Success story

envair360 for driving Cartagena to a more **efficient Low Emissions Zone**

libelium

Data technology, combined with community involvement, powerfully drives urban innovation. Data is a universal language, fostering dialogue between citizens and decision-makers to ensure information is understandable, intuitive, and, most importantly, actionable.

In Cartagena's case, data aids technicians and urban planners in decision-making. This includes designing the Low Emissions Zone through algorithmic modelling, ensuring that the city's mobility planning considers the correct sustainability, climate change, and air quality indicators. Moreover, it emphasizes a focus on the citizens' needs.

A Low Emissions Zone that leaves no one out

Cartagena, a Mediterranean port city, faces several climate-related challenges impacting its population and economy. Similar to other European cities, Cartagena was compelled to establish Low Emission Zones (LEZ) to curb pollution. However, the city struggled with a lack of data for designing these zones efficiently, affordably, and equitably. Creating an inclusive LEZ is particularly challenging under the constraints of time and the expectations of citizens.

Cartagena's response, in collaboration with Libelium, was to implement a Smart City platform leveraging IoT, AI, and FIWARE technologies. This integrated solution enabled:

- Real-time air quality monitoring (NO, NO2, SO2, CO, PM2.5, PM10), noise, and weather conditions using a metropolitan LoRa network.
- Integration of additional data from various devices like cameras and noise sensors for a more detailed city map.
- AI-driven analysis to interpret vast amounts of data, identifying correlations and patterns that facilitate evidence-based decision-making.

These efforts focused not only on mitigating existing negative impacts but also on preventing future environmental issues.

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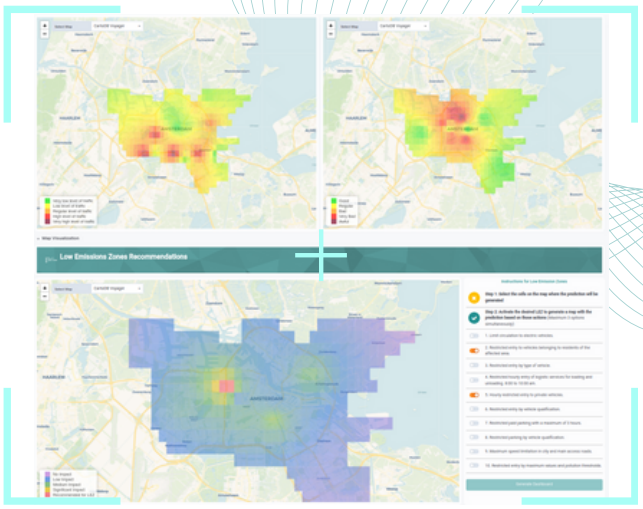
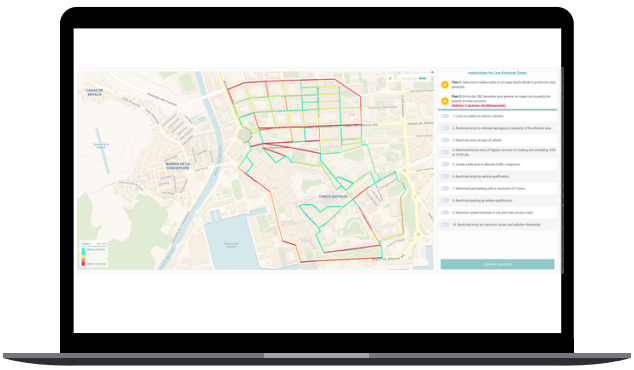
Thanks to envair360, Libelium's artificial intelligence platform for designing and managing Low low-emission zones, Cartagena now utilizes sophisticated algorithmic models to track air pollutant dispersion. This technology has enabled the creation of a streamlined LEZ proposal that benefits all citizens.



envair360 is a software that integrates large amounts of air quality, environmental and noise data and implements them with different algorithmic models such as Munich, Street Canyon, CHIMERE or WRF that allow hyperlocal knowledge of air quality.



From the sensor to the Smart Cities platform through AI

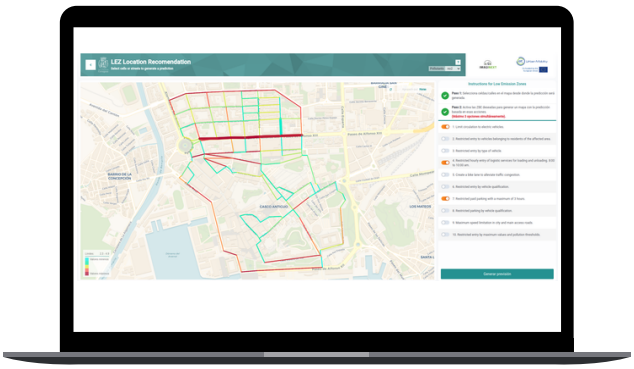
Libelium's Artificial Intelligence-based Low Emission Zone captures, processes, and integrates data with other urban datasets and algorithmic models to pinpoint the most polluted areas. This integration allows for anticipating emission levels and facilitates the formulation of effective mitigation strategies. Furthermore, strategically placed Libelium IoT devices across the city measure and collect data on air quality and other relevant parameters:

