen as key to profitability and capital efficiency.</p> <p>Trends:</p> <ol style="list-style-type: none">10. Full stream digital transformation11. Advanced drilling capabilities	<p>Geopolitical</p> <p>Oil & Gas are primary natural resources in Colombia, where debates about environmental protection including water and biodiversity, and fracking and unconventional well extraction are ongoing, along with the global debate about whether natural gas is an essential "bridge" resource towards renewable energy.</p> <p>Trends:</p> <ol style="list-style-type: none">12. Market intervention13. Crime and conflict zones
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For further information regarding trend descriptions, see the Appendix of this document.



Potential Emerging Risk Identification

Ecopetrol analyzed each of the trends identified in prior steps and defined the emerging risks that each trend may bring to Ecopetrol. Please see below for a complete list of potential emerging risks:

Risk Category	Related Trend	Risk Name
Societal	Consumer behavior trickle up effects	Acceleration on the Race to Net Zero
Technological	Fullsteam digital transformation	Technology Enabled Natural Capital Solutions
Technological	Fullsteam digital transformation	Skilled Workers
Societal	Rising standards of regulation across ecosystem	D&O Insurance Limitations
Economic	Price and reliability	Affordable Renewables
Economic	Price and reliability	Commodity Shocks
Economic	Redirection of global investment	Market Consolidation
Economic	Redirection of global investment	Shifting Export Regulations
Economic	Tapping into alternative markets	Market Projections
Economic	Tapping into alternative markets	Petrochemical Industry Regulation
Environmental	Aging infrastructure	Long-term Supply Chain Disruptions
Environmental	Aging infrastructure	Environmental Hazards
Environmental	Energy mix prerogative	Speed of Diversification
Environmental	Responsibility to local ecosystems	Extreme Weather Events
Environmental	Responsibility to local ecosystems	Peace Accord Implementation
Geopolitical	Crime & conflict zones	2022 Colombian Presidential Election
Geopolitical	Crime & conflict zones	Social Unrest
Geopolitical	Market intervention	Government Pricing and Availability
Societal	Consumer behavior trickle up effects	Strategic Corrections
Societal	Consumer behavior trickle up effects	Conflicting Strategic Priorities
Societal	Social and political unrest	Pandemic Evolution
Societal	Social and political unrest	Vaccine Availability
Technological	Advanced drilling capabilities	Oil and Gas Drilling Technology
Technological	Fullsteam digital transformation	Information Transparency



Emerging Risks Evaluate / Review

Ecopetrol evaluated the identified potential risks based on the two following criteria:

✓ **Potential Impact Rating:** How much of an impact would this risk have on Ecopetrol if it materializes.

Impact Rating	Rating Description
Very High	<ul style="list-style-type: none"> Significant impact short-term and long-term operations (extensive operational disruptions and/or economic affectation greater than USD150M, and/or irreparable environmental damage in a large area, or in nature preservation areas) Significant short-term and long-term impact to reputation (Prolonged coverage of national and / or international press media, and/or major loss of market share for nationally marketed products) Significant impact to long-term strategic objectives and business model, major impact to Company's ability to meet business objectives and near-term initiatives Significant legal / regulatory actions or fines (Loss of license to operate in significant markets, and/or condemnation by international organizations)
High	<ul style="list-style-type: none"> Significant impact on operations in the short-term, major impact on long-term operations (prolonged operational disruptions and/or economic affectation between USD50M and USD150M, and/or scattered or severe environmental damage in a specific area, or in nature preservation areas) Significant short-term and long-term impact to reputation (coverage of national press media, and/or loss of market share for nationally marketed products) Major impact to Company's ability to meet business objectives and near-term initiatives. Some impact to long-term strategic objectives and business model Moderate legal / regulatory actions or fines (Potential loss of license to operate in significant markets and/or condemnation national organizations)
Moderate	<ul style="list-style-type: none"> Major impact on operations in the short-term (long operational disruptions and/or economic affectation between USD10M and USD50M, and/or environmental damage in a located area) Major short-term impact to reputations (coverage of national or regional press media and/or impact on the commercial relationship with customers) Moderate impact to Company's ability to meet business objectives and near-term initiatives, minor impact to Company's ability to meet long-term strategic objectives Some legal / regulatory actions or fines (opening of investigations by national or international control entities)
Low	<ul style="list-style-type: none"> Minor impact to operations (short operational disruptions and/or economic affectation between USD1M and USD10M, and/or mild environmental damage) Some short-term impact to reputations (coverage of regional press media and/or mild impact on the commercial relationship with customers) Some impact on Company's ability to meet business objectives and near-term initiatives Minor legal / regulatory actions or fines (opening of internal investigations)
Very Low	<ul style="list-style-type: none"> Minimal to no operational impact Minimal to no impact to reputation Minimal impact on Company's ability to meet business objectives and near-term initiatives Little to no legal / regulatory actions or fines

