BREEZE

TECHNOLOGIES

Air pollution is one of the greatest challenges of municipalities.

Landmark 2008, 2009 and 2014 rulings from the European Court of Justice embedded the „**right to clean air**“ in European Union law.

Since then, multiple cases against German and European cities have been brought before national and international courts that could result in forced actions up to **driving bans**.

Countries and cities are facing **financial penalties** in the region of hundreds of millions of Euros.

Public awareness is rising swiftly ever since the Dieselgate scandal, increasing political pressure. At the same time, clean air initiatives offer **new opportunities** to cities.

The current methods of measuring air quality have limits.

Currently, cities are only gathering very limited amounts of air quality data through a handful of monitoring stations. Most of them have limited sensing capabilities, measuring **only a few air** quality indicators.

Data is then often only available after lengthy **manual processes**. While the monitoring stations are highly accurate, they are much **too expensive** to measure air quality in the whole cityscape.

This is why statistical dispersion models are used to interpolate data for the rest of the cityscape and provide a baseline for clean air action plans. These models are **highly inaccurate** and come with **lagged** availability.

Cities are adopting new technologies to measure hyperlocal air quality.

Air quality sensors based on the internet of things provide the possibility of enhancing current monitoring networks and gathering hyperlocal, **comprehensive air quality data** throughout the cityscape.

The lower accuracy of low-cost sensors is being mitigated by the higher number of sensors and **calibration and data analysis** based on cutting-edge technologies like machine learning, **artificial intelligence and big data**.

This is why international environmental agencies are recommending adopting low-cost sensors to gather comprehensive, hyperlocal air quality data. The result is a **more accurate urban air quality model**.

The technological development of air quality measurement is similar to the transformation of weather forecasting.

First observation and reporting

Calculation of numerical weather models

Specialised computer predictions

Data base: Automated weather stations

Development of weather observation and prediction

1800er

1920er

1950er

Today

Environmental Intelligence

Use of IoT, AI and big data for hyperlocal air quality monitoring networks

Comprehensive air quality predictions, integration of data in daily life

First monitoring of air quality (UK)

Chemical dispersion models for area models

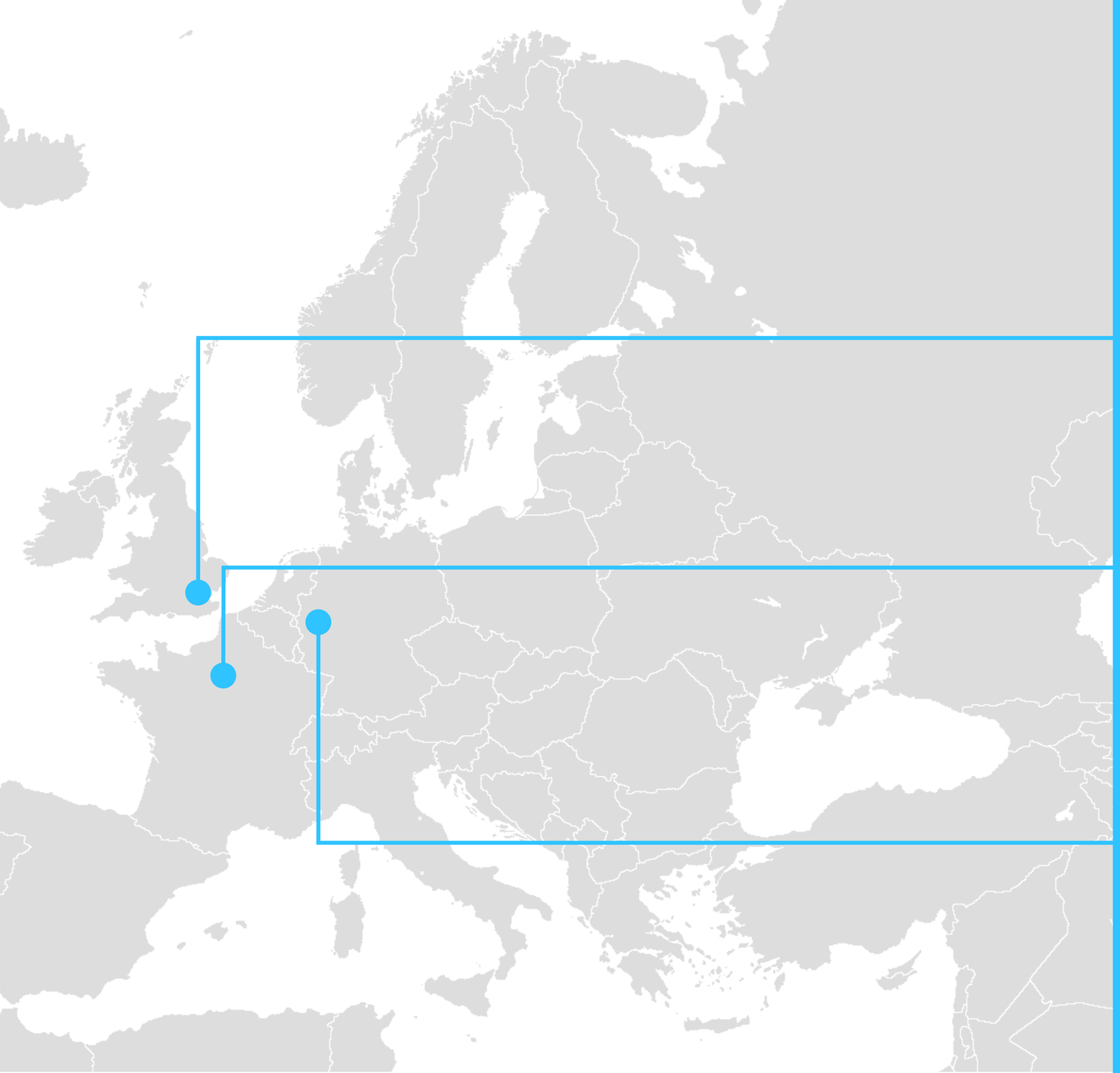
Development of air quality monitoring and prediction

