

# IMPACT OF CLIMATE CHANGES ON THE EUROPEAN INDUSTRY

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This paper gives an overview of direct consequences of serious weather events and mitigation actions undertaken in this respect by the Commission of the European Union (EU). The potential ramifications of climate change have been illustrated based on the example of the iron and steel industry. Taken together, the findings of this study suggest that climate changes present a threat to industrial activity through the occurrence of extreme weather events as well as the need to adjust operations to meet increasingly strict legal restrictions and penalties connected with the environmental policy pursued by the European Union.

*Keywords:* iron and steel industry, climate change, European Union, threat, disasters

## INTRODUCTION

In essence, enterprises today function in a volatile and dynamic environment. They need to constantly adapt to market shifts, legal regulations, control standards, investment opportunities, competition as well as respond to numerous other threats with regard to internal processes as well as the external environment of the enterprise.

One of the external threats to entrepreneurial operations are climate changes. Due to a heightened correlation between the environment and human activities they have a significant impact on both society and the economy [1]. Therefore, the paper attempts to show the impact of climate changes on industrial activity as illustrated by the example of the iron and steel industry. The study examines the implications of climate changes and actions launched by the Commission of the EU to limit the impact of these changes. The paper has drawn on reference literature and information generated in data bases, including information on natural and technological disasters.

## DIRECT CONSEQUENCES OF SERIOUS WEATHER EVENTS

Climate changes refer to detrimental phenomena in atmospheric conditions that cause various weather anomalies. According to statistical data and analyses there is a continued upward trend in the number of hazardous events over the year across the globe [2,3]. Furthermore, an increasing number of events are accompanied by a heightened intensity in their effects (e.g. flash

floods). A large number of victims (particularly in 1997 and 2000 as a result of floods in Austria, the Czech Republic, Germany, Slovakia, Poland, Hungary, Romania and Croatia) as well as the scale of destruction highlights the severity of threats posed by extreme weather events. Over 2002-2011 the costs generated by natural disasters totalled on average 131 trillion annually [3]. Across Europe all nations are exposed to climate changes occurring, though to varying degrees. According to the European Environment Agency heat waves, floods and storms are of greatest significance among catastrophic events [4].

As a result of weather anomalies, extreme weather events and natural disasters (floods, droughts, heat waves, extreme lightning), climate changes may contribute an outright threat to business operations. For the economy, the biggest threat is posed by sudden events such as floods, storms, hurricanes or flash floods [5]. From the viewpoint of industry they may trigger destruction of industrial infrastructure. Occurrence of floods or strong winds may undermine the stability of engineering structures, devastate or restrict transport routes and break communication and power cables. The events detailed may present a direct threat to human life and health and they may affect the security of processes and technology. They thus, constitute a source of operational risk in industrial activity.

## IMPACT OF THE EUROPEAN UNION'S POLICY REGARDING CLIMATE CHANGES ON INDUSTRIAL ACTIVITY

To mitigate adverse human impact on the environment the EU approved an integrated approach to climate and energy policy in March 2007. In essence it encompasses assumptions seeking to combat climate

change where effectiveness of the industry is critical to counteracting pollution [6]. Meanwhile in December 2008 the EU adopted the climate and energy package that constitutes a fulfilment of assumptions embraced by the European Council in 2007 [7]. Overall, until 2020 the European Union aims to reduce greenhouse gas emissions by 20 % from 1990 levels, raise the share of energy production from renewable resources to 20 %, and improve the EU's energy efficiency by 20 % in relation to 2020 forecasts, as well as to increase the share of biofuel in overall fuel consumption up to 10 %. In February 2011 the European Council endorsed the objective to curb the greenhouse gas emission by 80 – 95 % until 2050 compared to 1990 levels [8]. Yet, each move designed to stabilize the climate exerts a substantial influence on business operations [9].

In a broad view, EU legal requirements centred on mitigating detrimental effects on the environment are a burden on enterprises operations. Basically, they may lead to increased production costs, diminish profitability and limit expansion opportunities. Accordingly they rein in industrial activity and development [10, 11]. Nevertheless the actions aimed at alleviating climate changes seem to be justified and required. Hence, it is necessary to adjust industrial activity to current conditions and to launch ventures focused on mitigating any adverse impact on the environment.

## CONSEQUENCES OF CLIMATE CHANGES ACROSS IRON AND STEEL INDUSTRY IN EUROPEAN UNION

Climate changes affect the iron and steel industry in a direct as well as an indirect manner. The occurrence of extreme weather events poses a direct threat to life and health of people in a given area and they may also trigger immense damage to technical infrastructure (communication, energy networks, sewage system, etc.) and to plant infrastructure (tangible assets). The weather events most widespread on the EU territory presenting the biggest threat to industrial activity that affect iron and steel industry include:

- heat: adverse surface erosion of facilities, excessive dusting and heightened air pollution, threat to personnel health,
- floods and flash floods: flooding, inundation and destruction of plant's infrastructure, disturbed communication, water erosion and washing out impurities, threat to personnel's life and health,
- hurricanes and storms: exposure of plant's infrastructure and threat to personnel life and health.