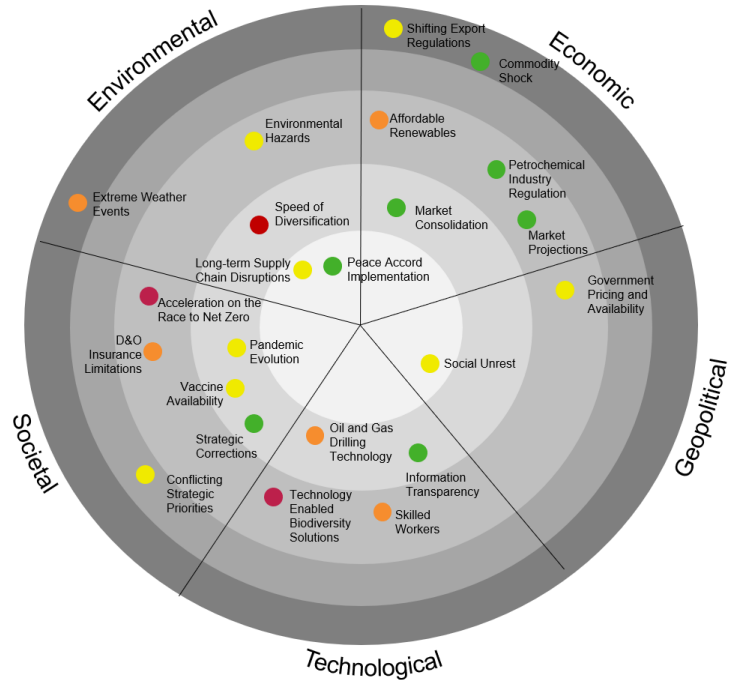
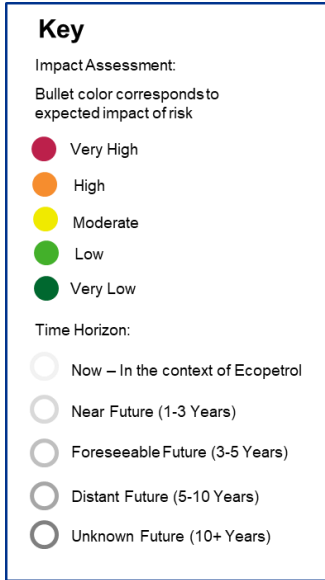
✓ **Speed of Emergence:** How quickly will this potential risk take to emerge

Speed of Emergence Rating	Now	Near Future	Foreseeable Future	Distant Future	Unknown Future
Speed in Years	starting to experience	1 - 3 Years	>3 - 5 Years	>5 - 10 Years	10+ Years



Emerging Risk Radar

Please see the risk radar below for the plotted potential emerging risks:



Ecopetrol will provide the detailed analysis of the top two emerging risks. The top two risks are selected based on the criteria of potential impact and speed of emergence (3 to 5+ years).