1960er

1970er

Today

Future



Major cities are already implementing clean air best practices.

London, United Kingdom: A network of 3.000 air quality sensors is scheduled to revolutionise city planning and administration. Example: The municipality's congestion charge is dynamically adjusted based on real-time air quality data.

Paris, France: Use of public transportation is free in times of high air pollution. After its tremendous success, the same measure has now also been implemented in **Brussels** to move people from individual transport options to public transport.

Cologne, Germany: So-called gatekeeper traffic lights are controlled based on real-time air quality data. Worse air quality means longer red phases to keep traffic out of the city center.

Breeze Technologies is a leading provider of Environmental Intelligence solutions: Air quality sensors, data and analytics.

Comprehensive real-time data

Comprehensive, hyper-local air quality data enabled by low-cost sensors and integration of existing data sources.

Automated analytics

Based on the Breeze calibration stack, data is automatically plausibility-checked, analysed and interpreted.

Fitting interventions

Machine-learning based insights and intervention recommendations from a catalogue of more than 3.500 measures.

Leading provider according to MarketsAndMarkets, 2018: https://www.marketsandmarkets.com/Market-Reports/environmental-sensor-market-36880440.html

The air quality sensors of Breeze Technologies are monitoring all important air quality parameters in real-time.

Temperature	T	Ozone	O_3
Humidity	RH	Nitric Oxide	NO
Carbon monoxide	CO	Nitrogen Dioxide	NO_2
Carbon dioxide	CO_2	Ammonia	NH_3
Particulate Matter (10µm + 2.5µm)	PM_x	Volatile Organic Compounds*	VOC
		Sulphur Dioxide*	SO_2

