City Air Management

Monitoring, predicting, and simulating measures to reduce air pollution

The challenge

There is a close link between urban infrastructure and quality of life, which only becomes apparent when things are not working as they should. In the face of continuing urbanization, this is increasingly the case.

Every week, the global urban population grows by 1.5 million people. While cities made up a third of the world population in 1950, by 2050 it will be more than two thirds.

This rapid process of urbanization poses a huge challenge for cities: In many parts of the world, existing infrastructure is stretched to full capacity and air pollution has reached dangerous levels.

According to the World Health Organization (WHO), almost 90 percent of the world's urban population breathe air with pollutant levels that far exceed the recommended thresholds. Approximately 7 million people die each year from the effects of air pollution, which, according to the WHO, makes it a greater global health threat than Ebola and HIV.

City leaders are under pressure to meet these challenges and define strategies for sustainable, clean and smart growth. However, they often lack the sufficient data or digital tools necessary to make the best decisions.

Real time monitoring and short-term predictions

As trusted global partner for sustainable city development, Siemens has developed a complete, cloud-based software suite: The City Air Management Tool visualizes air quality data recovered from municipal measuring stations in real time. In addition, it forecasts air pollution levels for the next three to five days with up to 90-percent accuracy and also simulates the impact of short-term measures on air quality.

Combining air quality forecasts with the simulation of the effectiveness of planned measures and technologies makes the City Air Management Tool unique.

Our air pollution prediction is based on a sophisticated algorithm that works with an artificial neural network. Using data on historic air pollution, weather and traffic patterns, Siemens is able to forecast a city's air quality and the impact of concrete measures for currently three major KPIs, including NOx, PM10 and PM2.5.

Cities may also choose from a list of 17 short-term measures and simulate their impact on the next three to five days, helping them proactively to stay within daily or hourly air pollution limits. Measures include, for example, implementing low emission zones, speed limits and free public transport.

Data helps to make better decisions

For mayors or city officials, having access to reliable information about their city's air pollution levels over the next five days is a game-changer. It enables informed, data-driven decisions that will become the basis for effective strategies.

Simulation will help cities in the first instance to activate short-term measures; however, it will also foster long-term air quality improvement measures in the upcoming years, such as the implementation of low emission zones or increased e-mobility.

The forecast algorithm not only considers the weather forecast, but also traffic data, other recurrent events, and relevant historic data.

Improving air quality with medium- to long-term measures

The perfect add-on for the City Air Management Tool

City Air Management technology focuses mainly on simulating short-term measures. However, cities can also rely on Siemens' technology, expertise and global database for their long-term planning.

In order to assess the effectiveness of medium- and long-term impact measures, cities may calculate the impact of approximately 40 transportation technologies on air pollution KPIs. Based on this data, more effective technology roadmaps and policy-making advice may be developed.

With this additional dataset, cities receive a complete picture of their pollutant emissions and, as a consequence, are able to tackle the problem more efficiently.

Having access to the forecasting KPIs at any time and being able to simulate the impact of short-term measures for specific days, will be decisive in the day-to-day battle against air pollution.

Furthermore, the possibility of assessing at the same time the impact of medium- and long-term measures on a city's overall emissions provides the necessary knowledge to make better long-term decisions.

City Performance Tool

Since 2012, we have been working with cities around the world, helping them to benefit from our interactive and comprehensive tool – the City Performance Tool (CyPT).

This tool provides guidance to cities on how to achieve their environmental targets, such as reducing carbon emissions and air pollution. It is a leading-edge simulation tool that can be used in many different decision-making scenarios, focus on the desired time period and required implementation level.

This dynamic tool can illustrate to city decision-makers the overall impact of their collective decisions and identify the right technologies to improve air quality while contributing to sustainability and economic growth.

Cleaning city air and reducing emissions is not easy. But by offering a standardized series of metrics and analysis of the impact of a wide range of technologies, the CyPT allows urban planners to understand not just the precise impact of their plans, but also the most efficient route to the desired outcome.

Case Study: Nuremberg

As the first city to test the medium- and long-term measures for air quality, Nuremberg can now present a plan to lower emissions with detailed predictions of the impact of policy and technology changes.

The city has a progressive environmental policy and is among the top 25 cities in the Mercer Quality of Living Ranking. It has been working for years to reduce air pollution and the emission of greenhouse gases. Nevertheless, due to local traffic, Nuremberg has not always been able to meet WHO recommendations for air pollution levels, particularly for nitrogen dioxide and particulate matter.

Now, Nuremberg can show environmental activists, citizens, and policymakers more than just its short-term plan to lower air pollution levels. The city has access to predictions of air pollution levels until 2030, as well as calculations that show which policy and technology changes will lower which types of pollutants by how much and by when.

The CyPT technology is taking measuring and forecasting air quality emissions to the next level – and thus enables the management of air quality as well as proactive decision-making.