**Description of the Challenge**

The challenge put forward by IBERDROLA is titled: ***"How to reduce the risk of trees falling on electrical power lines due to phenomena related to climate change?"***

This challenge addresses the needs described below:

- How can we make predictions that plan for and quantify climate-related risks?
- How can we reduce to a minimum the damage caused to grid assets due to falling trees or branches near electrical distribution lines?
- How could IBERDROLA optimise decision-making when making investments in the distribution grid, be it through considerations related to the easement strip or other alternatives?

## Background

The electrical system is the backbone of modern society. Basically, it is the sector on which almost all other sectors depend for their routine operation. This is especially true for Europe, which possibly has the world's most complex electrical grid, comprised of thousands of generating stations, hundreds of thousands of substations and more than 5 million kilometres of lines, operating across the continent. In addition, the electrical grid is tasked with maintaining its operations almost 100% of the time, even in conditions of extreme weather, fuel shortages, direct attacks and human errors.

Likewise, the necessary decarbonisation of our society involves, on the one hand, the "electrification" of many energy-consuming sectors, and on the other the integration of renewable distributed generation technologies that increasingly require a stable, robust and at the same time, flexible, operation of the electrical grid.

In order for the electrical system to operate efficiently and reliably, it must maintain the continuous operation of its four key elements: generation; transmission; distribution and demand. However, the distribution grid, due to its size and new environmental threats due to climate change, requires increasingly higher investments that improve its resilience in preparation for these challenges.

The historical data show that some of the distribution grid outages in forest environments are due to falling trees and branches on the power lines, both inside and outside the easement area of the lines.

These falls do not have a single cause, but rather in general they are due to an accumulation of them (wind, snow, pests, ground erosion, etc.); however, they all seem to become more frequent with the increase in extraordinary weather phenomena associated with climate change (strong storms, extreme heat waves, etc.).

As for the vegetation in the easement area of the electrical power lines, the current felling and pruning process is highly digitalised and industrialised. During the management of the vegetation prior visits are carried out to the work areas travelling along the electrical power lines (even carrying out flights with helicopters). On these visits, diseased trees or those which due to their inclination present a risk of falling on the power lines are identified within the easement area, and are cut down to eliminate the risk. However, electrical distribution companies cannot act outside these areas and this management does not take into account the above-mentioned extreme weather conditions associated with climate change, which are increasingly frequent and of higher intensity, making it more difficult to identify the trees at risk of falling.

Therefore, in order to determine the risks and threats of interruptions in the distribution grid caused by events associated with extreme climate phenomena or environmental conditions, and to evaluate investments that could reduce these risks, we must take into account the following primary environmental factors: wind, density of vegetation, structure of the ground (for example, plasticity as a result of humidity, slope, composition of the ground/horizons, roots and deep waterlogging of the ground), load on the trees (due to ice/snow, etc.) and their long-term evolution due to climate change.

## Stakeholders

The effects of climate change and information on the surrounding areas of electrical power lines are considered essential parameters in order to calculate the risk of falling trees. Which means that the bodies and entities that manage this type of information (generally public) are considered fundamental players in the implementation of a solution that calculates this risk.

Taking this into account, the series of related stakeholders in this challenge, and whose information must therefore be taken into account when presenting the solution, are the following:

- Global Historical Climatology Network-Daily (GHCN-Daily)
- National geographical Institute (types of ground)
- Copernicus is the European Union's Earth Observation Programme (www.copernicus.eu)