Acceleration on the Race to Net Zero	Technology Enabled Natural Capital Solutions
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Emerging Risk Treatment

To continue to treat the emerging risks, Ecopetrol will continuously monitor and plan for potential risk mitigation activities for each potential risk. As each emerging potential risk evolves, Ecopetrol will update its existing and planned mitigation activities accordingly.

Any risk could ultimately be incorporated into Ecopetrol’s current Business Risk Map and will be treated as a strategic risk; or it could be determined as not relevant to Ecopetrol, and therefore no additional actions are required. Ecopetrol performs the emerging risk identification process at least annually.



ER #1: Acceleration on the Race to Net Zero



Emerging Risk Definition

The risk that climate change and sustainability initiatives (e.g., proposed Colombian Climate Action Law, COP 26 (Glasgow 2021), tax credits, carbon offsets...) and the acceleration of reliable and cost-effective green alternatives changing societal demand could impact Ecopetrol's energy diversification portfolio and strategic priorities leading to increased expenses related to green initiatives and reduced demand for Ecopetrol's core products.



Emerging Risk Background

In 2021, the Colombian government enacted the Climate Action Law (Law 2169) which advances Colombia's focus and commitment to strengthening its strategy and actions against climate change. This law reaffirms the Carbon Neutrality Colombian Strategy launched in April 2021 by the Ministry of Environment and Sustainable Development which rises the ambition of reducing GHG emissions with a goal to reach carbon neutrality by 2050. At a global level, for the first time in almost 30 years of the Conference of the Parties (COP), the "Glasgow Climate Pact" agreed in COP26 to include a direct reference to fossil fuels, calling Parties to "accelerate efforts towards the phase-down of unabated coal power and inefficient fossil fuel subsidies, recognizing the need for support towards a just transition". In this regard, the Colombian government has included into its legislation decisions to reduce its emission of GHG, beyond having a mostly clean electricity generation matrix. Reaching the proposed objectives requires Ecopetrol to decisively advancing its strategy that diversifies the energy matrix by increasing the shares of renewable sources and promoting the use of cleaner technologies.



Potential Impact to Ecopetrol

Potential long-term impacts are expected to occur over the next five years and beyond as national environmental efforts ramp up and begin to focus on fossil fuels directly. The continued implementation of Climate Action Law also aims to accelerate the transition to public and private electric mobility. This has a direct impact on Ecopetrol's business as it continues to invest in different energy options while primarily operates in the Oil and Gas industry. These external shifts in Colombia's view on climate change and reduction in fossil fuels are also coupled with international and national companies updating their own strategies and investments to become less reliant on fossil fuels as alternatives become more reliable and cost-effective. The adoption of these alternatives could accelerate and lead to exponential growth in decarbonization and green alternatives, thus the speed of which this risk may materialize could increase and Ecopetrol may need to adjust its strategic priorities and projections in the diversification of its energy portfolio as the international and national energy transition continues to accelerate and evolve. The acceleration of national and international Net Zero commitments may also impact Ecopetrol's capacity to financial access and increase of capital cost.



Mitigation Activities

- ✓ Ecopetrol has started to disclose according to the TCFD⁽¹⁾ and SASB recommendations to respond to investors demands. Based on the TCFD framework the company is advancing in the identification of climate change risks and opportunities and scenario analysis, which will allow to improve the capacity of the company to manage climate change related risks and opportunities.
- ✓ Continuous update and verification of the GHG inventory to inform decision making around decarbonization targets⁽²⁾. The company will review its GHG emission reduction targets once the O&G sector guide by the Science-Based Targets initiative (SBTi) is released.
- ✓ Diversify into low-carbon emission businesses (e.g., recent acquisition of 51.4% of the regional energy transmission company ISA); and application of an internal carbon price to current and future projects.
- ✓ Gradual incorporation of competitive low carbon technologies (e.g., energy efficiency, reduction of gas flaring and fugitive emissions and vents, renewable energies, biofuels) and emergent technologies (e.g., green hydrogen and CCUS, energy storage of renewable energies).
- ✓ Implementation of Natural Climate Solutions to abate residual emissions.
- ✓ Active participation in public policy documents development (NDC alignment, National energy and mines climate change plan).
- ✓ Adoption of global initiatives that promote GHG reduction (Climate and Clean Air Coalition, Zero Routine Flaring, Climate Action 100+, Oil and Gas Methane Partnership).