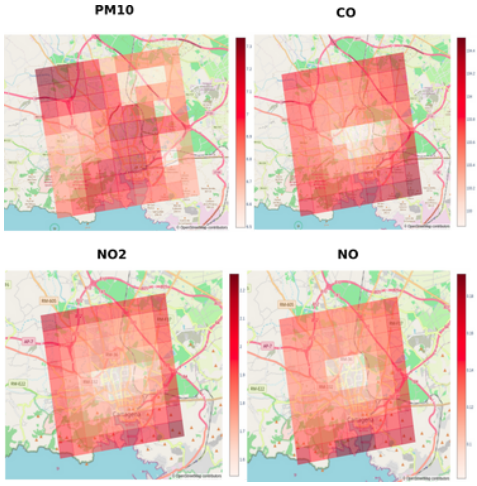
- Gases: NO, NO2, SO2, CO
- Particles: PM2.5 and PM10
- noise levels
- Air temperature and humidity
- Pedestrian flows

The traffic model is created with this data, and the dispersion models are trained so that Artificial Intelligence can simulate different scenarios. A combination of CHIMERE and Street Canyon was used for grainier results.

All data and algorithms are integrated via FIWARE to create dashboards where key plugins have been generated and made available to integrate our algorithms and data-driven tools.

City administrators can simulate 10 different types of LEZ creation measures and evaluate their impact on a selected area. Key features of the tool are:





Heatmap: Visually shows the effects of the LEZ in a specific area, with coloured cells representing the actual impact of different proposed measures.

Manual zone selection: Allows the user to manually choose the desired location for the LEZ and activate up to 3 restrictions on the map, offering a wide variety of scenarios for city analysis.

Prediction Service: Libelium provides reduction results once the LEZ has been implemented in a specific area, allowing its effect on the environment to be evaluated.

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Through the 10 Artificial Intelligence models, the impact of the following 10 restrictions can be evaluated and predicted (up to 3 of them can be combined in the same area):

- Access only to electric vehicles
- Access is restricted to all vehicles except residents
- Restriction by vehicle type
- Restricted time entry for loading and unloading logistics services from 8:00 to 10:00
- Restricted hourly entry to private vehicles
- Entry restricted by vehicle rating
- Restricted paid parking with a maximum of 3 hours
- Restricted parking due to vehicle authorization
- Limitation of the maximum speed in the city and main access roads
- Entry restricted by maximum values and contamination thresholds

Other criteria are to come, depending on the use case and city.

Thus, city managers can play with the elements at their disposal to anticipate possible pollution peaks, open and close traffic or issue notifications to citizens.

Smart City Platform: Cartagena's Answer to Environmental Challenges

envair360 can be operated by itself or be integrated into Smart City's platform, which is the use case of Cartagena.

Thanks to them, we generate a simulation of the data that allows us to translate it into much clearer indicators in decision-making. With them, we can identify:

- Pollution hot spots
- Heat Islands in the territory
- Critical levels of certain parameters

Furthermore, thanks to this modelling, envair360 allows Cartagena to simulate the impact of certain actions on air quality according to different regulations, such as an example of Low Emission Zones. We can see how each of the restrictions enabled for LEZ would affect the mobility of the city and how it would reduce pollution.

Thus, Cartagena has been able to design a superblock. This large area seeks, among other measures, to reduce traffic, promote public transport and electric vehicles, construction of more bike lanes and semi-pedestrian zones, or reduce circulation in specific urban areas and in specific schedules, The goal is ambitious: reduce CO2 emissions from vehicles by 30% in the next decade to make the city a friendlier and less polluted place.

Beyond Solutions: Cartagena's Innovative Approach

Cartagena and Libelium went beyond conventional solutions by:

This holistic approach has transformed environmental quality in Cartagena and set a replicable example for cities worldwide, proving that technology and collaboration can make a significant difference in combating climate change.

A Visionary Superblock Concept

Cartagena has conceptualised a superblock model to aim for a 30% reduction in vehicular CO2 emissions over the next decade. This model emphasizes traffic reduction, enhancing public transport and electric vehicle use, and creating additional bike lanes and semi-pedestrian zones, contributing to a cleaner, more sustainable urban environment.

Impact and Insights

Analysis of historical air quality data has revealed high levels of PM10 and PM2.5, the presence of urban heat islands, and high solar radiation, with a notable distinction that these conditions are more influenced by climate factors than traffic emissions. This insight challenges common perceptions and underscores the complexity of urban environmental management.