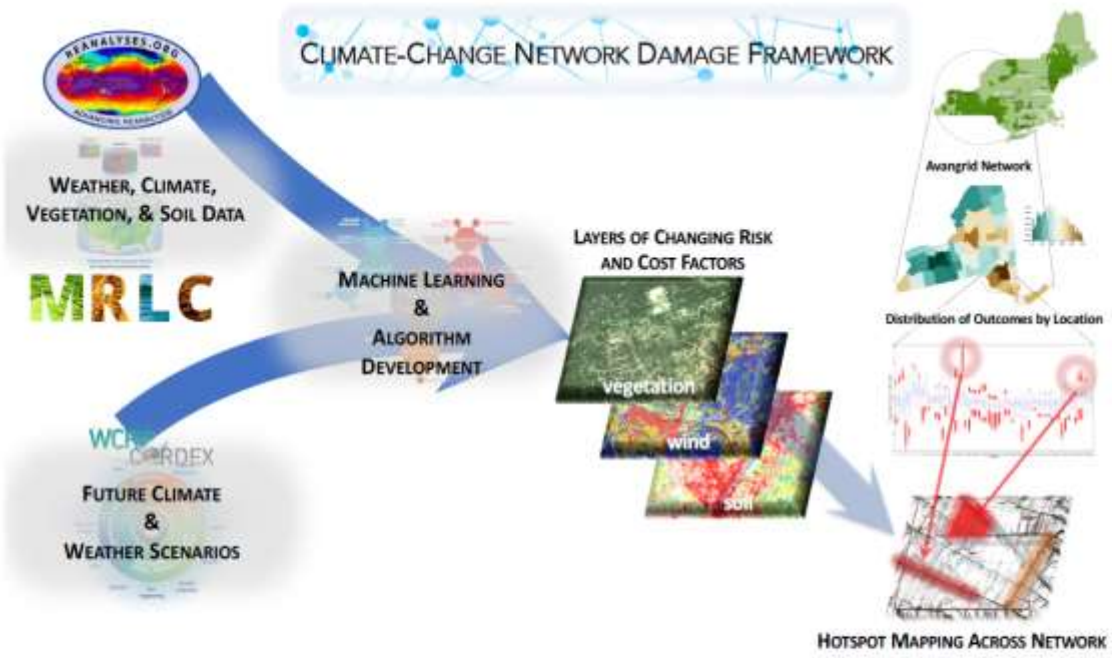
## Needs

IBERDROLA's need lies in seeking a **solution that enables making predictions that plan for and quantify climate-related risks**. **The aim is to reduce to a minimum the damage caused to grid assets due to falling trees or branches near electrical distribution lines** in the Bizkaia area.

Therefore, what is sought is to find a solution that quantifies the increase in damage risk to the electrical distribution grid caused by falling trees and/or branches and which can help to respond to the following questions:

- What are the **impacts and the cost-benefit compensations** of the different investments in the distribution grid?
- What **investment in the distribution grid will most reduce the risk**?
- How can we **improve the resilience of the electrical grid** against the threats of climate change?

For illustrative purposes, the following image that shows the conditioning factors and some of the alternatives to carefully consider in order to propose a solution to the present challenge is included:




## Objectives

Taking into account the starting point described above, the solution that IBERDROLA is looking for seeks to cover, at least, the functional needs included in the following table, rated as a requirement or positively valued:

| Variable | Functional need | Relevance |
|---|---|---|
| The solution predicts the falling of trees and/or branches | Reproduces the occurrence of grid interruptions | Requirement |
| | Shows the stability of trees | Requirement |
| | Forecasts resistance to the fracture of trees and/or branches (either through long-term evolution of the vegetation or due to adverse effects such as ice or snow) | Requirement |
| | Enables differentiating predictions associated to the type of vegetation (both shrubs and trees) | Will be positively valued |
| | Predicts the critical speed of wind for trees | Requirement |

| | | |
|---|---|---|
| The solution enables visualising the impact/importance of environmental conditions | Has a resolution of at least 30 metres (vegetation and ground) | Requirement |
| | Provides a dynamic and visual diagnosis | Requirement |
| | Considers seasonal variability (weather and climate conditions) | Requirement |
| | Enables combining variables to make accurate predictions | Requirement |
| | Combines different spatial granularities | Will be positively valued |
| | Conveys the information in an intuitive format | Will be positively valued |
| The solution evaluates the avoided costs | Assesses the consequential costs if actions/measures are not taken | Requirement |
| | Considers the costs associated with adaptation actions (e.g. updating of equipment, pruning, etc.) | Requirement |
| | Takes into account the costs and impact of the interruption/damage events on the distribution grid | Requirement |
| The solution is able to compare different scenarios | Calculates the risk of the current situation | Requirement |
| | Calculates the future risk for different emissions scenarios | Requirement |
| | Calculates the risk for the current situation of the grid | Requirement |
| | Calculates the risk for different improvements of the grid | Requirement |
| The solution proposes corrective measures | Suggests improvements in the conditions of the grid based on a catalogue of alternatives | Will be positively valued |
| This solution uses available information | The sources of information on the climate and the surrounding area are free of charge | Will be positively valued |
| | It is not necessary to generate the climate models | Will be positively valued |

**Scope**

The scope of the pilot project developed between the entity selected in this challenge and IBERDROLA will be the easement area of the medium voltage grid in Bizkaia.

In subsequent phases, and after carrying out the appropriate validations, the potential solution could be extended to any area where there is an electrical grid.

## References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