(1) See TCFD Report: [ecopetrol.com.co/wps/wcm/connect/f377c849-1135-49c3-abc6-d74c09e596d6/english-tcdf.pdf?MOD=AJPERES&attachment=false&id=1628049465069](https://www.ecopetrol.com.co/wps/wcm/connect/f377c849-1135-49c3-abc6-d74c09e596d6/english-tcdf.pdf?MOD=AJPERES&attachment=false&id=1628049465069).

(2) Ecopetrol's GHG reduction targets include reducing emissions by 25% in 2030 and achieve net zero GHG emissions by 2050 for scopes 1 and 2. In terms of total emissions (scopes 1, 2 and 3), achieve a 50% reduction by 2050, compared to a 2019 baseline.



ER #2: Technology Enabled Natural Capital Solutions

Emerging Risk Definition

The risk that Ecopetrol does not adequately adapt & align its technology capabilities & strategy (e.g., Nature Based Solutions, Big Data Analytics, Remote Sensing, Robotics and Drones, Artificial Intelligence) to effectively enable, assess, and report on the reduction of its impact to Colombia's biodiversity (e.g., contamination, habitat loss, deforestation, & GHG emissions) given the increase in Colombian sustainable development commitments leading to increased regulatory scrutiny and impacting Ecopetrol's strategic efforts and operations for minimizing its impacts to relevant ecosystems.

Emerging Risk Background

In 2021, the World Economic Forum's (WEF) Global Risk Report identified biodiversity loss, ecosystem collapse, and human-made environmental damage, as top risks. The WEF highlighted biodiversity loss as an existential global threat indicating that biodiversity loss is significantly increasing in importance. The action for corporations to ensure to appropriately report and identify their impact on biodiversity is also being considered as part of the Task Force on Nature-related Financial Disclosures (TNFD), which aims to create a standardized way of measuring threats to wildlife and ecosystems. There are no simple metrics for which biodiversity impacts can be measured, however, as governments and investors begin to turn their attention to contamination, habitat loss, urbanization, and deforestation it will require effective development of and use of digital capabilities and technology to gather relevant data, provide insights and mitigation opportunities to comply with potential future regulations and disclosures over the next few years. Financial institutions are also looking for more accurate and transparent information from Companies regarding their risk management of biodiversity loss, especially within the Oil and Gas Sector.

Potential Impact to Ecopetrol

Ecopetrol operates in a country that is recognized as a megadiverse territory where complexity, fragility, and biological diversity are interwoven with a rich history and a dynamic and complex social, economic, and political landscape, and where the government looks to businesses to participate in the country's sustainability development goals implementation. Ecopetrol's long term ability to meet the Country's biodiversity expectations and the Company's strategic objective of being the leading oil and gas company in Colombia may be impacted if it does not advance its technology capabilities to enable their products to be more efficient, safe, and sustainable.

Throughout Ecopetrol's analysis, we summarized the following potential impacts of this emerging risk specific to Ecopetrol:

- ✓ Increase of social or regulatory restrictions to operate in areas of interest for the company that cannot be addressed in a timely manner
- ✓ Impact to ecosystems due to operations that exceed Ecopetrol's current operational capacities
- ✓ Reduced availability of ecosystem services from which Ecopetrol's operations depend on
- ✓ Limited capabilities to adequately quantify CO2 capture and storage from Natural Climate Solutions
- ✓ Loss of markets and negative impact on Ecopetrol's reputation
- ✓ Increase of vulnerability towards climate related events