- Adopting a 'datacracy' model, where decisions are made based on in-depth data analysis, allows for more efficient and adaptable urban management.
- Prioritizing the creation of sustainable infrastructures that integrate urban health, climate resilience, and citizen well-being considerations.
- Promoting sustainable industrialization, demonstrating that economic development compatible with environmental respect is achievable.

Crossing the data with the traffic data, they saw that this is not associated with traffic but is related to the territory's climate, such as the lack of rain, haze, winds, and high temperatures. etc.

The relationship they have found between traffic and the PM associates it with the fact that the traffic raises the accumulated dust of the territory in large avenues. Since it does not rain, it stays in the air.

Other projects with Cartagena

Libelium installed air quality and noise monitoring devices in Cartagena's lamppost system to capture the raw data. A first step for the project; a big step for the citizen's well-being.

Conclusion: Cartagena's Initiative as a Global Beacon

Libelium's AI service for designing Low Emission Zones is a scalable, practical framework that demonstrates how these sustainability ideals can become a tangible reality thanks to the combination of external data sets, IoT sensors and artificial intelligence.

Cartagena is increasing its urban functionality and the quality of life of its population, addressing the complexity with the technological innovation of using data-based policies and urban planning to regenerate the city's green area and a new focus of urbanism.

FAQs

- **How do Low Emission Zones in Spain, particularly in Cartagena, contribute to environmental sustainability?**

- Low emission zones significantly reduce pollution levels by restricting access to the most polluting vehicles, thus contributing to cleaner air and a healthier urban environment.

- **What technologies are used in Cartagena's smart city solutions?**

- Cartagena utilizes IoT, AI, and FIWARE technologies for real-time environmental monitoring and data-driven decision-making.

- **Can Cartagena's approach be applied to other cities?**

- Yes, Cartagena's model is designed to be replicable, allowing other cities to adapt its strategies for their unique environmental and urban challenges.

- **What is the role of citizens in Cartagena's environmental initiatives?**

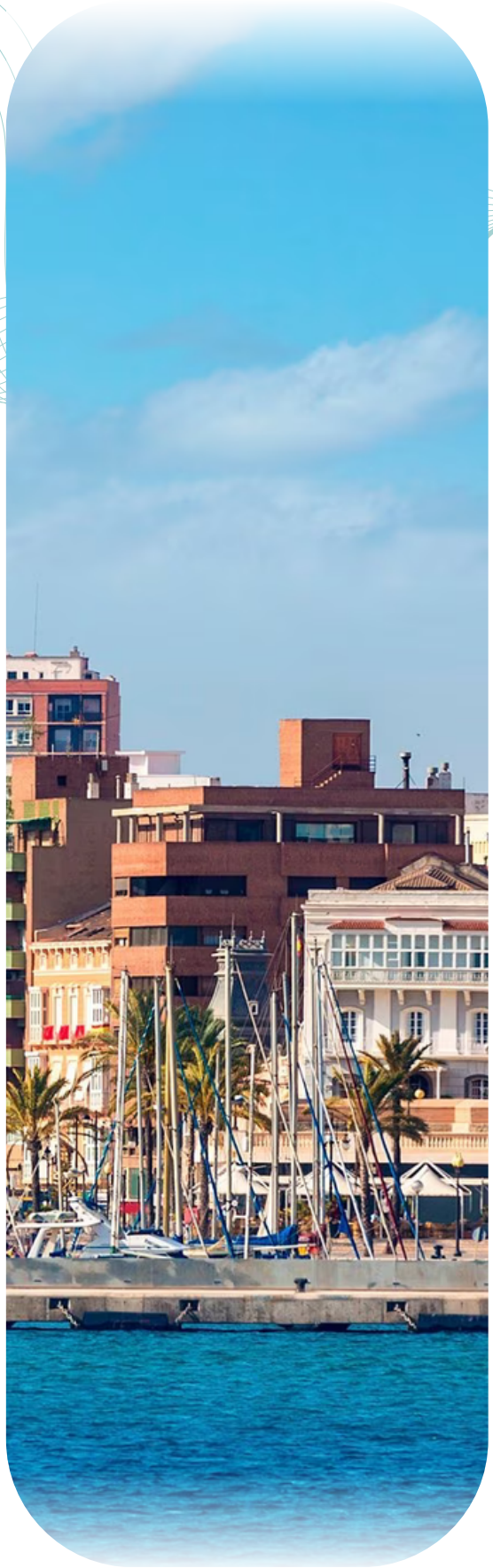
- Citizens play a crucial role through participation in sustainability programs, adherence to low emission zone regulations, and engagement in community-based environmental activities.

- **How does Cartagena ensure the sustainability of its environmental initiatives?**

- Cartagena ensures sustainability through continuous innovation, public-private partnerships, and integrating environmental considerations into all urban planning and development aspects.

- **What future plans does Cartagena have for environmental sustainability?**

- Cartagena aims to expand its smart city solutions, further reduce emissions, and enhance green spaces, continually striving for a more sustainable and livable city.

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