* built to order
Accuracy studies:
http://bit.ly/2FAMZsE

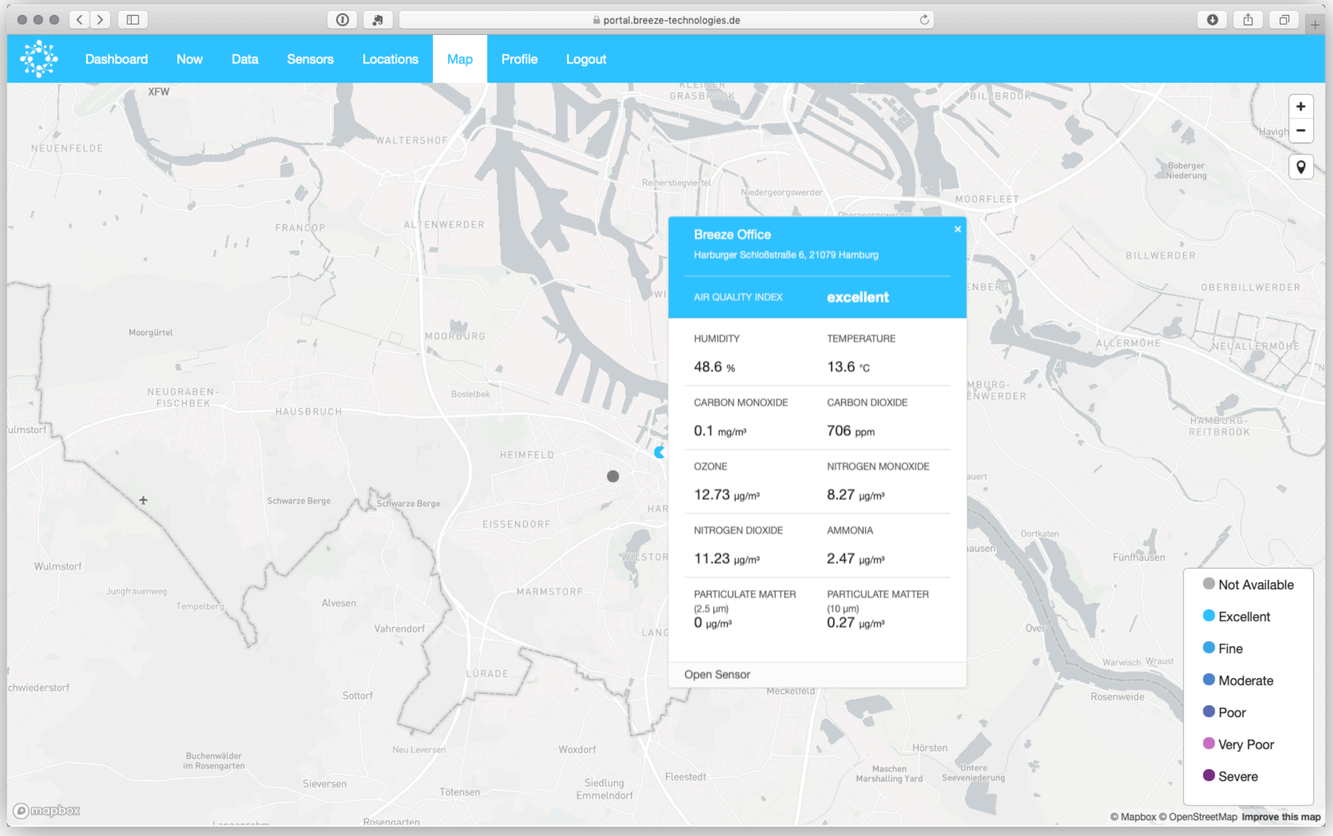
available data transmission standards

Wi Fi™

LTE-M

LoRa

The Breeze Environmental Intelligence Cloud allows real-time analysis of urban air quality data.



Through a **central cloud platform** city decision makers, urban planners and public agencies can interact with air quality data in real time. The data is embedded in a **geo information system** (GIS).

A comprehensive air quality monitoring tool:

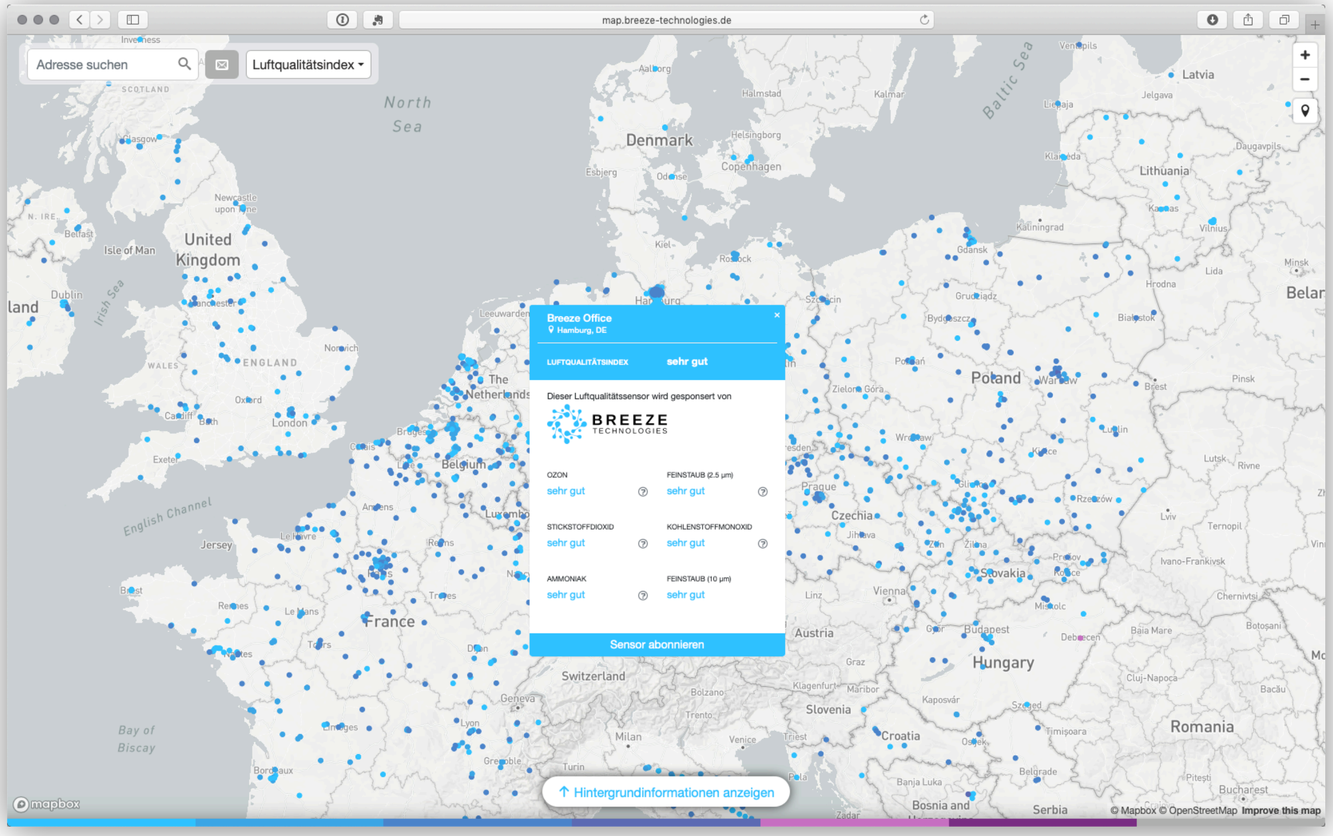
Real-time evaluation on the basis of national and international air quality standards