Mitigation Activities

- ✓ Participate as an active member of the Taskforce on Nature-related Financial Disclosures to anticipate management frameworks to report and act on evolving nature-related risks.
- ✓ Strengthen biodiversity baselines in prioritized ecosystems (Magdalena Medio and Orinoquia), which includes the installation of 780 camera traps for biodiversity monitoring.
- ✓ Development of a socio-ecological resilience tool, to analyze potential impacts of future interventions.
- ✓ Monitoring of springs and sites with potential for spills through genetic analysis of metabarcoding to identify native strains of microorganisms that allow bioremediation measures in case of oil spills.
- ✓ Research study on "CO2 capture in natural sinks", to reduce the uncertainty in the quantification of capture and storage of CO2 and other greenhouse gases.
- ✓ Development of soil amendments, based on oil molecules, to increase the carbon sequestration capacity, the regulation of the water cycle and the protection and strengthening of biodiversity.
- ✓ Promotion of regenerative agriculture by promoting the establishment of combined crops (included cocoa and native trees) systems in altered soil, with a view to improving soil quality, increasing tree cover and strengthening biodiversity and promoting a better income for the population.
- ✓ Launch of a nano satellite with the capacity to take multispectral images, to monitor forest cover and emissions of methane and carbon dioxide into the atmosphere.
- ✓ Development of technologies to costly-effective treat the produced water from the Orinoquia fields and to reuse it in the irrigation of agro-industrial and wood-fuel plantations.

EMERGING RISKS TRENDS

Ecopetrol 2021
Appendix

Gerencia Corporativa de Gestión Integrada de Riesgos
Vicepresidencia Corporativa de Cumplimiento

▪ Societal

Related Trend	Trend Description
Consumer behavior trickle up effects	Consumers continue to prioritize price and reliability over carbon impact, demonstrating contradicting priorities that challenge long term strategic and investment decisions.
Rising standards of regulation across ecosystem	Limitations in essential services—including insurance, advertising, and financing—due to stricter carbon standards and ESG reporting within third party organizations servicing the Oil & Gas industry.
Social and political unrest	An uncertain political climate that risks leading to renewed protests and social uprising, disrupting supply chains, transport and operations for local Oil & Gas producers and suppliers.

▪ Environmental

Related Trend	Trend Description
Aging infrastructure	Old pipelines, storage tanks and abandoned wells become environmental liabilities when operations have idled, leaving questions about who is responsible for resulting harm to the environment, and for the cost of safely plugging and cleaning up the sites.
Energy mix prerogative	Industry shift from Oil & Gas companies to Energy companies with diverse portfolios.
Responsibility to local ecosystems	Commitments by government, with the support and participation of businesses, to monitor and protect conditions of water, local biodiversity, and to empower communities to protect their territories.

▪ Economic

Related Trend	Trend Description
Price and reliability	Volatile gas prices introduce doubt as to viability of the “bridge” fuel, and drive support for renewable energy as renewables prices fall.
Redirection of global investment	International investment in local exploration declines, or shifts to alternative energies.
Tapping into alternative markets	Anticipated decline in demand for fossil fuels drives near-term plans for transition to petrochemical and Blue Hydrogen production (i.e., modifying refineries, updating supply chains, developing new sales channels).

▪ Technological

Related Trend	Trend Description
Fullsteam digital transformation	Digital transformation throughout the value chain drives increased worker / environmental safety and biodiversity and natural capital, improved climate reporting capabilities, long-term savings, and vulnerability to cyber attacks.
Advanced drilling capabilities	Unconventional drilling technology advancements increase profitability and lifetime of wells, and attract regulatory attention (i.e. impact on local community and water management).

▪ Geopolitical

Related Trend	Trend Description
Crime & conflict zones	Attacks on infrastructure, oil theft and smuggling by local gangs and guerrillas, and wells and pipelines that pass-through conflict zones with little government oversight, cause economic losses, property damage, and operational disruption.
Market intervention	Intervention by government on energy pricing and availability.