Meanwhile legal regulations put tremendous pressure on steel industry with regard to the urgency to re-vamp their ongoing production process and design more environment-friendly actions [12]. They, thus, generate increased business costs. The steel industry in the EU has already borne high costs related to reduction of hazardous dust and smoke emission, disposal of slag heaps

and waste treatment, e.g. from used gear oil. The solutions harnessed to curtail emission of harmful substances to the environment include, among other things, closed water circulation systems and setting up steel slag and dust processing plants. Stringent requirements for greenhouse gas reduction as well as related costs may decrease the competitiveness of European steel-yards in favour of manufacturers from other countries, e.g. from India or China [13].

Given that:

- production of iron and steel is one of the largest sources of industrial CO<sub>2</sub> emissions [14, 15],
  - key environmental aspects of the industry include exploitation of natural resources (iron ore, coal, limestone) electricity use, water consumption, solid waste, steel and sanitary effluent, and also dust and noise emission [16],
  - today's steel market is very unstable [17, 18],
- both hazardous climatic phenomena as well as legal requirements in this respect pose a threat to the operations of the iron and steel industry and they are generating extra costs. Therefore, it is essential to prepare plants to address climate changes and align operations to legal restrictions. An impact of climate changes on industrial activity as based on the example of iron and steel industry alongside the specification of critical mitigation actions is illustrated in Figure 1. The consequences of climate changes demonstrated may apply to any industrial

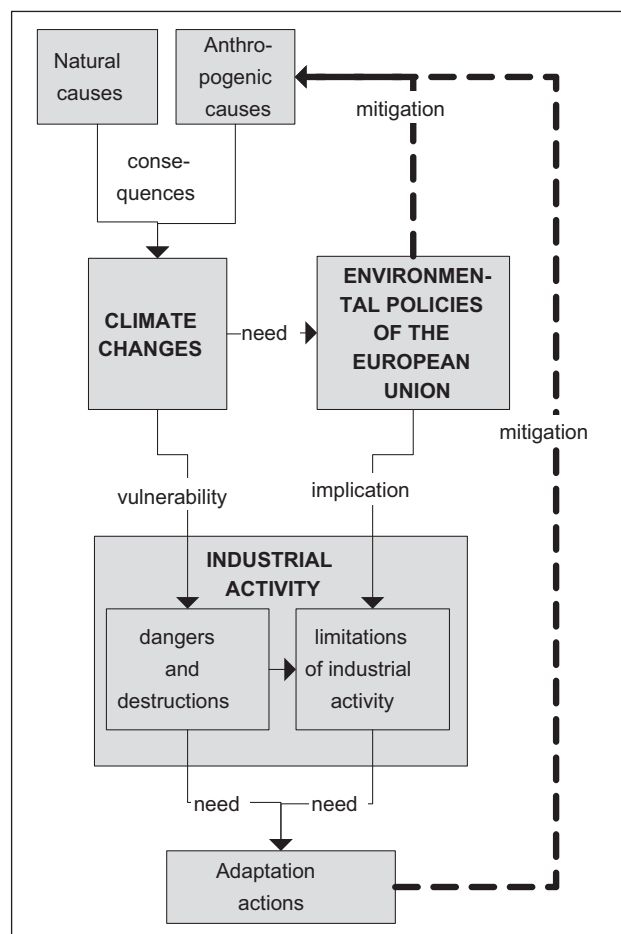


Figure 1 Impact of climate changes on industrial activity

activity linked to CO<sub>2</sub> emission and exploitation of natural resources across production processes.

As shown in Figure 1, natural causes (cyclic changes in the macro scale) and anthropogenic causes (such as greenhouse gases or aerosols) generate climate changes, which concern the weather anomalies (e.g. warmer temperatures, precipitation change), dangerous climatic events (e.g. floods, hurricanes), sea level rise etc. These events have a direct impact on the industry. They are a source of danger to human life and cause of serious damage to infrastructure. Furthermore, the need to reduce climate changes is the reason to take appropriate legislative actions by the EU (taxation, limits of emissions, charges). They restrict industrial activity by increasing of production costs and risk in supply chains and also reduction of profitability.

Discussed threats are the basis for taking adaptation actions, which result in reduction of industrial activities vulnerability, fulfillment of legal requirements and mitigation anthropogenic causes of climate changes.

## CONCLUSIONS

This paper covers preliminary exploration providing insight into the impact of climate changes on the operational risk across industrial activity in the EU. The studies accomplished suggest that climate changes, through their direct as well as indirect influence, may present a threat likely to substantially affect the operations of industrial plants, including the iron and steel industry. These threats stem from the vulnerability to severe weather events as well as from the need to adjust operations to meet increasing legal restrictions and penalties related to the environmental policy endorsed by the EU. Resilience of the iron and steel industry to climate changes hinges on the capability of the industry to predict the threat and swiftly respond to challenging occurrences. Therefore, it is crucial to take mitigating and adaptation actions.

Theoretical discussions featured in this paper highlight a wide variety of areas to be examined further. In the years to come they will be completed with the analysis of the vulnerability of iron and steel industry to climate changes, and necessary adaptation actions will be identified.

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**Note:** The responsible translator for English language is E. Trochimko-Kloch, Warsaw, Poland