Historical and location-based analyses

Data export (including CSV)

Integration with other ICT systems through programming interfaces (APIs)

Our optional air quality citizen platform is the first point of contact for interested citizens and creates transparency and trust.



Demo: map.breeze-technologies.de

An **optional** citizen platform can be used to make qualitative air quality data available to interested citizens and offers engagement tools like newsletters and a **knowledge database**.

More than 9.500 air quality data points are already available on the portal.

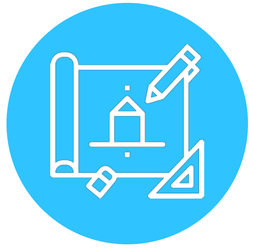
Feedback from projects:

Increased population awareness about current clean air and sustainability efforts of the city

Reduced number of information requests for the public administration

Fostered objective public discussion through increased public transparency

Environmental data is easily integrable in municipal management processes and helps to create more livable environments.



Evidence-based urban planning

Integration of environmental data in urban planning to identify potential for optimisation, successes and local best practices

Integration in chemical transport models

Air pollution dispersion can be geo-spatially analysed - even identifying individual polluters is sometimes possible

Use in climate protection management

Citizen science initiatives (citizens as sensor hosts, providing data for hackathons) activate citizens for climate protection activities

Integration in traffic management systems

Routing and traffic shaping based on air quality data to reduce overall pollution exposure in the cityscape, integration in public transport services

Use in city marketing activities

Showcase particularly good air quality to increase attractiveness in tourism and family settlement, as well as a tourism destination

Smart city integration

Integration of air quality data in a horizontal smart city platform to create synergies with other urban data sources

Your route to better air quality

Identify key project parameters

Provide answers for the following questions:

- Goal of measurements
- Pilot area
- Citizen involvement?
- Public data?

Implementation of a pilot project

Installation of air quality sensors in a representative area of the city, installation services usually managed by the customer (can be managed by Breeze on request)

Evaluation after 1-3 months

First evaluation of results and project achievements, as well as stakeholder feedback, either as local workshop or by virtual conference

Scaling

Decision to scale the project to other urban areas, invitation to other municipal departments to collaborate on the project.

Integration in smart city platform

Real-time and historic air quality data can be implemented in the existing urban infrastructure through standard APIs, e.g. city GIS, citizen apps, etc.

Breeze Technologies is a European success story.

The pioneering startup has been established in 2015 thanks to a European-funded innovation and accelerator programme for smart cities.

Together with NASA, Breeze Technologies presented its breakthrough innovation to gather hyperlocal air quality data at the 2016 World Clean Air Conference in the „**Next Generation Air Quality Monitoring**“ track.

Breeze Technologies has been named one of the **EU’s most promising start-ups** by the **European Parliament**. Breeze Technologies co-founders Robert Heinecke and Sascha Kuntze are part of the European **Forbes 30 Under 30** Social Entrepreneurs 2018.

Selected references & company profile

Foundation 2015, since 2017 known as BT UG
Main office: Hamburg

Google | DIGITAL NEWS INITIATIVE SAP

OTTO Miele

T··Systems· Universität Hamburg DER FORSCHUNG | DER LEHRE | DER BILDUNG

INFRA LAB BERLIN e·on

VOLKSWAGEN AKTIENGESELLSCHAFT HCU HafenCity Universität Hamburg

Stadt Neckarsulm STADT MOERS Hennef meine Stadt

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