



# HOW TO DEAL WITH THE EFFECTS OF CLIMATE CHANGE IN PORTS?

Noemí Monterde, Project Manager, Fundación Valenciaport

From the end of the 19th century until 2011-2016 the average temperature of the Earth's surface has increased by only 1.1°C and the average sea level by 0.2m, with wide geographical variability. These seemingly small variations have caused changes in the climate of the entire planet as well as an increase in the frequency, intensity and duration of extreme weather events. We are not moving from a stable ecosystem to another one that is also stable - but worse. The climate will continue to deteriorate, even in the fictitious scenario of the complete cessation of GHG emissions tomorrow.

## CURRENT STATE OF PLAY

There are two sources of uncertainty: what and when humans will do about that GHG emissions and how the climate will respond both directly and, above all, through interconnected feedback processes. But despite this,

the Intergovernmental Panel on Climate Change (IPCC), a non-alarmist body, expects a warming of between 3 and 4 degrees at the end of the 21st century, although every time it reviews the scenarios it corrects them towards more pessimistic forecasts.

In addition to eliminating or at least reducing CO2 emissions, there are two fields of technology that seek to reverse the effects of climate change: geoengineering and CO2 capture technology. Although both come with undesirable side effects. Meanwhile, the natural approach, revitalizing forests and with new plantations expressly designed for that purpose, does not seem to work on the necessary scale.

We will have to coordinate all kinds of measures to reduce emissions, mitigate impacts, adapt and capture CO2, acting as soon as possible to move away from the most catastrophic scenarios.

## PORT PROBLEMS

What's going to happen to the ports? Because of the location, ports are likely to be affected differently by climate change and associated extreme weather conditions.

Ports are complex environments where multiple factors interact, which, according to UNCTAD, can be classified into four groups: environmental, market, infrastructure and operational. Port and terminal authorities can only act directly on some elements of these last two groups and improve knowledge about the influence of the other factors to optimize the actions to be taken.

Environmental factors refer to climate variables, their variability, and the incidence of extreme events. The first step to be taken is to raise awareness among ports and their stakeholders of the importance of the effects of climate change and thus create the necessary



environment to take further action. In this regard, it should be noted that the time scales of port planning and climate change have reversed their roles. The effects of climate change are already evident and the response of ports to them is not being sufficiently agile.

Thus, for example, weather phenomena that could be expected every 100 years are now more frequent and we can expect them every 25 or even every 10 years, and both port infrastructure and superstructure are affected by more intense actions than foreseen when they were designed. On the other hand, they suffer an acceleration of wear and tear with a consequent reduction in their useful life. This results in the need to improve information on climate variables, associated risks and the vulnerability of each of the elements of the ports and their environment.

#### **PERCEIVED UNCERTAINTY**

Ports must change their perception of uncertainty by using prediction models based on the most probable emissions scenarios. Long-term downscaling models must be applied in order to know the forecasts of the climate variables that

affect each port and the effects that they may produce. Weather variable thresholds must be identified at each facility. With these models it can be calculated, for example, the interval of stop hours for operations due to wind gusts above a certain threshold. And the operator can decide if it is convenient to improve the equipment to raise the threshold or assume the losses for not operating. It allows decisions to be taken on the dimensioning and therefore necessary investments in infrastructure and equipment to maintain the operating conditions of the installations, as well as insurance policies that minimize the economic risks of the activity.

#### **EXTREME WEATHER**

A shift towards more extreme environmental conditions is already taking place: the increased intensity and frequency of rainfall can cause flooding because of capacity overload of the drainage systems, damage to warehouses, buildings and or cargo, the failure of inland links to other modes of transport, affecting supply and distribution of goods to and from the ports. Additionally extreme precipitations events will affect operations

leading to lost work time or even port closures.

High-speed winds can damage buildings, warehouses, cranes and other port equipment as well navigation and communication equipment, can cause delays and stoppages in cargo handling, can make berthing difficult, requiring more tug assistance, or even impossible, and can increase the wave action at waterfront structures and consequently an increase in overtopping rates, hence flooding of berth facilities, and more agitation of the port waters.

High temperatures and heat waves can affect infrastructures and building materials as pavements, steel, asphalt, and others. The structure of equipment can be affected, engine cooling and cause power failures. Extreme temperatures can greatly worsen working conditions in berths and on board, and increases the energy demand for buildings, equipment cabins and warehouses cooling, and for reefers. Periods of high temperatures and low rainfall will produce droughts that will cause water shortages, increased fire risk and poor agricultural commodity production. In some locations, dust storms are also a risk to evaluate.



Other possible effects are those related to wave regimes and storm surges. Changes in the prevailing wave directions can increase internal agitation. Breakwaters could be vulnerable to overtopping in storms combined with sea level rise that could cause flooding of facilities, damages in cargo, infrastructures and equipment.

It can be mentioned effects such as loss of draft in inland ports and navigation channels due to drought, declining water quality due to the presence of invasive organisms caused to changes in water temperature, or variations in water acidity and salinity that can increase corrosion, biodeterioration resulting in higher maintenance costs, among others that is needed to analyzed in each particular case.

**ECONOMY DECARBONIZATION**

In the market and logistic context, the degree of uncertainty in the medium term is very high. Measures taken with regard to the decarbonization of the economy can change production and consumption patterns. The risk of disruptions in transportation and storage due to extreme climate events and the more than possible internalization of the costs of transport emissions will bring the centres of production closer to those of consumption, in a combination process of deglobalization and greening of the economy.

Global warming will drive the relocation of agricultural production to moderate climate latitudes to maintain productivity, that would require new ports, and will reduce of productivity in existing areas, consequently reduction of traffic in linked ports. Oil and coal shipping can be reduced to historic lows. Ports must install LNG and other alternative fuels bunkering infrastructures, must move to cold ironing and renewable energy sources, being as independent of general grids as possible in order to guarantee supply. It is also expected an increased pressure on the coastline due to rising average sea levels, changing the need for space for retreating populations, and for ports and logistics facilities. Finally, in each location there are local effects to be studied.

**FAST ACTION**

Ports must begin to consider the effects of climate change as soon as possible and start taking mitigation and adaptation measures in multiple areas of action: technological and engineering, design and maintenance, planning, insurance, management systems and stakeholders governance. Valenciaport Authority, with the support of Valenciaport Foundation, has begun to reinforce this line of work and participates in the ECCLIPSE and CRISI ADAPT-II European projects.

**PORT OF VALENCIA VIDEO INTERVIEW**

**ABOUT THE AUTHOR**

Noemí Monterde is civil engineer, Project Manager in the Fundación Valenciaport, developing her activity in port planning and development, port governance, terminals and services, energy efficiency and R+D in ports. Now is in charge of two European projects in the field of adaptation and mitigation of climate change effects.

**ABOUT THE ORGANIZATION**

Fundación Valenciaport is an Applied Research, Innovation & Training centre providing services to the port and logistics cluster. This initiative of the Port Authority of Valencia has enjoyed the collaboration of notable businesses, universities and institutions from the port community. Since its establishment, it has developed projects in more than 60 countries, primarily Mediterranean nations, as well as from the rest of Europe, Asia and Latin America.